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Mathematics (5165)



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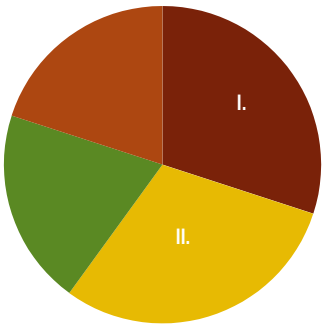
Mathematics (5165)

Test at a Glance

The *Praxis*® Mathematics test is designed to measure knowledge and competencies important for safe and effective beginning practice as a secondary school mathematics teacher. Test-takers have typically completed a bachelor's degree program with appropriate coursework in mathematics and education.

Test Name	Mathematics
Test Code	5165
Time	180 minutes
Number of Questions	66 selected-response questions
Format	The test consists of a variety of selected-response questions, where you select one or more answer choices; questions where you enter a numeric answer in a box; and other types of questions. You can review the possible question types in Understanding Question Types.
Test Delivery	Computer Delivered



Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
I. Number & Quantity and Algebra	20	30%
IA. Number & Quantity	7	10%
IB. Algebra	13	20%
II. Functions and Calculus	20	30%
IIA. Functions	13	20%
IIB. Calculus	7	10%
III. Geometry	13	20%
IV. Statistics & Probability	13	20%

All questions assess content from the Mathematics domains above. Approximately 25% of questions assess content applied to a Task of Teaching Mathematics.

About the Test

The Mathematics test content topics span the secondary mathematics curriculum including content related to (I) Number & Quantity and Algebra, (II) Functions and Calculus, (III) Geometry, and (IV) Statistics & Probability. A full list of the mathematics topics covered is provided in Content Topics.

Test takers will find that approximately 25 percent of the questions call for application of mathematics within a teaching scenario or an instructional task. Such questions—designed to measure applications of mathematics knowledge and skills to the kinds of decisions and evaluations a teacher must make during work with students, curriculum, and instruction—situate mathematics content questions in tasks that are critical for teaching. A full list of the teaching tasks covered, which have been identified based on research on mathematics instructions and are a routine part of mathematics instruction, is provided in Tasks of Teaching Mathematics.

Test takers have access to an on-screen graphing calculator. A list of notations, definitions, and formulas is available on the test's Help screen and is also provided in the Practice with Sample Test Questions section.

The assessment is designed and developed through work with practicing teachers and teacher educators to reflect the mathematics curriculum as well as state and national standards for mathematics, including the National Governors Association Center for Best Practices and the Council of Chief State School Officers *Common Core State Standards for Mathematics* (2010), the National Council of Teachers of Mathematics (NCTM) and the Council of the Accreditation of Educator Preparation (CAE) *NCTM CAEP Standards* (2012), and the NCTM *Principles and Standards for School Mathematics* (2000).

This test may contain some questions that will not count toward your score.

On-Screen Graphing Calculator

An on-screen graphing calculator is provided for the computer-delivered test. Please consult the Praxis Calculator Use web page (http://www.ets.org/praxis/test_day/policies/calculators/) for further information and for a link to download the calculator and view tutorials on using the calculator.

You are expected to know how and when to use the calculator since it will be helpful for some questions. The calculator is available as a free download for a 30-day trial period. You are expected to become familiar with its functionality before taking the test. The calculator may be used to perform calculations (e.g., division, exponents, roots, trigonometric values, logarithms, finding the mean of a data set), to graph and analyze functions, to find numerical solutions to equations, and to generate a table of values for a function.

Using Your Calculator

Take time to download the trial version of the calculator. View the tutorials on the website. Practice with the calculator so that you are comfortable using it on the test.

There are only some questions on the test for which a calculator is helpful or necessary. First, decide how you will solve a problem, then determine if you need a calculator. For many questions, there is more than one way to solve the problem. Don't use the calculator if you don't need to; you may waste time. Sometimes answer choices are rounded, so the answer that you get might not match the answer choices in the question. Since the answer choices are rounded, substituting the choices into the question might not produce an exact answer.

Don't round any intermediate calculations. For example, if the calculator produces a result for the first step of a solution, keep the result in the calculator and use it for the second step. If you round the result from the first step and the answer choices are close to each other, you might choose the incorrect answer.

Read the question carefully so that you know what you are being asked to do. Sometimes a result from the calculator is NOT the final answer. If an answer you get is not one of the choices in the question, it may be that you didn't answer the question being asked. Read the question again. It might also be that you rounded at an intermediate step in solving the problem.

Think about how you are going to solve the question before using the calculator. You may only need the calculator in the final step or two. Don't use it more than necessary.

Check the calculator modes (degree versus radian, floating decimal versus scientific notation) to see that these are correct for the question being asked. Make sure that you know how to perform the basic arithmetic operations and calculations (e.g., division, exponents, roots, trigonometric values, logarithms, finding the mean of a data set). Your test may involve questions that require you to do some of the following: graph functions and analyze the graphs, find zeros of functions, find points of intersection of graphs of functions, find minima/maxima of functions, find numerical solutions to equations, and generate a table of values for a function.

Content Topics

This list details the topics that may be included on the test. All test questions will cover one or more of these topics.

Discussion Questions

In this section, discussion questions are open-ended questions or statements intended to help test your knowledge of fundamental concepts and your ability to apply those concepts to classroom or real-world situations. **We do not provide answers for the discussion questions** but thinking about the answers will help improve your understanding of fundamental concepts and may help you answer a broad range of questions on the test. Most of the questions require you to combine several pieces of knowledge to formulate an integrated understanding and response. They are written to help you gain increased understanding and facility with the test's subject matter. You may want to discuss these questions and possible areas with a teacher or mentor.

I. Number & Quantity and Algebra

A. Number and Quantity

1. Understands the structure of the real number system and how the basic operations on numbers in this system are performed
   a. Represents and solves word problems involving addition, subtraction, multiplication, and division of real numbers
   b. Given operations on a number system, determines whether commutative, associative, and distributive properties hold
   c. Identifies whether the sum or product of rational and/or irrational numbers must be rational, must be irrational, or can be rational or irrational (e.g., the sum of two rational numbers must be rational, the product of two irrational numbers can be rational or irrational)
   d. Solves problems involving number theory properties (e.g., prime, composite, prime factorization, even, odd, factors, multiples)
   e. Uses proportional relationships to solve ratio, constant rate, and percent problems
2. Understands the properties of radicals and rational exponents
   a. Performs operations involving rational exponents
   b. Uses the properties of exponents to rewrite expressions that have radicals or expressions that have rational exponents
   c. Uses scientific notation to represent and compare numbers and to perform calculations
3. Understands how to reason quantitatively and use units to solve problems
   a. Chooses and interprets units consistently in formulas

   b. Chooses and interprets the scale and the origin in graphs and data displays
   c. Solves measurement, estimation, and conversion problems involving time, length, temperature, volume, and mass in standard measurement systems
   d. Solves problems involving dimensional analysis (e.g., feet per second to miles per hour, feet per second to kilometers per hour)
4. Knows the structure of the complex number system and how basic operations with complex numbers are performed
   a. Performs operations with complex numbers, including conjugates
   b. Applies the commutative, associative, and distributive properties to complex numbers

B. Algebra

1. Understands how to write algebraic expressions in equivalent forms
   a. Uses the structure of a polynomial or exponential expression to identify ways to rewrite it in an equivalent form (e.g., differences of squares, factoring, changing bases)
   b. Understands how to rewrite algebraic expressions for specific purposes (e.g., factored form to find zeros, vertex form to find maxima or minima)
   c. Rearranges formulas to solve for a specified variable
   d. Adds, subtracts, multiplies, and divides polynomials
   e. Factors special polynomials over the complex numbers (e.g., $x^2 + y^2 = (x + yi)(x - yi)$)
2. Understands how to create equations and inequalities that describe relationships
   a. Creates equations and inequalities in one variable, uses them to solve problems, and graphs solutions on the number line
   b. Creates equations and inequalities in two or more variables, uses them to solve problems, and graphs the equations in two variables on the coordinate plane with appropriate labels and scales
   c. In a modeling context, represents constraints by systems of equations and/or inequalities and interprets solutions as viable or nonviable options
3. Understands how varied techniques (e.g., graphical, algebraic, tabular) are used to solve equations and inequalities

a. Solves linear equations and inequalities in one variable, including equations with variable coefficients
b. Solves quadratic equations with real coefficients that have complex solutions
c. Uses the method of completing the square to transform any quadratic equation in x into the equivalent form $(x-p)^2=q$
d. Solves equations using a variety of methods (e.g., graphing, factoring, using the quadratic formula)
e. Uses different methods (e.g., discriminant analysis, graphical analysis) to determine the nature of the solutions of a quadratic equation
f. Graphs the solutions to a linear equation or inequality in two variables
g. Justifies each step in solving an equation or inequality

4. Understands how varied techniques (e.g., graphical, algebraic, tabular) are used to solve systems of equations and inequalities
   a. Solves a system consisting of two linear equations in two variables algebraically and graphically
   b. Solves a system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically
   c. Finds the solutions of $f(x)=g(x)$ approximately (e.g., uses technology to graph the functions, makes tables of values); includes cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, radical, or logarithmic functions
   d. Graphs the solution set to a system of linear inequalities in two variables
5. Understands the concept of rate of change of nonlinear functions
   a. Calculates and interprets the average rate of change of a function presented as a table of values, algebraically, or graphically over a given interval
6. Recognizes and is able to extract and interpret information about a linear equation when it is presented in various forms (e.g., slope-intercept, point-slope, standard)
   a. Calculates the intercepts of a line and interprets them in a modeling context
   b. Calculates the slope of a line presented as a table of values, algebraically, or graphically, and interprets it in a modeling context

7. Understands the relationship between zeros of polynomial functions (including their graphical representation) and factors of the related polynomial expressions
   a. Applies the remainder theorem to find factors of polynomials
   b. Uses factorization to identify zeros of polynomials
   c. Uses zeros and factorization of a polynomial to sketch a graph of the polynomial and uses the graph to determine the zeros and the factorization of the polynomial
   d. Uses a variety of techniques to find and analyze the zero or zeros (real and complex) of polynomial functions
8. Understands how to rewrite rational expressions
   a. Rewrites simple rational expressions in an equivalent form
   b. Adds, subtracts, multiplies, and divides rational expressions
9. Understands how to justify the reasoning process used to solve equations, accounting for potential extraneous solutions
   a. Solves simple rational and radical equations in one variable, accounting for potential extraneous solutions

Discussion areas: Number and Quantity

- Can you perform arithmetic operations on real numbers?
- Can you apply the order of operations in arithmetic computations?
- Can you solve word problems involving operations on real numbers?
- Can you identify the result of arithmetic operations on rational and irrational numbers as either rational or irrational?
- Can you compute or identify a ratio or rate?
- Can you solve problems involving primes, composites, factors, and multiples?
- Can you use proportional relationships to compute percent's?
- Can you use the properties of exponents to simplify and rearrange expressions?
- Can you simplify expressions that contain radicals or rational exponents?
- Can you define and use negative exponents?
- Can you verify that radical expressions are equivalent numerically and analytically?
- Can you identify and represent very small and very large numbers in scientific notation?
- Can you do calculations involving scientific notation?
- Can you convert between units—for example, converting inches to meters?
- Can you solve problems using units to guide the solution?
- Can you solve measurement problems involving time, length, temperature, volume, and mass?

- Can you solve problems involving dimensional analysis—for example, converting feet per second to miles per hour, feet per second to kilometers per hour?
- Can you perform arithmetic operations on complex numbers?
- Can you recognize and use $a - bi$ as the conjugate of $a + bi$?
- Can you identify the associative, commutative, inverse, identity, and distributive properties from a given algebraic statement?

Discussion areas: Algebra

- Can you rewrite quadratic expressions to find zeros, complete the square, and find the relative extrema?
- Can you solve for the variable of interest in a formula?
- Can you add, subtract, divide, and multiply polynomials?
- Can you use linear equations or linear inequalities to model real-life problems?
- Can you solve linear equations and linear inequalities in one variable algebraically?
- Can you graph the solution of a linear inequality in one variable on the number line and the solution of a linear inequality in two variables on the coordinate plane?
- Can you extract and interpret information about a linear equation presented in slope-intercept form, point-slope form, or standard form?
- Can you solve quadratic equations with real solutions and complex solutions?
- Can you solve quadratic equations by completing the square, factoring, and using the quadratic formula?
- Can you use the discriminant to identify the types and multiplicities of roots of a quadratic equation?
- Can you solve a system consisting of two linear equations in two variables algebraically?
- Can you solve a system consisting of two linear equations in two variables by graphing?
- Can you solve a system consisting of two linear inequalities in two variables algebraically?
- Can you represent constraints by systems of equations or inequalities in a modeling context, and interpret the solutions as viable or nonviable?
- Can you solve a system consisting of a linear equation and a quadratic equation in two variables algebraically?
- Can you solve a system consisting of a linear equation and a quadratic equation in two variables by graphing?
- Can you find the intersection(s) of two curves algebraically or using technology?
- Can you calculate the average rate of change for functions?
- Can you calculate and interpret the intercepts and slope of a line?
- Can you use the remainder theorem and factor theorem for polynomials?
- Can you use the graph of a quadratic function to identify the types and multiplicities of the zeros of the function?
- Can you find and use zeros to sketch a graph of the function?
- Can you add, subtract, multiply, and divide rational expressions?
- Can you identify when extraneous solutions may occur in solving rational and radical equations?

II. Functions and Calculus

A. Functions

1. Understands functions and function notation
   a. Determines whether a relation is a function
   b. Evaluates functions and interprets statements that use function notation in terms of a context
   c. Determines the domain and range of a function from a function rule (e.g., $f(x) = 2x + 1$) graph, set of ordered pairs, or table
2. Understands how function behavior is analyzed using different representations (e.g., graphs, mappings, tables)
   a. For a function that models a relationship between two quantities, interprets key features of graphs and tables (e.g., increasing/decreasing, maximum/minimum, discontinuities, end-behavior) in terms of the quantities
   b. Given a verbal description of a function, sketches graphs that show key features of that function
   c. Graphs functions (e.g., linear, quadratic, exponential, piecewise, absolute value, step, radical, polynomial, rational, logarithmic, trigonometric) defined by an expression and identifies key features of the graph
   d. Writes a function that is defined by an expression in different but equivalent forms to reveal different properties of the function (e.g., zeros, extreme values, symmetry of the graph)
   e. Interprets the behavior of exponential functions (e.g., growth, decay)
   f. Determines whether a function is odd, even, or neither and whether the graph of the function has any symmetries
   g. Compares properties of two functions each represented in a different way (e.g., as a table of values, algebraically, graphically, or by verbal descriptions)
   h. Recognizes and is able to extract information about a quadratic function when it is presented in various forms (i.e., standard, vertex, factored)
   i. Converts among various forms of quadratic equations (i.e., standard, vertex, factored) using methods such as factoring and completing the square
3. Understands how functions and relations are used to model relationships between quantities

a. Writes a function that relates two quantities
b. Determines an explicit expression or a recursive process that builds a function from a context
c. Writes arithmetic and geometric sequences both recursively and with an explicit formula and uses them to model situations
d. Translates between recursive and explicit forms of arithmetic and geometric sequences

4. Understands how new functions are obtained from existing functions (e.g., compositions, transformations, inverses)
   a. Describes how the graph of $g(x)$ is related to the graph of $f(x)$, where $g(x)=f(x)+k$, $g(x)=f(x+k)$, $g(x)=k\,f(x)$, or $g(x)=f(kx)$ for specific values of k (both positive and negative) and finds the value of k given the graphs
   b. Given that a function f has an inverse, finds values of the inverse function from a graph or a table of f
   c. Interprets the meaning of an inverse function in a modeling context
   d. Given a noninvertible function, determines the largest possible domain of the function that produces an invertible function
   e. Given a relation, finds its inverse and determines if its inverse is a function and writes an expression for the inverse function
   f. Uses the inverse relationship between exponential and logarithmic functions to solve problems
   g. Combines standard function types
   h. Analyzes the domain of functions created by combining functions using arithmetic operations
   i. Composes functions presented as tables of values, algebraically, or graphically
   j. Analyzes the domain of functions resulting from composition
   k. Uses composition to express the relationship between a function and its inverse
5. Understands differences between linear, quadratic, and exponential models, including how their equations are created and used to solve problems

a. Understands that linear functions grow by equal differences over equal intervals and that exponential functions grow by equal factors over equal intervals
b. Identifies situations in which one quantity changes at a constant rate per unit interval relative to another
c. Identifies situations in which a quantity using arithmetic operations grows or decays by a constant percent rate per unit interval relative to another
d. Constructs linear and exponential functions, including arithmetic and geometric sequences, given a graph, table of values, a set of ordered pairs, or a description of a relationship
e. Observes that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratic ally, or (more generally) as a polynomial function
f. Interprets the parameters in a linear or exponential function in terms of a context (e.g., $A(t) = Pe^{rt}$)

6. Understands how to use logarithms to solve problems
   a. Applies the properties of logarithms to solve problems
   b. Expresses the solution to an exponential equation with base b as a logarithm (e.g., $3\,(2^{5t}) = 20$, $3\,(e^{5t}) = 20$)
   c. Uses technology to evaluate logarithms that have any base
7. Understands the relationship between points on the unit circle and the values of trigonometric functions for any given angle measure
   a. Converts between degree measure and radian measure
   b. Identifies the reference angle for a given angle and the relationship between the trigonometric values of an angle and its reference angle
   c. Finds the values of trigonometric functions of any angle
   d. Uses the unit circle to explain symmetry and periodicity of trigonometric functions
8. Understands how periodic phenomena are modeled using trigonometric functions
   a. Chooses trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline

b. Uses inverse functions to solve trigonometric equations that arise in modeling contexts and interprets them in terms of the context

9. Understands how to solve trigonometric, logarithmic, and exponential equations
   a. Solves trigonometric, logarithmic, and exponential equations

B. Calculus

1. Understands the meaning of a limit of a function and how to calculate limits of functions and conditions when the limit does not exist
   a. Solves limit problems using properties of limits, where all limits of the individual functions exist at the value that x is approaching
   b. Determines limits to a fixed value and interprets the 'limit graphically
   c. Determines one-sided limits to a fixed value, from both left and right, interprets the limit graphically, and uses it to determine if the limit to the value exists
   d. Computes limits to infinity or negative infinity and interprets the result graphically
   e. Identifies limits that do not exist for functions presented algebraically or graphically

2. Understands the derivative of a function as a limit, as the slope of a line tangent to a curve, and as a rate of change
   a. Given the graph of a function and a point on that graph, knows the relationship between the derivative of the function at that point, the slope of the tangent to the graph at that point, and the succession of slopes of secant lines connecting $(a, f(a))$ to $(x, f(x))$ as x approaches a

3. Understands what it means for a function to be continuous at a given point and knows the relationship between continuity and differentiability
   a. Applies the three steps (i.e., $f(a)$ exists, $\lim_{x \to a} f(x)$ exists, and $f(a) = \lim_{x \to a} f(x)$) that are part of the definition of what it means for a function to be continuous at $x = a$ to verify whether a given function is continuous at a given point
   b. Gives examples of functions that are continuous at $x = a$ but not differentiable at $x = a$ and explains why

4. Understands how and when to use standard differentiation and integration techniques
   a. Uses standard differentiation techniques

   b. Uses standard integration techniques, including both definite and indefinite integrals
   c. Uses the relationship between the position, velocity, and acceleration functions to solve problems
5. Understands how to analyze the behavior of a function (e.g., extrema, concavity, symmetry) and understands how to use integration to compute area
   a. Uses the first and second derivatives to analyze the graph of a function
   b. Matches graphs of functions with graphs of their derivatives or accumulations based on the second part of the fundamental theorem of calculus
   c. Uses integration techniques to compute area

Discussion areas: Functions

- Can you recognize function notation and understand that for each input, the function produces one and only one output?
- Can you determine whether a relation is a function numerically, algebraically, as a set of ordered pairs, and graphically?
- Can you recognize the domain as the set of valid inputs for a function and the range as the set of resulting outputs, and can you find these for a given function?
- Can you evaluate a function that is given algebraically or graphically?
- Can you find the zeros, extreme values, intervals of increasing or decreasing, and symmetry of a function given a graph, algebraic representation, or verbal description?
- Can you graph radical, piecewise, absolute value, polynomial, rational, logarithmic, exponential, and trigonometric functions?
- Can you determine whether an exponential function will grow or decay and at what rate?
- Can you determine whether a function is odd, even, or neither and whether the graph of the function has any symmetries?
- Can you create a function that models a relationship between two described quantities?
- Can you recognize and define sequences as recursive or explicit functions?
- Can you take one or more functions and create another function using functional operations, function composition, and transformations?
- Can you identify the domain and range of the sum, product, difference, quotient, or composition of two functions?
- Can you find the inverse of a given function?
- Can you determine whether two functions are inverses graphically and analytically?
- Can you determine if two functions, given as sets of ordered pairs, are inverse functions of each other?
- Can you interpret the meaning of an inverse function in a modeling context?
- Can you determine the type of function (linear, quadratic, exponential) that best fits a given scenario or situation?

- Can you use logarithms to solve problems with and without technology?
- Can you express exponential equations as logarithms and evaluate logarithms with any base using technology?
- Can you use the unit circle and special right triangles to determine the values of given trigonometric functions?
- Can you find the values of trigonometric functions for an angle given the value of one trigonometric function and the quadrant of the angle?
- Can you model situations that occur periodically using trigonometric functions?
- Can you recognize and use trigonometric identities?
- Can you solve exponential, logarithmic and trigonometric equations?

Discussion areas: Calculus

- Can you compute and analyze the limit of a function at a given point?
- Can you recognize the difference between the limit of a function at a point and the value of the function at the point?
- Can you compute limits to infinity or negative infinity and interpret the result graphically?
- Can you identify limits that do not exist for functions presented algebraically or graphically?
- Can you use the limit definition of the derivative to differentiate a function?
- Can you approximate derivatives given a table by using the slope of a secant line?
- Can you determine the continuity and differentiability of a function at a given point?
- Can you find the derivative of a function using the differentiation rules?
- Can you compute a definite integral using the fundamental theorem of calculus?
- Can you use differentiation and integration techniques to identify the relationship between position, velocity, and acceleration functions?
- Can you calculate the extrema of a function and determine when the function is increasing or decreasing using the first derivative?
- Can you find the concavity of a curve at a particular point and find any point(s) of inflection?
- Can you find the area between curves?

III. Geometry

A. Geometry

1. Knows the properties of lines (e.g., parallel, perpendicular, intersecting) and angles
   a. Solves problems involving parallel, perpendicular, and intersecting lines
   b. Applies angle relationships (e.g., supplementary, vertical, alternate interior) to solve problems
2. Knows the properties of triangles, quadrilaterals (e.g., parallelogram, rectangle, rhombus), and other polygons

a. Determines whether given side lengths or angle measures would produce a triangle (e.g., triangle inequality theorem) and classifies triangles by their sides or angles
b. Solves problems involving special triangles (e.g., isosceles, equilateral, right, $30° – 60° – 90°$)
c. Uses the definitions of median, midpoint, and altitude to solve problems involving triangles
d. Identifies geometric properties of various quadrilaterals and the relationships among them (e.g., parallelogram, rectangle, rhombus)
e. Solves problems involving sides, angles, or diagonals of polygons

3. Understands transformations in the plane
   a. Uses rigid motions (e.g., translations, rotations, reflections) to transform figures
   b. Uses dilations to transform figures
   c. Applies properties of rigid motions (e.g., rigid motions preserve distance and angle measure)
   d. Applies properties of dilation transformations (e.g., dilation transformations preserve angle measure but not distance)
   e. Identifies a sequence of transformations that maps a preimage onto an image
   f. Given a figure, describes the transformations that map the figure onto itself, including reflection over a line of symmetry
   g. Represents translations using vector notation
4. Understands congruence and similarity
   a. Determines whether two figures are congruent using triangle congruence theorems (e.g., ASA, SAS, SSS)
   b. Determines whether two figures are similar using triangle similarity theorems (e.g., AA criterion)
   c. Determines whether two figures are congruent by directly mapping one figure onto another using a sequence of one or more rigid motions
   d. Determines whether two figures are similar by directly mapping one figure onto another using a sequence of one or more transformations (dilations and/or rigid motions)

   e. Uses congruence and similarity to solve problems involving unknown side lengths or angle measurements in two-dimensional and three-dimensional figures

5. Knows how to prove geometric theorems such as those about lines, angles, triangles, and parallelograms
   a. Solves problems involving proofs of theorems about lines and angles (e.g., vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are equidistant from the segment's endpoints)
   b. Solves problems involving proofs of theorems about triangles (e.g., measures of interior angles of a triangle sum to $180°$; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point; a line parallel to one side of a triangle divides the other two sides proportionally; the Pythagorean theorem proved using triangle similarity)
   c. Solves problems involving proofs of theorems about parallelograms (e.g., opposite sides are congruent; opposite angles are congruent; the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals)
   d. Identifies whether geometric proofs are valid (e.g., direct proofs, counterexamples)
6. Understands how trigonometry is applied to triangles
   a. Uses the relationship between the sine and cosine of complementary angles to solve problems
   b. Uses trigonometric ratios and the Pythagorean theorem to solve for side lengths and angle measures of right triangles in geometric or applied problems
   c. Uses the values of trigonometric functions of special angles (e.g., $30°, 45°, 60°, 90°$) to solve problems
   d. Applies the Law of Sines and the Law of Cosines to find unknown measurements in triangles

7. Understands how to apply theorems about circles
    a. Solves problems involving circumference and area of a circle
    b. Solves problems involving lengths of arcs and areas of sectors
    c. Solves problems involving measures of inscribed angles, central angles, circumscribed angles, and arcs
    d. Uses properties of lines in a circle to solve problems (e.g., chords, secants, tangents, radii, diameters)
    e. Identifies and uses the geometric description of a circle as the set of points for which the distance from a point to a fixed point (the center) is constant
    f. Determines the equation of a circle given the center and radius of the circle
    g. Finds the center and radius of a circle given by an equation of the circle in any form
8. Understands how to use coordinate geometry to describe properties of geometric objects
    a. Uses coordinate geometry to represent and identify the properties of geometric shapes and to solve problems (e.g., Pythagorean theorem, perimeter of a polygon, area of a rectangle)
    b. Determines the distance between two points
    c. Finds the point on a directed line segment between two given points that partitions the segment in a given ratio
    d. Uses the slope criteria for parallel and perpendicular lines to solve geometric problems
9. Knows how to solve problems involving perimeter and area of polygons
    a. Calculates and interprets perimeter and area of polygons that can be composed of triangles and quadrilaterals
    b. Calculates changes in perimeter and area as the dimensions of a polygon change
10. Knows how to solve problems involving solids
    a. Calculates and interprets surface area and volume of solids (e.g., prisms, pyramids, cones, cylinders, spheres), including in real-world situations
    b. Calculates changes in surface area and volume as the dimensions of a solid change

c. Identifies the shapes of two-dimensional cross sections of three-dimensional objects and identifies three-dimensional objects generated by rotations of two-dimensional objects

d. Uses two-dimensional representations (e.g., nets) of three-dimensional objects to visualize and solve problems

Discussion areas: Geometry

- Can you use the definitions of angles, circles, line segments, perpendicular lines, and parallel lines?
- Can you use the relationships of the angles formed when parallel lines are cut by a transversal?
- Can you use the definitions and properties of special triangles (e.g., isosceles, equilateral, right, $30° - 60° - 90°$) and special polygons (e.g., regular polygon, parallelogram, trapezoid, rhombus, rectangle, square, and kite)?
- Can you prove and apply the theorems of supplementary angles, complementary angles, vertical angles, exterior angles, triangle sum, and base angles?
- Can you prove and apply theorems about angles, triangles, and parallelograms?
- Can you describe and use the properties of the median, altitude, and angle bisector of a triangle?
- Can you translate, reflect, rotate, and dilate figures in the plane and describe these transformations geometrically?
- Can you identify or describe a sequence of transformations that map a preimage onto an image?
- Can you identify the lines of symmetry of a polygon?
- Can you describe or prove congruence and similarity in terms of transformations?
- Can you apply triangle congruence and similarity criteria to solve problems or prove theorems?
- Can you recognize logical fallacies such as assuming the equivalence of a proposition and its converse?
- Can you describe some real-life applications that involve the Pythagorean Theorem and trigonometric ratios?
- Can you use the law of sines and the law of cosines to solve problems?
- Can you use trigonometric ratios to solve problems involving right triangles?
- Can you use the relationship between sine and cosine of complementary angles to solve problems?
- Can you use the definitions, properties, and theorems about circles, such as inscribed and central angles, radii, diameters, chords, arcs, tangents, secants, circumference, and area?
- Can you derive and use the formula for the arc length and the sector area of a circle?
- Can you use definitions and properties of the coordinate plane (e.g., quadrants)?
- Can you derive the equation of a circle given its graph in the coordinate plane?
- Can you find the center and radius of a circle from a given equation?
- Can you compute the perimeter of a polygon and the area of a triangle and a quadrilateral using coordinates?

- Can you solve perimeter and area problems involving plane figures either directly or by decomposing into familiar shapes?
- Can you calculate the changes in perimeter and area when the dimensions of a polygon are changed?
- Can you use coordinates to compute the length or the midpoint of a line segment?
- Can you use coordinates to find the point on a line segment that partitions the segment in a given ratio?
- Can you use coordinates to compute the slope of a line, given the end points?
- Can you use the slope criteria for parallel and perpendicular lines graphed in the coordinate plane?
- Can you apply the correct formula to compute the surface area and volume of prisms, cylinders, pyramids, cones, and spheres?
- Can you identify 2-dimensional cross sections of 3-dimensional shapes?
- Can you use 2-dimensional (nets) to represent 3-dimensional objects?
- Can you calculate the changes in surface area and volume when the dimensions of a solid are changed?

IV. Statistics & Probability

A. Statistics & Probability

1. Understands how to make inferences and justify conclusions from samples, experiments, and observational studies
   a. Uses statistics to make inferences about population parameters based on a sample from that population
   b. Identifies the purposes of and differences among sample surveys, experiments, and observational studies and explains how randomization relates to each
   c. Uses data from a sample survey to estimate a population mean or proportion
   d. Uses data from a randomized experiment to compare two treatments
2. Understands how to summarize, represent, and interpret data collected from measurements on a single variable (e.g., boxplots, dot plots, normal distributions)
   a. Represents and interprets data with plots on the real number line (e.g., dot plots, histograms, boxplots)
   b. Computes the center (e.g., median, mean) and spread (e.g., interquartile range, standard deviation) for a data set
   c. Uses statistics appropriate to the shape of the data distribution to compare center (e.g., median, mean) and spread (e.g., interquartile range, standard deviation) of two or more different data sets

   d. Interprets differences in shape, center, and spread in the context of the data sets, accounting for possible effects of outliers

3. Understands how to summarize, represent, and interpret data collected from measurements on two variables, either categorical or quantitative (e.g., scatterplots, time series)
   a. Summarizes and interprets categorical data for two categories in two-way frequency tables (e.g., joint, marginal, conditional relative frequencies)
   b. Identifies possible associations and trends in the data
   c. Represents and interprets data for two quantitative variables on a scatterplot and describes how the variables are related
4. Understands how to create and interpret linear regression models (e.g., rate of change, intercepts, correlation coefficient)
   a. Uses technology to fit a function to data (i.e., linear regression) and determines a linear correlation coefficient
   b. Uses functions fitted to data to solve problems in the context of the data
   c. Assesses the fit of a function by plotting and analyzing residuals
   d. Interprets the slope and the intercept of a regression line in the context of the data
   e. Interprets a linear correlation coefficient
   f. Distinguishes between correlation and causation
5. Understands the concept of independence and understands how to compute probabilities of simple events, probabilities of compound events, and conditional probabilities
   a. Describes events as subsets of a sample space using characteristics of the outcomes or as unions, intersections, or complements of other events
   b. Determines and interprets when two events are independent
   c. Identifies and applies the concepts of conditional probability and independence
   d. Calculates probabilities of simple and compound events
   e. Constructs and interprets two-way frequency tables of data when two categories are associated with each object being classified; uses the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities

f. Applies the addition rule, $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ and interprets it in terms of a given model

g. Applies the general multiplication rule in a uniform probability model, $P(A \cap B) = P(A)P(B \mid A) = P(B)P(A \mid B)$ and interprets it in terms of a given model

6. Understands how to find probabilities involving finite sample spaces and independent trials
   a. Uses the fundamental counting principle to find probabilities involving finite sample spaces and independent trials
   b. Uses counting techniques (e.g., permutations, combinations) to solve problems
7. Knows how to make informed decisions using probabilities and expected values
   a. Interprets a probability distribution for a random variable, defined for a sample space in which theoretical probabilities can be calculated, and finds the expected value
   b. Interprets a probability distribution for a random variable, defined for a sample space in which probabilities are assigned empirically, and finds the expected value
   c. Weighs the possible outcomes of a decision by assigning probabilities to outcomes and finding expected values
8. Understands normal distributions
   a. Identifies whether data sets are normally distributed based on their shape
   b. Uses the mean and standard deviation of a normal distribution to interpret population percentages
   c. Estimates and interprets areas under the normal curve

Discussion areas: Probability and Statistics

- Can you recognize the purposes of and difference among samples, experiments, and observational studies?
- Can you create graphs such as histograms, line graphs, bar graphs, dot plots, circle graphs, scatterplots, stem-and-leaf plots, and boxplots from a given set of data?
- Can you understand and interpret simple diagrams of data sets presented in various forms, including tables, charts, histograms, line graphs, bar graphs, dot plots, circle graphs, scatterplots, stem-and-leaf plots, timelines, number lines, and boxplots?
- Can you determine measures of center (mean, median) and spread (interquartile range, standard deviation) for single-variable data presented in a variety of formats?
- Can you determine the differences between mean, median, and mode, including advantages and disadvantages of each?

- Can you identify possible effects of outliers on the shape, center, and spread of data sets?
- Can you calculate the interquartile range and standard deviation of a data set and use these values to compare the spread of two or more data sets?
- Can you analyze data presented in scatterplots and use this to predict associations or trends between two variables?
- Can you construct and interpret two-way frequency tables?
- Can you calculate the correlation coefficient between two variables and discuss the possibility of causation, causation by a third event, and coincidence?
- Can you use the correlation coefficient and explain what various values of that number mean?
- Can you use functions fitted to data to solve problems?
- Can you analyze and interpret unions, intersections, complements, and differences of sets given descriptions and/or Venn diagrams?
- Can you compute the probability of a single outcome occurring, one of multiple outcomes occurring, or an outcome occurring given certain conditions?
- Can you calculate conditional probabilities and understand the idea of independent events?
- Can you determine the expected gain or loss in a game of chance?
- Can you use counting techniques such as permutations and combinations to determine the number of outcomes in a given scenario or situation?
- Can you use appropriate counting principles to determine probabilities?
- Can you calculate a probability distribution and graph this distribution?
- Can you estimate areas under normal curves?

Tasks of Teaching Mathematics

This list includes instructional tasks that teachers engage in that are essential for effective teaching of secondary school mathematics. Approximately 25% of test questions will measure content knowledge by assessing how that content knowledge is applied in the context of one or more of these tasks.

Mathematical explanations, justifications, and definitions

1. Identifies valid explanations of mathematical concepts (e.g., explaining why a mathematical idea is considered to be true), procedures, representations, or models
2. Evaluates or compares explanations and justifications for their validity, generalizability, coherence, or precision, including identifying flaws in explanations and justifications
3. Determines the changes that would improve the validity, generalizability, coherence, and/or precision of an explanation or justification
4. Evaluates whether counterarguments address a critique of a given justification
5. Evaluates definitions or other mathematical language for validity, generalizability, precision, usefulness in a particular context, or support of key ideas

Mathematical problems, tasks, examples, and procedures

6. Identifies problems or tasks that fit a particular structure, address the same concept, demonstrate desired characteristics, or elicit particular student thinking
7. Identifies two or more problems that systematically vary in difficulty or complexity
8. Evaluates the usefulness of examples for introducing a concept, illustrating an idea, or demonstrating a strategy, procedure, or practice
9. Identifies examples that support particular strategies or address particular student questions, misconceptions, or challenges with content
10. Identifies no examples or counterexamples that highlight a mathematical distinction or demonstrate why a student conjecture is incorrect or partially incorrect
11. Evaluates procedures for working with mathematics content to identify special cases in which the procedure might be problematic or for validity, appropriateness, or robustness

Mathematical representations, models, manipulatives, and technology

12. Evaluates representations and models (e.g., concrete, pictorial) in terms of validity, generalizability, usefulness for supporting students' understanding, or fit to the concept, calculation, etc. to be represented
13. Evaluates how representations and models (e.g., concrete, pictorial) have been used to show particular ideas, relationships between ideas, processes, or strategies
14. Evaluates the use of technology (e.g., graphing tools, software) for its appropriateness or its support of key ideas

Students' mathematical reasoning

15. Identifies likely misconceptions about or partial understanding of particular mathematics content and practices
16. Identifies how new mathematics content and practices can build on or connect to students' prior knowledge, including misconceptions and errors
17. Evaluates or compares student work (e.g., solutions, explanations, justifications, representations) in terms of validity, generalizability, coherence, and/or precision
18. Evaluates student work to identify the use of a particular concept, idea, or strategy
19. Identifies how a student's reasoning would replicate across similar problems
20. Identifies different pieces of student work that demonstrate the same reasoning
21. Identifies situations in which student work that seems valid might mask incorrect thinking

Mathematics (5165) Sample Test Questions

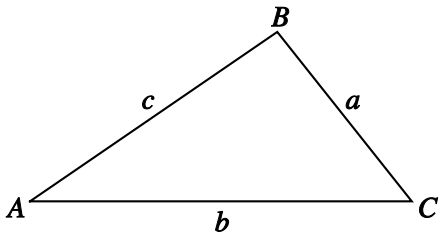
NOTATIONS

(a, b)	$\{x : a < x < b\}$
$[a, b)$	$\{x : a \le x < b\}$
$(a, b]$	$\{x : a < x \le b\}$
$[a, b]$	$\{x : a \le x \le b\}$
$\gcd(m, n)$	greatest common divisor of two integers m and n
$\text{lcm}\,(m, n)$	least common multiple of two integers m and n
$[x]$	greatest integer m such that $m \le x$
$m \equiv k \pmod{n}$	m and k are congruent modulo n (m and k have the same remainder when divided by n, or equivalently, $m - k$ is a multiple of n)
f^{-1}	Inverse of an invertible function f; (not to be read as $\frac{1}{f}$)
$\lim_{x \to a^+} f(x)$	right-hand limit of $f(x)$; limit of $f(x)$ as x approaches a from the right
$\lim_{x \to a^-} f(x)$	left-hand limit of $f(x)$; limit of $f(x)$ as x approaches a from the left
$\varnothing$	the empty set
$x \in S$	x is an element of set S
$S \subset T$	set S is a proper subset of set T
$S \subseteq T$	either set S is a proper subset of set T or $S = T$
$\overline{S}$	complement of set S; the set of all elements not in S that are in some specified universal set
$T \setminus S$	relative complement of set S in set T, i.e., the set of all elements of T that are not elements of S
$S \cup T$	union of sets S and T
$S \cap T$	intersection of sets S and T

FORMULAS

Range of Inverse Trigonometric Functions

$\sin^{-1} x$	$\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$
$\cos^{-1} x$	$\left[0, \pi\right]$
$\tan^{-1} x$	$\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$



Law of Sines

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

Law of Cosines

$$c^2 = a^2 + b^2 - 2ab\left(\cos C\right)$$

Volume

Sphere with radius *r*: $V = \frac{4}{3}\pi r^3$

Right circular cone with height *h* and base of radius *r*: $V = \frac{1}{3}\pi r^2 h$

Right circular cylinder with height *h* and base of radius *r*: $V = \pi r^2 h$

Pyramid with height *h* and base of area *B*: $V = \frac{1}{3}Bh$

Right prism with height *h* and base of area *B*: $V = Bh$

Surface Area

Sphere with radius r: $A = 4\pi r^2$

Right circular cone with radius r and slant height s: $A = \pi rs + \pi r^2$

Differentiation

$$\big(f(x)g(x)\big)' = f'(x)g(x) + f(x)g'(x)$$

$$\big(f(g(x))\big)' = f'\big(g(x)\big)g'(x)$$

$$\left(\frac{f(x)}{g(x)}\right)' = \frac{f'(x)g(x) - f(x)g'(x)}{\big(g(x)\big)^2} \text{ if } g(x) \neq 0$$

Sample Test Questions

The sample questions that follow are examples of the kinds of questions that are on the test. They are not, however, representative of the entire scope of the test in either content or difficulty. Answers with explanations follow the questions.

Directions: Select the best answer or answers for each question below.

1. If x and y are even numbers and $z = 2x^2 + 4y^2$, then the greatest even number that must be a divisor of z is

   (A) 2
   (B) 4
   (C) 8
   (D) 16

2. What is the units digit of 33^{408} ?

   (A) 1
   (B) 3
   (C) 7
   (D) 9

3. Jerry is 50 inches tall and is growing at the rate of $\frac{1}{24}$ inch per month. Adam is 47 inches tall and is growing at the rate of $\frac{1}{8}$ inch per month. If they each continue to grow at these rates for the next four years, after how many months will they be the same height?

   (A) 24
   (B) 30
   (C) 36
   (D) 42

4. **For the following question, select <u>all</u> the answer choices that apply.**

Three students found the correct solution to the equation $4(5x-11)=16$, but they used different methods to solve the equation.

Which of the following student methods are valid strategies for solving the equation?

Select **<u>ALL</u>** that apply.

(A)
$$4(5x-11)=16$$
$$\frac{1}{\cancel{4}}\times\cancel{4}\times(5x-11)=16\times\frac{1}{4}$$
$$5x-11=4$$
$$5x=15$$
$$x=3$$

(B)
$$4(5x-11)=16$$
$$\frac{20x}{20}-\frac{44}{20}=\frac{16}{20}$$
$$\frac{20x}{20}-\frac{44}{20}+\frac{44}{20}=\frac{16}{20}+\frac{44}{20}$$
$$x=\frac{60}{20}$$
$$x=3$$

(C)
$$4(5x-11)=16$$
$$\frac{\cancel{4}}{\cancel{4}}\left(\frac{5x}{4}-\frac{11}{4}\right)=\frac{16}{4}$$
$$\frac{5x}{4}-\frac{11}{4}+\frac{11}{4}=\frac{16}{4}+\frac{11}{4}$$
$$\frac{5x}{4}=4+\frac{11}{4}$$
$$\frac{5x}{4}=\frac{15}{4}$$
$$\frac{4}{5}\times\frac{5x}{4}=\frac{4}{5}\times\frac{15}{4}$$
$$x=3$$

5. Ms. Quinn asked her students to solve the following quadratic equation.

$$3x^2 - 6x - 24 = 0$$

The following is Maurice's solution.

$$3x^2 - 6x = 24$$
$$x^2 - 2x = 8$$
$$x(x - 2) = 8$$
$$x = 4 \text{ or } x = -2$$

When Ms. Quinn asked Maurice to explain his method, Maurice said, "The only pairs of numbers that are 2 apart and their product is 8 are 2 and 4, and -2 and -4. When you substitute these numbers in the last equation, you find out that only $x = 4$ and $x = -2$ work."

Which of the following statements best characterizes Maurice's approach to this problem?

(A) Maurice's method is wrong because you cannot solve an equation by factoring unless one side of the equation is equal to zero.
(B) Maurice's method is wrong because he should have first divided by 3 and then factored the left side of the equation.
(C) Maurice's method is correct, but his method often results in an equation that cannot be solved by inspection (that is, by reasoning about the factors of the constant term in the resulting equation).
(D) Maurice's method is correct, and his method always results in an equation that can be solved by inspection (that is, by reasoning about the factors of the constant term in the resulting equation).

6. **For the following question, select <u>all</u> the answer choices that apply.**

Three students found the correct equation when asked to write an equation of the linear function represented in the following table, but they gave different explanations when describing their strategies to the class.

x	y
1	6
2	11
3	16
4	21

Which of the following student explanations provide evidence of a mathematically valid strategy for finding an equation of the linear function?

Select **<u>ALL</u>** that apply.

(A) Each time the value of x goes up by 1, the value of y goes up by 5, so the slope is 5. And if x goes down by 1 from 1 to 0, then y will go down by 5 from 6 to 1, so the y-intercept is 1. That means the equation is $y = 5x + 1$.

(B) The equation is $y = mx + b$. I just looked at the value of x and saw that it kept increasing by 1, and I looked at the value of y and saw that it kept increasing by 5, so $m = 5$. In the equation $y = 5x + b$, I substituted 1 for x and 6 for y and got that $b = 1$. The equation is $y = 5x + 1$.

(C) For this function, I saw that you can always multiply the value of x by 5 and then add 1 to get the value of y, so the equation is $y = 5x + 1$.

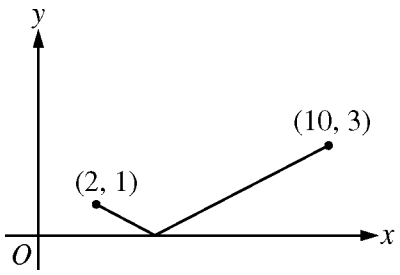
7. If $y = 5\sin x - 6$, what is the maximum value of y?

(A) −6
(B) −1
(C) 1
(D) 5

8. If $f(x) = 3x^2$, what are all real values of a and b for which the graph of $g(x) = ax^2 + b$ is below the graph of $f(x)$ for all values of x?

(A) $a \geq 3$ and b is positive.
(B) $a \leq 3$ and b is negative.
(C) a is negative and b is positive.
(D) a is any real number and b is negative.

9. **For the following question, enter your answer in the answer boxes.**



The graph of the function $f(x) = a|x - b|$ on the closed interval $[2, 10]$ is shown in the preceding *xy*-plane. What is the value of *a* ?

Give your answer as a fraction.

$$\frac{\square}{\square}$$

10. $$P(t) = 250 \cdot (3.04)^{\frac{t}{1.98}}$$

On January 1, 2010, the population of rabbits in a wooded area was 250. The preceding function was used to model the approximate population, *P*, of rabbits in the area *t* years after January 1, 2010. According to this model, which of the following best describes how the rabbit population changed in the area?

(A) The rabbit population doubled approximately every 4 months.
(B) The rabbit population tripled approximately every 6 months.
(C) The rabbit population doubled approximately every 36 months.
(D) The rabbit population tripled approximately every 24 months.

11. **For the following question, enter your answer in the answer box.**

If $3^{\log_3 2} + 5^{\log_5 9} = 8^{\log_8 x}$, what is the value of *x* ?

$x = \square$

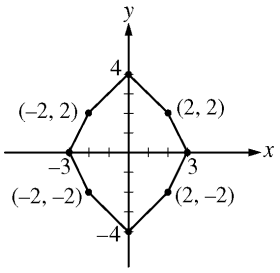
12. If $\lim_{x \to c} f(x) = 0$ and $\lim_{x \to c} g(x) = 0$, what can be concluded about the value of $\lim_{x \to c} \frac{f(x)}{g(x)}$?

(A) The value is not finite.
(B) The value is 0.
(C) The value is 1.
(D) The value cannot be determined from the information given.

13. In a certain chemical reaction, the number of grams, *N*, of a substance produced *t* hours after the reaction begins is given by $N(t) = 16t - 4t^2$, where $0 < t < 2$. At what instantaneous rate, in grams per hour, is the substance being produced 30 minutes after the reaction begins?

(A) 7
(B) 12
(C) 16
(D) 20

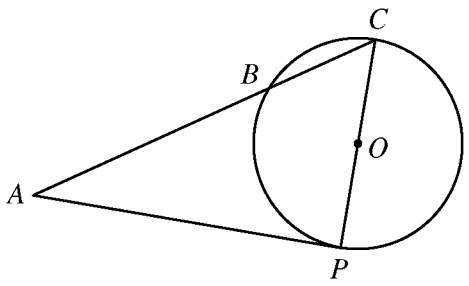
14.



For how many angles θ, where $0 < \theta \leq 2\pi$, will a rotation counterclockwise about the origin by angle θ map the octagon in the preceding figure onto itself?

(A) One
(B) Two
(C) Four
(D) Eight

15.



In the preceding circle with center *O* and radius 2, tangent $\overline{AP}$ has length 3 and is tangent to the circle at *P*. If $\overline{CP}$ is a diameter of the circle, what is the length of $\overline{BC}$?

(A) 1.25
(B) 2
(C) 3.2
(D) 5

16. The measures of the hand spans of ninth-grade students at Tyler High School are approximately normally distributed, with a mean of 7 inches and a standard deviation of 1 inch. Of the following, which group is expected to have the greatest percent of measures?

(A) The group of handspun measures that are less than 6 inches
(B) The group of handspun measures that are greater than 7 inches
(C) The group of handspun measures that are between 6 and 8 inches
(D) The group of handspun measures that are between 5 and 7 inches

17. A two-sided coin is unfairly weighted so that when it is tossed, the probability that heads will result is twice the probability that tails will result. If the coin is to be tossed 3 separate times, what is the probability that tails will result on exactly 2 of the tosses?

(A) $\frac{2}{9}$
(B) $\frac{3}{8}$
(C) $\frac{4}{9}$
(D) $\frac{2}{3}$

Sample Test Answers

1. The correct answer is (C). Since 2 is a divisor of both $2x^2$ and $4y^2$, it follows that 2 is a divisor of z. To find out if there is a greater even number that must be a divisor of z, consider the additional information given, which is that x and y are both even numbers. Since x and y are even numbers, they can be expressed as $x = 2m$ and $y = 2n$, respectively, where m and n can be either odd or even integers. Substituting these values for x and y into the expression for z yields $z = 2(2m)^2 + 4(2n)^2$. It follows then that $z = 8m^2 + 16n^2$ and that 8 is a divisor of z. The number 16 would also be a divisor of z if m is even but not if m is odd. Since m and n can be either even or odd and the question asks for the largest even number that must be a divisor of z, the correct answer is (C), 8.

Topic	I. Number & Quantity and Algebra
Subtopic	A. Number & Quantity

2. The correct answer is (A). To find the units digit of 33^{408}, it is helpful to find the first few integer powers of 33 and look for a pattern. For example,

$33^1 = 33$

$33^2 = 1{,}089$

$33^3 = 35{,}937$

$33^4 = 1{,}185{,}921$

$33^5 = 39{,}135{,}393$

$33^6 = 1{,}291{,}467{,}969$

The pattern in the units digit is 3, 9, 7, 1, 3, 9, ... The pattern will continue to repeat with every four integers of the exponent. Dividing 408 by 4 yields 102 with no remainder. Therefore, the units digit of 33^{408} will be the same as the units digit of 33^4, which is 1. So, the correct answer is (A).

Topic	I. Number & Quantity and Algebra
Subtopic	A. Number & Quantity

3. The correct answer is (C). The heights in this question can be expressed as two linear equations. Jerry's height in inches, J, can be expressed as $J = 50 + \frac{1}{24}m$, where m is the number of months from now. Adam's height in inches, A, can be expressed as $A = 47 + \frac{1}{8}m$. The question asks, "after how many months will they be the same height?" This is the same as asking, "for what value of m will $J = A$?" The solution can be found by solving $50 + \frac{1}{24}m = 47 + \frac{1}{8}m$ for m, as shown below.

$$50 + \frac{1}{24}m = 47 + \frac{1}{8}m$$
$$50 - 47 = \left(\frac{1}{8} - \frac{1}{24}\right)m$$
$$3 = \left(\frac{3}{24} - \frac{1}{24}\right)m$$
$$3 = \frac{1}{12}m$$
$$m = 36$$

So the correct answer is (C), 36 months.

Topic	I. Number & Quantity and Algebra
Subtopic	B. Algebra

4. The correct answers are (A) and (B).
Choice (A): The student method is valid. The student first multiplies both sides of the equation by $\frac{1}{4}$ then adds 11 to both sides of the equation and then divides both sides of the equation by 5.
Choice (B): The student method is valid. The student correctly uses the distributive property on the left-hand side of the equation, then divides both sides of the equation by 20, and lastly adds $\frac{44}{20}$ to both sides of the equation.
Choice (C): The student method is not valid. There are two errors. The first error is in the transition from the first line to the second line, where the student incorrectly indicates that $\frac{4(5x-11)}{4}$ is equivalent to $\frac{4}{4}\left(\frac{5x}{4}-\frac{11}{4}\right)$. The second error is in the transition from the third line to the fourth line, where the student incorrectly indicates that $4+\frac{11}{4}$ is equivalent to $\frac{4+11}{4}$.

Task of Teaching	17. Evaluates or compares student work (e.g., solutions, explanations, justifications, representations) in terms of validity, generalizability, coherence, and/or precision
Topic	I. Number & Quantity and Algebra
Subtopic	B. Algebra

5. The correct answer is (C). All the steps in Maurice's strategy are correct, so Maurice's method is correct. However, his method often results in an equation that cannot be solved by reasoning about the factors of the constant term in the resulting equation. For example, if Ms. Quinn started with another equation, such as $3x^2-6x-21=0$, Maurice's method would arrive at the equivalent equation $x(x-2)=7$, which cannot be solved by reasoning about the factors of 7.

Task of Teaching	17. Evaluates or compares student work (e.g., solutions, explanations, justifications, representations) in terms of validity, generalizability, coherence, and/or precision
Topic	I. Number & Quantity and Algebra
Subtopic	B. Algebra

6. The correct answers are (A), (B), and (C). The question presented to the students involves a table of *x*- and *y*-values, where the ratio of the change in *y*-values to the change in *x*-values is constant, which means there is a linear equation represented by the table of values that can be written in standard form, $y = mx + b$, where *m* is the slope and $(0, b)$ is the *y*-intercept. It remains to calculate the slope and the *y*-intercept, since neither is given directly.

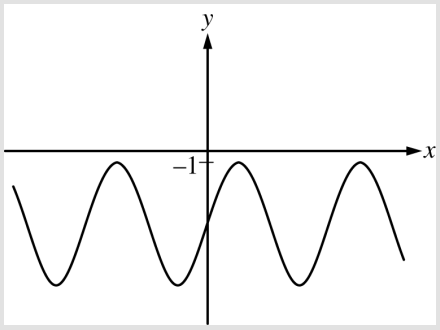
   Choice (A): This student correctly looks at the change in *x* and the change in *y* to find the slope of the line that passes through the points in the table. Since the ratio is a constant value of 5, the student concludes that this is the value for *m* in the standard form $y = mx + b$. Then the student determines the *y*-intercept by finding the value of *y* when *x* is equal to zero by subtracting 1 from the first *x*-value in the table and 5 from the corresponding *y*-value. The student concludes that the *y*-intercept is $(0, 1)$ and replaces *b* with 1. The explanation provides evidence of a mathematically valid strategy for finding an equation of the linear function.

   Choice (B): This student correctly looks at the change in *x* and the change in *y* to find the slope of the line that passes through the points in the table. Since the ratio is a constant value of 5, the student concludes that this is the value for *m* in the standard form $y = mx + b$ Then the student uses $(1, 6)$, the first pair of *x*- and *y*-values in the table; substitutes *x* with 1 and *y* with 6 in the equation $y = 5x + b$; and concludes that the value of *b* is 1. The explanation provides evidence of a mathematically valid strategy for finding an equation of the linear function.

   Choice (C): This student notices a consistent relationship between the values of *x* and *y* throughout the table and is able to find by inspection an equation that shows this relationship. Presumably, given another table for a different linear function, this student would also look for the pattern and would be able to come up with the appropriate equation. The explanation provides evidence of a mathematically valid strategy for finding an equation of the linear function.

Task of Teaching	17. Evaluates or compares student work (e.g., solutions, explanations, justifications, representations) in terms of validity, generalizability, coherence, and/or precision
Topic	I. Number & Quantity and Algebra
Subtopic	B. Algebra

7. The correct answer is (B). There are two ways to answer this question. The first solution is based on reasoning about the function $f(x) = \sin x$. First recall that the maximum value of $\sin x$ is 1, and, therefore, the maximum value of $5\sin x$ is 5. The maximum value of $y = 5\sin x - 6$ is then $5 - 6 = -1$. Alternatively, graph the function $y = 5\sin x - 6$ and find the maximum value of *y* from the graph.

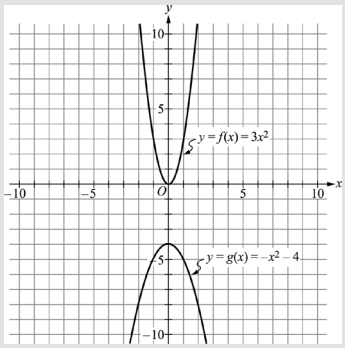


The maximum value is -1, and the correct answer is (B).

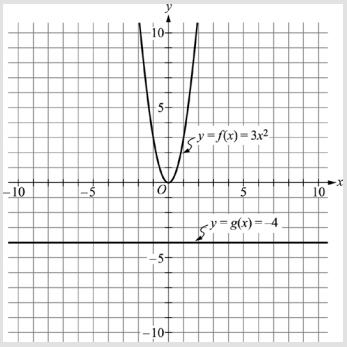
Topic	II. Functions and Calculus
Subtopic	A. Functions

8. The correct answer is (B). Since the graph of function *g* is below the graph of function *f* for all values of *x*, then $ax^2 + b < 3x^2$ for all values of *x*; that is, $(a-3)x^2 + b < 0$ for all values of *x*. In particular, substituting 0 for *x* in the last inequality gives $(a-3)(0) + b < 0$, or $b < 0$, so *b* is negative. If *a* were greater than 3, then the graph of $y = (a-3)x^2 + b$ would be a parabola that opens upward and there would be values of *x* that would make $(a-3)x^2 + b$ positive, which contradicts the information that $(a-3)x^2 + b < 0$ for all values of *x*; this contradiction means that $a \le 3$ must be true. Therefore, the correct answer is (B). An alternate solution is as follows. Note that the graphs of *f* and *g* are parabolas in the *xy*-plane, with the *y*-axis as the common line of symmetry. (The graph of *g* degenerates to a horizontal line when $a = 0$.)

When *b* is negative, the vertex of the parabola $y = g(x)$ is lower than the vertex of the parabola $y = f(x)$. When *b* is negative and *a* is negative, the graph of *g* is a parabola in the third and fourth quadrants that opens downwards, so it's always under the graph of *f*, which is a parabola in the first and second quadrants that opens upwards. See the following graph of $f(x) = 3x^2$ and $g(x) = -x^2 - 4$.

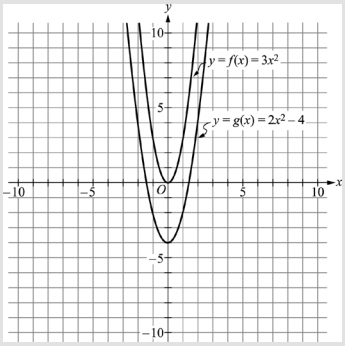


When *b* is negative and $a = 0$, the graph of *g* is a horizontal line in the third and fourth quadrants, so it's always under the graph of *f*, which is a parabola in the first and second quadrants that opens upwards. See the following graph of $f(x) = 3x^2$ and $g(x) = -4$.

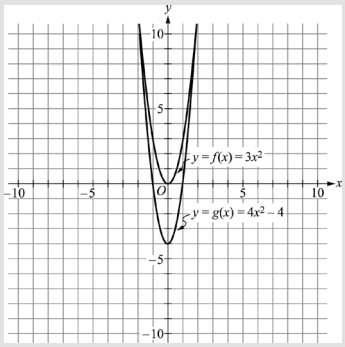


When *b* is negative and $0 < a \le 3$, the graph of *g* is a parabola that opens upwards and that grows wider

horizontally more than or at the same rate as the parabola representing the graph of *f*; since the vertex for *g* is lower than the vertex for *f*, the two parabolas do not intersect and the graph of *g* is always below the graph of *f*. See the following graph of $f(x) = 3x^2$ and $g(x) = 2x^2 - 4$.



When *b* is negative and $a > 3$, the vertex for *g* is lower than the vertex for *f* and the parabola $y = f(x)$ grows wider horizontally than the parabola $y = g(x)$, so the two parabolas intersect at two points; therefore, the graph of *g* is not always below the graph of *f*. See the following graph of $f(x) = 3x^2$ and $g(x) = 4x^2 - 4$.



So, the correct answer is (B).

Topic	II. Functions and Calculus
Subtopic	A. Functions

9. The correct answer is $\frac{1}{2}$. The graph of the function *f* consists of two line segments that have a common endpoint at the point $(b, 0)$ on the *x*- axis. Since the graph of $y = f(x)$ lies on or above the *x*-axis, *a* is positive. The slope of the left line segment [with endpoints at $(2, 1)$ and $(b, 0)$] is $-a$, and the slope of the right line segment [with endpoints at $(b, 0)$ and $(10, 3)$] is *a*. Therefore,

$$a = -\frac{0-1}{b-2} = \frac{3-0}{10-b}$$

Solving for *b* gives $b = 4$, which implies that $a = \frac{1}{2}$

Topic	II. Functions and Calculus
Subtopic	A. Functions

10. The correct answer is (D). The question asks for a verbal description of the change in the rabbit population, based on the function given. Recall the meaning of the base (growth factor) and the exponent in an exponential growth model. Note that $P(t) = 250 \cdot (3.04)^{\frac{t}{1.98}} \approx 250 \cdot 3^{\frac{t}{2}}$. Observe from this approximation, with base 3 and exponent $\frac{t}{2}$, that the population tripled approximately every two years. In fact, $(3.04)^{\frac{2}{1.98}} \approx 3.07$, so the population tripled in a time period of a little less than 2 years. Thus, the correct answer is (D), "The rabbit population tripled approximately every 24 months."

Topic	II. Functions and Calculus
Subtopic	A. Functions

11. The correct answer is 11. Recall that logarithmic functions are the inverse functions of exponential functions and that, more specifically, we have the identity $a^{\log_a b} = b$ for any positive numbers a and b, where $a \neq 1$. Since $3^{\log_3 2} = 2$, $5^{\log_5 9} = 9$, and $8^{\log_8 x} = x$, the equation in the problem is equivalent to $2 + 9 = x$. Therefore, the value of x is 11.

Topic	II. Functions and Calculus
Subtopic	A. Functions

12. The correct answer is (D). Although both f and g have the limit 0 as $x \to 0$, one function might be approaching 0 more quickly than the other, which would affect the value of the limit of the quotient. For example, if one of the functions is x and the other is x^2, then the quotient is either x or $\frac{1}{x}$, and so the limit of the quotient is either 0 or nonexistent, respectively. In fact, the value of the limit can be any nonzero real number b, as shown by $\lim_{x \to 0} \frac{bx}{x} = b$. Thus, answer choices (A), (B), and (C) are incorrect and the correct answer is (D).

Topic	II. Functions and Calculus
Subtopic	B. Calculus

13. The correct answer is (B). The instantaneous rate of change in the number of grams of substance produced 30 minutes after the reaction begins is the value of the first derivative of N evaluated at 30 minutes. First convert 30 minutes into hours, then evaluate the first derivative of N at that value of t. Since 30 minutes equals $\frac{1}{2}$ hour, you will need to evaluate $N'\left(\frac{1}{2}\right)$. Then find $N'(t)$.

$$N'(t) = 16 - 8t$$

Therefore, $N'\left(\frac{1}{2}\right) = 16 - 8\left(\frac{1}{2}\right) = 12$. The answer is 12 grams per hour, so the correct answer is (B).

Topic	II. Functions and Calculus
Subtopic	B. Calculus

14. The correct answer is (B). To begin, consider a single point on the octagon, such as the point $(0,4)$ at the top of the octagon in the figure. This point is 4 units from the origin, so any counterclockwise rotation about the origin that maps the octagon onto itself would need to map this point onto a point that is also 4 units from the origin. The only other point on the octagon that is 4 units from the origin is the point $(0, -4)$. A counterclockwise rotation about the origin of angle $\theta = \pi$ would map the point $(0,4)$ onto the point $(0, -4)$. The octagon is symmetric about the x- and y-axes, so a rotation of angle $\theta = \pi$ would map all of the points of the octagon onto corresponding points of the octagon.

Likewise, a counterclockwise rotation about the origin of angle $\theta = 2\pi$ would map the point $(0,4)$ onto itself (and map all other points of the octagon onto themselves). No other values of θ such that $0 < \theta \leq 2\pi$ would map the octagon onto itself. Therefore, the correct answer is two, choice (B).

Topic	III. Geometry
Subtopic	A. Geometry

15. The correct answer is (C). To determine the length of $\overline{BC}$, it would be helpful to first label the figure with the information given. Since the circle has radius 2, then both $\overline{OC}$ and $\overline{OP}$ have length 2 and $\overline{CP}$ has length 4. $\overline{AP}$ is tangent to the circle at *P*, so angle *APC* is a right angle. The length of $\overline{AP}$ is given as 3. This means that triangle *ACP* is a 3-4-5 right triangle and $\overline{AC}$ has length 5. Notice that since $\overline{CP}$ is a diameter of the circle, angle *CBP* is also a right angle. Angle *BCP* is in both triangle *ACP* and triangle *PCB*, and, therefore, the two triangles are similar. Then find the length of $\overline{BC}$ by setting up a proportion between the corresponding parts of the similar triangles as follows:

$$\frac{CP}{AC} = \frac{BC}{PC}$$

$$\frac{4}{5} = \frac{BC}{4}$$

$$BC = \frac{16}{5} = 3.2$$

An alternate solution is to apply the tangent-secant theorem, which states that the square of the length of tangent $\overline{AP}$ equals the product of the lengths of the secants $\overline{AB}$ and $\overline{AC}$. That is, $AP^2 = AB \times AC$. It was already established that $AC = 5$. If *x* represents the length of $\overline{BC}$, then $AB = AC - BC = 5 - x$. Substituting $AP = 3$, $AB = 5 - x$, and $AC = 5$ in $AP^2 = AB \times AC$ results in the equation $3^2 = (5 - x)5$ with solution $x = 3.2$. The correct answer is (C), 3.2.

Topic	III. Geometry
Subtopic	A. Geometry

16. The correct answer is (C). Recall that approximately 68% of a normally distributed set of data lie within ± 1 standard deviation of the mean and approximately 95% of the data lie within ± 2 standard deviations of the mean. Evaluate each answer choice in order to determine which of the groups has the greatest percent. Choice (A): Since the mean handspun is 7 inches and the standard deviation is 1 inch, the group of handspun measures that are less than 6 inches is the group that is more than 1 standard deviation less than the mean. The group of handspun measures that are less than 7 inches includes 50% of the measures. Approximately 34 percent ($\frac{1}{2}$ of 68 percent) of the measures are between 6 inches and 7 inches (within 1 standard deviation less than the mean). So, the group with handspun measures less than 6 inches would be approximately equal to $50\% - 34\%$, or 16% of the measures.

Choice (B): Since 7 inches is the mean, approximately 50% of the measures are greater than the mean.
Choice (C): This is the group that is within ± 1 standard deviation of the mean. This group contains approximately 68% of the measures.

Choice (D): This group is between the mean and 2 standard deviations less than the mean. Approximately 47.5% ($\frac{1}{2}$ of 95%) of the measures are between 5 inches and 7 inches.

Of the answer choices given, the group described in (C) is expected to contain the greatest percent of the measures, approximately 68%, so (C) is the correct answer.

Topic	IV. Statistics & Probability
Subtopic	A. Statistics & Probability

17. The correct answer is (A). Because each toss of the coin is an independent event, the probability of tossing heads and then 2 tails, $P(HTT)$, is equal to $P(H)\cdot P(T)\cdot P(T)$, where $P(H)$ is the probability of tossing heads and $P(T)$ is the probability of tossing tails. The probability of tossing heads is twice the probability of tossing tails, so $P(H)=\frac{2}{3}$ and $P(T)=\frac{1}{3}$ Therefore, $P(HTT)=\left(\frac{2}{3}\right)\left(\frac{1}{3}\right)\left(\frac{1}{3}\right)=\frac{2}{27}$ There are 3 ways in which exactly 2 of 3 tosses would be tails, and each of them has an equal probability of occurring:

$P(THT)=P(TTH)=P(HTT)=\frac{2}{27}$

Therefore, the total probability that tails will result exactly 2 times in 3 tosses is $3\left(\frac{2}{27}\right)=\frac{2}{9}$

An alternate solution is to use the binomial probability formula $P(k \text{ out of } n)=\binom{n}{k}p^k(1-p)^{n-k}$, which computes the probability of getting exactly k successes in n independent trials of a binomial experiment in which each trial has two possible outcomes (success and failure), the probability of success in each trial is p, and the probability of failure in each trial is $1-p$. In this problem, $n=3$, $k=2$, and $p=\frac{1}{3}$, so the probability that tails will result on exactly 2 of the 3 tosses is $P(2 \text{ out of } 3)=\binom{3}{2}\left(\frac{1}{3}\right)^2\left(\frac{2}{3}\right)^1$, which is equivalent to $3\times\frac{1}{9}\times\frac{2}{3}$ or $\frac{2}{9}$
Therefore, the correct answer is (A).

Topic	IV. Statistics & Probability
Subtopic	A. Statistics & Probability

Understanding Question Types

The *Praxis*® assessments include a variety of question types: constructed response (for which you write a response of your own); selected response, for which you select one or more answers from a list of choices or make another kind of selection (e.g., by selecting a sentence in a text or by selecting part of a graphic); and numeric entry, for which you enter a numeric value in an answer field. You may be familiar with these question formats from taking other standardized tests. If not, familiarize yourself with them so you don't spend time during the test figuring out how to answer them.

Understanding Selected-Response and Numeric-Entry Questions

For most questions, you respond by selecting an oval to select a single answer from a list of answer choices.

However, interactive question types may also ask you to respond by:

- Selecting more than one choice from a list of choices.
- Typing in a numeric-entry box. When the answer is a number, you may be asked to enter a numerical answer. Some questions may have more than one entry box to enter a response.
- Selecting parts of a graphic. In some questions, you will select your answers by selecting a location (or locations) on a graphic such as a map or chart, as opposed to choosing your answer from a list.
- Selecting sentences. In questions with reading passages, you may be asked to choose your answers by selecting a sentence (or sentences) within the reading passage.
- Dragging and dropping answer choices into targets on the screen. You may be asked to select answers from a list of choices and to drag your answers to the appropriate location in a table, paragraph of text or graphic.
- Selecting answer choices from a drop-down menu. You may be asked to choose answers by selecting choices from a drop-down menu (e.g., to complete a sentence).

Remember that with every question you will get clear instructions.

Understanding Constructed-Response Questions

Constructed-response questions require you to demonstrate your knowledge in a subject area by writing your own response to topics. Essays and short-answer questions are types of constructed-response questions.

For example, an essay question might present you with a topic and ask you to discuss the extent to which you agree or disagree with the opinion stated. You must support your position with specific reasons and examples from your own experience, observations, or reading.

Review a few sample essay topics:

- *Brown v. Board of Education of Topeka*

  "We come then to the question presented: Does segregation of children in public schools solely on the basis of race, even though the physical facilities and other 'tangible' factors may be equal, deprive the children of the minority group of equal educational opportunities? We believe that it does."

  A. What legal doctrine or principle, established in *Plessy v. Ferguson* (1896), did the Supreme Court reverse when it issued the 1954 ruling quoted above?
  B. What was the rationale given by the justices for their 1954 ruling?

- *In his self-analysis, Mr. Payton says that the better-performing students say small-group work is boring and that they learn more working alone or only with students like themselves. Assume that Mr. Payton wants to continue using cooperative learning groups because he believes they have value for all students.*

  - Describe **TWO** strategies he could use to address the concerns of the students who have complained.
  - Explain how each strategy suggested could provide an opportunity to improve the functioning of cooperative learning groups. Base your response on principles of effective instructional strategies.

- *"Minimum-wage jobs are a ticket to nowhere. They are boring and repetitive and teach employees little or nothing of value. Minimum-wage employers take advantage of people because they need a job."*

  - Discuss the extent to which you agree or disagree with this opinion. Support your views with specific reasons and examples from your own experience, observations, or reading.

Keep these things in mind when you respond to a constructed-response question:

1. **Answer the question accurately.** Analyze what each part of the question is asking you to do. If the question asks you to describe or discuss, you should provide more than just a list.
2. **Answer the question completely.** If a question asks you to do three distinct things in your response, you should cover all three things for the best score. Otherwise, no matter how well you write, you will not be awarded full credit.
3. **Answer the question that is asked.** Do not change the question or challenge the basis of the question. You will receive no credit or a low score if you answer another question or if you state, for example, that there is no possible answer.
4. **Give a thorough and detailed response.** You must demonstrate that you have a thorough understanding of the subject matter. However, your response should be straightforward and not filled with unnecessary information.
5. **Take notes on scratch paper** so that you don't miss any details. Then you'll be sure to have all the information you need to answer the question.
6. **Reread your response.** Check that you have written what you thought you wrote. Be sure not to leave sentences unfinished or omit clarifying information.

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www.ets.org/praxis/testprep

To purchase official test prep made by the creators of the *Praxis* tests, visit the ETS Store:

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ETS PRAXIS

Measuring the Power of Learning.®

The *Praxis*® Study Companion

Art: Content Knowledge

5134



www.ets.org/praxis

Welcome to *The Praxis® Study Companion*

Prepare to Show What You Know

You have been working to acquire the knowledge and skills you need for your teaching career. Now you are ready to demonstrate your abilities by taking a *Praxis®* test.

Using the *Praxis® Study Companion* is a smart way to prepare for the test so you can do your best on test day. This guide can help keep you on track and make the most efficient use of your study time.

The Study Companion contains practical information and helpful tools, including:

- An overview of the *Praxis* tests
- Specific information on the *Praxis* test you are taking
- A template study plan
- Study topics
- Practice questions and explanations of correct answers
- Test-taking tips and strategies
- Frequently asked questions
- Links to more detailed information

So where should you start? Begin by reviewing this guide in its entirety and note those sections that you need to revisit. Then you can create your own personalized study plan and schedule based on your individual needs and how much time you have before test day.

Keep in mind that study habits are individual. There are many different ways to successfully prepare for your test. Some people study better on their own, while others prefer a group dynamic. You may have more energy early in the day, but another test taker may concentrate better in the evening. So use this guide to develop the approach that works best for you.

Your teaching career begins with preparation. Good luck!

Know What to Expect

Which tests should I take?

Each state or agency that uses the *Praxis* tests sets its own requirements for which test or tests you must take for the teaching area you wish to pursue.

Before you register for a test, confirm your state or agency's testing requirements at www.ets.org/praxis/states.

How are the *Praxis* tests given?

Praxis tests are given on computer. Other formats are available for test takers approved for accommodations (see page 36).

What should I expect when taking the test on computer?

When taking the test on computer, you can expect to be asked to provide proper identification at the test center. Once admitted, you will be given the opportunity to learn how the computer interface works (how to answer questions, how to skip questions, how to go back to questions you skipped, etc.) before the testing time begins. Watch the What to Expect on Test Day video to see what the experience is like.

Where and when are the *Praxis* tests offered?

You can select the test center that is most convenient for you. The *Praxis* tests are administered through an international network of test centers, which includes Prometric® Testing Centers, some universities, and other locations throughout the world.

Testing schedules may differ, so see the *Praxis* web site for more detailed test registration information at www.ets.org/praxis/register.

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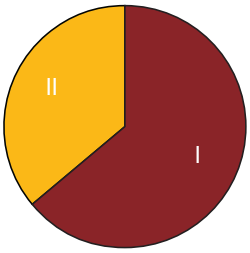
1. Learn About Your Test

Learn about the specific test you will be taking

Art: Content Knowledge (5134)

Test at a Glance	
Test Name	Art: Content Knowledge
Test Code	5134
Time	2 hours
Number of Questions	120
Format	Selected-response questions
Test Delivery	Computer delivered



Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
I. Art Making	**76**	**64%**
A. General	15	13%
B. Media and Processes	61	51%
II. Historical and Theoretical Foundations of Art	**44**	**36%**
A. Materials and Processes in an Art Historical Context	6–7	5%
B. The Western Tradition in Art History	17–18	15%
C. Art Beyond the Western Tradition	9	7%
D. Responding to Art	11	9%

About This Test

Art: Content Knowledge measures whether entry-level art teachers have the standards-relevant knowledge, skills, and abilities deemed necessary for beginning professional practice. The test is intended primarily for individuals completing teacher training programs who plan to become art teachers. Candidates typically have completed a bachelor's degree program in art or art education. The test questions focus on concepts that are considered central to the study of art, measuring knowledge of art making and the historical and theoretical foundations of art. Images are included on the screen with some of the questions.

The test may contain some questions that will not count toward your score.

Test Specifications

Test specifications in this chapter describe the knowledge and skills measured by the test. Study topics to help you prepare to answer test questions can be found on page 27.

I. Art Making

A. General

The candidate:

1. Knows and understands the elements of art and principles of visual organization (i.e., principles of design) as applied to two-dimensional and three-dimensional media
   a. identifies elements and principles of design in visual stimuli
   b. explains relationships of elements to principles
   c. distinguishes uses of elements and principles in two-dimensional and three-dimensional art
2. Knows and understands various historical methods (e.g., golden mean, hierarchical organization, perspective) and contemporary approaches (juxtaposition, appropriation, transformation, etc.) to creating art
   a. defines/identifies both historical and contemporary methods

B. Media and Processes

The candidate:

1. Knows and understands safety, environmental, and storage issues related to the use of art materials (e.g., clay dust, lead pigments, safety-label information) and art processes (e.g., cutting, etching, spraying)
   a. identifies dangerous materials and their effects
   b. categorizes dangerous materials and their effects
   c. describes proper ventilation, storage, and disposal procedures based on the medium
   d. demonstrates knowledge of MSDS sheets
   e. demonstrates understanding of safety procedures and precautions for using artists' materials and tools
   f. demonstrates knowledge of health issues related to the use of artists' materials and tools (e.g., toxicity)
2. Knows and understands how to use a variety of drawing, painting, and printmaking materials and processes
   a. identifies characteristics of materials
   b. identifies similarities and differences among materials
   c. knows vocabulary related to drawing, painting, and printmaking materials and processes
   d. describes drawing, painting, and printmaking processes
   e. solves problems and evaluates possible solutions
   f. compares materials and techniques, and analyzes the compatibility of materials and techniques
   g. recognizes or identifies processes through reproductions
3. Knows and understands how to use digital photography and image processes
   a. demonstrates basic camera knowledge (camera parts, vocabulary)
   b. demonstrates knowledge of common editing and imaging software (e.g., cropping, basic manipulation, resizing)
   c. demonstrates knowledge of uploading, downloading, storing common file types such as .jpg and .tif, transferring, and printing images
   d. knows and understands the process of creating digital images
4. Knows and understands materials, tools, and processes for videography, filmmaking, and installations
   a. identifies/describes materials, tools, and processes for videography, filmmaking, and installations
5. Knows and understands how to use sculptural materials and processes
   a. identifies characteristics of materials
   b. identifies similarities and differences among materials
   c. knows vocabulary related to sculptural materials and processes

d. describes sculptural processes

e. solves problems and evaluates possible solutions

f. compares materials and techniques, and analyzes the compatibility of materials and techniques

g. recognizes or identifies processes through reproductions

6. Knows and understands how to use a variety of fiber art materials and processes (e.g., weaving, basketry, paper making, jewelry making, processes based on sewing)

   a. identifies characteristics of materials

   b. identifies similarities and differences among materials

   c. knows vocabulary related to fiber materials and processes

   d. describes fiber processes

   e. solves problems and evaluates possible solutions

   f. compares materials and techniques, and analyzes the compatibility of materials and techniques

   g. recognizes or identifies processes through reproductions

7. Knows and understands the physical aspects and effective ways of presenting artwork for display purposes (e.g., cutting mats, display boards)

   a. identifies and describes methods of mounting and matting work in ways appropriate to the medium

   b. identifies and describes methods of displaying three-dimensional work

   c. describes appropriate ways of using exhibition spaces

II. Historical and Theoretical Foundation of Art

A. Materials and Processes in an Art Historical Context

The candidate:

1. Knows and understands the following materials within an art historical context: painting, drawing, printmaking, sculpture, architecture, photography, fiber arts, and crafts

   a. identifies characteristics of materials, processes, and techniques within an art historical context

   b. identifies similarities and differences among materials, processes, and techniques (e.g., evolution over time)

   c. knows vocabulary related to two-dimensional and three-dimensional media and processes within an art historical context

   d. recognizes or identifies processes within an art historical context through reproductions

B. The Western Tradition in Art History

The candidate:

1. Recognizes stylistic traits of art and architecture from each of the following time periods: Prehistory; Egypt and the Ancient Near East; Ancient Greece and Rome; Early Christian, Byzantine, and Medieval periods; the Renaissance; the Baroque; 18th through 20th centuries in Europe and North America; and contemporary art

   a. identifies the styles of works of art and architecture

   b. categorizes art and architecture according to style and/or period

   c. identifies major works of art and architecture by title, style, and/or artist, as appropriate

   d. analyzes/explains the influence of art historical periods or schools on later work

   e. analyzes compositional elements and principles of design in works of art and architecture

   f. recognizes the impact of major artistic and technological innovations (e.g., linear perspective, the invention of the camera, the invention of oil and acrylic paints) on the stylistic traits of art

2. Knows and understands the content, context, and/or purpose of art and architecture from each of the following time periods: Prehistory; Egypt and the Ancient Near East; Ancient Greece and Rome; Early Christian, Byzantine, and Medieval periods; the Renaissance; the Baroque; 18th through 20th centuries in Europe and North America; and contemporary art
   a. explains the purposes of works of art from various time periods
   b. decodes/analyzes the narrative or intended content of a work of art
   c. analyzes/explains the interrelationships between art and social factors, cultural context, and events
   d. explains the impact of major artistic and technological innovations on the content, context, and purposes of art (e.g., linear perspective, the invention of the camera, the invention of oil and acrylic paints)
   e. evaluates information about art and artists from various sources

C. Art Beyond the Western Tradition

The candidate:

1. Knows and understands the general visual characteristics of art and architecture from Asia, Africa, the Americas, and the South Pacific region
   a. classifies works of art and architecture by regions/cultures
   b. describes/analyzes works of art and architecture using compositional elements and principles of design
   c. describes/analyzes the interrelationships between art from beyond the Western tradition and art from the Western tradition
   d. identifies major works of art and architecture by title, style, and/or artist, as appropriate
2. Knows and understands the general content, context, and purposes of art from Asia, Africa, the Americas, and the South Pacific region
   a. explains the content and/or purpose (as appropriate) of frequently referenced works of art from various locations and cultures
   b. identifies the general role of a work of art in its culture (e.g., celebration, ritual or ceremony, historical documentation)
   c. explains how the context in which a work of art is created conveys information about various lifestyles and belief systems (e.g., how Mesoamerican pyramids illuminate life and culture)
   d. evaluates information about art and artists from various sources

D. Responding to Art

The candidate:

1. Knows and understands the major theories of art and aesthetics (e.g., formalism, expressionism, deconstructivism, and representationalism)
   a. recognizes the major characteristics of various theories of art and aesthetics
   b. distinguishes among the major theories of art and aesthetics
   c. compares and contrasts the differences/similarities among theories of art and aesthetics
   d. interprets and evaluates works of art based on theories of art and aesthetics (as opposed to personal opinion)
2. Knows and understands the relationship between art and critical response
   a. demonstrates knowledge of critical reactions to well-known works and/or art movements
   b. recognizes/uses multiple viewpoints in examining a work of art (e.g., multiple viewpoints can be applied to the same work of art; visual or written analysis; looking at various analyses of works in history; "lenses")
   c. recognizes the way personal experience affects interpretation of art (understanding that each person's experiences will affect how that person sees art)
   d. recognizes how meaning is created in art (e.g., through symbols, iconography, formal elements and principles)

2. Familiarize Yourself with Test Questions

Become comfortable with the types of questions you'll find on the Praxis *tests*

The *Praxis* assessments include a variety of question types: constructed response (for which you write a response of your own); selected response, for which you select one or more answers from a list of choices or make another kind of selection (e.g., by clicking on a sentence in a text or by clicking on part of a graphic); and numeric entry, for which you enter a numeric value in an answer field. You may be familiar with these question formats from taking other standardized tests. If not, familiarize yourself with them so you don't spend time during the test figuring out how to answer them.

Understanding Computer-Delivered Questions

Questions on computer-delivered tests are interactive in the sense that you answer by selecting an option or entering text on the screen. If you see a format you are not familiar with, read the directions carefully. The directions always give clear instructions on how you are expected to respond.

For most questions, you respond by clicking an oval to select a single answer from a list of answer choices.

However, interactive question types may also ask you to respond by:

- **Clicking more than one oval** to select answers from a list of choices.
- **Typing in an entry box.** When the answer is a number, you may be asked to enter a numerical answer. Some questions may have more than one place to enter a response.
- **Clicking check boxes.** You may be asked to click check boxes instead of an oval when more than one choice within a set of answers can be selected.
- **Clicking parts of a graphic.** In some questions, you will select your answers by clicking on a location (or locations) on a graphic such as a map or chart, as opposed to choosing your answer from a list.
- **Clicking on sentences.** In questions with reading passages, you may be asked to choose your answers by clicking on a sentence (or sentences) within the reading passage.
- **Dragging and dropping answer choices into targets on the screen.** You may be asked to select answers from a list of choices and drag your answers to the appropriate location in a table, paragraph of text or graphic.
- **Selecting answer choices from a drop-down menu.** You may be asked to choose answers by selecting choices from a drop-down menu (e.g., to complete a sentence).

Remember that with every question you will get clear instructions.

Perhaps the best way to understand computer-delivered questions is to view the Computer-delivered Testing Demonstration on the Praxis web site to learn how a computer-delivered test works and see examples of some types of questions you may encounter.

Understanding Selected-Response Questions

Many selected-response questions begin with the phrase "which of the following." Take a look at this example:

Which of the following is a flavor made from beans?

(A) Strawberry

(B) Cherry

(C) Vanilla

(D) Mint

How would you answer this question?

All of the answer choices are flavors. Your job is to decide which of the flavors is the one made from beans.

Try following these steps to select the correct answer.

1) **Limit your answer to the choices given.** You may know that chocolate and coffee are also flavors made from beans, but they are not listed. Rather than thinking of other possible answers, focus only on the choices given ("which of the following").

2) **Eliminate incorrect answers.** You may know that strawberry and cherry flavors are made from fruit and that mint flavor is made from a plant. That leaves vanilla as the only possible answer.

3) **Verify your answer.** You can substitute "vanilla" for the phrase "which of the following" and turn the question into this statement: "Vanilla is a flavor made from beans." This will help you be sure that your answer is correct. If you're still uncertain, try substituting the other choices to see if they make sense. You may want to use this technique as you answer selected-response questions on the practice tests.

Try a more challenging example

The vanilla bean question is pretty straightforward, but you'll find that more challenging questions have a similar structure. For example:

Entries in outlines are generally arranged according to which of the following relationships of ideas?

(A) Literal and inferential

(B) Concrete and abstract

(C) Linear and recursive

(D) Main and subordinate

You'll notice that this example also contains the phrase "which of the following." This phrase helps you determine that your answer will be a "relationship of ideas" from the choices provided. You are supposed to find the choice that describes how entries, or ideas, in outlines are related.

Sometimes it helps to put the question in your own words. Here, you could paraphrase the question in this way: "How are outlines usually organized?" Since the ideas in outlines usually appear as main ideas and subordinate ideas, the answer is (D).

QUICK TIP: Don't be intimidated by words you may not understand. It might be easy to be thrown by words like "recursive" or "inferential." Read carefully to understand the question and look for an answer that fits. An outline is something you are probably familiar with and expect to teach to your students. So slow down, and use what you know.

Watch out for selected-response questions containing "NOT," "LEAST," and "EXCEPT"

This type of question asks you to select the choice that does not fit. You must be very careful because it is easy to forget that you are selecting the negative. This question type is used in situations in which there are several good solutions or ways to approach something, but also a clearly wrong way.

How to approach questions about graphs, tables, or reading passages

When answering questions about graphs, tables, or reading passages, provide only the information that the questions ask for. In the case of a map or graph, you might want to read the questions first, and then look at the map or graph. In the case of a long reading passage, you might want to go ahead and read the passage first, noting places you think are important, and then answer the questions. Again, the important thing is to be sure you answer the questions as they refer to the material presented. So read the questions carefully.

How to approach unfamiliar formats

New question formats are developed from time to time to find new ways of assessing knowledge. Tests may include audio and video components, such as a movie clip or animation, instead of a map or reading passage. Other tests may allow you to zoom in on details in a graphic or picture.

Tests may also include interactive questions. These questions take advantage of technology to assess knowledge and skills in ways that standard selected-response questions cannot. If you see a format you are not familiar with, **read the directions carefully**. The directions always give clear instructions on how you are expected to respond.

QUICK TIP: Don't make the questions more difficult than they are. Don't read for hidden meanings or tricks. There are no trick questions on *Praxis* tests. They are intended to be serious, straightforward tests of your knowledge.

Understanding Constructed-Response Questions

Constructed-response questions require you to demonstrate your knowledge in a subject area by creating your own response to particular topics. Essays and short-answer questions are types of constructed-response questions.

For example, an essay question might present you with a topic and ask you to discuss the extent to which you agree or disagree with the opinion stated. You must support your position with specific reasons and examples from your own experience, observations, or reading.

Take a look at a few sample essay topics:

- "Celebrities have a tremendous influence on the young, and for that reason, they have a responsibility to act as role models."
- "We are constantly bombarded by advertisements—on television and radio, in newspapers and magazines, on highway signs, and the sides of buses. They have become too pervasive. It's time to put limits on advertising."
- "Advances in computer technology have made the classroom unnecessary, since students and teachers are able to communicate with one another from computer terminals at home or at work."

Keep these things in mind when you respond to a constructed-response question

1) **Answer the question accurately.** Analyze what each part of the question is asking you to do. If the question asks you to describe or discuss, you should provide more than just a list.

2) **Answer the question completely.** If a question asks you to do three distinct things in your response, you should cover all three things for the best score. Otherwise, no matter how well you write, you will not be awarded full credit.

3) **Answer the question that is asked.** Do not change the question or challenge the basis of the question. You will receive no credit or a low score if you answer another question or if you state, for example, that there is no possible answer.

4) **Give a thorough and detailed response.** You must demonstrate that you have a thorough understanding of the subject matter. However, your response should be straightforward and not filled with unnecessary information.

5) **Reread your response.** Check that you have written what you thought you wrote. Be sure not to leave sentences unfinished or omit clarifying information.

QUICK TIP: You may find that it helps to take notes on scratch paper so that you don't miss any details. Then you'll be sure to have all the information you need to answer the question.

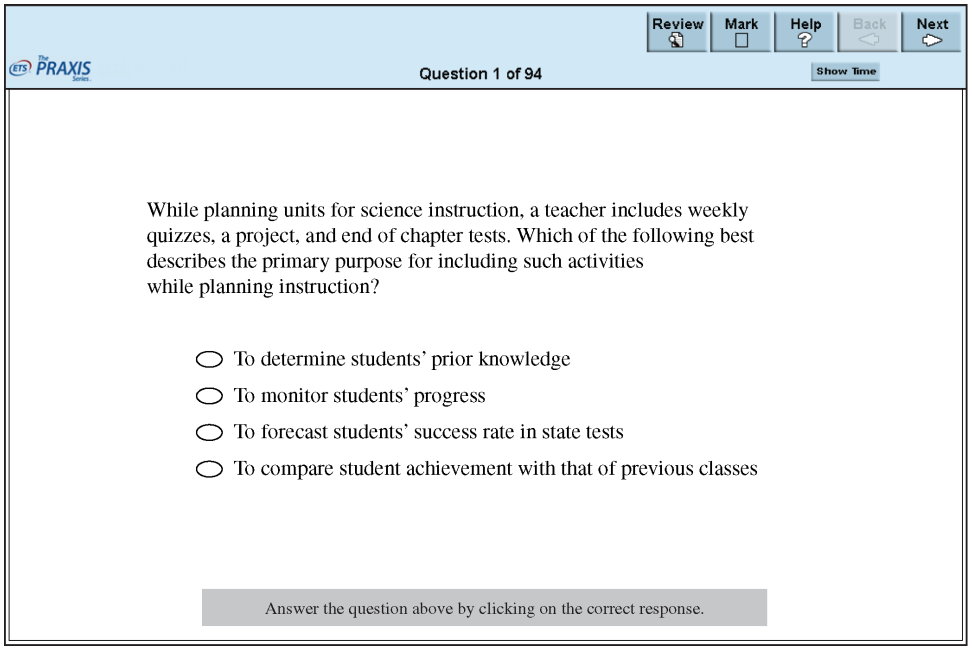
For tests that have constructed-response questions, more detailed information can be found on page 11.

3. Practice with Sample Test Questions

Answer practice questions and find explanations for correct answers

Computer Delivery

This test is available on computer. To illustrate what the computer-delivered test looks like, the following sample question shows an actual screen used in a computer-delivered test. For the purposes of this guide, sample questions are provided as they would appear in a paper-delivered test.



Sample Test Questions

The sample questions that follow illustrate the kinds of questions in the test. They are not, however, representative of the entire scope of the test in either content or difficulty. Answers with explanations follow the questions.

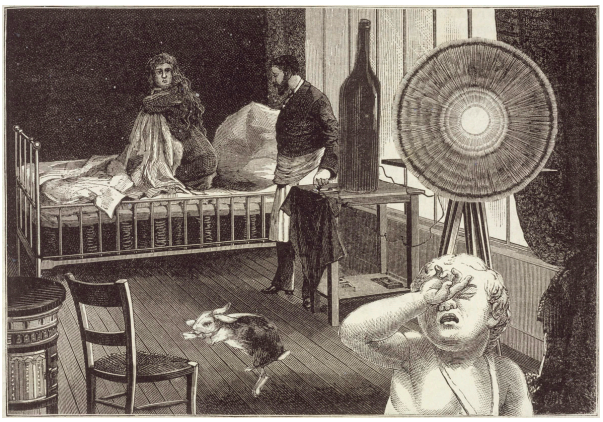
For the test, images appear as small thumbnail versions above or to the left of the question(s) they refer to. To expand an image thumbnail, click on the plus sign in the lower right corner. While the image is expanded, you will see a plus sign and a minus sign that allow you to zoom in and out. To close the image, click on the "x "in the upper right corner. You can open and close each image as many times as you like.

Directions: Each of the questions or incomplete statements below is followed by four suggested answers or completions. Select the one that is best in each case.

Art Making

1. Which of the following terms refers to the use of distortion to create the illusion of an object extending into space?
   (A) Cantilevering
   (B) Contrapposto
   (C) Sfumato
   (D) Foreshortening

2. A triad on a color wheel can be described as
   (A) three analogous colors
   (B) three colors equally spaced apart
   (C) three colors of equal value
   (D) a complementary set



© CNAC / MNAM / Dist. Réunion des Musées Nationaux / Art Resource, NY

3. In the work shown above, Ernst anticipated and manipulated which of the following postmodern design principles as a means of conveying a sense of the irrational and the illogical?
   (A) Gazing
   (B) Hybridity
   (C) Appropriation
   (D) Juxtaposition

4. Which of the following is the most reasonable action to take for an artist whose work requires the use of a specific hazardous product?
   (A) Finding a nontoxic product to use and adapting the art-making process as necessary
   (B) Reading the product's label and proceeding according to the label directions
   (C) Making sure no children are present when using the product
   (D) Checking with a qualified toxicologist before using the material

5. In storing printmaking supplies, it is important to store which of the following materials separately from the others?
   (A) Acetic acid
   (B) Rosin powder
   (C) Nitric acid
   (D) Solvents

6. Which of the following is most characteristic of gesture drawing?
   (A) An outline
   (B) Action and movement
   (C) Gradual shading
   (D) Carefully observed details

7. A hard-edge painting is most likely to be characterized by
   (A) an even, solid paint application
   (B) blurry color mixed on the painting's surface
   (C) scratchy brush marks clearly separated
   (D) translucent multiple layers of paint

8. Which of the following terms refers to the process of using thick applications of paint?
   (A) Scumbling
   (B) Alla prima
   (C) Impasto
   (D) Frottage

9. Which of the following statements accurately describes a JPEG compressed digital photograph?
   (A) The JPEG format is used only for color photos.
   (B) A JPEG compression alters the proportions of the original image by rearranging data.
   (C) A JPEG compression sharpens the details in an image.
   (D) The JPEG format compresses file size by selectively discarding data.

10. Which of the following digital camera settings can be used to keep colors accurate under a variety of light conditions?
    (A) White balance
    (B) Aperture
    (C) ISO speed
    (D) Shutter speed

11. The term that best describes an artwork that incorporates theatrical elements such as body movement, audience participation, music, and projected images is
    (A) mimesis
    (B) installation art
    (C) performance art
    (D) digital collage

12. Which of the following terms refers to pottery that has not been bisque fired?
    (A) Raku
    (B) Greenware
    (C) Terracotta
    (D) Stoneware

13. Which of the following tools is LEAST likely to be used in the process of creating a wood sculpture?
    (A) A rasp
    (B) A gouge
    (C) A lathe
    (D) An extruder

14. In weaving, the vertical and horizontal threads in a loom are called the
    (A) bobbin and quill
    (B) shuttle and paddle
    (C) ply and twist
    (D) warp and weft

15. Fragile works of sculpture can be displayed most securely by placing the works
    (A) in glass-paneled cases
    (B) on a series of pedestals
    (C) on wall-mounted shelves with sturdier works around them
    (D) in shadow boxes with signs that read "Do Not Touch"

Historical and Theoretical Foundations of Art

16. Which of the following terms refers to Archaic Greek statues whose poses—rigidly frontal with clenched fists—recall the stance of ancient Egyptian statues?

    (A) Caryatids
    (B) Telamones
    (C) Discoboloi
    (D) Kouroi



© View Stock / Alamy

17. The layout and design of the Temple of Heaven in Beijing, China, are intended mainly as a symbolic expression of the

    (A) philosophical principles of feng shui
    (B) metaphysical teachings of the Buddha
    (C) connection between imperial and cosmic orders
    (D) emperor's absolute power over earthly matters



© Michele Burgess / Corbis

18. The imagery in the work shown above is a typical decorative motif of Islamic architectural mosaics known as

    (A) calligraphy
    (B) an arabesque
    (C) a rosette
    (D) a paisley



© Scala / Art Resource, NY

19. In Michelangelo's sculpture, David's expression is best characterized as
    (A) calm and brave
    (B) youthful and idealized
    (C) tense and watchful
    (D) angry and intense

20. Which of the following artists is an English landscape painter who created a poetic sense of changing atmospheric effects by using tiny applications of local color?
    (A) John Constable
    (B) William Morris
    (C) William Hogarth
    (D) Joshua Reynolds

21. The nineteenth-century photographic process used to create a daguerreotype was notable for its
    (A) quick exposure time
    (B) ability to capture sharp detail
    (C) capacity to be reproduced multiple times
    (D) use of paper negatives

22. The Pointillist paintings of Georges Seurat are most notable for containing which of the following characteristics?
    (A) An expressionistic use of broad brushstrokes and tactile surface texture
    (B) Lively figures created through the use of forceful lines
    (C) Static figures and a sense of optical surface movement
    (D) An emotional use of strident colors with a high degree of simplification

23. The intention of making traditional, saleable art objects was abandoned by
    (A) Impressionists
    (B) Pop artists
    (C) Abstract Expressionists
    (D) Conceptual artists

24. Which of the following figures is a contemporary installation artist who uses image projection and videos?
    (A) Bill Viola
    (B) Betye Saar
    (C) Damien Hirst
    (D) Rachel Whiteread

25. The aesthetic philosophy that claims that the value of a work of art is determined by museums and galleries is known as
    (A) capitalism
    (B) conceptualism
    (C) structuralism
    (D) institutionalism

Answers to Sample Questions

1. The correct answer is (D). Foreshortening is the representation of any object on a two-dimensional surface in such a way that the object appears to advance or recede. This is accomplished by representing the perspectival "distortion" of the form.

2. The correct answer is (B). A triad on a color wheel refers to any three equally spaced colors. The most common triads are the primary colors (red, blue, yellow) and the secondary colors (purple, green, orange). However, any three hues that are equidistant from each other constitute a triad.

3. The correct answer is (D). Juxtaposition refers to the use of unrelated images, materials, etc., to create a new image. Although the term has become standard in recent years, Surrealists such as Max Ernst sometimes used much the same process. In *L'Immaculée Conception manquée*, Ernst included images that have no apparent connection to each other, such as the rabbit, the weeping statue, and the figures, to create a sense of connection outside the scope of reason.

4. The correct answer is (B). Although it is preferable for artists of all ages to avoid toxic materials, there are times when a working artist may have to use a toxic material for a specific purpose. In such cases, the most reasonable course of action is for the artist to read all directions and cautions carefully and take the necessary precautions.

5. The correct answer is (C). Nitric acid is an oxidizing agent that can react with any of the other supplies to cause an explosion or fire.

6. The correct answer is (B). Gesture drawing refers to quick, expressive representation, usually of figures, which is intended to convey the essential movement of the figure. Action and movement are the essence of gesture drawing.

7. The correct answer is (A). "Hard-edge" is a term used to refer to paintings such as those of Frank Stella and Ellsworth Kelly in which each area of paint is sharply defined and applied in a smooth way, without visible brushstrokes or other signs of gesture.

8. The correct answer is (C). Although the other choices refer to various ways of working with two-dimensional images, only impasto refers to thick applications of paint to a surface.

9. The correct answer is (D). JPEG (widely known as .jpg) compression of a digital file is a process through which a file can be made smaller and, therefore, easier to store and transfer. The compression is executed by selectively removing data from the image file. It can be used for black-and-white as well as color files. JPEG compression does not sharpen details or alter proportions.

10. The correct answer is (A). Different lighting conditions—for example, daylight, incandescent light, fluorescent light—tend to push the colors in a photograph toward a particular hue, so it is important to be able to adjust the camera to keep unwanted tints out of the photo. White balance refers to the way the camera compensates for variations in light to keep colors constant.

11. The correct answer is (C). Performance art differs from painting, sculpture, or even some other forms of experimental media in that it emphasizes art as a participatory event that happens at a particular place and a particular time. It is usually avant-garde or conceptual in scope. Although not all works of performance art include every element listed here, the only kind of art that could incorporate all of them is performance art.

12. The correct answer is (B). Bisque firing refers to preliminary firing that is done to harden the piece prior to glazing and glaze firing. Greenware is a term referring to any pottery that has not been bisque fired.

13. The correct answer is (D). This question asks for the tool that a wood sculptor would **not** use. Rasps, gouges, and lathes are all used in working with wood. An extruder is used with malleable materials, such as clay.

14. The correct answer is (D). Weaving on a loom involves stringing a series of threads along the loom lengthwise (warp) and weaving other threads crosswise (weft), in and out of the lengthwise threads.

15. The correct answer is (A). Although some of the other choices might provide a bit of protection for fragile sculptures, a glass-paneled case that allows viewers to see fragile items but not touch them is the best solution for secure display.

16. The correct answer is (D). "Kouroi" is the term used for Archaic Greek statues of standing male youths. Made primarily from marble, but sometimes from limestone, wood, bronze, or terracotta, these life-size Greek statues imitate Egyptian prototypes in that each is posed stiffly, facing directly forward, with clenched fists and an advancing left foot.

17. The correct answer is (C). A Daoist temple complex constructed between 1406 and 1420, the Temple of Heaven is laid out in a grid of interlocking circles and squares intended to symbolize the connection between Heaven and Earth. Traditionally, this relationship was mediated by the emperor, called the Son of Heaven, who prayed at the Hall of Prayer for Good Harvests, located in the center of the complex, during important biannual ceremonies.

18. The correct answer is (B). An arabesque is an intricate design of repeated lines, often in the form of plants whose leafy vines interlace. In Islam, these designs constitute an infinite pattern that extends beyond the material world, symbolizing the limitless nature of creation and conveying a sense of spirituality.

19. The correct answer is (C). For his monumental statue of David, Michelangelo chose not to portray the biblical hero holding the head of the slain Goliath—as both Donatello and Verrocchio had done—but rather to depict him awaiting the fatal encounter. David stands with furrowed brow, veins bulging from his neck, his gaze one of studied concentration as he prepares for Goliath's challenge.

20. The correct answer is (A). Perhaps the best known English landscape painter of his era, John Constable used delicate brushstrokes to convey a sense of changing weather in works such as *The Haywain*. Constable's use of natural color, stippled with white, is one of the most innovative aspects of his paintings; it was central to his ability to demonstrate shifting atmosphere and changing seasons.

21. The correct answer is (B). The first commercially successful photographic process, the daguerreotype was developed in France in the early nineteenth century by Louis-Jacques-Mandé Daguerre. Each image was a direct positive made in the camera on a silver-plated copper plate. Since the image was made directly on the silvered surface, it was very fragile and could not be reproduced; it also required a somewhat lengthy exposure period. Despite such drawbacks, the daguerreotype quickly became a popular medium, especially for portraiture, largely because of its ability to capture crisp, accurate detail.

22. The correct answer is (C). Georges Seurat's *Sunday Afternoon on the Island of La Grande Jatte* typifies the dominant aesthetic of his major canvases. The flat, sharply defined figures are so stiff as to appear almost timeless, while the very surface of the painting seems to shimmer because of the Pointillist technique of using thousands of precisely placed, tiny colored dots.

23. The correct answer is (D). The Conceptual Art movement expanded the fundamental definition of what qualifies as art. Conceptual artists, as a rule, reject traditional notions of what constitutes a work of art. Concepts and ideas are valued over standard visual art conventions. A major component of this artistic viewpoint is the lack of concern with the creation of physical objects that can be sold in the art marketplace. Conceptual art need not be limited by its marketability since, as artist Sol LeWitt said, "Ideas alone can be works of art."

24. The correct answer is (A). Bill Viola is an internationally recognized contemporary video artist, whose installations frequently incorporate the projection of images and videos.

25. The correct answer is (D). Institutionalism, also known as the institutional theory of art, is an aesthetic philosophy that stipulates that an object can only be considered art within the framework of the art world, defined primarily—but not exclusively—by museums and galleries. Theorists often cite the example of Marcel Duchamp's *Fountain*, the urinal submitted to the Society for Independent Artists exhibit in New York City in 1917. By being placed in a gallery, the work's meaning changed: it ceased to be a functional object and became an art object instead. *Fountain* is now studied as an exemplar of the readymade.

4. Determine Your Strategy for Success

Set clear goals and deadlines so your test preparation is focused and efficient

Effective *Praxis* test preparation doesn't just happen. You'll want to set clear goals and deadlines for yourself along the way. Otherwise, you may not feel ready and confident on test day.

1) Learn what the test covers.

You may have heard that there are several different versions of the same test. It's true. You may take one version of the test and your friend may take a different version a few months later. Each test has different questions covering the same subject area, but both versions of the test measure the same skills and content knowledge.

You'll find specific information on the test you're taking on page 5, which outlines the content categories that the test measures and what percentage of the test covers each topic. Visit www.ets.org/praxis/testprep for information on other *Praxis* tests.

2) Assess how well you know the content.

Research shows that test takers tend to overestimate their preparedness—this is why some test takers assume they did well and then find out they did not pass.

The *Praxis* tests are demanding enough to require serious review of likely content, and the longer you've been away from the content, the more preparation you will most likely need. If it has been longer than a few months since you've studied your content area, make a concerted effort to prepare.

3) Collect study materials.

Gathering and organizing your materials for review are critical steps in preparing for the *Praxis* tests. Consider the following reference sources as you plan your study:

- Did you take a course in which the content area was covered? If yes, do you still have your books or your notes?
- Does your local library have a high school-level textbook in this area? Does your college library have a good introductory college-level textbook in this area?

Practice materials are available for purchase for many *Praxis* tests at www.ets.org/praxis/testprep. Test preparation materials include sample questions and answers with explanations.

4) Plan and organize your time.

You can begin to plan and organize your time while you are still collecting materials. Allow yourself plenty of review time to avoid cramming new material at the end. Here are a few tips:

- Choose a test date far enough in the future to leave you plenty of preparation time. Test dates can be found at www.ets.org/praxis/register/centers_dates.
- Work backward from that date to figure out how much time you will need for review.
- Set a realistic schedule—and stick to it.

5) Practice explaining the key concepts.

Praxis tests with constructed-response questions assess your ability to explain material effectively. As a teacher, you'll need to be able to explain concepts and processes to students in a clear, understandable way. What are the major concepts you will be required to teach? Can you explain them in your own words accurately, completely, and clearly? Practice explaining these concepts to test your ability to effectively explain what you know.

6) Understand how questions will be scored.

Scoring information can be found on page 39.

7) Develop a study plan.

A study plan provides a road map to prepare for the *Praxis* tests. It can help you understand what skills and knowledge are covered on the test and where to focus your attention. Use the study plan template on page 25 to organize your efforts.

And most important—get started!

Would a Study Group Work for You?

Using this guide as part of a study group

People who have a lot of studying to do sometimes find it helpful to form a study group with others who are working toward the same goal. Study groups give members opportunities to ask questions and get detailed answers. In a group, some members usually have a better understanding of certain topics, while others in the group may be better at other topics. As members take turns explaining concepts to one another, everyone builds self-confidence.

If the group encounters a question that none of the members can answer well, the group can go to a teacher or other expert and get answers efficiently. Because study groups schedule regular meetings, members study in a more disciplined fashion. They also gain emotional support. The group should be large enough so that multiple people can contribute different kinds of knowledge, but small enough so that it stays focused. Often, three to six members is a good size.

Here are some ways to use this guide as part of a study group:

- **Plan the group's study program.** Parts of the study plan template, beginning on page 25, can help to structure your group's study program. By filling out the first five columns and sharing the worksheets, everyone will learn more about your group's mix of abilities and about the resources, such as textbooks, that members can share with the group. In the sixth column ("Dates I will study the content"), you can create an overall schedule for your group's study program.
- **Plan individual group sessions.** At the end of each session, the group should decide what specific topics will be covered at the next meeting and who will present each topic. Use the topic headings and subheadings in the Test at a Glance table on page 5 to select topics, and then select practice questions, beginning on page 13.
- **Prepare your presentation for the group.** When it's your turn to present, prepare something that is more than a lecture. Write two or three original questions to pose to the group. Practicing writing actual questions can help you better understand the topics covered on the test as well as the types of questions you will encounter on the test. It will also give other members of the group extra practice at answering questions.

- **Take a practice test together.** The idea of a practice test is to simulate an actual administration of the test, so scheduling a test session with the group will add to the realism and may also help boost everyone's confidence. Remember, complete the practice test using only the time that will be allotted for that test on your administration day.
- **Learn from the results of the practice test.** Review the results of the practice test, including the number of questions answered correctly in each content category. For tests that contain constructed-response questions, look at the Sample Test Questions section, which also contain sample responses to those questions and shows how they were scored. Then try to follow the same guidelines that the test scorers use.
- **Be as critical as you can.** You're not doing your study partner(s) any favors by letting them get away with an answer that does not cover all parts of the question adequately.
- **Be specific.** Write comments that are as detailed as the comments about the sample responses. Indicate where and how your study partner(s) are doing an inadequate job of answering the question. Writing notes in the margins of the answer sheet may also help.
- **Be supportive.** Include comments that point out what your study partner(s) got right.

Then plan one or more study sessions based on aspects of the questions on which group members performed poorly. For example, each group member might be responsible for rewriting one paragraph of a response in which someone else did an inadequate job.

Whether you decide to study alone or with a group, remember that the best way to prepare is to have an organized plan. The plan should set goals based on specific topics and skills that you need to learn, and it should commit you to a realistic set of deadlines for meeting those goals. Then you need to discipline yourself to stick with your plan and accomplish your goals on schedule.

5. Develop Your Study Plan

Develop a personalized study plan and schedule

Planning your study time is important because it will help ensure that you review all content areas covered on the test. Use the sample study plan below as a guide. It shows a plan for the *Core Academic Skills for Educators: Reading* test. Following that is a study plan template that you can fill out to create your own plan. Use the "Learn about Your Test" and "Test Specifications" information beginning on page 5 to help complete it.

Use this worksheet to:
1. **Define Content Areas:** List the most important content areas for your test as defined in chapter 1.
2. **Determine Strengths and Weaknesses:** Identify your strengths and weaknesses in each content area.
3. **Identify Resources:** Identify the books, courses, and other resources you plan to use for each content area.
4. **Study:** Create and commit to a schedule that provides for regular study periods.

Praxis Test Name (Test Code): Core Academic Skills for Educators: Reading (5712)
Test Date: 9/15/15

Content covered	Description of content	How well do I know the content? (scale 1–5)	What resources do I have/need for the content?	Where can I find the resources I need?	Dates I will study the content	Date completed
Key Ideas and Details						
Close reading	Draw inferences and implications from the directly stated content of a reading selection	3	Middle school English textbook	College library, middle school teacher	7/15/15	7/15/15
Determining Ideas	Identify summaries or paraphrases of the main idea or primary purpose of a reading selection	3	Middle school English textbook	College library, middle school teacher	7/17/15	7/17/15
Determining Ideas	Identify summaries or paraphrases of the supporting ideas and specific details in a reading selection	3	Middle and high school English textbook	College library, middle and high school teachers	7/20/15	7/21/15
Craft, Structure, and Language Skills						
Interpreting tone	Determine the author's attitude toward material discussed in a reading selection	4	Middle and high school English textbook	College library, middle and high school teachers	7/25/15	7/26/15
Analysis of structure	Identify key transition words and phrases in a reading selection and how they are used	3	Middle and high school English textbook, dictionary	College library, middle and high school teachers	7/25/15	7/27/15
Analysis of structure	Identify how a reading selection is organized in terms of cause/effect, compare/contrast, problem/solution, etc.	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/15	8/1/15
Author's purpose	Determine the role that an idea, reference, or piece of information plays in an author's discussion or argument	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/15	8/1/15

(continued on next page)

Content covered	Description of content	How well do I know the content? (scale 1–5)	What resources do I have/need for the content?	Where can I find the resources I need?	Dates I will study the content	Date completed
Language in different contexts	Determine whether information presented in a reading selection is presented as fact or opinion	4	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/15	8/1/15
Contextual meaning	Identify the meanings of words as they are used in the context of a reading selection	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/15	8/1/15
Figurative Language	Understand figurative language and nuances in word meanings	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/8/15	8/8/15
Vocabulary range	Understand a range of words and phrases sufficient for reading at the college and career readiness level	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/15/15	8/17/15
Integration of Knowledge and Ideas						
Diverse media and formats	Analyze content presented in diverse media and formats, including visually and quantitatively, as well as in words	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/22/15	8/24/15
Evaluation of arguments	Identify the relationship among ideas presented in a reading selection	4	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/24/15	8/24/15
Evaluation of arguments	Determine whether evidence strengthens, weakens, or is relevant to the arguments in a reading selection	3	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/27/15	8/27/15
Evaluation of arguments	Determine the logical assumptions upon which an argument or conclusion is based	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/28/15	8/30/15
Evaluation of arguments	Draw conclusions from material presented in a reading selection	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/30/15	8/31/15
Comparison of texts	Recognize or predict ideas or situations that are extensions of or similar to what has been presented in a reading selection	4	High school textbook, college course notes	College library, course notes, high school teacher, college professor	9/3/15	9/4/15
Comparison of texts	Apply ideas presented in a reading selection to other situations	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	9/5/15	9/6/15

My Study Plan

Use this worksheet to:

1. **Define Content Areas:** List the most important content areas for your test as defined in chapter 1.
2. **Determine Strengths and Weaknesses:** Identify your strengths and weaknesses in each content area.
3. **Identify Resources:** Identify the books, courses, and other resources you plan to use for each content area.
4. **Study:** Create and commit to a schedule that provides for regular study periods.

Praxis Test Name (Test Code): _____

Test Date: _____

Content covered	Description of content	How well do I know the content? (scale 1–5)	What resources do I have/need for this content?	Where can I find the resources I need?	Dates I will study this content	Date completed

(continued on next page)

Content covered	Description of content	How well do I know the content? (scale 1–5)	What resources do I have/need for the content?	Where can I find the resources I need?	Dates I will study the content	Date completed

6. Review Study Topics

Detailed study topics with questions for discussion

Using the Study Topics That Follow

The Art: Content Knowledge test is designed to measure the knowledge and skills necessary for a beginning teacher.

This chapter is intended to help you organize your preparation for the test and to give you a clear indication of the depth and breadth of the knowledge required for success on the test.

Virtually all accredited programs address the topics covered by the test; however, you are not expected to be an expert on all aspects of the topics that follow.

You are likely to find that the topics below are covered by most introductory textbooks. Consult materials and resources, including lecture and laboratory notes, from all your coursework. You should be able to match up specific topics and subtopics with what you have covered in your courses.

Try not to be overwhelmed by the volume and scope of content knowledge in this guide. Although a specific term may not seem familiar as you see it here, you might find you can understand it when applied to a real-life situation. Many of the items on the actual test will provide you with a context to apply to these topics or terms.

Discussion Areas

Interspersed throughout the study topics are discussion areas, presented as open-ended questions or statements. These discussion areas are intended to help test your knowledge of fundamental concepts and your ability to apply those concepts to situations in the classroom or the real world. Most of the areas require you to combine several pieces of knowledge to formulate an integrated understanding and response. If you spend time on these areas, you will gain increased understanding and facility with the subject matter covered on the test. You may want to discuss these areas and your answers with a teacher or mentor.

Note that this study companion *does **not** provide answers for the discussion area questions*, but thinking about the answers to them will help improve your understanding of fundamental concepts and will probably help you answer a broad range of questions on the test.

Study Topics

An overview of the areas covered on the test, along with their subareas, follows.

I. Art Making

A. General

The candidate:

1. Knows and understands the elements of art and principles of visual organization (i.e., principles of design) as applied to two-dimensional and three-dimensional media
   a. identifies elements and principles of design in visual stimuli
   b. explains relationships of elements to principles
   c. distinguishes uses of elements and principles in two-dimensional and three-dimensional art
2. Knows and understands various historical methods (e.g., golden mean, hierarchical organization, perspective) and contemporary approaches (juxtaposition, appropriation, transformation, etc.) to creating art
   a. defines/identifies both historical and contemporary methods

Discussion areas: General

- Consider why you chose particular media or processes for several of your works. In what ways were the media or processes successful?
- What difficulties did they present?
- Think about the ideas on which some of your art works are based. How is each idea communicated? How would you describe the ideas and your artistic process to others?
- How did you structure the composition of one of your works? Why did you structure it that way?
- How do the elements and principles interact in the work? How do they support the meaning of work?
- Name the principles and elements used to organize 2-D and 3-D art.
- Identify how rhythm is achieved in a particular work of art. What impact is created by the use of rhythm in the work?
- How can the elements in a work of art be used to support the principles in a representational work and in an abstract work?
- How do artistic concerns regarding the element of space differ in works that are two-dimensional and works that are three-dimensional?
- How have new technologies and time-based artworks changed the understanding of visual organization
- Name three historical ways of organizing space on a 2-D picture plane. What are some of the ways in which many contemporary artists organize space differently?

B. Media and Processes

The candidate:

1. Knows and understands safety, environmental, and storage issues related to the use of art materials (e.g., clay dust, lead pigments, safety-label information) and art processes (e.g., cutting, etching, spraying)
   a. identifies dangerous materials and their effects
   b. categorizes dangerous materials and their effects
   c. describes proper ventilation, storage, and disposal procedures based on the medium
   d. demonstrates knowledge of MSDS sheets
   e. demonstrates understanding of safety procedures and precautions for using artists' materials and tools
   f. demonstrates knowledge of health issues related to the use of artists' materials and tools (e.g., toxicity)
2. Knows and understands how to use a variety of drawing, painting, and printmaking materials and processes
   a. identifies characteristics of materials
   b. identifies similarities and differences among materials
   c. knows vocabulary related to drawing, painting, and printmaking materials and processes

   d. describes drawing, painting, and printmaking processes
   e. solves problems and evaluates possible solutions
   f. compares materials and techniques, and analyzes the compatibility of materials and techniques
   g. recognizes or identifies processes through reproductions
3. Knows and understands how to use digital photography and image processes
   a. demonstrates basic camera knowledge (camera parts, vocabulary)
   b. demonstrates knowledge of common editing and imaging software (e.g., cropping, basic manipulation, resizing)
   c. demonstrates knowledge of uploading, downloading, storing common file types such as .jpg and .tif, transferring, and printing images
   d. knows and understands the process of creating digital images
4. Knows and understands materials, tools, and processes for videography, filmmaking, and installations
   a. identifies/describes materials, tools, and processes for videography, filmmaking, and installations
5. Knows and understands how to use sculptural materials and processes
   a. identifies characteristics of materials
   b. identifies similarities and differences among materials
   c. knows vocabulary related to sculptural materials and processes
   d. describes sculptural processes
   e. solves problems and evaluates possible solutions
   f. compares materials and techniques, and analyzes the compatibility of materials and techniques
   g. recognizes or identifies processes through reproductions
6. Knows and understands how to use a variety of fiber art materials and processes (e.g., weaving, basketry, paper making, jewelry making, processes based on sewing)
   a. identifies characteristics of materials
   b. identifies similarities and differences among materials
   c. knows vocabulary related to fiber materials and processes
   d. describes fiber processes
   e. solves problems and evaluates possible solutions
   f. compares materials and techniques, and analyzes the compatibility of materials and techniques
   g. recognizes or identifies processes through reproductions
7. Knows and understands the physical aspects and effective ways of presenting artwork for display purposes (e.g., cutting mats, display boards)
   a. identifies and describes methods of mounting and matting work in ways appropriate to the medium
   b. identifies and describes methods of displaying three-dimensional work
   c. describes appropriate ways of using exhibition spaces

Discussion areas: Media and Processes

- Name three art materials that are toxic.
- Which pigments used in paint, ink, or glaze have a greater level of toxicity and which have less?
- What is a safe way to dispose of oily rags?
- What type of precautions should be taken when using workable fixative on a regular basis?
- In what type of setting is it safest to perform a raku firing?
- What are the hazards of prolonged exposure to clay dust or plaster dust?
- How does vine charcoal differ from compressed charcoal?
- What are the advantages and disadvantages of using gouache?

- How does hot-press illustration board differ from cold-press illustration board? What kind of media work best on each?
- How is a burin used in printmaking? How is a brayer used?
- What are some general differences between the effects created by a particular drawing medium and those created by a particular painting medium?
- What are the major printmaking processes?
- If a drawing is too light in value, what other media might the artist experiment with?
- Why is canvas generally primed before an artist paints on it? In what cases might an artist choose not to prime canvas?
- In what ways do the effects achieved by using watercolor as a painting medium generally differ from those achieved by using oil paint?
- How do changes in the aperture setting affect photographs?
- What functions do filters have in Adobe Photoshop™?
- What is the difference between raster and vector formats in computer graphics?
- How many kilobytes are in a megabyte?
- How many megabytes are in a gigabyte?
- What is meant by ppi and dpi, and what information do they provide for projecting or printing a digital image?
- Why are installations classified with time-based media?
- How can wood be used to create an additive, subtractive, or assembled work?
- What are the differences among earthenware, stoneware, and porcelain? Why might an artist choose one of them over another?
- What is a maquette and, why is it useful to make one?
- What types of hand-building techniques can be used to create a ceramic vessel, and what are the advantages of each?
- What are the steps in creating a hollow cast bronze sculpture? What are the advantages of casting?
- How can a viewer distinguish by looking at a sculpture whether the process used was additive or subtractive?
- How do available workspace and tools affect decisions about what sculptural materials to use?
- What different kinds of materials can be used to make paper?
- In weaving, what is the difference between the warp and the weft?
- How is the shuttle used in weaving?
- How can the use of a mat or frame influence perception of a work of art?
- What are the advantages and disadvantages of dry mounting?
- What are the best ways of displaying 3D sculptures of various sizes and media?
- How can lighting be of benefit to the exhibition of artwork?

II. Historical and Theoretical Foundation of Art

A. Materials and Processes in an Art Historical Context

The candidate:

1. Knows and understands the following materials within an art historical context: painting, drawing, printmaking, sculpture, architecture, photography, fiber arts, and crafts
   a. identifies characteristics of materials, processes, and techniques within an art historical context
   b. identifies similarities and differences among materials, processes, and techniques (e.g., evolution over time)
   c. knows vocabulary related to two-dimensional and three-dimensional media and processes within an art historical context
   d. recognizes or identifies processes within an art historical context through reproductions

Discussion areas: Materials and Processes in an Art Historical Context

- In what ancient culture did the use of the arch in architecture become commonplace?
- Identify advantages the arch had over post-and-lintel construction.
- What are some reasons why artists during the Renaissance abandoned the traditional egg tempera technique for painting in oils?

B. The Western Tradition in Art History

The candidate:

1. Recognizes stylistic traits of art and architecture from each of the following time periods: Prehistory; Egypt and the Ancient Near East; Ancient Greece and Rome; Early Christian, Byzantine, and Medieval periods; the Renaissance; the Baroque; 18th through 20th centuries in Europe and North America; and contemporary art
   a. identifies the styles of works of art and architecture
   b. categorizes art and architecture according to style and/or period
   c. identifies major works of art and architecture by title, style, and/or artist, as appropriate
   d. analyzes/explains the influence of art historical periods or schools on later work
   e. analyzes compositional elements and principles of design in works of art and architecture
   f. recognizes the impact of major artistic and technological innovations (e.g., linear perspective, the invention of the camera, the invention of oil and acrylic paints) on the stylistic traits of art
2. Knows and understands the content, context, and/or purpose of art and architecture from each of the following time periods: Prehistory; Egypt and the Ancient Near East; Ancient Greece and Rome; Early Christian, Byzantine, and Medieval periods; the Renaissance; the Baroque; 18th through 20th centuries in Europe and North America; and contemporary art
   a. explains the purposes of works of art from various time periods
   b. decodes/analyzes the narrative or intended content of a work of art
   c. analyzes/explains the interrelationships between art and social factors, cultural context, and events
   d. explains the impact of major artistic and technological innovations on the content, context, and purposes of art (e.g., linear perspective, the invention of the camera, the invention of oil and acrylic paints)
   e. evaluates information about art and artists from various sources

Discussion areas: The Western Tradition in Art History

- When in the history of Western culture did European artists begin to create self-portraits and why?
- What does it mean to say that art is conceptual?
- Why were the Surrealists attracted to the idea of automatic drawing?
- How did the shift of patronage from the church to secular merchants in the Renaissance affect the creation of art?
- How did the First World War affect art in Europe?
- What are some of the reasons that artists in the early twentieth century began to create works without representational imagery?

- How did technological innovations that enabled the building of taller buildings (skyscrapers) in the late nineteenth century impact cities and urban life?

C. Art Beyond the Western Tradition

The candidate:

1. Knows and understands the general visual characteristics of art and architecture from Asia, Africa, the Americas, and the South Pacific region
   a. classifies works of art and architecture by regions/cultures
   b. describes/analyzes works of art and architecture using compositional elements and principles of design
   c. describes/analyzes the interrelationships between art from beyond the Western tradition and art from the Western tradition
   d. identifies major works of art and architecture by title, style, and/or artist, as appropriate
2. Knows and understands the general content, context, and purposes of art from Asia, Africa, the Americas, and the South Pacific region
   a. explains the content and/or purpose (as appropriate) of frequently referenced works of art from various locations and cultures
   b. identifies the general role of a work of art in its culture (e.g., celebration, ritual or ceremony, historical documentation)
   c. explains how the context in which a work of art is created conveys information about various lifestyles and belief systems (e.g., how Mesoamerican pyramids illuminate life and culture)
   d. evaluates information about art and artists from various sources

Discussion areas: Art Beyond the Western Tradition

- Choose one African culture. What are the salient visual characteristics of that culture's art?
- What are some features of a Maya pyramid that distinguish it from an Egyptian pyramid?
- What visual characteristics distinguish a landscape painted in China or Japan from those painted in the European tradition?
- Identify at least one mosque and one Buddhist temple that you can recognize visually.
- What was the function of a pyramid in Maya life and culture?
- How can the design and use of art forms in at least one culture function as signifiers of social rank or family importance?
- In what ways is a statue of Buddha designed to suggest spiritual enlightenment?

D. Responding to Art

The candidate:

1. Knows and understands the major theories of art and aesthetics (e.g., formalism, expressionism, deconstructivism, and representationalism)
   a. recognizes the major characteristics of various theories of art and aesthetics
   b. distinguishes among the major theories of art and aesthetics
   c. compares and contrasts the differences/similarities among theories of art and aesthetics
   d. interprets and evaluates works of art based on theories of art and aesthetics (as opposed to personal opinion)
2. Knows and understands the relationship between art and critical response
   a. demonstrates knowledge of critical reactions to well-known works and/or art movements
   b. recognizes/uses multiple viewpoints in examining a work of art (e.g., multiple viewpoints can be applied to the same work of art; visual or written analysis; looking at various analyses of works in history; "lenses")

c. recognizes the way personal experience affects interpretation of art (understanding that each person's experiences will affect how that person sees art)

d. recognizes how meaning is created in art (e.g., through symbols, iconography, formal elements and principles)

Discussion areas: Responding to Art

- Identify two or three works or movements that caused controversy. In each case, how did art critics respond?
- How do culture, experiences, and individual perception affect a critical response? For example, how might a critical response to a Christian religious work differ if the work is viewed by a Muslim or an atheist?
- How might gender or age affect a person's critical responses to a specific work of art or a general type of art?
- Choose three works of art from three different time periods. In each work, how is the meaning of the work communicated?

7. Review Smart Tips for Success

Follow test-taking tips developed by experts

Learn from the experts. Take advantage of the following answers to questions you may have and practical tips to help you navigate the *Praxis* test and make the best use of your time.

Should I guess?

Yes. Your score is based on the number of questions you answer correctly, with no penalty or subtraction for an incorrect answer. When you don't know the answer to a question, try to eliminate any obviously wrong answers and then guess at the correct one. Try to pace yourself so that you have enough time to carefully consider every question.

Can I answer the questions in any order?

You can answer the questions in order or skip questions and come back to them later. If you skip a question, you can also mark it so that you can remember to return and answer it later. Remember that questions left unanswered are treated the same as questions answered incorrectly, so it is to your advantage to answer every question.

Are there trick questions on the test?

No. There are no hidden meanings or trick questions. All of the questions on the test ask about subject matter knowledge in a straightforward manner.

Are there answer patterns on the test?

No. You might have heard this myth: the answers on tests follow patterns. Another myth is that there will never be more than two questions in a row with the correct answer in the same position among the choices. Neither myth is true. Select the answer you think is correct based on your knowledge of the subject.

Can I write on the scratch paper I am given?

Yes. You can work out problems on the scratch paper, make notes to yourself, or write anything at all. Your scratch paper will be destroyed after you are finished with it, so use it in any way that is helpful to you. But make sure to select or enter your answers on the computer.

Smart Tips for Taking the Test

1. **Skip the questions you find extremely difficult.** Rather than trying to answer these on your first pass through the test, you may want to leave them blank and mark them so that you can return to them later. Pay attention to the time as you answer the rest of the questions on the test, and try to finish with 10 or 15 minutes remaining so that you can go back over the questions you left blank. Even if you don't know the answer the second time you read the questions, see if you can narrow down the possible answers, and then guess. Your score is based on the number of right answers, so it is to your advantage to answer every question.

2. **Keep track of the time.** The on-screen clock will tell you how much time you have left. You will probably have plenty of time to answer all of the questions, but if you find yourself becoming bogged down, you might decide to move on and come back to any unanswered questions later.

3. **Read all of the possible answers before selecting one.** For questions that require you to select more than one answer, or to make another kind of selection, consider the most likely answers given what the question is asking. Then reread the question to be sure the answer(s) you have given really answer the question. Remember, a question that contains a phrase such as "Which of the following does NOT …" is asking for the one answer that is NOT a correct statement or conclusion.

4. **Check your answers.** If you have extra time left over at the end of the test, look over each question and make sure that you have answered it as you intended. Many test takers make careless mistakes that they could have corrected if they had checked their answers.

5. **Don't worry about your score when you are taking the test.** No one is expected to answer all of the questions correctly. Your score on this test is not analogous to your score on the *GRE*® or other tests. It doesn't matter on the *Praxis* tests whether you score very high or barely pass. If you meet the minimum passing scores for your state and you meet the state's other requirements for obtaining a teaching license, you will receive a license. In other words, what matters is meeting the minimum passing score. You can find passing scores for all states that use the *Praxis* tests at http://www.ets.org/s/praxis/pdf/passing_scores.pdf or on the web site of the state for which you are seeking certification/licensure.

6. **Use your energy to take the test, not to get frustrated by it.** Getting frustrated only increases stress and decreases the likelihood that you will do your best. Highly qualified educators and test development professionals, all with backgrounds in teaching, worked diligently to make the test a fair and valid measure of your knowledge and skills. Your state painstakingly reviewed the test before adopting it as a licensure requirement. The best thing to do is concentrate on answering the questions.

8. Check on Testing Accommodations

See if you qualify for accommodations to take the Praxis *test*

What if English is not my primary language?

Praxis tests are given only in English. If your primary language is not English (PLNE), you may be eligible for extended testing time. For more details, visit www.ets.org/praxis/register/plne_accommodations/.

What if I have a disability or other health-related need?

The following accommodations are available for *Praxis* test takers who meet the Americans with Disabilities Act (ADA) Amendments Act disability requirements:

- Extended testing time
- Additional rest breaks
- Separate testing room
- Writer/recorder of answers
- Test reader
- Sign language interpreter for spoken directions only
- Perkins Brailler
- Braille slate and stylus
- Printed copy of spoken directions
- Oral interpreter
- Audio test
- Braille test
- Large print test book
- Large print answer sheet
- Listening section omitted

For more information on these accommodations, visit www.ets.org/praxis/register/disabilities.

Note: Test takers who have health-related needs requiring them to bring equipment, beverages, or snacks into the testing room or to take extra or extended breaks must request these accommodations by following the procedures described in the *Bulletin Supplement for Test Takers with Disabilities or Health-Related Needs* (PDF), which can be found at http://www.ets.org/s/disabilities/pdf/bulletin_supplement_test_takers_with_disabilities_health_needs.pdf.

You can find additional information on available resources for test takers with disabilities or health-related needs at www.ets.org/disabilities.

9. Do Your Best on Test Day

Get ready for test day so you will be calm and confident

You followed your study plan. You prepared for the test. Now it's time to prepare for test day.

Plan to end your review a day or two before the actual test date so you avoid cramming. Take a dry run to the test center so you're sure of the route, traffic conditions, and parking. Most of all, you want to eliminate any unexpected factors that could distract you from your ultimate goal—passing the *Praxis* test!

On the day of the test, you should:

- be well rested
- wear comfortable clothes and dress in layers
- eat before you take the test
- bring an acceptable and valid photo identification with you
- bring an approved calculator only if one is specifically permitted for the test you are taking (see Calculator Use, at http://www.ets.org/praxis/test_day/policies/calculators)
- be prepared to stand in line to check in or to wait while other test takers check in

You can't control the testing situation, but you can control yourself. Stay calm. The supervisors are well trained and make every effort to provide uniform testing conditions, but don't let it bother you if the test doesn't start exactly on time. You will have the allotted amount of time once it does start.

You can think of preparing for this test as training for an athletic event. Once you've trained, prepared, and rested, give it everything you've got.

What items am I restricted from bringing into the test center?

You cannot bring into the test center personal items such as:

- handbags, knapsacks, or briefcases
- water bottles or canned or bottled beverages
- study materials, books, or notes
- pens, pencils, scrap paper, or calculators, unless specifically permitted for the test you are taking (see Calculator Use, at http://www.ets.org/praxis/test_day/policies/calculators)
- any electronic, photographic, recording, or listening devices

Personal items are not allowed in the testing room and will not be available to you during the test or during breaks. You may also be asked to empty your pockets. At some centers, you will be assigned a space to store your belongings, such as handbags and study materials. Some centers do not have secure storage space available, so please plan accordingly.

Test centers assume no responsibility for your personal items.

If you have health-related needs requiring you to bring equipment, beverages or snacks into the testing room or to take extra or extended breaks, you need to request accommodations in advance. Procedures for requesting accommodations are described in the Bulletin Supplement for Test Takers with Disabilities or Health-related Needs (PDF).

Note: All cell phones, smart phones (e.g., Android® devices, iPhones®, etc.), and other electronic, photographic, recording, or listening devices are strictly prohibited from the test center. If you are seen with such a device, you will be dismissed from the test, your test scores will be canceled, and you will forfeit your test fees. If you are seen *using* such a device, the device will be confiscated and inspected. For more information on what you can bring to the test center, visit www.ets.org/praxis/test_day/bring.

Are You Ready?

Complete this checklist to determine whether you are ready to take your test.

- ❒ Do you know the testing requirements for the license or certification you are seeking in the state(s) where you plan to teach?
- ❒ Have you followed all of the test registration procedures?
- ❒ Do you know the topics that will be covered in each test you plan to take?
- ❒ Have you reviewed any textbooks, class notes, and course readings that relate to the topics covered?
- ❒ Do you know how long the test will take and the number of questions it contains?
- ❒ Have you considered how you will pace your work?
- ❒ Are you familiar with the types of questions for your test?
- ❒ Are you familiar with the recommended test-taking strategies?
- ❒ Have you practiced by working through the practice questions in this study companion or in a study guide or practice test?
- ❒ If constructed-response questions are part of your test, do you understand the scoring criteria for these questions?
- ❒ If you are repeating a *Praxis* test, have you analyzed your previous score report to determine areas where additional study and test preparation could be useful?

If you answered "yes" to the questions above, your preparation has paid off. Now take the *Praxis* test, do your best, pass it—and begin your teaching career!

10. Understand Your Scores

Understand how tests are scored and how to interpret your test scores

Of course, passing the *Praxis* test is important to you so you need to understand what your scores mean and what your state requirements are.

What are the score requirements for my state?

States, institutions, and associations that require the tests set their own passing scores. Visit www.ets.org/praxis/states for the most up-to-date information.

If I move to another state, will my new state accept my scores?

The *Praxis* tests are part of a national testing program, meaning that they are required in many states for licensure. The advantage of a national program is that if you move to another state that also requires *Praxis* tests, you can transfer your scores. Each state has specific test requirements and passing scores, which you can find at www.ets.org/praxis/states.

How do I know whether I passed the test?

Your score report will include information on passing scores for the states you identified as recipients of your test results. If you test in a state with automatic score reporting, you will also receive passing score information for that state.

A list of states and their passing scores for each test are available online at www.ets.org/praxis/states.

What your *Praxis* scores mean

You received your score report. Now what does it mean? It's important to interpret your score report correctly and to know what to do if you have questions about your scores.

Visit http://www.ets.org/s/praxis/pdf/sample_score_report.pdf to see a sample score report.
To access *Understanding Your Praxis Scores*, a document that provides additional information on how to read your score report, visit www.ets.org/praxis/scores/understand.

Put your scores in perspective

Your score report indicates:

- Your score and whether you passed
- The range of possible scores
- The raw points available in each content category
- The range of the middle 50 percent of scores on the test

If you have taken the same *Praxis* test or other *Praxis* tests in the last 10 years, your score report also lists the highest score you earned on each test taken.

Content category scores and score interpretation

Questions on the *Praxis* tests are categorized by content. To help you in future study or in preparing to retake the test, your score report shows how many raw points you earned in each content category. Compare your "raw points earned" with the maximum points you could have earned ("raw points available"). The greater the difference, the greater the opportunity to improve your score by further study.

Score scale changes

ETS updates *Praxis* tests on a regular basis to ensure they accurately measure the knowledge and skills that are required for licensure. When tests are updated, the meaning of the score scale may change, so requirements may vary between the new and previous versions. All scores for previous, discontinued tests are valid and reportable for 10 years, provided that your state or licensing agency still accepts them.

These resources may also help you interpret your scores:

- *Understanding Your Praxis Scores* (PDF), found at www.ets.org/praxis/scores/understand
- *The Praxis Passing Scores* (PDF), found at www.ets.org/praxis/scores/understand
- State requirements, found at www.ets.org/praxis/states

Appendix: Other Questions You May Have

Here is some supplemental information that can give you a better understanding of the *Praxis* tests.

What do the *Praxis* tests measure?

The *Praxis* tests measure the specific knowledge and skills that beginning teachers need. The tests do not measure an individual's disposition toward teaching or potential for success, nor do they measure your actual teaching ability. The assessments are designed to be comprehensive and inclusive but are limited to what can be covered in a finite number of questions and question types. Teaching requires many complex skills that are typically measured in other ways, including classroom observation, video recordings, and portfolios.

Ranging from Agriculture to World Languages, there are more than 80 *Praxis* tests, which contain selected-response questions or constructed-response questions, or a combination of both.

Who takes the tests and why?

Some colleges and universities use the *Praxis* Core Academic Skills for Educators tests (Reading, Writing, and Mathematics) to evaluate individuals for entry into teacher education programs. The assessments are generally taken early in your college career. Many states also require Core Academic Skills test scores as part of their teacher licensing process.

Individuals entering the teaching profession take the *Praxis* content and pedagogy tests as part of the teacher licensing and certification process required by many states. In addition, some professional associations and organizations require the *Praxis* Subject Assessments for professional licensing.

Do all states require these tests?

The *Praxis* tests are currently required for teacher licensure in approximately 40 states and United States territories. These tests are also used by several professional licensing agencies and by several hundred colleges and universities. Teacher candidates can test in one state and submit their scores in any other state that requires *Praxis* testing for licensure. You can find details at www.ets.org/praxis/states.

What is licensure/certification?

Licensure in any area—medicine, law, architecture, accounting, cosmetology—is an assurance to the public that the person holding the license possesses sufficient knowledge and skills to perform important occupational activities safely and effectively. In the case of teacher licensing, a license tells the public that the individual has met predefined competency standards for beginning teaching practice.

Because a license makes such a serious claim about its holder, licensure tests are usually quite demanding. In some fields, licensure tests have more than one part and last for more than one day. Candidates for licensure in all fields plan intensive study as part of their professional preparation. Some join study groups, others study alone. But preparing to take a licensure test is, in all cases, a professional activity. Because a licensure exam surveys a broad body of knowledge, preparing for a licensure exam takes planning, discipline, and sustained effort.

Why does my state require the *Praxis* tests?

Your state chose the *Praxis* tests because they assess the breadth and depth of content—called the "domain"—that your state wants its teachers to possess before they begin to teach. The level of content knowledge, reflected in the passing score, is based on recommendations of panels of teachers and teacher educators in

each subject area. The state licensing agency and, in some states, the state legislature ratify the passing scores that have been recommended by panels of teachers.

How were the tests developed?

ETS consulted with practicing teachers and teacher educators around the country during every step of the *Praxis* test development process. First, ETS asked them what knowledge and skills a beginning teacher needs to be effective. Their responses were then ranked in order of importance and reviewed by hundreds of teachers.

After the results were analyzed and consensus was reached, guidelines, or specifications, for the selected-response and constructed-response tests were developed by teachers and teacher educators. Following these guidelines, teachers and professional test developers created test questions that met content requirements and *ETS Standards for Quality and Fairness*.*

When your state adopted the research-based *Praxis* tests, local panels of teachers and teacher educators evaluated each question for its relevance to beginning teachers in your state. During this "validity study," the panel also provided a passing-score recommendation based on how many of the test questions a beginning teacher in your state would be able to answer correctly. Your state's licensing agency determined the final passing-score requirement.

ETS follows well-established industry procedures and standards designed to ensure that the tests measure what they are intended to measure. When you pass the *Praxis* tests your state requires, you are proving that you have the knowledge and skills you need to begin your teaching career.

How are the tests updated to ensure the content remains current?

Praxis tests are reviewed regularly. During the first phase of review, ETS conducts an analysis of relevant state and association standards and of the current test content. State licensure titles and the results of relevant job analyses are also considered. Revised test questions are then produced following the standard test development methodology. National advisory committees may also be convened to review and revise existing test specifications and to evaluate test forms for alignment with the specifications.

How long will it take to receive my scores?

Scores for tests that do not include constructed-response questions are available on screen immediately after the test. Scores for tests that contain constructed-response questions or essays aren't available immediately after the test because of the scoring process involved. Official score reports are available to you and your designated score recipients approximately two to three weeks after the test date for tests delivered continuously, or two to three weeks after the testing window closes for other tests. See the test dates and deadlines calendar at www.ets.org/praxis/register/centers_dates for exact score reporting dates.

Can I access my scores on the web?

All test takers can access their test scores via My *Praxis* Account free of charge for one year from the posting date. This online access replaces the mailing of a paper score report.

The process is easy—simply log into My *Praxis* Account at www.ets.org/praxis and click on your score report. If you do not already have a *Praxis* account, you must create one to view your scores.

Note: You must create a *Praxis* account to access your scores, even if you registered by mail or phone.

**ETS Standards for Quality and Fairness* (2014, Princeton, N.J.) are consistent with the *Standards for Educational and Psychological Testing*, industry standards issued jointly by the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education (2014, Washington, D.C.).

Your teaching career is worth preparing for, so start today!

Let the *Praxis*® *Study Companion* guide you.

To search for the *Praxis* test prep resources that meet your specific needs, visit:

www.ets.org/praxis/testprep

To purchase official test prep made by the creators of the *Praxis* tests, visit the ETS Store:

www.ets.org/praxis/store

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ETS PRAXIS

The *PRAXIS*® Study Companion

Biology (5236)



ETS Professional Educator PROGRAMS

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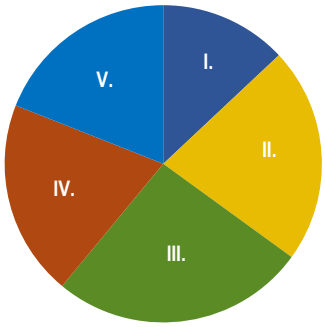
Biology (5236)

Test at a Glance

The *Praxis*® Biology test is designed to measure knowledge and competencies important for safe and effective beginning practice as a teacher of biology. Test takers have typically completed a bachelor's degree program with appropriate coursework in biology and education.

Test Name	Biology
Test Code	5236
Time	2.5 hours
Number of Questions	150 selected-response questions
Format	The test consists of a variety of selected-response questions, where you select one or more answer choices, and other types of questions. You can review the possible question types in "Understanding Question Types."
Test Delivery	Computer Delivered



Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
I. Nature and Impact of Science and Engineering	19	13%
II. Cell Biology: Cell Structure and Function	33	22%
III. Genetics and Evolution	39	26%
IV. Diversity of Life and Organismal Biology	30	20%
V. Ecology: Organisms and Environments	29	19%

All questions assess content from the above Biology domains. More than 40 percent of questions integrate a Science and Engineering Practice, and approximately 25 percent of questions assess content applied to a Task of Teaching Science.

About The Test

On the Biology test, content topics span the biology curriculum, including content related to (I) Nature and Impact of Science and Engineering, (II) Cell Biology: Cell Structure and Function, (III) Genetics and Evolution, (IV) Diversity of Life and Organismal Biology, (V) Ecology: Organisms and Environments.

The assessment is designed and developed through work with practicing biology teachers, teacher educators, and higher education biology specialists to reflect the science knowledge teachers need to teach the biology curriculum and to reflect state and national standards, including the National Science Teaching Association Preparation Standards for biology. Content and practices measured reflect the Disciplinary Core Ideas (DCIs) and Science and Engineering Practices (SEPs) established by the National Research Council in A Framework for K-12 Science Education and included in the Next Generation Science Standards.

The 150 selected-response questions measure concepts, terms, phenomena, methods, applications, data analysis, and problem solving in science. A full list of the topics covered is provided in **Content Topics**.

Test takers can expect 40 percent or more of the questions on the test to integrate biology content knowledge with one or more of the SEPs, listed under **Science and Engineering Practices**.

Test takers will also find that approximately 25 percent of questions call for application of biology content and processes within a teaching scenario or an instructional task. Such questions—designed to measure applications of biology knowledge to the kinds of decisions and evaluations a teacher must make during work with students, curriculum, and instruction—situate biology content questions in tasks critical for teaching. Below, in **Tasks of Teaching Science**, is a list of tasks that are a routine part of biology instruction. These tasks, identified based on research on science instruction, have been confirmed by a national committee of teachers and teacher educators as important for effective teaching of secondary science.

This test may contain some questions that will not count toward your score.

Content Topics

This list details the topics that may be included on the test. All test questions cover one or more of these topics.

Discussion Questions

In this section, discussion questions are open-ended questions or statements intended to help test your knowledge of fundamental concepts and your ability to apply those concepts to classroom or real-world situations. We do **not** provide answers for the discussion questions but thinking about the answers will help improve your understanding of fundamental concepts and may help you answer a broad range of questions on the test. Most of the questions require you to combine several pieces of knowledge to formulate an integrated understanding and response. They are written to help you gain increased understanding and facility with the test's subject matter. You may want to discuss these questions with a teacher or mentor.

I. Nature and Impact of Science and Engineering

A. Nature of Science

1. Nature of scientific knowledge
   a. Observations and experiments provide evidence
   b. Understanding develops and changes over time in light of new evidence
   c. Science is interdisciplinary in nature (e.g., principles of chemistry and physics and earth science in biology)
   d. Scientific methodologies
   e. Scientific skills include observing, categorizing, comparing, generalizing, inferring, and concluding
   f. Distinguish between scientific laws, and scientific theories, and hypotheses
   g. Models are developed, revised, and applied to explain natural phenomena
2. Experimental design, data collection, and analysis
   a. Standard units of measurement, dimensional analysis, and unit conversion
   b. Scientific notation and use of significant figures
   c. Experimental design, including hypothesis development, identifying variables, and planning data collection
   d. Processing, organizing, and reporting of quantitative and qualitative data
   e. Error analysis, including identifying the sources and effects of error
   f. Interpreting, extrapolating, and drawing valid conclusions from data
3. Laboratory procedures
   a. Preparation of materials for classroom or field use
   b. Appropriate and safe use, storage, and disposal of chemicals and biological materials
   c. Appropriate and safe use and care of laboratory equipment
   d. Safety and emergency procedures for science laboratories

B. Science, Engineering, Technology, Society, and the Environment

1. Engineering design and the interdependence of science, engineering, and technology
   a. Defining problems, including identifying the success criteria and the constraints
   b. Designing solutions, including proposing and evaluating in terms of criteria, constraints, and limitations
   c. Optimizing the design, including systematic modification and refinement
   d. Engineering advances lead to important discoveries in science
   e. Science and technology drive each other forward
2. Impacts of science, technology, human activity, and natural phenomena on society and the environment
   a. Sources of air and water pollution
   b. Sources of greenhouse gases and impacts of global climate change
   c. Production, use, disposal, and recycling of consumer products
   d. Consequences of natural disasters, resource extraction, and industrial accidents
   e. Forestry, agriculture, wildlife, and fisheries practices
   f. Ocean, estuary, freshwater, and wetland degradation
   g. Conservation, including species protection and habitat preservation and restoration
   h. Renewable or sustainable use of energy and resource management
3. Applications of science in public health, medicine, and agriculture
   a. Epidemiology, disease, and medicine (e.g., epidemics/pandemics, HIV/AIDS, pathogens, vaccines)
   b. Biotechnology (e.g., genetic engineering, GMOs)
   c. Medical technologies for disease diagnosis and treatment (e.g., medical imaging, X-rays, radiation therapy)
   d. Ethical research concerns (e.g., use of stem cells and toxic chemicals)
   e. Ethical use of technology, genetic information, organisms, and cloning

Discussion Questions: Nature and Impact of Science and Engineering

- What is the most effective way to compare information obtained from television, a newspaper article, a Web site, and a scientific journal for accuracy? For understandability? For use in the classroom setting?
- A scientist studying nutrient requirements for a particular type of bacteria inoculates three flasks of culture medium with an equal number of bacteria. Extra glucose is added to one of the flasks, and extra lactose is added to another. The number of bacteria per milliliter is determined every two hours for a period of 12 hours. What type of graph is best used to represent the data?
- Describe how to prepare 1 liter of an 0.85% sodium chloride solution.

- If a solution is to be used to culture living cells, is it important to include a buffer in the solution? Explain.
- Name some of the most likely reasons for the increased number of emerging infectious diseases affecting humans in recent years.
- Why do many infectious diseases spread rapidly through temporary settlements established after an area is devastated by war or a natural disaster?
- Name a disease transmitted by aerosol spray of a sneeze, a disease transmitted through drinking water, and a disease transmitted by an insect or arthropod vector.
- What is the relationship between the materials of which many plastics are produced and nonrenewable resources?
- A significant threat to marine turtles is incidental capture, injury, or death as a result of commercial fishing practices. What procedure has been implemented to protect marine turtles that are caught in nets, and what government agencies have been involved in implementing the turtle protection?
- What are some potentially beneficial uses of embryonic stem cells? Why do some people object to the use of these cells in research and development?

II. Cell Biology: Cell Structure and Function

A. Basic biochemistry and metabolism of living organisms

1. Chemical structures and properties of biologically important molecules
   a. Atomic and molecular structures
   b. Chemical bonding
   c. Organic versus inorganic molecules
   d. Properties of water based on structure and bonding characteristics
   e. Major macromolecules, including nucleic acids, proteins, lipids, and carbohydrates
2. Dependency of biological processes on chemical principles developmental and content domains
   a. Chemical and physical gradients, and factors that influence the gradients
   b. Laws of thermodynamics
   c. Anabolic and catabolic reactions in metabolism
   d. Reduction-oxidation reactions in metabolism
3. Structure and function of enzymes and the factors that influence their activity
   a. Active site structure and substrate binding
   b. Energy profile of a reaction in the presence or absence of an enzyme
   c. Reaction kinetics, including the effects of temperature, pH, concentrations, and other molecules, including inhibitors

   d. Regulation, including cooperative binding and feedback inhibition
4. Major biochemical pathways and energy flow within an organism
   a. Cellular locations of biochemical pathways
   b. Structure and function of ATP
   c. Photosynthesis, including photosystems, electron transport, Calvin-Benson cycle
   d. Processes associated with aerobic and anaerobic cellular respiration and fermentation, including glycolysis, citric acid cycle, and oxidative phosphorylation
   e. Chemosynthesis as an alternative to photosynthesis

B. Structure and function of cells and the mechanisms of basic cellular processes

1. Characteristics of living versus nonliving things
   a. Cell theory
   b. Obtaining and transforming energy
   c. Growth and development
   d. Homeostasis: regulation and responses to the environment
   e. Reproduction
2. Structure and function of cells and organelles
   a. Prokaryotic versus eukaryotic cells, including organelles, cell walls, and chromosomes
   b. Plant cells versus animal cells
   c. Plasma/cell membranes
   d. Membrane-bound organelles and ribosomes
   e. Cytoskeleton and extracellular matrix
3. How cells maintain their internal environment and respond to external signals
   a. Selective permeability, including structure and function of phospholipid bilayer
   b. Active and passive transport
   c. Water movement, including osmolarity and water potential
   d. Cell surface proteins, cell communication, signal molecules, and signal transduction
   e. Exocytosis and endocytosis
   f. Negative-feedback and positive-feedback mechanisms
4. Eukaryotic cell division, the cell cycle, and regulation of the processes
   a. Cell cycle stages and checkpoints
   b. Mitosis, including functions, stages, and results
   c. Cytokinesis, including differences between animals and plants
   d. Cancer (e.g., unregulated checkpoints and cell proliferation)

Discussion Questions: Cell Biology: Cell Structure and Function

- What are the four most abundant elements in the human body?
- What are functional groups of organic molecules? How do the differing charges of functional groups influence the behavior of the functional groups, the structure of molecules bearing the functional groups, and the interactions of the molecules with water?
- Why are fats insoluble in water?

- Describe the structural and functional differences between starch and cellulose.
- What factors influence the rate at which an ion diffuses across a cell membrane?
- How is ATP involved in the transfer of usable energy between molecules?
- How do temperature, pH, and competitive or noncompetitive inhibitors influence enzyme activity?
- State some similarities and differences between aerobic and anaerobic respiration.
- Explain the benefit, at the cellular level, of producing ATP aerobically. After strenuous activity, one may feel a burning sensation in some muscles. What is responsible for the sensation?
- How does the consumption of too many carbohydrates lead to an increase in body fat?
- A rock is found with patches of an unfamiliar orange-colored flakey material on the surface. What possible features of the orange-colored material would indicate that the material is alive?
- What structures are likely to be found in a plant cell but not in an animal cell?
- What structures are likely to be found in an animal cell but not in a bacterium?
- What organelles are likely to be present in greater abundance in a cell that is secreting a large amount of protein than in a cell secreting very little protein?
- Describe the difference between active and passive transport. Compare simple diffusion, osmosis, and facilitated diffusion.
- If an individual is stranded in a lifeboat on an ocean, why is drinking seawater more harmful to the individual than drinking no water at all?
- Compare mitosis and meiosis: the stages, genetic makeup of daughter cells, unique features. Name the three cell cycle checkpoints. What criteria must be met at each of the checkpoints for a cell to progress through the cell cycle?
- In addition to killing many types of cancer cells, why does chemotherapy treatment cause side effects such as anemia, gastrointestinal distress, and hair loss?

III. Genetics and Evolution

A. Mechanisms of molecular biology and genetic transmission

1. Structure of nucleic acids and chromosomes
   a. Sugar-phosphate backbone and complementary base pairing
   b. DNA versus RNA
   c. Chromosome structure, including nucleosomes and telomeres
2. Transfer of genetic information
   a. Central dogma of molecular biology
   b. Process of DNA replication
   c. The process of RNA transcription
   d. Pre-mRNA processing in eukaryotes

e. The process of translation, including the role of mRNA, tRNA, rRNA and ribosomes
f. Gene regulation (e.g., promoters, enhancers, transcription factors, and posttranslational regulation)
g. Utilization of a genetic code chart
h. Protein synthesis in eukaryotes versus prokaryotes

3. Nature of mutations
   a. Causes of mutations, including recombination and mutagens
   b. Types of mutations, including substitution, deletion, insertion, inversion, and translocation
   c. Disorders resulting from point mutations, frameshift mutations, changes in chromosome structure, and changes in chromosome numbers
   d. Significance of somatic versus germ-line mutations
4. Laboratory techniques
   a. Microscopy
   b. Gel electrophoresis
   c. Spectrophotometry
   d. Polymerase chain reaction (PCR)
   e. Genome sequencing
   f. Gene therapy
   g. Protein sequence analysis
   h. Genetically engineered cells and transgenic organisms
   i. Chromosome analysis
5. Mendelian genetics
   a. Dominant and recessive alleles
   b. The law of independent assortment and the role of meiosis
   c. The law of segregation and the role of meiosis
   d. Monohybrid and dihybrid crosses
   e. Pedigree analysis
6. Non-Mendelian inheritance
   a. Gene linkage and mapping by recombination analysis
   b. Sex-linked inheritance
   c. Multiple alleles, codominance, and incomplete dominance
   d. Polygenic inheritance, epistasis, and pleiotropy
   e. Extranuclear inheritance, including mitochondrial and chloroplast inheritance
   f. Environmental influences, including epigenetics
   g. Pedigree analysis

B. Mechanisms of evolution as a consequence of genetic variation and factors affecting evolution

1. Sources of genetic variation
   a. Mutation
   b. Sexual reproduction, including crossing-over, random fertilization, segregation and independent assortment
   c. Horizontal genetic exchange, including conjugation, transformation, and transduction
2. Mechanisms of evolution
   a. Darwin-Wallace theories of reproductive fitness and natural selection
   b. Hardy-Weinberg equilibrium: calculations and factors that may alter the equilibrium

c. Effects of mutations, gene flow, genetic drift (including bottleneck and founder effects), and nonrandom mating (including sexual selection)
d. Artificial selection
e. Macroevolution versus microevolution
f. Patterns of evolution: convergent, divergent, coevolution, parallel evolution, adaptive radiation
g. Gradualism versus punctuated equilibrium
h. Mechanisms of speciation, including reproductive isolation and allopatric and sympatric speciation

3. Evidence supporting evolution
   a. Fossil record
   b. Biogeographical similarities
   c. Biodiversity over geological time
   d. Endosymbiosis
   e. Structural and developmental evidence, including homology, embryology and vestigial structures
   f. Molecular evidence, including universal genetic code, DNA, RNA, and amino acid sequence comparisons
   g. Direct observation of evolution (e.g., antibiotic resistance)
4. Models of evolution
   a. Molecular clock (mitochondrial DNA)
   b. Phylogenetic relationships, including cladograms and phylogenetic trees
5. Scientific explanations for the origin and early evolution of life on Earth
   a. Abiotic synthesis of organic compounds (e.g., the Miller-Urey experiment)
   b. Development of self-replicating molecules, including the RNA-first hypothesis
   c. Biological influences on atmospheric composition, including the role of photosynthesis
6. Factors that lead to the extinction of species
   a. Lack of genetic diversity
   b. Interspecific competition
   c. Meteorite impacts and the effects of geological processes, including tectonic plate movement and volcanism
   d. Human-caused environmental pressures, including climate and habitat change

Discussion Questions: Genetics and Evolution

- Compare the structure of DNA and RNA: number of strands, flexibility, molecular composition.
- During DNA synthesis at a replication fork, why is one new strand of DNA synthesized in a continuous fashion and the other new strand synthesized in a discontinuous fashion?
- What is the signal for the start site of transcription? What is the signal for the start site of translation?
- What causes human liver cells to be structurally and functionally different from human muscle cells?

- In what types of cells must a mutation be found for the mutation to be passed on to offspring? Mutations in what types of cells are not inherited by offspring?
- What types of molecules are typically separated by gel electrophoresis? Where are the largest molecules in a sample typically found with respect to the wells in which the samples are loaded onto the gel?
- What type of microscope is typically used to examine live, anaesthetized fruit flies? What type of microscope is typically used to examine thin sections of cells?
- What are the roles of plasmids and restriction endonucleases in DNA cloning?
- How are viruses used in gene therapy?
- To determine whether a plant with purple flowers is homozygous or heterozygous with respect to flower color, the plant should be crossed with another pea plant with what genotype and phenotype?
- Name a genetic disorder that is most commonly caused by fusion of a gamete with a normal chromosome number with another gamete that contains two copies of a particular chromosome. What is the most likely cause of the abnormal chromosome number in the gamete?
- Describe the relationship between DNA mutation, skin cancer, and prolonged exposure to the sun.
- A particular genetic trait is inherited in an autosomal recessive fashion. If one out of every 400 individuals has the trait, what percent of the population are expected to be carriers of the trait?
- A particular population exhibits variation in certain traits. For natural selection to act on the variations, what two requirements must be met by the variations?
- As a result of habitat fragmentation, a small population of leopards becomes isolated from the larger original population. As time progresses, are allele frequencies and genetic variation expected to differ between the original population and the isolated population? If so, describe how and why they will differ.
- What structural and functional characteristics of mitochondria and chloroplasts provide evidence to support the theory of endosymbiosis?
- Horses and donkeys can mate and produce viable offspring, but horses and donkeys are considered to be separate species. Explain why this is so.
- What organic compounds were produced in the Miller-Urey experiment? How did the design of the experiment support the hypothesis that organic compounds are likely to have arisen from abiotic materials present in the atmosphere of early Earth?

IV. Diversity of Life and Organismal Biology

A. Diversity of Life

1. Biological classification of organisms
   a. Taxonomic hierarchy, including domains and kingdoms
   b. Binomial nomenclature
2. Defining characteristics of viruses, eubacteria, archaea, protists, fungi, plants, and animals
   a. Structural characteristics of viruses, eubacteria, archaea, protists, fungi, plants, and animals
   b. Cellular organization, including unicellular versus multicellular
   c. Modes of nutrition, including autotrophic versus heterotrophic
   d. Modes of reproduction/replication
3. Organizational hierarchy
   a. Cells
   b. Tissues
   c. Organs
   d. Organ systems
4. Cell differentiation and specialization
   a. Differential gene expression
   b. Stem cells, including characteristics and sources

B. Animal Biology

1. Characteristics of animals
   a. Major evolutionary trends, including body plans, body cavities, cephalization and multicellularity
   b. Modes of reproduction (sexual versus asexual)
   c. Modes of temperature regulation (endotherm versus ectotherm)
2. Structure and function of major human organ systems
   a. Cardiovascular and respiratory
   b. Digestive and excretory
   c. Immune
   d. Musculoskeletal
   e. Nervous and endocrine
   f. Reproductive
3. How homeostasis is maintained in organisms
   a. Role of organs or tissues, such as the kidney, adrenals, and hypothalamus, and pituitary
   b. Role of hormones, such as insulin, antidiuretic hormone, and sex hormones
   c. Feedback mechanisms, including negative and positive
   d. Role of behaviors, including diurnal, nocturnal, hibernation, and basking
4. Reproduction, development, and growth in organisms
   a. Gamete formation, including the stages of meiosis and changes in chromosome number
   b. Fertilization, including internal versus external
   c. Embryonic development
   d. Patterns of growth and development, including metamorphosis
5. Behavior
   a. Innate versus learned behaviors
   b. Territoriality
   c. Group versus individual
   d. Social behavior (e.g., hunting, flocking, migration, altruism)

C. Plant Biology

1. Characteristics of plants
   a. Vascular versus nonvascular plants
   b. Angiosperms versus gymnosperms
   c. Tissues, including dermal, ground, and vascular (xylem and phloem)
   d. Structure of organs, including flowers, stems, leaves, and roots
2. How plants obtain, transport, and store materials
   a. Roles of roots, stems, and leaves
   b. Water and nutrient transport, including xylem and transpiration through stomata
   c. Production, transport, and storage of products of photosynthesis, including simple and complex carbohydrates, phloem transport, and storage structures
3. Reproduction, growth and development
   a. Gametogenesis
   b. Alternation of generations, including gametophyte and sporophyte
   c. Pollination/fertilization strategies and seed/spore propagation
   d. Germination and growth
4. How plants respond to the environment
   a. Plant tropisms
   b. Plant defenses, including physical and chemical
   c. Major plant hormones, including auxin, gibberellins, ethylene, and cytokinins

Discussion Questions: Diversity of Life and Organismal Biology

- Compare the structure of chromosomes in eukaryotes, bacteria, and archaea.
- Carl Woese based his phylogenetic classification on analyses of what macromolecule? As a result of Woese's analyses, how was the tree of life revised from that based on morphological similarities?
- What are the sources of carbon dioxide, oxygen, and water used by a plant in photosynthesis or cellular respiration? Through what structures and by what processes do these molecules enter and exit a plant?
- Describe the characteristics of mushrooms that distinguish them as fungi rather than viruses, bacteria, protists, plants, or animals.
- Give an example of an animal with radial symmetry and one with bilateral symmetry. Is cephalization likely to be a feature of either one of these forms of symmetry? If so, of which?
- Describe the features of body cavities by which triploblastic animals can be distinguished as coelomates, pseudocoelomates, or acoelomates. Give an example of an animal that is a coelomate, one that is a pseudocoelomate, and one that is an acoelomate.
- Trace the flow of a drop of blood from the right atrium of the heart as the blood passes through the heart, the lungs, and one complete circuit of the human circulatory system.

- Describe the two ways in which ventilation in birds is particularly efficient in comparison to ventilation in most mammals.
- Describe the digestion of proteins in the human digestive system, specifically the enzymes involved, the location of the cells that produce the enzymes, and the organs in which the digestion occurs.
- Name two ways by which the skin plays a role in thermoregulation in humans.
- Name four features of monocots that can frequently (although not always) be used to distinguish monocots from eudicots.
- What materials are transported in the xylem? What materials are transported in the phloem? In which direction does material flow in each type of vessel?
- In what root tissue are new root cells produced? Name four important functions of plant roots. Under what circumstance are stomata typically closed? Describe the mechanism by which ion flow and osmosis regulate the opening and closing of guard cells.
- Prairie dogs typically live in large colonies and dig extensive underground systems of burrows. If a predator approaches a colony, a prairie dog who spots the predator will sound a loud alarm that alerts the other members of the colony, most of whom will dive into the burrows and hide. The prairie dog that sounds the alarm is, however, drawing attention to itself and may be attacked by the predator. Explain why this behavior is often considered to be an example of altruism in animals.

V. Ecology: Organisms and Environment

A. Biosphere organization and factors affecting organism interactions and population size

1. Hierarchical structure of the biosphere
   a. Biomes
   b. Ecosystems
   c. Communities
   d. Populations
   e. Organisms
2. Relationships within and between species
   a. Symbiotic relationships including mutualism, parasitism, commensalism
   b. Predator – prey relationship, including evolutionary adaptations
   c. Competition
   d. Keystone species
3. Relationships among reproductive strategies, demographics, and population growth
   a. Sexual versus asexual reproduction
   b. r-strategists versus K-strategists
   c. Exponential growth
   d. Logistic growth and carrying capacity
   e. Population demographics
4. Influence of biotic and abiotic components on community structure
   a. Limiting factors

b. Habitat and niche
c. Competition and predation
d. Density-dependent versus density-independent factors

5. Human impacts on ecosystems
   a. Habitat destruction (e.g., deforestation, fragmentation, urbanization and agriculture)
   b. Pollution (e.g., plastics, acid precipitation, ozone layer destruction (CFCs))
   c. Climate change, including greenhouse gases and ocean acidification
   d. Introduced and reintroduced species and invasive species
   e. Overconsumption of resources
   f. Remediation (e.g., reforestation, movement corridors, captive breeding programs, and biotechnology)

B. Characteristics of biomes, energy flow in ecosystems, and major biogeochemical cycles

1. Ecological succession
   a. Primary versus secondary succession
   b. Biomass, diversity, productivity, and habitat changes during succession
   c. Temporal and spatial disturbances (e.g., climate, fire, and disease)
2. Types of biomes and energy flow in the biomes
   a. Characteristics of aquatic and terrestrial biomes
   b. Trophic levels, including pyramids of numbers, biomass, and energy
   c. Food chains and food webs and trophic cascades
   d. Flow of energy versus cycling of matter, including biomagnification
3. Biogeochemical cycles, including biotic and abiotic components
   a. Water cycle
   b. Carbon cycle
   c. Nitrogen cycle
   d. Phosphorus cycle

Discussion Questions: Ecology: Organisms and Environment

- Vegetable crops growing on a commercial farm are damaged by an unknown disease or pest with a 70 to 90 percent mortality rate. The farmer claims that he has not changed his procedures for watering and fertilizer application. Formulate a hypothesis about the causative agent, given the observations above. What type of experiments should be used to help support or falsify the hypothesis?
- Distinguish between a population of organisms and a community of organisms.
- Name the two most common limiting factors to primary production in aquatic ecosystems.
- Draw the predicted growth curve for a population introduced into a new environment in which resources are initially unlimited. How will the shape of the curve change as the population reaches carrying capacity? What factors might determine the carrying capacity?
- Compare primary and secondary succession. Is soil initially present in

the environments where each type of succession occurs? What are the first organisms that typically colonize the environment where each type of succession occurs?
- What types of natural disturbances are most likely to lead to primary ecological succession?
- What kind of natural disturbances are most likely to lead to secondary succession? In the immediate aftermath of a disturbance, what will be the most likely effect on biodiversity of the region?
- Why is the density of water important to freshwater pond ecosystems in temperate regions?
- Why is the air temperature along the coast generally higher than the air temperature of inland areas in the same regions? How does this influence the types of organisms present in each region?
- A large percent of the mice in a particular population are infected by a virus that is usually fatal. What is the relationship between the virus and the mice? How will the viral infection most likely ultimately affect other members of the ecosystem such as grasses and owls?
- What is meant by acid precipitation, and how is it harmful? How do human activities contribute to acid precipitation?
- How do lawn and agricultural fertilizers get into the natural water system? Why are the fertilizers harmful to many aquatic and semi-aquatic organisms or to any organisms that depend on the water supply?
- What are the major reservoirs of carbon in the biosphere?
- What is the major natural route by which nitrogen enters an ecosystem?
- What are the major biotic and abiotic processes that drive the water cycle?

Science and Engineering Practices

The SEPs represent eight practices that scientists and engineers—and students and teachers—use to investigate the world and to design and build systems. Many test questions will integrate one or more of these practices.

1. Asking questions (for science) and defining problems (for engineering)
   - Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.
   - Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.
   - Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.
   - Ask questions to clarify and refine a model, an explanation, or an engineering problem.
   - Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.

- Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.
- Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.

2. Developing and using models
   - Evaluate merits and limitations of two different models of the same proposed tool, process, mechanism, or system in order to select or revise a model that best fits the evidence or design criteria.
   - Design a test of a model to ascertain its reliability.
   - Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.
   - Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.
   - Develop a complex model that allows for manipulation and testing of a proposed process or system.
   - Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.
3. Planning and carrying out investigations
   - Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.
   - Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
   - Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.
   - Select appropriate tools to collect, record, analyze, and evaluate data.
   - Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.
   - Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables.

4. Analyzing and interpreting data
   - Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
   - Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
   - Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.
   - Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations.
   - Evaluate the impact of new data on a working explanation and/or model of a proposed process or system.
   - Analyze data to identify design features or characteristics of the components of a proposed process or system to optimize it relative to criteria for success.
5. Using mathematics and computational thinking
   - Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system.
   - Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
   - Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
   - Use simple limit cases to test mathematical expressions, computer programs, algorithms, or simulations of a process or system to see if a model "makes sense" by comparing the outcomes with what is known about the real world.
   - Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL , kg/m^3 , acre-feet, etc.).
6. Constructing explanations (for science) and designing solutions (for engineering)
   - Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.
   - Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
   - Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

- Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.
- Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

7. Engaging in argument from evidence
   - Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (e.g., trade-offs), constraints, and ethical issues.
   - Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.
   - Respectfully provide and/or receive critiques on scientific arguments by probing reasoning and evidence and challenging ideas and conclusions, responding thoughtfully to diverse perspectives, and determining what additional information is required to resolve contradictions.
   - Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence.
   - Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge, and student-generated evidence.
   - Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and/or logical arguments regarding relevant factors (e.g., economic, societal, environmental, ethical considerations).
8. Obtaining, evaluating, and communicating information
   - Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
   - Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.
   - Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.
   - Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible.

- Communicate scientific and/or technical information or ideas (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).

Tasks of Teaching Science

This list includes instructional tasks that teachers engage in that are essential for effective General Science teaching. Many test questions will measure content through application to one or more of these tasks.

Scientific Instructional Goals, Big Ideas, and Topics

1. Selecting or sequencing appropriate instructional goals or big ideas for a topic
2. Identifying the big idea or instructional goal of an instructional activity
3. Choosing which science ideas or instructional activities are most closely related to a particular instructional goal
4. Linking science ideas to one another and to particular activities, models, and representations within and across units

Scientific Investigations and Demonstrations

5. Selecting investigations or demonstrations, including virtual, that facilitate understanding of disciplinary core ideas, scientific practices, or crosscutting concepts
6. Evaluating investigation questions for quality (e.g., testable, empirical)
7. Determining the variables, techniques, or tools that are appropriate for use by students to address a specific investigation question
8. Critiquing scientific procedures, data, observations, or results for their quality, accuracy, or appropriateness
9. Supporting students in generating questions for investigation or identifying patterns in data and observations

Scientific Resources (texts, curriculum materials, journals, and other print and media-based resources)

10. Evaluating instructional materials and other resources for their ability to address scientific concepts; engage students with relevant phenomena; develop and use scientific ideas; promote students' thinking about phenomena, experiences, and knowledge; take account of students' ideas and background; and assess student progress
11. Choosing resources that support the selection of accurate, valid, and appropriate goals for science learning

Student Ideas (including common misconceptions, alternate conceptions, and partial conceptions)

12. Analyzing student ideas for common misconceptions regarding intended scientific learning
13. Selecting diagnostic items and eliciting student thinking about scientific ideas and practices to identify common student

misconceptions and the basis for those misconceptions

14. Developing or selecting instructional moves, approaches, or representations that provide evidence about common student misconceptions and help students move toward a better understanding of the idea, concept, or practice

Scientific Language, Discourse, Vocabulary, and Definitions

15. Selecting scientific language that is precise, accurate, grade-appropriate, and illustrates key scientific concepts
16. Anticipating scientific language and vocabulary that may be difficult for students
17. Modeling the use of appropriate verbal and written scientific language in critiquing arguments or explanations, in describing observations, or in using evidence to support a claim, etc.
18. Supporting and critiquing students' participation in and use of verbal and written scientific discourse and argumentation

Scientific Explanations (includes claim, evidence, and reasoning)

19. Critiquing student-generated explanations or descriptions for their generalizability, accuracy, precision, or consistency with scientific evidence
20. Selecting explanations of natural phenomena that are accurate and accessible to students

Scientific Models and Representations (analogies, metaphors, simulations, illustrations, diagrams, data tables, performances, videos, animations, graphs, and examples)

21. Evaluating or selecting scientific models and representations that predict or explain scientific phenomena or address instructional goals
22. Engaging students in using, modifying, creating, and critiquing scientific models and representations that are matched to an instructional goal
23. Evaluating student models or representations for evidence of scientific understanding
24. Generating or selecting diagnostic questions to evaluate student understanding of specific models or representations
25. Evaluating student ideas about what makes for good scientific models and representations

Biology (5236) Sample Test Questions

The sample questions that follow represent a number of the types of questions and topics that appear on the test. They are not, however, representative of the entire scope of the test in either content or difficulty. Answers with explanations follow the questions.

Directions: Each of the questions or incomplete statements below is followed by suggested answers or completions. Select the one that is best in each case.

1. The transfer of pollen from one flower to another while a bee is collecting nectar is an example of which of the following relationships?

   (A) Commensalism
   (B) Mutualism
   (C) Competition
   (D) Parasitism

2. Taxonomic classification of two different organisms as members of the same order indicates that they are also members of the same

   (A) family
   (B) genus
   (C) phylum
   (D) species

3. Which of the following changes typically occurs in a eukaryotic cell as it progresses through the S phase of the cell cycle?

   (A) The nuclear membrane breaks down.
   (B) The quantity of DNA in the cell doubles.
   (C) The cell membrane pinches inward to form a cleavage furrow.
   (D) The duplicated chromosomes line up along the equatorial plate.

4. Which **TWO** of the following characteristics are shared by members of the kingdom Fungi?

   (A) Can perform photosynthesis
   (B) Have cell walls that contain chitin
   (C) Secrete digestive enzymes into the surrounding environment
   (D) Have circular chromosomes that are unprotected by a nuclear membrane

5. The population of a particular mammalian species has dwindled to less than 1,000 individuals. Which of the following is most likely to cause the population to become extinct?

   (A) Absence of interspecific competition
   (B) Increased gene flow
   (C) Presence of disruptive selection
   (D) Decreased genetic diversity

6. Which of the following visual aids will best support an investigation of energy flow through the organisms in a particular ecosystem?

   (A) A cladogram
   (B) A Punnett square
   (C) A diagram of a food web
   (D) A topographic map

7. Which of the following is a technique used to determine the three-dimensional structure of a protein at high resolution?

   (A) Flow cytometry
   (B) Immunoprecipitation
   (C) Polyacrylamide gel electrophoresis
   (D) X-ray crystallography

8. Which of the following terms refers to the collective evidence that links the origin of some eukaryotic organelles to prokaryotes?

   (A) Hybrid inviability
   (B) Heterozygote advantage
   (C) The endosymbiotic theory
   (D) The germ theory of disease

9. A segmented body is a key characteristic of the members of which of the following animal phyla?

   (A) Annelida
   (B) Cnidaria
   (C) Nematoda
   (D) Porifera

10. A teacher asks students to identify a type of organism that reproduces primarily through asexual reproduction. Which of the following is the most accurate response?

    (A) A whale
    (B) A shark
    (C) A maple tree
    (D) A bacterium

11. Students spread bacteria on several slabs of solid culture medium. Some of the slabs were prepared from a culture medium that contained glucose, whereas the remaining slabs were prepared from a culture medium that lacked glucose or any other simple sugar. The students placed the inoculated slabs in an incubator overnight and recorded observations the following day. The students found that colonies of bacteria were visible only on the glucose-containing slabs. Which of the following ideas is most closely linked to the results of the experiment?

    (A) Living things adapt to their environment.
    (B) Living things require a source of energy.
    (C) Living things are sensitive and respond to stimuli.
    (D) Living things can move from one location to another.

12. A teacher is preparing a lesson on how biotechnology is used in research. Which of the following is an example of how biotechnology is used to produce transgenic organisms?

    (A) Selectively breeding dogs to maximize specific behaviors
    (B) Editing the DNA of rice plants to introduce specific base-pair substitutions
    (C) Inserting a jellyfish gene into the genome of different strains of mice
    (D) Translocating deer from a large population to a small, isolated population

13. A segment of a messenger RNA molecule has the following nucleotide sequence.

    5′-AUGGCUCUCGAGAGAUAA-3′

    If the first codon is a start codon and the last codon is a stop codon, how many amino acids are encoded in the nucleotide sequence?

    (A) Three
    (B) Five
    (C) Six
    (D) Nine

14. To link a discussion about the mechanisms of evolution to a previous lesson on molecular biology, a teacher asks students to identify the principal mechanism by which new alleles of a gene are produced. Which of the following is the most accurate response?

    (A) Fertilization
    (B) Mutation
    (C) Transcription
    (D) Translation

15. A teacher asks students to describe what will likely happen to a body cell when the concentration of solutes in the extracellular fluid decreases as a result of excessive water consumption. Which of the following student responses provides the most accurate reasoning?

    (A) "The extracellular fluid will become hypotonic to the cytosol, resulting in a net movement of water into the cell by osmosis."
    (B) "The extracellular fluid will become hypotonic to the cytosol, resulting in a net movement of water out of the cell by osmosis."
    (C) "The extracellular fluid will become hypertonic to the cytosol, resulting in a net movement of water into the cell by osmosis."
    (D) "The extracellular fluid will become hypertonic to the cytosol, resulting in a net movement of water out of the cell by osmosis."

16. Students will isolate DNA from yeast cells that result from a genetic cross. The students will then determine which of two different alleles of a certain gene are present in each sample of DNA. Which **THREE** of the following techniques are most appropriate for the students to use for analyzing the results of the genetic cross?

    (A) Agarose gel electrophoresis
    (B) Restriction digestion
    (C) NMR spectroscopy
    (D) PCR

17. Students and their teacher are discussing different models that explain how concentration gradients are established and maintained across cell membranes. The teacher tells the students that a certain uncharged molecule has a higher concentration outside a cell than inside the cell. The teacher then asks the students to propose a way in which the cell can maintain the molecule's concentration gradient. Which of the following student responses demonstrates the most accurate reasoning?

    (A) "The cell can use cytosolic enzymes to convert the molecule to a different molecule."
    (B) "The cell can activate biochemical pathways that will produce more of the molecule inside the cell."
    (C) "The cell can turn on membrane proteins that pump the molecule from the surrounding environment to the inside of the cell."
    (D) "The cell can open channel proteins that will allow some of the molecules to diffuse across the plasma membrane into the cell."

18. Students conducted a survey of the invertebrates that were present at several different ponds. For each pond, the students recorded the different types of invertebrates that were observed and the relative abundance of each type. Which of the following characteristics can the students compare most directly using the data collected in the survey?

    (A) Dissolved oxygen levels in the different ponds
    (B) Diversity of the different communities
    (C) Primary productivity of the different ecosystems
    (D) Climate change at the different locations

19. A student wonders whether molecule X affects a particular enzyme-catalyzed reaction through competitive inhibition. To investigate, the student proposes an experiment in which the initial reaction velocity is the dependent variable. If the concentrations of molecule X and the enzyme are held constant, then the independent variable in the student's experiment should be which of the following?

    (A) The reaction temperature
    (B) The concentration of the buffer
    (C) The initial substrate concentration
    (D) The pH of the reaction solution

20. Students use a computer simulation to investigate the outcome of a genetic cross between a true-breeding line of fruit flies with sepia eyes and a true-breeding line of fruit flies with wild-type eyes. The teacher recommends that the students allow the flies in the F_1 generation to interbreed and produce an F_2 generation. The teacher then asks the students whether the results of the simulation support a claim that the sepia-eyes trait exhibits an autosomal recessive mode of inheritance.

    If the results support the claim, flies that have sepia eyes will make up approximately what percent of the F_2 generation?

    (A) 25%
    (B) 50%
    (C) 75%
    (D) 100%

21. A student is preparing a poster to show the proposed evolutionary relationships among several different species. Which of the following types of representations should the student use for the poster?

    (A) A histogram
    (B) A flow chart
    (C) A scatterplot
    (D) A phylogenetic tree

22. Recently, seasonal dead zones in low-oxygen waters have been occurring annually in the Gulf of Mexico near the mouth of the Mississippi River. The dead zones result from the rapid growth of photosynthetic phytoplankton and their subsequent decay by oxygen-depleting microbes in the water column. Which of the following changes most likely triggers the rapid growth of the photosynthetic phytoplankton?

    (A) A decrease in competition from other marine phytoplankton during the summer months
    (B) A decrease in the light level in surface waters as day length starts to shorten after the summer solstice
    (C) An increase in predation by marine larvae and other zooplankton during the summer months
    (D) An increase in the influx of nutrients derived from chemical fertilizers that are high in nitrogen and phosphorus

23. Damage to the sinoatrial node in the human heart is most likely to result in which of the following?

    (A) Disruption of the rate and timing of cardiac muscle contractions
    (B) Blockage of valve closure between the atria and the ventricles
    (C) Mixing of blood in the right and left atria
    (D) Decrease in blood pressure in the pulmonary artery

24. A teacher tells students that the hydrolysis of one molecule of lactose produces one molecule of glucose and one molecule of galactose. The teacher then asks the students to use the information to identify a term that describes a molecule of lactose. Which of the following responses is the most accurate?

    (A) Amino acid
    (B) Disaccharide
    (C) Fatty acid
    (D) Nucleotide

25. Which of the following scientific disciplines resulted primarily from the development of high-speed, low-cost methods for determining and analyzing DNA sequences?

    (A) Conservation ecology
    (B) Genomics
    (C) Histology
    (D) Plant breeding

26. A teacher asks students to explain how the presence of lignin is an adaptation that helps plants survive in terrestrial habitats. The teacher encourages the students to provide reasoning to support their explanations. Which of the following written responses provides the most accurate reasoning?

    (A) Lignin catalyzes the synthesis of amino acids inside cells, allowing plants to make proteins.
    (B) Lignin attracts pollinators like birds and insects, allowing plants to reproduce on land.
    (C) Lignin absorbs light energy, allowing plants to make sugars by the process of photosynthesis.
    (D) Lignin provides structural support, allowing plants to grow tall and compete better for sunlight.

27. If 35 percent of a sample of double-stranded DNA is adenine, what percent of the DNA is cytosine?

    (A) 10 percent
    (B) 15 percent
    (C) 30 percent
    (D) 70 percent

28. A teacher asks students to describe the most likely mechanism by which the seeds of a blueberry plant will be dispersed. Which of the following written responses demonstrates the most accurate understanding?

    (A) The blueberry plant will release the seeds into the air, and the blueberry seeds will be blown by the wind to a new location far away.
    (B) The plant's blueberries will disintegrate, and the seeds inside will fall to the ground and later stick to the fur of an animal that walks by.
    (C) The blueberries produced by the plant will be eaten by an animal, and the blueberry seeds will be excreted in the animal's droppings at a new location.
    (D) The blueberries on the plant will ripen and build up lots of gas, and eventually the seeds will be shot out of ripe blueberries to a location far away from the plant.

29. A teacher presents students with images of a cell. Which **TWO** of the following questions will best help the students determine whether the images are of a eukaryotic cell or a prokaryotic cell?

    (A) Does the cell contain ribosomes?
    (B) Does the cell contain mitochondria?
    (C) Does the cell contain chromosomal DNA?
    (D) Does the cell contain a membrane-enclosed nucleus?

30. Stomatal opening in plants requires an increase in the rate at which guard cells take up which of the following?

    (A) Iodine atoms
    (B) Nitrogen gas
    (C) Potassium ions
    (D) Sucrose molecules

31. Which of the following is the most likely benefit of periodic natural wildfires in some forest ecosystems?

    (A) The fires remove dead and decaying plant matter, reducing the risk of more intense and destructive fires.
    (B) The fires leach nutrients from the soil, preventing the germination of plants that might compete with native species.
    (C) The fires drive off herbivores whose plant-based diets reduce the amount of vegetation.
    (D) The fires dry out the soil and decrease the chance of flooding after heavy rains.

32. Students are creating a poster of a eukaryotic cell that shows the subcellular locations of metabolic processes associated with cellular respiration. The students should indicate on their poster that enzymes located in the mitochondrial matrix most directly facilitate which of the following processes?

    (A) Citric acid cycle
    (B) Fermentation
    (C) Glycolysis
    (D) Oxidative phosphorylation

33. A gas phase is generally absent from which of the following biogeochemical cycles?

    (A) Water
    (B) Carbon
    (C) Sulfur
    (D) Phosphorus

34. Hemophilia is a rare X-linked recessive disorder in which the body has a reduced ability to form blood clots. If a woman with hemophilia has a child with a man who does not have hemophilia, what is the chance that the child will be a carrier of the disorder?

    (A) 0%
    (B) 25%
    (C) 50%
    (D) 100%

35. Students designed an experiment for investigating how environmental conditions affect the rate of carbon dioxide release by corn seedlings. In the experiment, the students will put nearly identical corn seedlings into separate test tubes containing a carbon dioxide indicator solution. The students will then seal the test tubes and place them in different locations, as indicated in the following table. The students will determine the rates of carbon dioxide release by monitoring changes in the indicator solutions.

Test Tube	Location of the Test Tube	Light Source
1	In a refrigerator	Absent
2	On a table in a classroom	Present
3	In boiling water	Present

Which **THREE** of the following suggestions will best help the students improve their experimental design?

(A) Place a light source inside the refrigerator.
(B) Use seedlings of three different plant species.
(C) Use water maintained at 35°C instead of boiling water.
(D) Increase the number of seedlings in each treatment group.

36. A teacher asks students whether genetic drift is more likely to occur in a large population or a small population. The teacher specifies that the students should provide reasoning to support their answer. Which of the following written responses demonstrates the most accurate understanding of genetic drift?

(A) It is more likely to happen in a large population, because the population has more alleles to be lost.
(B) It is more likely to happen in a large population, because more offspring are produced than in a small population.
(C) It is more likely to happen in a small population, because the members of the small population are not as healthy as are the members of the large population.
(D) It is more likely to happen in a small population, because random events can have a greater effect on allele frequencies in a small population than in a large population.

37. A teacher asks students to describe a type of electric power generation that relies on a nonrenewable resource. Which of the following responses demonstrates the most accurate understanding of the term "nonrenewable resource"?

    (A) Generating electric power by burning natural gas
    (B) Producing electric power by allowing water to flow through a dam
    (C) Converting wind energy to electric energy by using wind turbines
    (D) Producing electric energy by harnessing light energy with solar panels

38. In vertebrate embryos, which of the following developmental processes most directly results in the formation of the three primary germ layers?

    (A) Neurulation
    (B) Blastula formation
    (C) Cleavage
    (D) Gastrulation

Biology (5236) Answers

1. Option (B) is correct. Because both the bee and the flowering plant benefit from the interaction, the ecological relationship is best described as mutualism.

Topic	V. Ecology: Organisms and Environment
Subtopic	A. Biosphere organization and factors affecting organism interactions and population size

2. Option (C) is correct. A phylum is a more inclusive level of classification than an order. As such, members of the same order are also members of the same phylum.

Task of Teaching Science	15. Selecting scientific language that is precise, accurate, grade-appropriate, and illustrates key scientific concepts
Topic	IV. Diversity of Life and Organismal Biology
Subtopic	A. Diversity of Life

3. Option (B) is correct. During the S phase of the cell cycle, the quantity of DNA in a eukaryotic cell doubles as a result of DNA replication. After the S phase, each of the cell's chromosomes is composed of two identical chromatids that will separate during cell division.

Topic	II. Cell Biology: Cell Structure and Function
Subtopic	B. Structure and function of cells and the mechanisms of basic cellular processes

4. Options (B) and (C) are correct. Fungi are heterotrophic eukaryotes that share the characteristics of having chitin-containing cell walls and carrying out external digestion by secreting digestive enzymes into the surrounding environment.

Topic	IV. Diversity of Life and Organismal Biology
Subtopic	A. Diversity of Life

5. Option (D) is correct. As a population of organisms gets smaller, the population's gene pool also gets smaller, resulting in a decrease in genetic diversity. With less genetic diversity, the population will be more vulnerable to disease, natural disasters, and extreme changes in the environment.

Topic	III. Genetics and Evolution
Subtopic	B. Mechanisms of evolution as a consequence of genetic variation and factors affecting evolution

6. Option (C) is correct. A diagram of a food web is typically used to represent the interconnected feeding relationships in a community. Students can use diagrams of food webs to investigate the flow of energy through the organisms of different ecosystems.

Science and Engineering Practice	8. Obtaining, evaluating, and communicating information
Task of Teaching Science	10. Evaluating instructional materials and other resources for their ability to address scientific concepts; engage students with relevant phenomena; develop and use scientific ideas; promote students' thinking about phenomena, experiences, and knowledge; take account of students' ideas and background; and assess student progress
Topic	V. Ecology: Organisms and Environment
Subtopic	B. Characteristics of biomes, energy flow in ecosystems, and major biogeochemical cycles

7. Option (D) is correct. X-ray crystallography is a technique that relies on an analysis of x-ray diffraction patterns to obtain a three-dimensional molecular structure from a crystal. If a protein can be isolated from a biological source and crystallized, a high-resolution structure of the protein can often be determined using x-ray crystallography.

Science and Engineering Practice	3. Planning and carrying out investigations
Topic	I. Nature and Impact of Science and Engineering
Subtopic	A. Nature of Science

8. Option (C) is correct. The endosymbiotic theory proposes that some eukaryotic organelles have a prokaryotic origin. Evidence in support of the theory includes the observation that organelles such as mitochondria, chloroplasts, and the nucleus have a double membrane. Also, mitochondria and chloroplasts have DNA genomes that are separate from the nuclear DNA genome, and the organelles reproduce by a process of binary fission.

Topic	III. Genetics and Evolution
Subtopic	B. Mechanisms of evolution as a consequence of genetic variation and factors affecting evolution

9. Option (A) is correct. Organisms in the phylum Annelida share the characteristic of body segmentation. The phylum Annelida includes earthworms, as well as leeches, bristle worms, and many other marine and freshwater species.

Topic	IV. Diversity of Life and Organismal Biology
Subtopic	B. Animal Biology

10. Option (D) is correct. Bacteria typically reproduce by a process of binary fission, which is a type of asexual reproduction.

Task of Teaching Science	18. Supporting and critiquing students' participation in and use of verbal and written scientific discourse and argumentation
Topic	V. Ecology: Organisms and Environment
Subtopic	A. Biosphere organization and factors affecting organism interactions and population size

11. Option (B) is correct. Glucose is a source of stored chemical energy that is accessible to many types of bacteria. The observation that colonies of bacteria were visible only on the glucose-containing slabs demonstrates that the bacteria are living things that require a source of energy.

Science and Engineering Practice	7. Engaging in argument from evidence
Task of Teaching Science	4. Linking science ideas to one another and to particular activities, models, and representations within and across units
Topic	II. Cell Biology: Cell Structure and Function
Subtopic	B. Structure and function of cells and the mechanisms of basic cellular processes

12. Option (C) is correct. A transgenic organism is an organism that contains genetic material from an unrelated organism. The foreign genetic material is often a gene that was isolated from the genome of one species and inserted into the genome of another species through the use of genetic engineering techniques. Inserting a jellyfish gene into the mouse genome is an example of using biological engineering to produce transgenic organisms.

Science and Engineering Practice	8. Obtaining, evaluating, and communicating information
Task of Teaching Science	3. Choosing which science ideas or instructional activities are most closely related to a particular instructional goal
Topic	I. Nature and Impact of Science and Engineering
Subtopic	B. Science, Engineering, Technology, Society, and the Environment

13. Option (B) is correct. A codon consists of three adjacent nucleotides. The nucleotide sequence has 18 nucleotides and begins with a start codon, so there are six codons in total. Although the start codon also codes for methionine, the stop codon does not code for an amino acid. As a result, the nucleotide sequence encodes five amino acids.

Science and Engineering Practice	5. Using mathematics and computational thinking
Topic	III. Genetics and Evolution
Subtopic	A. Mechanisms of molecular biology and genetic transmission

14. Option (B) is correct. A mutation is a change in the nucleotide sequence of an organism's genetic material, which is typically DNA. A change in the nucleotide sequence of the RNA genome of some viruses is also considered to be a mutation. Mutations can result in changes to the structure of individual genes, producing new alleles of that gene.

Task of Teaching Science	4. Linking science ideas to one another and to particular activities, models, and representations within and across units
Topic	III. Genetics and Evolution
Subtopic	B. Mechanisms of evolution as a consequence of genetic variation and factors affecting evolution

15. Option (A) is correct. A decrease in the concentration of solutes in the fluid outside the cell will result in the extracellular fluid becoming hypotonic with respect to the cell's cytosol. There will likely be a net movement of water across the cell's plasma membrane from the hypotonic extracellular fluid to the cytosol by the process of osmosis, which will result in an increase in the amount of water inside the cell.

Science and Engineering Practice	2. Developing and using models
Task of Teaching Science	12. Analyzing student ideas for common misconceptions regarding intended scientific learning
Topic	II. Cell Biology: Cell Structure and Function
Subtopic	B. Structure and function of cells and the mechanisms of basic cellular processes

16. Options (A), (B), and (D) are correct. The students can analyze the results of the genetic cross using a combination of PCR, restriction digestion, and agarose gel electrophoresis. For each DNA sample, the students can use PCR and a specific primer set to amplify the region of the yeast genome that contains the gene of interest. If the two alleles of the gene differ by the presence or absence of a specific restriction site, the students can treat each sample of PCR-amplified DNA with a restriction enzyme that recognizes the specific restriction site. The students can then use agarose gel electrophoresis to separate the DNA fragments in each sample on the basis of size. Finally, the students can analyze the resulting patterns of different restriction fragments to determine which of the two different alleles of the gene are present in each DNA sample.

Science and Engineering Practice	3. Planning and carrying out investigations
Task of Teaching Science	7. Determining the variables, techniques, or tools that are appropriate for use by students to address a specific investigation question
Topic	III. Genetics and Evolution
Subtopic	A. Mechanisms of molecular biology and genetic transmission

17. Option (A) is correct. Converting the molecule to a different molecule inside the cell will decrease the molecule's intracellular concentration, which will increase the difference between the molecule's extracellular concentration and its intracellular concentration.

Science and Engineering Practice	2. Developing and using models
Task of Teaching Science	24. Generating or selecting diagnostic questions to evaluate student understanding of specific models or representations
Topic	II. Cell Biology: Cell Structure and Function
Subtopic	A. Basic biochemistry and metabolism of living organisms

18. Option (B) is correct. Diversity refers to the number of different species in a community and the relative abundance of each species. The data collected by the students are best used to analyze the diversity of the community associated with each pond. The students can then compare the diversity of the different communities.

Science and Engineering Practice	4. Analyzing and interpreting data
Task of Teaching Science	9. Supporting students in generating questions for investigation or identifying patterns in data and observations
Topic	V. Ecology: Organisms and Environment
Subtopic	A. Biosphere organization and factors affecting organism interactions and population size

19. Option (C) is correct. Competitive inhibition can be overcome by increasing the initial substrate concentration while keeping the concentrations of the inhibitor and the enzyme constant. If molecule X affects the enzyme-catalyzed reaction through a mechanism of competitive inhibition, the initial reaction velocity will approach the maximum reaction velocity as the initial substrate concentration is increased.

Science and Engineering Practice	1. Asking questions and defining problems
Task of Teaching Science	7. Determining the variables, techniques, or tools that are appropriate for use by students to address a specific investigation question
Topic	II. Cell Biology: Cell Structure and Function
Subtopic	A. Basic biochemistry and metabolism of living organisms

20. Option (A) is correct. All the flies in the F_1 generation will be heterozygous at the genetic locus associated with the sepia-eyes phenotype. If the sepia-eyes trait has an autosomal recessive mode of inheritance, 75% of the F_2 generation will have wild-type eyes and 25% will have sepia eyes.

Science and Engineering Practice	5. Using mathematics and computational thinking
Task of Teaching Science	18. Supporting and critiquing students' participation in and use of verbal and written scientific discourse and argumentation
Topic	III. Genetics and Evolution
Subtopic	A. Mechanisms of molecular biology and genetic transmission

21. Option (D) is correct. A phylogenetic tree is typically used to represent the proposed evolutionary relationships among several different species.

Science and Engineering Practice	2. Developing and using models
Task of Teaching Science	21. Evaluating or selecting scientific models and representations that predict or explain scientific phenomena or address instructional goals
Topic	III. Genetics and Evolution
Subtopic	B. Mechanisms of evolution as a consequence of genetic variation and factors affecting evolution

22. Option (D) is correct. An increase in the influx of chemical fertilizers most likely triggers the rapid growth of the photosynthetic phytoplankton. Many chemical fertilizers used to stimulate crop growth contain high levels of nitrogen and phosphorus. Rainfall can wash the fertilizers off the fields into local waterways that drain into the Mississippi River, which connects with the Gulf of Mexico. The fertilizer accumulation at the mouth of the river promotes the rapid growth of photosynthetic phytoplankton. Subsequent degradation of dead phytoplankton by bacteria depletes the water of oxygen. Organisms cannot survive in the hypoxic waters, and terrestrial organisms that depend on the river-dwelling organisms are also negatively affected.

Topic	V. Ecology: Organisms and Environment
Subtopic	A. Biosphere organization and factors affecting organism interactions and population size

23. Option (A) is correct. The sinoatrial node is made up of a group of cells that are located in the wall of the heart's right atrium. The cells control cardiac muscle contractions through the production of action potentials that propagate throughout the heart. Damage to the sinoatrial node would likely disrupt the rate and timing of cardiac muscle contractions.

Topic	IV. Diversity of Life and Organismal Biology
Subtopic	B. Animal Biology

24. Option (B) is correct. Based on the information presented, lactose can be described as a disaccharide because it is made up of two monosaccharides, glucose and galactose.

Task of Teaching Science	18. Supporting and critiquing students' participation in and use of verbal and written scientific discourse and argumentation
Topic	II. Cell Biology: Cell Structure and Function
Subtopic	A. Basic biochemistry and metabolism of living organisms

25. Option (B) is correct. Genomics focuses on the study and manipulation of entire genomes. A genome is the complete set of DNA that contains all the genes and other genetic information needed for the development, growth, and reproduction of an organism. Advances in DNA sequencing technologies have allowed researchers to determine and analyze the genomic DNA sequences of a wide variety of organisms, including many different types of bacteria, plants, and animals.

Science and Engineering Practice	4. Analyzing and interpreting data
Topic	I. Nature and Impact of Science and Engineering
Subtopic	B. Science, Engineering, Technology, Society, and the Environment

26. Option (D) is correct. Lignin is a rigid component of some plant cell walls that provides structural support to certain tissues in vascular plants. The structural support provided by lignin allows vascular plants to grow taller than nonvascular plants, which provides an advantage when competing for limited resources such as sunlight.

Science and Engineering Practice	6. Constructing explanations and designing solutions
Task of Teaching Science	19. Critiquing student-generated explanations or descriptions for their generalizability, accuracy, precision, or consistency with scientific evidence
Topic	IV. Diversity of Life and Organismal Biology
Subtopic	C. Plant Biology

27. Option (B) is correct. Because adenine pairs with thymine, double-stranded DNA that is 35 percent adenine is also 35 percent thymine. The remaining 30 percent of the DNA is composed of guanine-cytosine base pairs, such that 15 percent of the DNA is guanine and 15 percent is cytosine.

Science and Engineering Practice	5. Using mathematics and computational thinking
Topic	III. Genetics and Evolution
Subtopic	A. Mechanisms of molecular biology and genetic transmission

28. Option (C) is correct. Blueberries are typically ingested by birds and other animals, and the seeds inside the fruit are dispersed through the feces of those animals.

Task of Teaching Science	19. Critiquing student-generated explanations or descriptions for their generalizability, accuracy, precision, or consistency with scientific evidence
Topic	IV. Diversity of Life and Organismal Biology
Subtopic	C. Plant Biology

29. Options (B) and (D) are correct. The presence of membrane-bound organelles, such as mitochondria, and the presence of a membrane-enclosed nucleus are typical features of a eukaryotic cell but not a prokaryotic cell. Ribosomes and chromosomal DNA are present in both eukaryotic and prokaryotic cells.

Science and Engineering Practice	1. Asking questions and defining problems
Task of Teaching Science	22. Engaging students in using, modifying, creating, and critiquing scientific models and representations that are matched to an instructional goal
Topic	II. Cell Biology: Cell Structure and Function
Subtopic	B. Structure and function of cells and the mechanisms of basic cellular processes

30. Option (C) is correct. The mechanism of stomatal opening in plants typically involves an increase in the volume and turgor pressure of guard cells. Changes in environmental conditions can trigger the opening of potassium ion channels in the plasma membrane of guard cells. The accumulation of potassium ions inside the guard cells results in a net movement of water into the cells by osmosis. The influx of water increases the volume and turgor pressure of the guard cells, resulting in an increase in the size of the stomatal opening.

Topic	IV. Diversity of Life and Organismal Biology
Subtopic	C. Plant Biology

31. Option (A) is correct. Typically, periodic natural wildfires are of relatively low intensity. They remove dead and decaying plant matter, including dead trees, leaf litter and pine needles, and shrubs. Without periodic wildfires, the material accumulates so that when a fire eventually does occur, it is much greater in intensity and size and potentially very destructive to living organisms.

Topic	V. Ecology: Organisms and Environment
Subtopic	B. Characteristics of biomes, energy flow in ecosystems, and major biogeochemical cycles

32. Option (A) is correct. The enzymes that facilitate the citric acid cycle are located in the mitochondrial matrix.

Science and Engineering Practice	8. Obtaining, evaluating, and communicating information
Task of Teaching Science	22. Engaging students in using, modifying, creating, and critiquing scientific models and representations that are matched to an instructional goal
Topic	II. Cell Biology: Cell Structure and Function
Subtopic	A. Basic biochemistry and metabolism of living organisms

33. Option (D) is correct. A gas phase is generally absent from the phosphorus cycle. The largest reservoir of phosphorus is in sedimentary rocks of marine origin. Most phosphorus cycles among rocks, soil, water, and living organisms.

Topic	V. Ecology: Organisms and Environment
Subtopic	B. Characteristics of biomes, energy flow in ecosystems, and major biogeochemical cycles

34. Option (C) is correct. Based on the information presented, the woman who has hemophilia is homozygous recessive. In contrast, the man has a single X chromosome that has the dominant allele. As a result, only a female child will be a carrier of the disorder, and all female children of the woman and the man will be carriers. There is a 50% chance that the child will be female.

Science and Engineering Practice	5. Using mathematics and computational thinking
Topic	III. Genetics and Evolution
Subtopic	A. Mechanisms of molecular biology and genetic transmission

35. Options (A), (C), and (D) are correct. Placing a light source inside the refrigerator will help make sure that environmental temperature is the only independent variable in the experiment. Using warm water instead of boiling water is more likely to provide useful data, because the environmental temperature will be more tolerable. Increasing the number of seedlings in each treatment group will help the students to determine the reproducibility of the experiment's results and to analyze variation both within and between treatment groups. Using seedlings of three different species is not recommended, because having more than one independent variable in the experiment will make the results more difficult to interpret.

Science and Engineering Practice	3. Planning and carrying out investigations
Task of Teaching Science	8. Critiquing scientific procedures, data, observations, or results for their quality, accuracy, or appropriateness
Topic	I. Nature and Impact of Science and Engineering
Subtopic	A. Nature of Science

36. Option (D) is correct. Genetic drift refers to changes in allele frequencies in a population that occur as a result of chance and not as a result of natural selection. Changes in allele frequencies are likely to be more significant in a small population than in a large population, because the small population has a comparatively smaller gene pool.

Science and Engineering Practice	6. Constructing explanations and designing solutions
Task of Teaching Science	19. Critiquing student-generated explanations or descriptions for their generalizability, accuracy, precision, or consistency with scientific evidence
Topic	III. Genetics and Evolution
Subtopic	B. Mechanisms of evolution as a consequence of genetic variation and factors affecting evolution

37. Option (A) is correct. Natural gas is considered to be a nonrenewable resource because it cannot be regenerated on a human timescale. The response that describes a type of electric power generation that relies on the burning of natural gas demonstrates the most accurate understanding of the term "nonrenewable resource."

Task of Teaching Science	18. Supporting and critiquing students' participation in and use of verbal and written scientific discourse and argumentation
Topic	I. Nature and Impact of Science and Engineering
Subtopic	B. Science, Engineering, Technology, Society, and the Environment

38. Option (D) is correct. During embryogenesis, after formation of the hollow ball of cells called the blastula, one end of the embryo folds in and expands to gradually fill the space in the blastula. This process is referred to as gastrulation and results in the formation of the three primary germ layers: the endoderm, the mesoderm, and the ectoderm.

Topic	IV. Diversity of Life and Organismal Biology
Subtopic	B. Animal Biology

Understanding Question Types

The *Praxis*® assessments include a variety of question types: constructed response (for which you write a response of your own); selected response, for which you select one or more answers from a list of choices or make another kind of selection (e.g., by selecting a sentence in a text or by selecting part of a graphic); and numeric entry, for which you enter a numeric value in an answer field. You may be familiar with these question formats from taking other standardized tests. If not, familiarize yourself with them so you don't spend time during the test figuring out how to answer them.

Understanding Selected-Response and Numeric-Entry Questions

For most questions, you respond by selecting an oval to select a single answer from a list of answer choices.

However, interactive question types may also ask you to respond by:

- Selecting more than one choice from a list of choices.
- Typing in a numeric-entry box. When the answer is a number, you may be asked to enter a numerical answer. Some questions may have more than one entry box to enter a response. Numeric-entry questions typically appear on mathematics-related tests.
- Selecting parts of a graphic. In some questions, you will select your answers by selecting a location (or locations) on a graphic such as a map or chart, as opposed to choosing your answer from a list.
- Selecting sentences. In questions with reading passages, you may be asked to choose your answers by selecting a sentence (or sentences) within the reading passage.
- Dragging and dropping answer choices into targets on the screen. You may be asked to select answers from a list of choices and to drag your answers to the appropriate location in a table, paragraph of text or graphic.
- Selecting answer choices from a drop-down menu. You may be asked to choose answers by selecting choices from a drop-down menu (e.g., to complete a sentence).

Remember that with every question you will get clear instructions.

Understanding Constructed-Response Questions

Some tests include constructed-response questions, which require you to demonstrate your knowledge in a subject area by writing your own response to topics. Essays and short-answer questions are types of constructed-response questions.

For example, an essay question might present you with a topic and ask you to discuss the extent to which you agree or disagree with the opinion stated. You must support your position with specific reasons and examples from your own experience, observations, or reading.

Review a few sample essay topics:

- *Brown v. Board of Education of Topeka*

  "We come then to the question presented: Does segregation of children in public schools solely on the basis of race, even though the physical facilities and other 'tangible' factors may be equal, deprive the children of the minority group of equal educational opportunities? We believe that it does."

  A. What legal doctrine or principle, established in *Plessy v. Ferguson* (1896), did the Supreme Court reverse when it issued the 1954 ruling quoted above?
  B. What was the rationale given by the justices for their 1954 ruling?

- *In his self-analysis, Mr. Payton says that the better-performing students say small-group work is boring and that they learn more working alone or only with students like themselves. Assume that Mr. Payton wants to continue using cooperative learning groups because he believes they have value for all students.*

  - Describe **TWO** strategies he could use to address the concerns of the students who have complained.
  - Explain how each strategy suggested could provide an opportunity to improve the functioning of cooperative learning groups. Base your response on principles of effective instructional strategies.

- *"Minimum-wage jobs are a ticket to nowhere. They are boring and repetitive and teach employees little or nothing of value. Minimum-wage employers take advantage of people because they need a job."*

  - Discuss the extent to which you agree or disagree with this opinion. Support your views with specific reasons and examples from your own experience, observations, or reading.

Keep these things in mind when you respond to a constructed-response question:

1. **Answer the question accurately.** Analyze what each part of the question is asking you to do. If the question asks you to describe or discuss, you should provide more than just a list.
2. **Answer the question completely.** If a question asks you to do three distinct things in your response, you should cover all three things for the best score. Otherwise, no matter how well you write, you will not be awarded full credit.
3. **Answer the question that is asked.** Do not change the question or challenge the basis of the question. You will receive no credit or a low score if you answer another question or if you state, for example, that there is no possible answer.
4. **Give a thorough and detailed response.** You must demonstrate that you have a thorough understanding of the subject matter. However, your response should be straightforward and not filled with unnecessary information.
5. **Take notes on scratch paper** so that you don't miss any details. Then you'll be sure to have all the information you need to answer the question.
6. **Reread your response.** Check that you have written what you thought you wrote. Be sure not to leave sentences unfinished or omit clarifying information.

General Assistance For The Test

Praxis® Interactive Practice Test

This full-length *Praxis*® practice test lets you practice answering one set of authentic test questions in an environment that simulates the computer-delivered test.

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- Correct answers with detailed explanations
- Practice test results for each content category

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Doing Your Best

Strategy and Success Tips

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Develop Your Study Plan

Planning your study time is important to help ensure that you review all content areas covered on the test. View a sample plan and learn how to create your own. Learn more at Develop a Study Plan.

Helpful Links

Ready to Register – How to register and the information you need to know to do so.

Disability Accommodations – Testing accommodations are available for test takers who meet ETS requirements.

PLNE Accommodations (ESL) – If English is not your primary language, you may be eligible for extended testing time.

What To Expect on Test Day – Knowing what to expect on test day can make you feel more at ease.

Getting Your Scores – Find out where and when you will receive your test scores.

State Requirements – Learn which tests your state requires you to take.

Other Praxis Tests – Learn about other *Praxis* tests and how to prepare for them.

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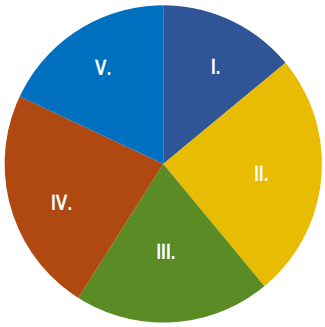
Chemistry (5246)

Test at a Glance

The *Praxis*® Chemistry test is designed to measure knowledge and competencies important for safe and effective beginning practice as a teacher of chemistry. Test takers have typically completed a bachelor's degree program with appropriate coursework in chemistry and education.

Test Name	Chemistry
Test Code	5246
Time	2 hours 30 minutes
Number of Questions	125 selected-response questions
Format	The test consists of a variety of selected-response questions, where you select one or more answer choices, and other types of questions. You can review the possible question types in Understanding Question Types.
Test Delivery	Computer Delivered



Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
I. Nature and Impact of Science and Engineering	17	14%
II. Principles and Models of Matter and Energy	31	25%
III. Chemical Composition, Bonding, and Structure	25	20%
IV. Chemical Reactions and Periodicity	29	23%
V. Solutions and Acid-Base Chemistry	23	18%
Half or more of the questions integrate a Science and Engineering Practice, and approximately one-quarter to one-third of the questions assess content applied to a Task of Teaching of Science.		

About The Test

Content topics for the Chemistry test span the chemistry curriculum, including content related to (I) Nature and Impact of Science and Engineering, (II) Principles and Models of Matter and Energy, (III) Chemical Composition, Bonding, and Structure, (IV) Chemical Reactions and Periodicity, and (V) Solutions and Acid Base Chemistry.

The assessment is designed and developed through work with practicing chemistry teachers, teacher educators, and higher education chemistry specialists to reflect the science knowledge teachers need to teach the chemistry curriculum and to reflect state and national standards, including the National Science Teaching Association Preparation Standards for chemistry. Content and practices measured reflect the Disciplinary Core Ideas (DCIs) and Science and Engineering Practices (SEPs) established by the National Research Council in A Framework for K-12 Science Education and included in the Next Generation Science Standards.

The 125 selected-response questions measure concepts, terms, phenomena, methods, applications, data analysis, and problem solving in science. A full list of the topics covered is provided in Content Topics.

Test takers will not need to use calculators in taking this test. The periodic table of the elements is available as a Help screen, along with a table of information that presents various physical constants and a few conversion factors among SI units. Whenever necessary, additional values of physical constants are included with the text of a question.

Test takers can expect half or more of the questions on the test to integrate chemistry content knowledge with one or more of the SEPs, listed under Science and Engineering Practices.

Test takers will also find that approximately one-quarter to one-third of the questions call for application of chemistry content and processes within a teaching scenario or an instructional task. Such questions—designed to measure applications of chemistry knowledge to the kinds of decisions and evaluations a teacher must make during work with students, curriculum, and instruction—situate chemistry content questions in tasks critical for teaching. The Tasks of Teaching Science section has a list of tasks that are a routine part of chemistry instruction. These tasks, identified based on research on science instruction, have been confirmed by a national committee of teachers and teacher educators as important for effective teaching of secondary science.

This test may contain some questions that will not count toward your score.

Content Topics

This list details the topics that may be included on the test. All test questions cover one or more of these topics.

Discussion Questions

In this section, discussion questions are open-ended questions or statements intended to help test your knowledge of fundamental concepts and your ability to apply those concepts to classroom or real-world situations. We do **not** provide answers for the discussion questions but thinking about the answers will help improve your understanding of fundamental concepts and may help you answer a broad range of questions on the test. Most of the questions require you to combine several pieces of knowledge to formulate an integrated understanding and response. They are written to help you gain increased understanding and facility with the test's subject matter. You may want to discuss these questions with a teacher or mentor.

I. Nature and Impact of Science and Engineering

A. Nature of Science

1. Nature of scientific knowledge
   a. Variety of investigation methods
   b. Based on experimental evidence that is reproducible
   c. How major concepts develop and change over time in light of new evidence
   d. Forming and testing hypotheses
   e. Use of models, laws, and theories to explain natural phenomena
   f. Development and application of models to explain natural phenomena
   g. Process skills, including observing, categorizing, comparing, generalizing, inferring, and concluding
2. Experimental design, data collection, and analysis
   a. Standard units of measurement, dimensional analysis, and unit conversion
   b. Scientific notation and use of significant figures
   c. Experimental design, including identifying variables, planning data collection, and how it supports testing of the hypothesis
   d. Processing, organizing, and reporting of data
   e. Error analysis, including accuracy and precision, mean, and percent error
   f. Identifying the sources and effects of error
   g. Interpreting, extrapolating, and drawing conclusions from data
3. Laboratory procedures
   a. Appropriate preparation, use, storage, and disposal of materials
   b. Appropriate use of laboratory equipment (including selection, calibration, and maintenance)
   c. Safety procedures and precautions for the laboratory

B. Science, Engineering, Technology, Society, and the Environment

1. Interdependence of science, engineering, and technology
   a. Engineering advances that lead to important discoveries in science
   b. Science and technology that drive each other forward
2. Engineering Design
   a. Defining problems, including identifying the success criteria and the constraints
   b. Designing solutions, including proposing and evaluating in terms of criteria, constraints, and limitations
   c. Optimizing the design, including systematic modification and refinement
3. Using science and engineering to identify and address negative impacts on the environment and society
   a. Acid rain
   b. Air and water pollution
   c. Greenhouse gases
   d. Ozone layer depletion
   e. Polymers and plastics
   f. Waste disposal and recycling
4. Advantages and disadvantages associated with various types of energy production
   a. Conservation and recycling of energy
   b. Renewable and nonrenewable energy resources
   c. Pros and cons of power generation based on various sources such as fossil and nuclear fuel, hydropower, wind power, solar power, and geothermal power
5. Applications of chemistry and technology in daily life
   a. Water purification
   b. Plastics, soap, batteries, and other commercial products
   c. Mining and industrial processes
   d. Biological systems
   e. Radiation in medicine and technology

Discussion Questions: Nature and Impact of Science and Engineering

- What are the similarities and differences between laws, hypotheses, and theories?
- What is the difference between independent and dependent variables? Describe an experiment and identify the independent and the dependent variables.
- Describe something in chemistry that illustrates the relationship between form and function.
- What is Boyle's law and what is Charles's law?
- What was the role of Bohr's model of the atom in the development of modern atomic theory?
- What is the uncertainty in volume measurements made when using a buret and how many significant figures should be included in the recorded volume?
- How many significant figures are in 0.1360 grams?

- Determine the endpoint in an acid-base titration using a plot of pH versus the volume of base added to an acid.
- What is the mass in grams of a sample that has a mass of 20 milligrams?
- Express the number 0.000450 in scientific notation.
- What is the difference between the accuracy and the precision of a data set?
- How do you prepare 200 mL of 0.5 *M* $CaSO_4$ from a stock solution of 2.0 *M* $CaSO_4$?
- Can a very dilute solution of HCl acid be disposed of in a sink with running water?
- What are each of the following pieces of equipment used for in the laboratory: buret, pipet, Erlenmeyer flask, and volumetric flask?
- When and why is a fume hood needed in a chemistry laboratory?
- In what settings is solar power most effective?
- What are the major contributors of acid rain?
- What are some of the reactions in the stratosphere that lead to ozone depletion?
- What are the acid-base properties of commonly used consumer products such as ammonia cleaner, vinegar, and orange juice?
- Describe the reverse osmosis process that is sometimes used for water purification.
- What are some examples of nonrenewable energy resources?

II. Principles and Models of Matter and Energy

A. Atomic and Nuclear Structure and Processes

1. Current model of atomic structure
   a. Description of basic model, including number and location of protons, neutrons, and electrons
   b. Quantum mechanical model of atom, including orbitals and subatomic particles
   c. Experimental basis of model, including gold foil experiment and atomic spectra
2. Electron configuration of the elements
   a. Aufbau principle, Hund's rule, Pauli exclusion principle
   b. Correlation between electron configuration and the periodic table
   c. Relationship between electron configuration and chemical and physical properties of elements
3. Relationship between electronic absorption and emission spectra and electron energy levels in atoms
   a. Electronic energy transitions in atoms
   b. Relationship between energy, frequency, and wavelength of electromagnetic radiation
   c. Identification of atoms based on analysis of spectra
   d. Correlation of electronic transitions to spectral lines in electromagnetic spectrum

4. Radioactivity
    a. Characteristics of alpha particles, beta particles, and gamma radiation
    b. Radioactive decay: include the process, half-life, and applications
    c. Identifying fission and fusion reactions
    d. Balancing nuclear reactions and identifying products of nuclear reactions

B. Relationships Between Energy and Matter in Chemistry

1. Organization of matter
    a. Pure substances (elements and compounds)
    b. Mixtures (homogeneous, heterogeneous, solutions, suspensions)
    c. States of matter (solid, liquid, gas, and plasma)
    d. Atoms, ions, molecules
2. Difference between chemical and physical properties and changes
    a. Chemical versus physical properties
    b. Chemical versus physical changes
    c. Intensive versus extensive properties
    d. Conservation of matter in chemical processes
3. Conservation of energy
    a. Conservation of energy in chemical and physical processes
    b. Kinetic and potential energy concepts and particulate models
    c. Forms of energy including chemical, electrical, thermal, electromagnetic, and nuclear
    d. Conversion between different forms of energy
4. Temperature, thermal energy, and heat capacity, including calculations
    a. Temperature scales
    b. Heat transfer
    c. Heat capacity and specific heat
    d. Calorimetry
5. Energy concepts and calculations involving phase transitions, including particulate and mathematical models
    a. Phase transition diagrams
    b. Heats of vaporization, fusion, and sublimation
    c. Heating curves
6. Kinetic molecular theory, including particulate and mathematical models
    a. Assumptions and applications of the kinetic molecular theory
    b. Ideal gas behavior and the ideal gas laws
7. How thermodynamics relates to chemical and physical processes
    a. Laws of thermodynamics
    b. Spontaneous (favorable) and reversible processes
    c. Changes in enthalpy, entropy, and Gibbs energy
    d. Exothermic and endothermic processes

e. Reaction progress diagrams based on potential energy of reactants and products.
f. Energy involved in breaking and forming bonds

Discussion Questions: Principles and Models of Matter and Energy

- How are isotopes of the same element alike? How are they different?
- An element has three isotopes, each with a different mass. Explain why the mass number for the element that is listed on the periodic table is not equal to the mass of any of the isotopes.
- What are the electron configurations for atoms of sodium and sulfur?
- Based on their electron configurations, what is the formula of the compound that forms in the reaction of sodium and sulfur?
- Give an example of Hund's rule.
- Given that the half-life of carbon-14 is 5,730 years, estimate the age of a piece of charcoal that has a carbon-14 content equal to 12.5% of that in living matter.
- How is fission different than fusion or radioactive decay?
- What is the wavelength of the energy emitted for an electronic transition in a hydrogen atom from $n = 3$ to $n = 2$ electronic energy level?
- In what part of the electromagnetic spectrum are electron emission spectral lines located?
- Test tubes contain three colorless liquids: alcohol, water, and a weak solution of ammonia. What properties could be used to identify the liquids?
- What are some examples of the different types of mixtures?
- What is a cation?
- In their standard state, which of the following elements are diatomic: bromine, chlorine, argon, and helium?
- What are some examples of chemical properties?
- Describe a process that involves both a chemical change and a physical change.
- Is balancing a chemical equation an application of the law of conservation of energy or the law of conservation of matter?
- List in order of increasing energy (or decreasing wavelength) the following forms of electromagnetic radiation: gamma rays, microwaves, x-rays, visible light, ultraviolet, and infrared.
- What is an example of the conversion of chemical energy to electrical energy?
- Convert 350 kelvin to degrees Celsius.
- Consider the following list: erg, joule, electron volt, and ohm. Which of them are units of energy?
- If a substance has high heat capacity, will its temperature increase faster as heat is absorbed than will the temperature of a substance with lower heat capacity absorbing the same amount of heat?

- How much heat is absorbed as 10 grams of ice melts at the freezing point?
- What is the boiling point of water at high altitudes compared to that at sea level, and why is it different?
- When a gas expands from 5 liters to 10 liters as its temperature increases from 300 kelvin to 500 kelvin, what is the change in the pressure of the gas?
- What are the major differences between an ideal gas and a real gas?
- Given the heats of formation of H_2O, CO_2, and CH_4, calculate the heat of combustion of CH_4.
- Is the combustion of CH_4 an exothermic or an endothermic process?
- Based on the first and second laws of thermodynamics, predict whether a reaction is spontaneous.
- Describe some processes in which the entropy of the system is increasing.

III. Chemical Composition, Bonding, and Structure

A. Chemical Composition

1. Mole concept and application to chemical systems
   a. Avogadro's number, molar mass, and mole conversions
   b. Calculation of empirical and molecular formulas
   c. Percent composition
2. Systematic names and chemical formulas for simple inorganic compounds
   a. Binary compounds
   b. Acids, bases, and salts
   c. Hydrates
3. Identification of common organic functional groups and compounds
   a. Alkanes, alkenes, and alkynes
   b. Alcohols, ethers, ketones, aldehydes, carboxylic acids, and amines

B. Bonding and Structure

1. Properties and models of bonding
   a. Ionic bonding
   b. Covalent bonding (polar, nonpolar, and hybridization)
   c. Metallic bonding
   d. Relative bond strengths and bond lengths
2. Molecular structure models
   a. Lewis structures, including formal charges
   b. Resonance structures
   c. Molecular geometry (shape and bond angles)
3. Identification of polar and nonpolar molecules
   a. Analysis of polarity of the bonds within a molecule
   b. Symmetry of molecular structure
4. Types of interparticle interactions
   a. London forces (instantaneous induced dipole-dipole attractions)
   b. Dipole-dipole attractive forces
   c. Dipole-induced dipole attractive forces
   d. Hydrogen bonding

5. How bonding, structure, and interparticle interactions are related to physical properties of pure substances
    a. Boiling points and melting points
    b. Solubility
    c. Equilibrium vapor pressure

Discussion Questions: Chemical Composition, Bonding, and Structure

- What are the IUPAC names for the following compounds: $HClO_4$, $CuCl_2$, and $CaSO_4 \cdot 2H_2O$?
- Write the molecular formula for each of the following compounds: acetone, ethanol, ethanal, and formic acid.
- Identify the functional group in each of the following compounds: CH_3OCH_3, CH_3NH_2, CH_3OH, and CH_3COOH.
- What are the structures in the following types of molecules that distinguish them from other biochemical compounds: carbohydrates, amino acids, and DNA?
- What is the number of moles of oxygen atoms in 5 moles of $CaSO_4 \cdot 2H_2O$?
- What is the molecular formula of a compound that has the empirical formula C_2H_4O and a molar mass of 88 grams?
- Which of the following molecules has the shortest bond length: HF, HCl, N_2, or O_2?
- Which type of bonding is found in each of the following solids: KCl, $NaSO_4$, and Cu?
- What is the difference between a pi bond and a sigma bond?
- Why does a NH_3 molecule have trigonal pyramidal geometry?
- What are the Lewis dot and the structural formulas for CH_4?
- What are the resonance structures for the carbonate ion?
- Does CO_2 have any polar bonds? Is it a polar molecule? Why?
- What is the predominate intermolecular force involved between two PCl_3 molecules?
- Correlate the relative boiling points of the following molecules with their molecular structure and intermolecular interactions: H_2O, Cl_2, Br_2, HCl, and H_2.

IV. Chemical Reactions and Periodicity

A. Periodicity

1. The periodic table as a model
    a. Arranged in groups and periods
    b. Symbols of the element, atomic number, and atomic mass
    c. Location of metals, nonmetals, metalloids, and transition elements
2. Predicting and justifying patterns and trends in physical and chemical properties of the elements based on their position on the periodic table
    a. Atomic and ionic radius
    b. Ionization energy
    c. Electron affinity

d. Electronegativity
e. Physical properties
f. Chemical properties and reactivity

B. Basic Principles of Chemical Reactions

1. Balancing equations for chemical reactions
   a. Simple chemical reactions
   b. Oxidation-reduction reactions
2. Stoichiometric calculations for chemical reactions
   a. Based on balanced equations involving moles, mass, or volume
   b. Limiting reagent calculations and percent yield
3. Predicting products of simple reaction types
   a. Combustion, neutralization, synthesis, decomposition, and dehydration reactions
   b. Single and double replacement reactions
4. Oxidation states and oxidation-reduction reactions
   a. Assigning oxidation numbers
   b. Identifying oxidation-reduction reactions and half-reactions
   c. Standard reduction potentials and the electrochemical reactivity series
5. Chemical kinetics: models based on collision theory
   a. Rate laws, rate constants, and reaction order
   b. Activation energy and catalysts
6. Equilibrium in chemical systems
   a. Equilibrium constants
   b. Le Chatelier's principle

Discussion Questions: Chemical Reactions and Periodicity

- In what location of the periodic table are nonmetals generally found?
- List some examples of transition elements
- How do the atomic radii, ionization energies, and melting points change across period and down columns in the periodic table?
- Using the location of the elements on the periodic table, predict the formula of the compound that would exist containing Mg and O.
- What needs to be considered when balancing oxidation-reduction reactions that does not need to be accounted for when balancing a standard formation reaction such as $2\ H_2 + O_2 \rightarrow 2\ H_2O$?
- At standard temperature and pressure, what is the ratio of the volumes of hydrogen gas and oxygen gas that react to form water?
- What is the limiting reagent in the reaction to form water when 10 grams of hydrogen is mixed with 32 grams of oxygen?
- How is a decomposition reaction different from a dehydration reaction?
- What is the effect of temperature and catalysts on reaction rates?
- How are simple rate equations determined based on experimental data?

- What changes will occur to chemical systems that are at equilibrium when pressure or concentration of one of the reactants or products is changed?
- What is the effect of temperature on equilibrium constants?
- Based on a table of standard reduction potentials, predict whether the following reaction will occur spontaneously: $Cu + FeCl_2 \rightarrow CuCl_2 + Fe$.
- What is the oxidation state of Mn in $KMnO_2$?

V. Solutions and Acid-Base Chemistry

A. Solutions and Solubility

1. Analysis of types of solutions
   a. Dilute, concentrated, unsaturated, saturated, and supersaturated
   b. Identification of solute and solvent
   c. Representations of concentration in terms of various units, such as molarity, mole fraction, and percent by mass or volume
   d. Calculations needed to prepare solutions of varying concentrations
2. Factors affecting rate of dissolving and solubility
   a. Rate of dissolving (temperature, pressure, surface area, stirring)
   b. Solubility and solubility curves (temperature and pressure dependence)
3. Phenomena based on colligative properties of solutions
   a. Freezing point depression and boiling point elevation
   b. Vapor pressure effect
4. Equilibrium in ionic solutions
   a. Highly soluble and slightly soluble compounds
   b. Predictions of precipitation based on the solubility product (K_{sp})
   c. Common ion effect when mixing ionic solutions
   d. Electrolytes, nonelectrolytes, and electrical conductivity of solutions

B. Acid-Base Chemistry

1. Models of acids and bases and their properties
   a. Arrhenius acids and bases
   b. Brønsted-Lowry acids and bases
   c. Lewis acids and bases
2. The concept of pH and calculations involving pH and pOH
   a. pH scale
   b. Calculation of pH and pOH
   c. Calculation of $[H^+]$ and $[OH^-]$
3. Concepts, representations, and calculations involving acid-base titrations
   a. Neutralization and equivalence point
   b. Use and selection of indicators
   c. End point determination
   d. Analysis of titrations curves

4. Equilibrium relationships in acid-base systems
    a. Strong and weak acids and bases
    b. Monoprotic and polyprotic acids
    c. K_a, K_b, K_w and dissociation
    d. Buffer solutions

Discussion questions: Solutions and Acid-Base Chemistry

- How many grams of solute are present in 1.5 liters of $0.30\ M\ KNO_3$?
- What is the difference between a 1 molar $NaCl$ solution and a 1 molal $NaCl$ solution?
- Is a very concentrated solution saturated, supersaturated, or unsaturated? What else do you need to know to answer the question?
- Why is ammonia gas very soluble in water while oxygen is only slightly soluble?
- What is the relationship between surface area and dissolution rate?
- Will increasing temperature increase the solubility of any substance?
- How will the vapor pressure, boiling point, and freezing point of water change when a nonvolatile solute is added to water?
- Compare the degree of dissociation of HCl and H_2S in water.
- Write a chemical equation that illustrates the common ion effect.
- Is CCl_4 an electrolyte?
- When an aqueous solution of $NaCl$ is mixed with an aqueous solution of $AgNO_3$ the precipitate $AgCl$ forms. Why?
- Select an acid that is both a Brønsted-Lowry acid and a Lewis acid and explain why it fits both definitions.
- What is $[H^+]$ in an aqueous solution with $pH = 5.5$?
- What is the pOH of a solution with $[H^+] = 1 \times 10^{-8}\ M$?
- Based on a titration curve, determine the pK_a of the acid and the volume of base required to neutralize the acid.
- What indicator would be used in a titration involving a strong acid and a weak base and why?
- Is HF a strong acid? Why or why not?
- If Na_2CO_3 is dissolved in water, will the solution be acidic, basic, or neutral?
- For an acid HA, $K_a = 1 \times 10^{-8}$, what is the pH of $0.001\ M\ HA$?

Science and Engineering Practices

Science and Engineering Practices (SEPs) represent eight practices that scientists and engineers—and students and teachers—use to investigate the world and to design and build systems. Many test questions will integrate one or more of these practices.

1. Asking questions (for science) and defining problems (for engineering)
   - Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.
   - Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.
   - Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.
   - Ask questions to clarify and refine a model, an explanation, or an engineering problem.
   - Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.
   - Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.
   - Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.
2. Developing and using models
   - Evaluate merits and limitations of two different models of the same proposed tool, process, mechanism, or system in order to select or revise a model that best fits the evidence or design criteria.
   - Design a test of a model to ascertain its reliability.
   - Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.
   - Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.
   - Develop a complex model that allows for manipulation and testing of a proposed process or system.
   - Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.
3. Planning and carrying out investigations
   - Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or

testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.
- Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
- Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.
- Select appropriate tools to collect, record, analyze, and evaluate data.
- Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.
- Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables.

4. Analyzing and interpreting data
- Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.
- Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations.
- Evaluate the impact of new data on a working explanation and/or model of a proposed process or system.
- Analyze data to identify design features or characteristics of the components of a proposed process or system to optimize it relative to criteria for success.

5. Using mathematics and computational thinking
- Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system.
- Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
- Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
- Use simple limit cases to test mathematical expressions, computer programs, algorithms, or simulations of a process or system

to see if a model "makes sense" by comparing the outcomes with what is known about the real world.
- Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m^3, acre-feet, etc.).

6. Constructing explanations (for science) and designing solutions (for engineering)
   - Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.
   - Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
   - Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
   - Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.
   - Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.
7. Engaging in argument from evidence
   - Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (e.g., trade-offs), constraints, and ethical issues.
   - Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.
   - Respectfully provide and/or receive critiques on scientific arguments by probing reasoning and evidence and challenging ideas and conclusions, responding thoughtfully to diverse perspectives, and determining what additional information is required to resolve contradictions.
   - Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence.
   - Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge, and student-generated evidence.
   - Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and/or logical arguments regarding relevant factors (e.g. economic, societal,

environmental, ethical considerations).

8. Obtaining, evaluating, and communicating information
   - Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
   - Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.
   - Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.
   - Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible.
   - Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).

Tasks of Teaching Science

This list includes instructional tasks that teachers engage in that are essential for effective Chemistry teaching. Many test questions will measure content through application to one or more of these tasks.

Scientific Instructional Goals, Big Ideas, and Topics

1. Selecting or sequencing appropriate instructional goals or big ideas for a topic
2. Identifying the big idea or instructional goal of an instructional activity
3. Choosing which science ideas or instructional activities are most closely related to a particular instructional goal
4. Linking science ideas to one another and to particular activities, models, and representations within and across units

Scientific Investigations and Demonstrations

5. Selecting investigations or demonstrations, including virtual, that facilitate understanding of disciplinary core ideas, scientific practices, or crosscutting concepts
6. Evaluating investigation questions for quality (e.g., testable, empirical)
7. Determining the variables, techniques, or tools that are appropriate for use by students to address a specific investigation question
8. Critiquing scientific procedures, data, observations, or results for their quality, accuracy, or appropriateness

9. Supporting students in generating questions for investigation or identifying patterns in data and observations

Scientific Resources (texts, curriculum materials, journals, and other print and media-based resources)

10. Evaluating instructional materials and other resources for their ability to address scientific concepts; engage students with relevant phenomena; develop and use scientific ideas; promote students' thinking about phenomena, experiences, and knowledge; take account of students' ideas and background; and assess student progress
11. Choosing resources that support the selection of accurate, valid, and appropriate goals for science learning

Student Ideas (including common misconceptions, alternate conceptions, and partial conceptions)

12. Analyzing student ideas for common misconceptions regarding intended scientific learning
13. Selecting diagnostic items and eliciting student thinking about scientific ideas and practices to identify common student misconceptions and the basis for those misconceptions
14. Developing or selecting instructional moves, approaches, or representations that provide evidence about common student misconceptions and help students move toward a better understanding of the idea, concept, or practice

Scientific Language, Discourse, Vocabulary, and Definitions

15. Selecting scientific language that is precise, accurate, grade-appropriate, and illustrates key scientific concepts
16. Anticipating scientific language and vocabulary that may be difficult for students
17. Modeling the use of appropriate verbal and written scientific language in critiquing arguments or explanations, in describing observations, or in using evidence to support a claim, etc.
18. Supporting and critiquing students' participation in and use of verbal and written scientific discourse and argumentation

Scientific Explanations (includes claim, evidence, and reasoning)

19. Critiquing student-generated explanations or descriptions for their generalizability, accuracy, precision, or consistency with scientific evidence
20. Selecting explanations of natural phenomena that are accurate and accessible to students

Scientific Models and Representations (analogies, metaphors, simulations, illustrations, diagrams, data tables, performances, videos, animations, graphs, and examples)

21. Evaluating or selecting scientific models and representations that predict or explain scientific phenomena or address instructional goals

22. Engaging students in using, modifying, creating, and critiquing scientific models and representations that are matched to an instructional goal
23. Evaluating student models or representations for evidence of scientific understanding
24. Generating or selecting diagnostic questions to evaluate student understanding of specific models or representations
25. Evaluating student ideas about what makes for good scientific models and representations

Chemistry (5246) Sample Test Questions

The sample questions that follow represent a number of the types of questions and topics that appear on the test. They are not, however, representative of the entire scope of the test in either content or difficulty. Answers with explanations follow the questions.

Directions: Each of the questions or incomplete statements below is followed by suggested answers or completions. Select the one that is best in each case.

1. Completely dry crystals of an unknown inorganic compound were heated in a clean, dry glass test tube. The total mass of the test tube and its solid contents was measured before and after heating. After heating, the total mass was observed to be less. Which **TWO** of the following could explain the observation?

   (A) The crystals were a hydrate, and some of the water vaporized.
   (B) The crystals were a compound that decomposed into two different solid compounds.
   (C) A reaction occurred in which one of the products was a gas.
   (D) The crystals were a compound that reacted with oxygen in the air to form a single compound of lower mass than the original compound.

2. Which **TWO** of the following processes involve a decrease in entropy?

   (A) Water freezing
   (B) Snow subliming
   (C) Dew forming on grass
   (D) Sugar dissolving in water

$$Pt(NH_3)Cl_2(aq) + Br^-(aq) \rightarrow Pt(NH_3)_2ClBr(aq) + Cl^-(aq)$$

3. For an upcoming lab activity, a teacher asks students to identify variables that should be controlled when six different trials are done to determine the rate of disappearance of Br^- in the preceding chemical reaction. Which **THREE** of following student responses are correct?

   (A) Concentration of Cl^-
   (B) Temperature
   (C) Initial amount of $Pt(NH_3)Cl_2(aq)$
   (D) Initial volume of the reaction mixture

4. In which of the following compounds do molecules interact through London dispersion forces only?

   (A) H_2O
   (B) CF_4
   (C) CH_3Cl
   (D) CO

5. Of the following, which best describes a solution with $pOH = 12.0$ at $25°C$?

   (A) An acidic solution that will turn blue litmus paper red because $[H^+] = 1.0 \times 10^{-2} M$
   (B) An acidic solution that will turn red litmus paper blue because $[H^+] = 1.0 \times 10^{-2} M$
   (C) A basic solution that will turn red litmus paper blue because $[H^+] = 1.0 \times 10^{-12} M$
   (D) A basic solution that will turn blue litmus paper red because $[H^+] = 1.0 \times 10^{-12} M$

$$CuSO_4 + Zn \rightarrow ZnSO_4 + Cu$$

6. Which of the following species is reduced in the preceding oxidation-reduction reaction?

   (A) Zn
   (B) Cu^{2+}
   (C) S^{6+}
   (D) O^{2-}

7. Based on its position on the periodic table, which of the following has the largest atomic radius?

   (A) Cs
   (B) Mg
   (C) I
   (D) Se

8. If $50\,\text{mL}$ of $0.02\,M\ \text{Na}_2\text{SO}_4$ is diluted with sufficient water to make a total volume of $200\ \text{mL}$, which of the following is the concentration of Na^+ ions in the diluted solution?

   (A) $0.005\,M$
   (B) $0.01\,M$
   (C) $0.02\,M$
   (D) $0.04\,M$

9. Of the following, which best describes smoke?

   (A) A suspension
   (B) An alloy
   (C) A solution
   (D) A homogeneous mixture

10. Which of the following is the ground-state electron configuration of Mg^{2+}?

    (A) $1s^2 2s^2 2p^6$
    (B) $1s^2 2s^2 2p^6 3s^2$
    (C) $1s^2 2s^2 2p^6 3s^2 3p^6$
    (D) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

11. How many oxygen atoms are in two moles of CuSO_4?

    (A) 4
    (B) 8
    (C) 6.02×10^{23}
    (D) 4.82×10^{24}

12. If a $20\ g$ sample of a substance is compared to a $10\ g$ sample of the same substance, both at $25°C$, the $20\ g$ sample will have a higher

    (A) density
    (B) thermal heat content
    (C) temperature
    (D) boiling point

13. A well-designed experiment always includes which of the following?

    (A) A scientific law
    (B) A well-written conclusion
    (C) Multiple independent variables
    (D) A plan about how to measure the dependent variable

14. If a weak acid is titrated with a strong base, which of the following could be the pH at the equivalence point?

    (A) 2.0
    (B) 6.0
    (C) 7.0
    (D) 8.0

15. Of the following molecules, which has the most polar covalent bonds?

    (A) HBr
    (B) CH_4
    (C) Cl_2
    (D) H_2

16. At standard temperature and pressure, what volume of CO_2 is produced when 1.000 mol of C_8H_{18} undergoes complete combustion?

(A) 8.00 L
(B) 22.4 L
(C) 89.6 L
(D) 179.2 L

17. Ozone in the atmosphere is most closely related to which of the following?

(A) Acid rain production
(B) Water pollution
(C) Absorption of ultraviolet radiation in the stratosphere
(D) Nuclear power plant waste

18. Which of the following is a carboxylic acid?

(A) CH_3CH_2COOH
(B) CH_3OCH_3
(C) CH_3CH_2OH
(D) CH_3NH_2

19. For $Mg(OH)_2$ at room temperature, the solubility product K_{sp} is approximately 7×10^{-12}. The magnitude of the solubility constant indicates which of the following about $Mg(OH)_2$?

(A) If sufficient $Mg(OH)_2$ is mixed with water, it can form $11 M\, Mg(OH)_2(aq)$.
(B) It cannot form a saturated solution.
(C) It is a weak acid.
(D) It is only slightly soluble.

$$MnO_2 + 4\ HCl \rightarrow MnCl_2 + Cl_2 + 2\ H_2O$$

20. Based on the preceding balanced equation, what is the maximum number of moles of Cl_2 that can be produced if $2.0\ mol$ of MnO_2 and $6.0\ mol$ of HCl are initially provided in a reaction vessel?

    (A) 1.0 mol
    (B) 1.5 mol
    (C) 2.0 mol
    (D) 4.0 mol

21. The elements F, Cl, Br and I all form compounds with Na and are in the same column of the periodic table. The elements in this group are known as

    (A) transition elements
    (B) alkaline earth metals
    (C) noble gases
    (D) halogens

22. Which of the following is a balanced equation for a chemical reaction?

    (A) $2\ K + 2\ H_2O \rightarrow 2\ KOH + H_2$
    (B) $Mg + O_2 \rightarrow 2\ MgO$
    (C) $NaOH + H_2SO_4 \rightarrow NaSO_4 + H_2O$
    (D) $Cl_2 + NaI \rightarrow NaCl + I_2$

23. In an experiment to investigate the photoelectric effect, a clean surface of a certain metal was illuminated with light of different but sufficiently high frequencies. This resulted in electrons being emitted from the surface of the metal. The kinetic energy of the emitted electrons varied with the frequency of the incident light. Which of the following is the dependent variable in the experiment?

    (A) Atomic number of the metal
    (B) Atomic mass of the metal
    (C) Frequency of the incident light
    (D) Kinetic energy of the emitted electrons

$$2\ AB(g) \rightleftharpoons A_2(g) + B_2(g)$$

24. The preceding reaction is at equilibrium. Which of the following is true if the volume of the reaction vessel is decreased?

(A) The partial pressure of AB will decrease.
(B) The partial pressure of both A_2 and B_2 will decrease.
(C) The total pressure of the system will remain constant.
(D) The decrease in volume will have no effect on the equilibrium.

25. Of the following $0.05\ M$ aqueous solutions, which is most likely to have the lowest freezing point?

(A) KBr
(B) CsI
(C) $MgCl_2$
(D) CH_3OH

Compound	K_a
HOCN	3.5×10^{-4}
HIO_4	2.2×10^{-2}
$ClCH_2COOH$	1.4×10^{-3}
C_6H_6COOH	6.3×10^{-5}

26. A teacher asks students to use the data in the preceding table to identify the strongest acid among the weak acids listed and explain their choice. A student says that C_6H_6COOH is the strongest acid because it has the smallest K_a. Of the following, which statement, if true, would best help correct the student's misconception?

    (A) In general, an acid that contains a Cl atom in its chemical formulas is a strong acid, regardless of the value of its K_a.

    (B) In general, an acid that contains a large number of atoms is a very weak acid, regardless of the value of its K_a.

    (C) The acid with the largest value for K_a is the strongest acid because the K_a indicates the degree to which the acid dissociates.

    (D) The acid with the smallest value for its K_a will dissociate to the largest degree and therefore be a very weak acid.

27. Which of the following molecules is nonpolar?

    (A) CCl_4

    (B) H_2O

    (C) HF

    (D) CO

28. Which of the following gases is produced when concentrated aqueous HF is added to an aqueous solution of Na_2CO_3 ?

(A) CO_2
(B) O_2
(C) H_2
(D) Cl_2

$$^{232}Th \rightarrow X + \text{alpha particle}$$

29. When a thorium-232 atom emits an alpha particle, as represented in the preceding equation, which of the following is X?

(A) ^{228}Th
(B) ^{230}Ac
(C) ^{228}Ra
(D) ^{230}Rn

30. Which of the following is an exothermic change of state?

(A) Solid to liquid
(B) Liquid to gas
(C) Gas to solid
(D) Solid to gas

31. Based on the valence shell electron pair repulsion (VSEPR) model, which of the following gives the approximate bond angles about the carbon atom in a CCl_4 molecule?

(A) 30°
(B) 45°
(C) 90°
(D) 109.5°

32. Which of the following compounds contained in some beverages is a strong electrolyte?

(A) Sucrose
(B) Citric acid
(C) Starch
(D) Sodium chloride

Chemistry (5246) Answers

1. **Options (A) and (C) are correct.** The correct answers are (A) and (C). Inorganic hydrates are compounds that in their solid state contain some water molecules within their crystal lattice. When heated, the water can vaporize, resulting in a lower mass for the remaining solid. An example of a hydrate is $MgCO_3 \cdot 5H_2O$. When a reaction occurs in an open vessel in which one of the products is a gas, the gas can escape, resulting in a loss of mass. A decomposition reaction that produced two solid compounds would NOT result in a loss of mass. If an oxide had been produced in a reaction with oxygen, the mass of the contents would have increased, NOT decreased.

Content	I A
Science and Engineering	7
Task of Teaching	20

2. **Options (A) and (C) are correct.** Entropy decreases as liquid water becomes solid water and as water vapor condenses on grass as dew. Entropy increases as snow changes to gaseous water as it sublimates and as sugar dissolves in water.

Content	II B

3. **Options (B), (C) and (D) are correct.** The rate of a chemical reaction depends on the temperature and can also depend on the concentrations of the reactants. To determine the rate with respect to Br^-, the concentration of $Pt(NH_3)Cl_2(aq)$ must be kept constant. Hence, the initial volume of the reaction mixture must also be kept constant to avoid changes in concentration of $Pt(NH_3)Cl_2(aq)$.

Content	IV B
Science and Engineering	3
Task of Teaching	7

4. **Option (B) is correct.** CF_4 molecules interact through London dispersion forces only because they are nonpolar molecules. The other three compounds consist of polar molecules that can interact by dipole-dipole interactions and H_2O molecules can also interact through hydrogen bonding.

Content	III B

5. **Option (A) is correct.**
$\text{pOH} = -\log[\text{OH}^-]$ for an aqueous solution. Hence, $[\text{OH}^-] = 1.0 \times 10^{-12} M$ if $\text{pOH} = 12.0$. At $25°\text{C}$, $[\text{H}^+][\text{OH}^-] = K_w = 1.0 \times 10^{-14}$. Based on this relationship, $[\text{H}^+] = \frac{1.0 \times 10^{-14}}{1.0 \times 10^{-12}} = 1.0 \times 10^{-2}$. Since $\text{pH} = -\log[\text{H}^+] = -\log(1 \times 10^{-2}) = 2.0$ pH, the solution is acidic and will turn blue litmus paper red.

Content	V B
Science and Engineering	6

6. **Option (B) is correct.** Reduction involves gaining electrons which results in a reduction of the oxidation number of the species. Cu^{2+} in $CuSO_4$ is reduced to Cu, with oxidation number of 0. Zn, with oxidation number of 0, loses electrons and is oxidized to Zn^{2+} in $ZnSO_4$. S^{6+} and O^{2-} do not undergo a change in oxidation number during the reaction.

Content	IV B
Science and Engineering	2

7. **Option (A) is correct.** An atom of Cs has a radius that is larger than the radius of an atom of Mg, I, or Se based on the location of Cs on the periodic table. Going down a column, the atomic radius generally increases, and going from left to right across a row, the atomic radius generally decreases. Cs is located near the lower corner on the left side of the periodic table.

Content	IV A
Science and Engineering	2

8. **Option (B) is correct.** The concentration of Na^+ ions is $0.01 M$, and it is found from $\frac{0.05 \text{ L} \times 0.02 M \text{ } Na_2SO_4}{0.2 \text{ L}} \times \frac{2 \text{ } Na^+}{Na_2SO_4} = 0.10 M$, where $50 \text{ mL} = 0.05 \text{ L}$ and $200 \text{ mL} = 0.2 \text{ L}$.

Content	V A
Science and Engineering	5

9. **Option (A) is correct.** Smoke is a suspension. Tiny particles are temporarily suspended in the air as they are randomly moving as a result of collisions with molecules of nitrogen, oxygen, and other gases. Eventually, the particles may settle and collect on surfaces.

Content	II B
Science and Engineering	15

10. **Option (A) is correct.** The electron configuration for the Mg^{2+} ion based on the Aufbau principle is $1s^2 2s^2 2p^6$. Mg atoms each have 12 electrons, but Mg^{2+} ions each have 10 electrons.

Content	II A
Science and Engineering	2
Task of Teaching	21

11. **Option (D) is correct.** Two moles of $CuSO_4$ contain 8 moles of oxygen atoms. The number of oxygen atoms is equal to $8 \times 6.02 \times 10^{23} = 4.82 \times 10^{24}$ oxygen atoms.

Content	III A
Science and Engineering	5

12. **Option (B) is correct.** The 20 g sample will have a higher thermal heat content because heat content depends on both the temperature and the amount of the substance. Since both samples contain the same substance, they will have the same density, temperature, and boiling point.

Content	II B

13. **Option (D) is correct.** The experimental design should have only one independent variable and should include a procedure.

Content	I A
Science and Engineering	3
Task of Teaching	7

14. **Option (D) is correct.** The pH at the equivalence point for a titration of a weak acid with a strong base will not be at 7.0 but will be greater than 7.0 because the hydrolysis of the salt of the weak acid will produce OH^- ions, resulting in the formation of a basic solution. An example is the titration of the weak acid CH_3COOH with the strong base $NaOH$. At the equivalence point of the titration, Na^+, CH_3COO^-, and H_2O have been produced. But there is a hydrolysis equilibrium that exists: $CH_3COO^- + H_2O \rightleftharpoons CH_3COOH + OH^-$. Hence, the pH will be greater than 7.0.

Content	V B

15. **Option (A) is correct.** Since the difference in electronegativity between H and Br is greater than the difference in electronegativity between C and H, the covalent bond between H and Br in HBr is more polar than the covalent bonds between C and H in CH_4. There is a nonpolar bond in Cl_2 and in H_2.

Content	III B

16. **Option (D) is correct.** The balanced equation for the complete combustion reaction is $2\ C_8H_{18} + 25\ O_2 \rightarrow 16\ CO_2 + 18\ H_2O$. Based on the balanced equation, 8 mol of CO_2 would be produced. The volume of 8 mol of CO_2 at standard temperature and pressure is approximately $8 \times 22.4\ L = 179.2\ L$.

Content	II B
Science and Engineering	5

17. **Option (C) is correct.** Ozone absorbs harmful ultraviolet radiation in the stratosphere.

Content	I B

18. **Option (A) is correct.** Carboxylic acids include the carboxyl functional group, which contains a carbonyl group bonded to a hydroxyl group. Answer choice (B) is an ether, answer choice (C) is carbonic acid, and answer choice (D) is an amine.

Content	III A
Science and Engineering	15

19. **Option (D) is correct.** A very low K_{sp} indicates that $Mg(OH)_2$ is only slightly soluble and can form a saturated solution that will have a very small concentration of Mg^{2+} ions and OH^- ions present in solution. Hence, an $11M$ solution cannot be prepared. It is a base, not an acid.

Content	V A
Science and Engineering	7
Task of Teaching	20

20. **Option (B) is correct.** Based on the balanced equation, the maximum possible number of moles of Cl_2 that can be produced is 1.5 mol. This is found from $6\ mol\ HCl \times \frac{1\ mol\ Cl_2}{4\ mol\ HCl} = 1.5\ mol\ Cl_2$. In this case, MnO_2 is in excess and HCl is the limiting reagent, since to use up all the 2.0 mol of MnO_2 would require 8.0 mol of HCl.

Content	III B
Science and Engineering	5

21. **Option (D) is correct.** F, Cl, Br, and I are nonmetals in a group called the halogens and are found in the next-to-last column of the periodic table. Transition elements are metals located in columns 3 through 12 in rows in the middle of the periodic table, starting in row 4. The alkaline earth metals are in the second column of the periodic table. The noble gases are located in the last column of the periodic table.

Content	IV A
Science and Engineering	2

22. **Option (A) is correct.** $2\ K + 2\ H_2O \rightarrow\ 2\ KOH + H_2$ is a balanced equation for a chemical reaction because it has an equal number of atoms of each element in the reactants and in the products. The other response choices are unbalanced chemical reaction equations.

Content	III B
Science and Engineering	2

23. **Option (D) is correct.** The kinetic energy of the emitted electrons is the dependent variable because the kinetic energy varied as the independent variable changed. The frequency of the incident light is the independent variable. As different frequencies of light are used, the kinetic energy of the emitted electrons will be different. The atomic number and atomic mass were not variables that changed during the experiment, since one particular metal was used.

Content	II A
Science and Engineering	1

24. **Option (D) is correct.** Although the total pressure will increase, the decrease in volume will have no effect on the equilibrium because there is an equal number of moles of gas on the reactant side and the product side of the reaction equation.

Content	IV B
Science and Engineering	6

25. **Option (C) is correct.** Based on colligative properties, $MgCl_2$ will have the lowest freezing point. Assuming complete dissociation, it will form three particles per formula unit, one Mg^{2+} ion and two Cl^- ions. Assuming complete dissociation, KBr and CsI will each form only two particles per formula unit. CH_3OH has an extremely low ability to dissociate in water to form H^+ and CH_3O^- ions, and thus has a total of approximately one particle per formula unit.

Content	V A
Science and Engineering	5

26. **Option (C) is correct.** The student's assertion that C_6H_6COOH is the strongest acid of those listed is incorrect. The teacher can help correct the student's misconception by explaining that the strongest acid is the one with the highest degree of dissociation. Since all of the acids are monoprotic, and can be represented by HA, the K_a will indicate the degree of dissociation since $K_a = \frac{[H^+][A^-]}{[HA]}$.

Content	V B
Science and Engineering	4
Task of Teaching	14

27. **Option (A) is correct.** All of the compounds are composed of molecules with polar bonds. But based on a symmetrical tetrahedral molecular geometry, CCl_4 is a nonpolar molecule with a net dipole moment of zero. H_2O is a polar molecule with bent molecular geometry and a nonzero net dipole moment, and HF and CO are each polar molecules with linear molecular geometry and a nonzero net dipole moment.

Content	III B

28. **Option (A) is correct.** The reaction will produce CO_2. The reaction is $Na_2CO_3(aq) + 2\ HCl(aq) \rightarrow CO_2(aq) + 2\ NaCl(aq) + H_2O(l)$.

Content	IV B

29. **Option (C) is correct.** The nucleus of thorium-232 contains 90 protons and can be represented by $^{232}_{90}Th$, which undergoes a radioactive decay and emits an alpha particle as represented in the balanced nuclear equation $^{232}_{90}Th \rightarrow {}^{228}_{88}Ra + {}^{4}_{2}He$. An alpha particle is a helium nucleus and is represented by $^{4}_{2}He$. To balance the nuclear equation, X must have 88 protons and a mass number of 228. Thus, X is $^{228}_{88}Ra$.

Content	II A
Science and Engineering	2

30. **Option (C) is correct.** When a gas is converted to a solid, the process is exothermic because energy is released. The conversion of a solid to a liquid and the conversion of a liquid to a gas both involve the absorption of energy and are endothermic processes.

Content	II B

31. **Option (D) is correct.** Based on the valence shell electron pair repulsion (VSEPR) model, the bond angles about a central carbon atom in a CCl_4 molecule are $109.5°$ because CCl_4 is predicted to have a tetrahedral molecular geometry.

Content	III B
Science and Engineering	2

32. **Option (D) is correct.** Of the compounds listed, only sodium chloride is a strong electrolyte, which means that it undergoes a high degree of dissociation in aqueous solutions. Sucrose is a nonelectrolyte, some starches are weak electrolytes, and citric acid is a weak electrolyte.

Content	I B

Understanding Question Types

The *Praxis*® assessments include a variety of question types: constructed response (for which you write a response of your own); selected response, for which you select one or more answers from a list of choices or make another kind of selection (e.g., by selecting a sentence in a text or by selecting part of a graphic); and numeric entry, for which you enter a numeric value in an answer field. You may be familiar with these question formats from taking other standardized tests. If not, familiarize yourself with them so you don't spend time during the test figuring out how to answer them.

Understanding Selected-Response and Numeric-Entry Questions

For most questions, you respond by selecting an oval to select a single answer from a list of answer choices.

However, interactive question types may also ask you to respond by:

- Selecting more than one choice from a list of choices.
- Typing in a numeric-entry box. When the answer is a number, you may be asked to enter a numerical answer. Some questions may have more than one entry box to enter a response. Numeric-entry questions typically appear on mathematics-related tests.
- Selecting parts of a graphic. In some questions, you will select your answers by selecting a location (or locations) on a graphic such as a map or chart, as opposed to choosing your answer from a list.
- Selecting sentences. In questions with reading passages, you may be asked to choose your answers by selecting a sentence (or sentences) within the reading passage.
- Dragging and dropping answer choices into targets on the screen. You may be asked to select answers from a list of choices and to drag your answers to the appropriate location in a table, paragraph of text or graphic.
- Selecting answer choices from a drop-down menu. You may be asked to choose answers by selecting choices from a drop-down menu (e.g., to complete a sentence).

Remember that with every question you will get clear instructions.

Understanding Constructed-Response Questions

Some tests include constructed-response questions, which require you to demonstrate your knowledge in a subject area by writing your own response to topics. Essays and short-answer questions are types of constructed-response questions.

For example, an essay question might present you with a topic and ask you to discuss the extent to which you agree or disagree with the opinion stated. You must support your position with specific reasons and examples from your own experience, observations, or reading.

Review a few sample essay topics:

- *Brown v. Board of Education of Topeka*

  "We come then to the question presented: Does segregation of children in public schools solely on the basis of race, even though the physical facilities and other 'tangible' factors may be equal, deprive the children of the minority group of equal educational opportunities? We believe that it does."

  A. What legal doctrine or principle, established in *Plessy v. Ferguson* (1896), did the Supreme Court reverse when it issued the 1954 ruling quoted above?
  B. What was the rationale given by the justices for their 1954 ruling?

- *In his self-analysis, Mr. Payton says that the better-performing students say small-group work is boring and that they learn more working alone or only with students like themselves. Assume that Mr. Payton wants to continue using cooperative learning groups because he believes they have value for all students.*

  - Describe **TWO** strategies he could use to address the concerns of the students who have complained.
  - Explain how each strategy suggested could provide an opportunity to improve the functioning of cooperative learning groups. Base your response on principles of effective instructional strategies.

- *"Minimum-wage jobs are a ticket to nowhere. They are boring and repetitive and teach employees little or nothing of value. Minimum-wage employers take advantage of people because they need a job."*

  - Discuss the extent to which you agree or disagree with this opinion. Support your views with specific reasons and examples from your own experience, observations, or reading.

Keep these things in mind when you respond to a constructed-response question:

1. **Answer the question accurately.** Analyze what each part of the question is asking you to do. If the question asks you to describe or discuss, you should provide more than just a list.
2. **Answer the question completely.** If a question asks you to do three distinct things in your response, you should cover all three things for the best score. Otherwise, no matter how well you write, you will not be awarded full credit.
3. **Answer the question that is asked.** Do not change the question or challenge the basis of the question. You will receive no credit or a low score if you answer another question or if you state, for example, that there is no possible answer.
4. **Give a thorough and detailed response.** You must demonstrate that you have a thorough understanding of the subject matter. However, your response should be straightforward and not filled with unnecessary information.
5. **Take notes on scratch paper** so that you don't miss any details. Then you'll be sure to have all the information you need to answer the question.
6. **Reread your response.** Check that you have written what you thought you wrote. Be sure not to leave sentences unfinished or omit clarifying information.

General Assistance For The Test

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Doing Your Best

Strategy and Success Tips

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Develop Your Study Plan

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Helpful Links

Ready to Register – How to register and the information you need to know to do so.

Disability Accommodations – Testing accommodations are available for test takers who meet ETS requirements.

PLNE Accommodations (ESL) – If English is not your primary language, you may be eligible for extended testing time.

What To Expect on Test Day – Knowing what to expect on test day can make you feel more at ease.

Getting Your Scores – Find out where and when you will receive your test scores.

Getting Your Scores – Find out where and when you will receive your test scores.

State Requirements – Learn which tests your state requires you to take.

Other Praxis Tests – Learn about other *Praxis* tests and how to prepare for them.

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ETS PRAXIS

The *PRAXIS*® Study Companion

Theatre (5641)



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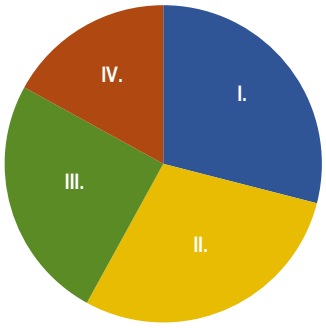
Theatre (5641)

Test at a Glance

The *Praxis*® Theatre test is designed to assess a beginning theatre teacher's knowledge and understanding of theatre and theatre education. Test takers will typically have completed, or will have nearly completed, an undergraduate or graduate theatre education program.

Test Name	Theatre
Test Code	5641
Time	2 hours
Number of Questions	120 selected-response questions
Format	The test consists of a variety of selected-response questions, where you select one or more answer choices. You can review the possible question types in "Understanding Question Types."
Test Delivery	Computer Delivered



Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
I. Curriculum, Instruction, and Classroom Practices	35	29%
II. Creating and Performing	35	29%
III. Production	30	25%
IV. History, Literature, and Criticism	20	17%

About The Test

The *Praxis*® Theatre test measures whether test takers applying for a teaching license can show evidence that they have the knowledge necessary to begin practice as K through 12 theatre instructors.

The 120 selected-response test questions cover four content domains as described in the table above. Materials appearing on the test reflect the diversity of theatre instruction specialties as well as the cultural and demographic inclusiveness of contemporary theatre education.

This test may contain some questions that will not count toward your score.

Content Topics

This list details the topics that may be included on the test. All test questions cover one or more of these topics.

The nature and distribution of topics included on the test are based on the results of a national survey given to theatre educators. A nationally representative panel of theatre educators was convened to study the survey results and assist ETS's professional assessment staff in determining the distribution of topics on the test. Each ETS assessment specialist working on this test has extensive experience in theatre education. Additionally, ETS assessment specialists consult regularly with theatre teachers and theatre education professors from throughout the country to ensure the appropriateness of individual test questions. The following is an outline of the topics covered on the test. Question content is based specifically on practitioners' judgments of what a new theatre teacher should know to begin a career as a theatre education professional.

Discussion Questions

In this section, discussion questions provide examples of content that may be included in the questions that will be presented to you on the test. These examples are open-ended questions or statements that are intended to help you review your knowledge of fundamental concepts and your ability to apply these concepts to classroom or real-world situations. We do **not** provide responses for the discussion questions, but thinking about them will help you engage with key concepts and may help you answer a broad range of test questions. Most of the discussion questions require you to combine several aspects of knowledge to formulate an integrated understanding and response. They are written to help you gain increased understanding and facility with the test's subject matter. You may wish to discuss these discussion questions with a teacher or mentor.

I. Curriculum, Instruction, and Classroom Practices

A. Understands how to select appropriate materials and activities, as well as plan instruction for various theatre subject areas (e.g., dramatic literature, performance, production, history)

1. Selecting materials that are appropriate (developmentally, contextually, etc.) and that reinforce learning objectives (e.g., dramatic literature, acting exercises, improvisation games, textbooks, videos)
2. Planning instruction that is developmentally appropriate and reinforces learning objectives (e.g., using curriculum maps, unit and lesson plans)
3. Aligning curriculum with current standards (district, state, national)
4. Applying knowledge of human growth and development to theatre instruction
5. Applying knowledge of variables that affect how students learn, engage, and perform (e.g., gender and sexual orientation, socio-economic status, self-confidence and self-esteem, language use and development)

Discussion Questions

- Explain why a person with good interpersonal skills functions well as a stage manager.
- Describe a progression of acting exercises that might span a four-year high school theatre program.
- What are some of the casting concerns that emanate from considerations of race and gender?
- What are some signs young actors display when they are uncomfortable with dramatic material?
- Identify specific dramatic texts for rehearsal at the elementary, middle, and high school levels.
- Identify specific nonliterary texts to teach design principles at the elementary, middle, and high school levels.
- Identify best practices for incorporating various improvisational and experiential lessons to promote a safe and comfortable space for students to learn.
- Explain how the principles of playwriting relate to curriculum and current standards.
- Explain what design principles the standards require students to understand and how such principles would fit into a unit plan.
- What are some of the standard texts in which to find acting exercises?
- How do lecture-based lesson plans vary from experiential lesson plans?

B. Understands how to select, create, and modify appropriate assessments for evaluating instructional effectiveness and student learning and progress, as well as understands scope and sequence of curriculum development in theatre

1. Planning units, lessons, and activities across grade levels in theatre
2. Applying knowledge of a variety of assessments (e.g., formative, summative, formal vs. informal, authentic) to theatre instruction
3. Aligning assessments with appropriate standards (district, state, national) of theatre instruction
4. Knowing appropriate and effective interpretation and use of assessment results
5. Knowing how to evaluate student readiness across grade levels and provide appropriate differentiated instruction to meet student needs

Discussion Questions

- Describe how formative and summative assessments could be used in theatre units such as improvisation, playwriting, acting, set construction, and scenic design.
- Describe how you would use authentic assessment in more focused units, such as on Elizabethan drama or the use of iambic pentameter in Shakespeare.
- Explain when you would use the different assessments in the teaching of your state's acting standards.

- Describe how you would use formative assessment to reflect on your lessons.
- What are some ways in which peer assessments can be incorporated into theatre lessons?
- What are some of the criteria for assessing audition monologues?
- Describe the scope of acting exercises from kindergarten through twelfth grade.
- At what point in the training process should performance of different theatrical styles be introduced?
- At what points in various theatre production classes should safety lessons and activities be introduced?

C. Understands how to provide students with learning experiences that enhance their knowledge and skills in theatre

1. Appropriate use of performance and production opportunities in class, rehearsal, shops, productions, touring, and workshops
2. Appropriate use of media (e.g., filmed version of performances, interviews with artists, audio and video of students' rehearsal and performance)
3. Appropriate use of guest artists and residencies (with e.g., directors, dramaturgs, playwrights, critics)
4. Appropriate opportunities for students to view live performances in various venues (e.g., schools, community theatre, professional theatre)

Discussion Questions

- Identify funding opportunities in your state and community to bring artists to your school.
- Explain how to prepare students for field trips to live performances by professional companies and how to discuss these performances in class.
- What is a comprehensive list of opportunities available to students in producing a play?
- What are some professional sources for finding qualified guest artists?
- What are the main types of theatrical experiences in the United States that students should be exposed to?

D. Understands how to provide students with learning experiences that make theatre personally relevant and meaningful

1. Supporting student input in the learning process as appropriate
2. Working with students to select, create or devise material that is relevant to student interests and needs (e.g., connected to students' real lives, communities, and families)
3. Working with students to select, create or devise material that addresses contemporary social issues (e.g., oral history, ethno-theatre, political theatre, forum theatre, feedback theatre)
4. Appropriate use of discussions, games, presentations, dialogues, etc.

Discussion Questions

- Describe a process of introducing students to critical responses to their work and the work of their peers.
- Explain how to incorporate "I poems" or other student-centered writings into scene work.
- Identify acting techniques that incorporate students' personal histories and cultural background into scene work.
- Describe several socially conscious theatre companies and their role in bringing issues to the forefront of public awareness.
- What are some of the ways to help students gather performable material that is relevant to their lives?
- Who are some of the theatre artists and theorists who are known for creating material collaboratively?

E. Understands how to provide students with learning experiences that demonstrate ways in which theatre can help us explore/understand human nature and the human condition

1. Introducing students to dramatic literature and other performance texts that deal with philosophical, social, cultural, personal, and political issues
2. Exploration of dramatic situations and methods that deal with philosophical, social, cultural, personal, and political issues
3. Exploration of personal experiences through performance
4. Exploration of human nature and the human condition through theatre

Discussion Questions

- Update a classical piece of theatre to address contemporary social issues.
- Explain how several different plays can be seen as reflections of their times.
- Describe how a theatrical production changed the way you viewed your personal history.
- Identify age-appropriate theatre texts to teach cultural issues to elementary students.
- Demonstrate ways to dramatize a text that explores human nature, such as Aesop's *Fables*.
- Identify several playwrights and directors throughout history who have engaged in political theatre. How has theatre been used as subversive or coercive medium of expression?
- How have alternative forms of theatre, such as forum theatre, joker, and invisible theatre, been used for social and political awareness?
- How can journaling be used as a technique in the theatre classroom and in rehearsal and production?

F. Knows how to provide students with learning experiences that foster creativity

1. Knows the steps of the creative process (e.g., preparation, incubation, illumination, implementation and modeling, evaluation)

2. Knows how to use exploration and imaginative play
3. Knows the kinds of learning activities that stimulate imagination in order to foster creativity

Discussion Questions

- Describe ways to utilize costumes in the theatre classroom to encourage creativity.
- Explain how improvisation can be used to deepen characterization.
- Distinguish acting techniques for students in high school from those in earlier grades.
- Describe lesson plans with open-ended objectives that allow for creative flow and spontaneous impulse.
- What are some activities that Augusto Boal used to develop his socially focused theatre?
- How can the establishment of boundaries foster creativity?

G. Knows how to provide students with learning experiences that foster independence, responsibility, and self-direction

1. Supporting students
2. Guiding students in making ethical decisions related to goals and avoiding unethical behavior (e.g., plagiarism, cheating, violations of privacy)
3. Facilitating effective collaboration among students

Discussion Questions

- List the components of an effective rehearsal schedule?
- Demonstrate how directors run a rehearsal efficiently and effectively.
- Explain how to evaluate in-class scenes and exercises.
- Describe how all of the artists of the theatre collaborate to create a theatrical work.
- In what ways could digital tools such as blogs help students to monitor their progress?
- What are the parameters of effective and positive peer feedback?
- What are the typical hierarchies in a theatre production or organization, and how will adopting them help students to collaborate appropriately?

H. Knows how to provide students with learning experiences that foster critical thinking and problem solving

1. Identifying complex cognitive processes as they apply to theatre (e.g., concept learning, problem solving, metacognition, critical thinking, transfer)
2. Instructional activities specific to the development of students' cognitive processes (e.g., distinguishing fact from opinion, comparing and contrasting, detecting bias, predicting, categorizing, analyzing, sequencing, summarizing, inferring, decision making, visualizing, evaluating, synthesizing, creating, generalizing)

Discussion Questions

- Identify the steps needed to write a successful play.
- Describe how a set designer creates an environment for performance, from script analysis to opening night.
- Describe how a dramaturg contributes to a production by researching the history of a play or company.
- Describe how scaffolding can be used in the rehearsal process.
- Identify individual, small-group, and whole-group activities in the production process.
- Describe how a lighting design for a specific scene can be turned into a geometry and physics problem.
- What are some of the methods of evaluation students need to acquire to avoid an analysis of plays that is based solely on personal taste?
- What specific steps can a teacher take to help students identify a thesis statement in critical writing?

I. Understands how to select and differentiate teaching methods and materials to address a variety of student needs (e.g., diverse backgrounds, exceptionalities)

1. Identifying learning accommodations specific to theatre for students with diverse needs (e.g., English language learners, gifted and talented, special needs, local cultures)
2. Identifying areas of exceptionality that may impact a student's learning (e.g., developmental delays, health impairments, deafness, giftedness)
3. Developing appropriate adaptations and accommodations for learning about and working in theatre (e.g., as an Individualized Education Program team member)

Discussion Questions

- Describe specific teaching tools that can be used to teach English-language learners in the theatre classroom.
- Describe the challenges encountered when working with gifted and talented students in a theatre classroom that has students of mixed levels of ability.
- Identify several methods of including deaf students in theatre exercises.
- Explain techniques for keeping students with various types of attention-deficit/hyperactivity disorder (ADHD) involved in the theatre classroom.
- Describe methods used to help students with dyslexia approach a text in the theatre classroom.
- What are some of the aspects of theatre that may encourage student with autism spectrum disorder (ASD) to participate in theatrical activities in the school setting?

J. Understands the importance of both process and product in the theatre, and the appropriate uses of cooperation and competition in the processes and development of theatrical productions

1. Learning activities that explore the process of creating a performance (e.g., creative drama, process drama, role play, improvisation, drafting, rendering, model building)
2. Learning activities that explore products developed in theatre (e.g., readings and performances, scripts, designs, reviews, talk-backs, portfolios)
3. Recognizing theatre as a collaborative art form and the skills required to work with others on theatrical projects (e.g., team building, listening and communication processes, being reliable, sharing, creating a supportive environment)
4. Helping students understand and work with competitive aspects of theatre (e.g., audition and selection processes, theatre competitions, career paths)
5. Helping students understand the ethical issues related to the competitive aspects of theatre (e.g., respect for competitors, honesty and integrity, fairness and transparency)

Discussion Questions

- Describe an effective production management plan, from first concept meeting to opening night.
- What are the most important milestones for rehearsing a successful production?
- Describe how theatre is conceived as a collaborative art form.
- Describe how all the members of a cast and crew collaborate to ensure the success of a production.
- Identify ways students can work together to create scenes in class.
- Describe best practices in the audition process and how they have evolved.
- Identify various audition techniques (e.g., cold readings, prepared monologues, and improvisations) and explain how students might best prepare for each.
- Identify the pitfalls of typecasting and describe its prevalence in professional and commercial theatre.
- List several strategies and exercises that will help students understand the process of creative collaboration.

K. Knows how to use current technologies to support theatre instruction (e.g., video cameras, use of digital audio media, websites, student response systems)

1. Use of technology in the classroom
2. Use of technology in productions
3. Use of technology in assessment

Discussion Questions

- Explain the value of technical elements to the audience's enjoyment of a production.
- Explain how costumes, sets, lighting, and sound can each further storytelling in the theatre.
- Explain how recording of scenes and monologues in class can be used effectively to critique classwork.

- What computer software platforms are widely used to create and implement designs in all aspects of theatre production (e.g., sets, lights, costumes, sound, projections)?
- What are some of the best online tools available for collaboration in the areas of dramaturgy, production management, marketing and publicity, and box office and ticketing operations?

L. Understands theatre as a collaborative art form and its relationship to the other arts

1. Encourages collaboration in the classroom and in productions with peers and other professionals
2. Encourages students to see the connections between theatre and other art forms

Discussion Questions

- Explain how performers, directors, and stage management interact during a rehearsal.
- Explain how movement skills are helpful to the acting student.
- Identify ways in which students could incorporate music into scene work.
- How do theatrical periods and styles relate to periods and styles in fine arts (e.g., visual art, music, dance, film) throughout history?

M. Knows how to create learning activities that place theatre in a social and historical context

1. Discussing and/or having classes create or devise performances that deal with contemporary and historical issues and concerns in an appropriate manner
2. Researching and creating re-enactments to interpret historical events
3. Recognizing and discussing developments in theatre as they relate to history and society (e.g., introduction of female performers, history of theatrical censorship, development of the Federal Theatre Project)
4. Discussing issues contemporary with a play's historical context
5. Exploring theatre as a reflection of society and an instrument of social change

Discussion Questions

- Explain how theatre has been used to address social issues and concerns and why it is a good vehicle to do so.
- Describe how Bertolt Brecht's style is particularly suited for dealing with social problems.
- Explain various methods of researching historical events for use in theatrical production.
- Describe the work of reenactors to bring history alive for student audiences.
- Identify pivotal moments of social change in the history of theatre.
- Evaluate Shakespeare's *Richard III* or *Julius Caesar* in relation to current events.

- Explain Ibsen's *A Doll's House* as a reflection of women's rights movements.
- How can some of the activities of Augusto Boal and Eugenio Barba be used for learning purposes?
- What are some of the steps involved in devising a collaborative creation for group performance?
- What are some of the methods used to gather information about community issues and to generate a performance derived from those issues?

N. Is familiar with the interdisciplinary connections between theatre and other academic subjects (e.g., social studies, science, mathematics)

1. Influence of other academic subjects on theatrical materials and courses (e.g., influence of science in certain play scripts, impact of developments in visual art on scenic design, use of mathematics in set design importance of writing skills and reading in theatre courses)
2. Integration of theatre methods, practices, activities, and processes to support the teaching and learning of other subjects
3. Collaboration with other faculty members (e.g., history teacher helping with production of Steinbeck's *The Grapes of Wrath*, science on stage)
4. Alignment and integration of curriculum across subjects

Discussion Questions

- Identify several plays and theatrical works that have science or mathematics as subject matter.
- Name several principles of the physics of light that play a role in understanding lighting design.
- Identify ways to teach historical events through theatrical activities.
- Compare and contrast works of literature with their representations in theatre and film.
- Explain how a history teacher could use tableaux to deepen students' understanding.
- Identify ways to incorporate current standards of English language arts, mathematics, and social studies into theatre lessons.
- How do the concepts of STEM subjects intersect with a typical theatre production?
- How can studying box office reports, production budgets, and theatre management strategies support the development of financial literacy?
- How can Shakespeare's history plays, such as *Julius Caesar* and *Henry V*, be incorporated into the study of world history?
- Identify ways in which proper instruction in movement for actors can support the physical education requirements of the general curriculum.

O. Understands ethical and legal issues related to theatre education and practice

1. Physical and emotional safety in the classroom, in rehearsals and performances, in shops and work areas, and in student relations
2. Laws related to theatrical productions (e.g., in acquiring rights for performance, safety regulations in theatre facilities, regulated accommodations)
3. Ethical issues with interactions among administrators, teachers, students, and parents

Discussion Questions

- Explain the safe use of various power tools to a high school student.
- Identify ways to make a theatre classroom an emotionally safe place for student actors.
- Explain the prevailing rules for using copyrighted materials and why copyrights are important to the continuation of theatrical art.
- Explain the use of music in a production and the best practices for how to obtain rights for its legal use.
- Identify the ethical lines that should not be crossed with regard to students and their parents.
- What are royalties in the context of play production?
- What is the scope of discussing casting decisions with parents?

P. Knows how to create a safe and supportive learning environment to encourage student participation within the artistic process

1. Fostering an environment of trust and collaboration among all participants
2. Coaching and feedback that encourage participation and improvement
3. Basic techniques for establishing and maintaining standards of conduct for discussions, critiques, and performance activities (e.g., engaging all learners, creating a supportive environment, respecting diverse opinions, supporting risk taking)
4. Ensuring access to learning opportunities for everyone

Discussion Questions

- Explain how to create a safe environment during a rehearsal.
- Describe the process of teaching students to give and receive positive criticism in classroom exercises and performance.
- Identify the principles of appropriate audience conduct in various theatrical contexts.
- Identify the principles of appropriate performer and crew conduct.
- Describe ways to facilitate the participation of all of the students in a theatre classroom.

Q. Knows how to use creative drama and process drama techniques in the classroom

1. Theatre games and other exercises
2. Improvisations

3. Storytelling
4. Adaptation, interpretation, and performance of literature
5. Role-play
6. Interactive theatre
7. Devised theatre
8. Creative dramatics (e.g., acting out stories, narrative pantomime)
9. Puppetry
10. Masks
11. Tableau

Discussion Questions

- Identify three theatre games that are useful for teaching collaboration in elementary, middle, and high school classrooms.
- Describe approaches to devising theatrical experiences to teach social issues.
- Explain the use of masks to explore movement skills.
- Describe the process of adapting a work of literature for the stage.
- Compare and contrast role playing with realistic acting.
- Explain how tableaux can be used to teach playwriting.
- Describe basic trust exercises and their use in the theatre classroom.

R. Is familiar with the theatre profession, including current trends, possible career paths, and other opportunities

1. Current trends in the theatre profession, including trends in professional training (e.g., networking, brand development) and trends in professional productions (e.g., site specific theatre, jukebox musicals, integration of media into live productions)
2. Career opportunities in theatre and non-theatrical contexts, including college and university programs (e.g., BA and BFA programs), resources for young artists (e.g., ETA, USITT), and opportunities for performance in non-theatrical contexts (e.g., medical schools)

Discussion Questions

- Identify a current trend in the theatre profession and explain its significance to the art form.
- Compare and contrast three professional training programs in terms of their strengths and weaknesses.
- Identify how theatre skills and techniques can be used in business careers.
- Describe how the soft skills that are a fundamental part of theatre production are essential in health care and politics.
- Describe a voice actor's work in theatre and nontheatrical contexts.

- Describe current controversies regarding the casting of roles written for women, LGTBQ individuals, and members of racial minority groups.
- List crossover employment opportunities for stage directors.
- How has sound and projection design changed in the past decade?

II. Creating and Performing

A. Knows various methods for creating performance material

1. Researching
2. Writing and revising scripts
3. Literary adaptation
4. Adapting, editing, or modifying a script
5. Storytelling techniques
6. Drama play
7. Creative dramatics
8. Process drama
9. Theatre games
10. Role playing
11. Improvisations
12. Storyboarding

Discussion Questions

- Describe the process for selecting a play that is suitable for a public high school.
- You are directing a children's show that will be performed by your introductory theatre class. What theatre games might you choose in early rehearsals to prepare them for the rehearsal and production process? Explain your reason for choosing each game.
- What preliminary steps would you take to create a devised theatrical production with advanced-level high school students?

B. Knows how to teach students to select, create, or devise appropriate performance material

1. Types of material to be selected or created, including for auditions, scene study, classwork, competition, and performance
2. Knows script development and the writing process and how to introduce it to students
3. Recognizes literary merit in various pieces of performance material
4. Helps students evaluate and address their own strengths and weaknesses when selecting, creating, or devising appropriate performance material

Discussion Questions

- Create a list of 15 plays that every high school theatre student should read before graduating. Explain your choices.
- What advice might you give to a young writer with writer's block?
- Choose a short fairy tale that would be suitable for performance in a middle school theatre class. What direction would you give students to adapt that fairy tale into a play script of two to three pages?

C. Is familiar with major theoretical approaches to acting

1. Basic knowledge of theoretical approaches, including those of Konstantin Stanislavski, Jerzy Grotowski, Uta Hagen, Viola Spolin, Sanford Meisner, Lee Strasberg, Stella Adler, Anne Bogart, and Augusto Boal
2. Basic knowledge of techniques used in these major approaches (e.g., objective, side-coaching, physical action, endowment, substitution, viewpoints, joker)

Discussion Questions

- Compare the improvisational techniques of Viola Spolin and Keith Johnstone.
- Describe Konstantin Stanislavski's approach to acting and actor training.
- Identify and define the significance of Anne Bogart and Tina Landau's nine Viewpoints. How might these be used in the theatre classroom?
- Articulate the differences among fourth-wall realism, improvisation, and forum theatre.
- What is method acting, and how is it adapted to theatre education?

D. Understands the common approaches, techniques, and basic steps involved in creating a performance (e.g., script analysis or devising, character development, improvisation)

1. Script analysis (including understanding of beats or units of actions, superobjectives, objectives, obstacles and actions (tactics or intentions), given circumstances, and subtext)
2. Developing physical characterization
3. Developing voice and speech appropriate for the character
4. Using improvisation approaches and techniques to explore given circumstances, inner-thoughts, objectives, tactics, and motivations
5. Rehearsal approaches and techniques
6. Understanding the importance of imagination and believability in the creation of a character
7. Understanding relationship of character to other characters
8. Memorizing lines and blocking
9. Listening and responding to other performers

Discussion Questions

- Describe your process for creating a character for a theatrical production, from the moment you are cast to the final performance of the production.
- Define "given circumstances," and explain their significance to script analysis.
- What guidance or suggestions would you offer a student who is struggling to memorize lines for an in-class scene or production?

E. Understands the basic principles of vocal production and technique (e.g., projection, articulation, variety)

1. Basic anatomy and maintenance of vocal instrument
2. Breath and support
3. Relaxation
4. Warm-ups
5. Projection
6. Pitch and tone
7. Articulation and enunciation
8. Dialect
9. Variety and contrast
10. Tempo, timing, and rhythm

Discussion Questions

- What vocal exercises might you use when working with student performers who are struggling to project and articulate?
- What exercises might you use when working with a student who lacks vocal and pitch variety?
- What is the International Phonetic Alphabet (IPA), and how does it relate to work on dialects and accents in performances?

F. Understands the basic principles of movement, physicality, and expression

1. Basic anatomy and physiology
2. Basic kinesiology
3. Breath and its relationship to movement
4. Balance
5. Relaxation
6. Warm-ups
7. Movement safety and basic health concerns
8. Spatial awareness
9. Tempo, timing, and rhythm
10. Basic understanding of mime, pantomime, and mask work
11. Basic understanding of stage combat

Discussion Questions

- What theatre exercises are appropriate for a student who has difficulty standing still on stage?
- What exercises are appropriate for a student who appears physically uncomfortable on stage?
- What safety protocols and measures should be taken before choreographing an onstage fight that either is hand-to-hand combat or involves a weapon such as a sword or knife?

G. Understands the basic elements of the audition process

1. Types of auditions (e.g., cattle call, cold readings, call-backs)
2. Audition preparation (e.g., preparing monologues, introductions/slating, etiquette)
3. Running an audition
4. Nontraditional casting
5. Creating an ensemble
6. Understands the need for fairness and providing opportunities for student growth
7. Ways to help students and parents deal appropriately with audition results
8. Understands ethical considerations related to auditions

Discussion Questions

- Plan a one-to-two-day audition process for the following two scenarios. Detail your considerations for each audition, including the type of audition format you will use, whether lines should be memorized, whether or not other individuals need to attend the audition, etc.
  - You are directing a high school production of *West Side Story*. Excitement and enthusiasm are running high among the student population, and you are anticipating an audition turnout of approximately 150 students.
  - You are directing a classroom production of "The Three Little Pigs" in your elementary school class of fourteen students. In order to create more performance opportunities for the students, you will use two different casts, each with one wolf, three pigs, and three houses.
- What guidance would you offer a student preparing for a cattle call-style audition at a local community theatre?

H. Understands the importance of considering the audience when selecting and creating performance material

1. Selecting appropriate material for school theatre programs
2. Knows common issues and concerns regarding censorship and how to address them
3. Selecting appealing material that meets student interests
4. Choosing and/or making material that is relevant to a contemporary audience
5. Selecting challenging material

Discussion Questions

- Choose two plays that would be suitable for high school students to perform for family and peers. Explain your choices.
- Choose two plays suitable for middle school students to perform for family and peers. Explain your choices.
- Choose two plays suitable for elementary school students to perform for mostly parents and older siblings. Explain your choices.

I. Understands the role of the audience in various performance contexts (e.g., traditional play, storytelling, classroom)

1. Audience expectations and reactions in various contexts
2. Recognizes the audience's role as a participant in a variety of theatrical contexts
3. Knows how to engage the audience in a variety of theatrical contexts
4. Recognizes when audience interaction is appropriate and inappropriate in a variety of theatrical contexts

Discussion Questions

- What is the role of an audience during a theatrical event? How do they contribute to the overall meaning of a production?

- What steps might you take to prepare audiences for the differing experiences of traditional realistic plays and plays that involve audience participation?

J. Knows ways to use performance material and theatrical exercises for developing and refining student skills and knowledge

1. Knows how to select, develop, and coach scenes from a variety of theatrical and non-theatrical sources for addressing specific theatre skills and knowledge
2. Selecting improvisation exercises that address specific theatre skills and knowledge
3. Adapting cross-curricular instructional materials
4. Using various technologies (e.g., video and audio recording) for instructional purposes
5. Using performance material for instructional and life-skill purposes

Discussion Questions

- You have been invited by a teacher colleague in the history department to work on a classroom performance project that will dramatize the experience of the Underground Railroad. The students have limited or no performance experience. Plan a series of improvisation games that will prepare the students for the performance project.
- You are the teacher in a high school intermediate-level theatre class. Presumably the students in the class did well enough to advance from introductory level and have a foundation of theatre knowledge and skills. Design a duet scene assignment in which students choose their own content to perform, then memorize and present their work to the class for a grade. Define the parameters of the assignment, including the time limit for the scene, acceptable source material, etc. Additionally, create a rubric that will be utilized to assess each performance.
- What is your grading scale? What performance elements will be assessed? How will you accurately and fairly assess each student?

K. Knows how to observe student performances and provide feedback that enhances those performances

1. Recognizes and communicates appropriate goals and outcomes for performance assignments
2. Knows techniques for providing effective side coaching
3. Knows techniques for facilitating peer feedback sessions
4. Recognizes effective approaches for providing individuals and groups with appropriate feedback
5. Knows how to guide students in self-reflection

Discussion Questions

- Articulate what constructive criticism you might give a student who is struggling to connect with a scene partner and how you might handle resistance to criticism.
- Choose three important performance elements on which to grade beginning middle school students who will prepare five-minute scenes.

III. Production

A. Understands standard theatre terminology used in acting, directing, stage management, and theatre technology

1. Acting terminology
2. Directing terminology
3. Stage management terminology
4. Technical theatre terminology

Discussion Questions

- Select and define 10 theatre terms for areas of focus (such as acting, directing, and design) that you believe are essential for your students to know.
- List the terms currently in use to communicate the concept of a character's objective.
- List basic blocking terms directors use to communicate with actors.
- Describe the standard blocking shorthand used by stage managers.

B. Understands the various roles in theatre production

1. Performance roles
2. Production roles
3. Technical roles

Discussion Questions

- Name and define the different individuals responsible for the execution of a theatrical event, such as a professional production at a regional theatre.
- Name the different roles that make up front-of-house personnel and the responsibilities of each role.
- Articulate the responsibility of the stage manager during a theatrical event.
- Diagram the hierarchy of theatrical production personnel during rehearsals. Explain how that hierarchy might change during performances.
- What is the difference between a production manager and a technical director?
- What kind of staffing can you expect to find for typical Broadway musical? A regional production of a nonmusical play? A college production? A fringe festival show?

C. Understands key elements of production, including their sequencing and interrelationships (e.g., rehearsal, casting, set construction)

1. Production timelines and scheduling
2. Required staff and roles within each element of production
3. Collaboration among all people working on a production

4. Interrelationship of the key elements of a production (e.g., technical elements impacting the rehearsal schedule or how design elements relate to one another)

Discussion Questions

- Articulate the responsibilities of the director up until the casting of a theatrical production.
- Explain the function of load-in and light and sound priority days.
- Create a schedule that maximizes the use of actors during rehearsal. What factors need to be considered when doing so?
- What is the difference between a paper tech, a cue-to-cue, a technical rehearsal, and a dress rehearsal? Are all these types of rehearsals always necessary?
- What is the difference between paper blocking and organic blocking? What are the strengths and weakness of each?

D. Knows the processes of theatre operations/management (e.g., producing, publicity, front of house)

1. Producing responsibilities (e.g., play and/or season selection, fund raising and grant writing, budgets, royalties, marketing and publicity, designing a playbill or program)
2. Front-of-house responsibilities (e.g., box office management and operations, house management and operations)

Discussion Questions

- Research the process of acquiring rights for the production of a musical and how much it would cost to produce the musical three times for an average audience size of 350 patrons.
- Create and fill out a useful box office report.
- What is the basic structure of a marketing plan?
- What is the basic structure of a press release?

E. Is familiar with the production of works in a variety of theatre genres and styles (e.g., musicals, theatre for social change, theatre for young audiences, devised theatre)

1. Production responsibilities common to all genres and styles
2. Production responsibilities specific to particular genres, styles, and theatrical spaces

Discussion Questions

- You are teaching a theatre styles class for your upper-level high school theatre students. Create a reading list for your students that includes ten modern or contemporary plays, each of which has a distinctly different theatrical style.
- Describe the logistical complications of street theatre.
- What differences between preparing to direct musicals and nonmusical plays should a teacher highlight with a high school directing class?

- Under what circumstances of theatrical production should a high school theatre program engage a fight choreographer? An accent coach?
- How do the roles of light and sound operators differ during an improvised performance and a performance of scripted material?

F. Understands key elements of the directing process

1. Basic approaches to directing (e.g., organic versus structured, time management)
2. Directing in various theatre spaces
3. Play selection and analysis
4. Developing a production concept or a unified vision for the production
5. Knowing the stages of the production process, including scheduling and planning
6. Collaboration with designers
7. Collaboration with producers and/or administrators
8. Collaboration with other teachers and colleagues
9. Collaboration with the local community
10. Auditions and casting
11. Rehearsal process

Discussion Questions

- Describe the major elements of effective script analysis.
- You are directing a middle school production of *James and the Giant Peach*. From the first rehearsal to the first performance is exactly six weeks. Your school district places certain restrictions on rehearsal time, including a limit of ten hours of rehearsal per week (with the exception of tech week, when rehearsal time may be extended to fifteen hours for the week). Create a rehearsal schedule and plot out how you will use rehearsal time. What do you want to accomplish in each rehearsal? Be specific.
- Consider a production you have been a part of that utilized a strong, well-envisioned concept. What made the concept work? Why was it effective? How did it aid the overall success of the production?
- What types of material and analysis does a director bring to a preliminary concept meeting?

G. Knows the design and technical skills required for a variety of theatre productions and spaces, as well as understands current safety guidelines for various theatre spaces, classrooms, and productions

1. Age-appropriate safety guidelines and practices within classroom and rehearsal spaces, shops and technical areas, and during production (e.g., builds, rehearsals, load-ins, and strikes)
2. Different skills related to various types of production spaces (e.g., design elements, technical elements, and touring needs in proscenium, thrust, arena, black box, flexible, outdoor, or environmental/site-specific spaces)
3. Different skills related to various types and styles of productions

Discussion Questions

- Describe the fundamental material elements of costume design, including costume renderings, costume plots, etc.
- Describe the fundamental material elements of scenic design, including renderings, ground plan, models, etc.
- Describe the design and technical challenges posed by various theatrical spaces, including proscenium, thrust, arena, environmental, etc.
- Enumerate the limitations that a thrust space poses for scenic design.
- Explain how the depth and length of a space affects placement of projectors.
- How does an arena stage affect light design?
- You are introducing first-year technical theatre students to theatre scene shop tools. Choose ten theatre tools that students will use regularly during the school year and for each tool clearly articulate its purpose, safety guidelines, and important safety ware or accessories to accompany its use.
- Describe the basic procedures in case of injury during a rehearsal or performance.
- Create a basic list of protective equipment for the theatre shop.
- What rules would you implement before beginning an improvisation unit?
- You are training a first-time stage manager. What responsibilities will you articulate to the trainee to ensure the safety of actors during the rehearsal process?
- Do you understand the role and format of fight call?

H. Knows key elements of lighting and sound design/production, and is familiar with the use of a variety of current technologies (e.g., software, projection) to produce theatrical works

1. Familiar with basic lighting instruments and their uses (e.g., LEDs, par cans, ellipsoidals, follow spots, tracking lights)
2. Familiar with lighting tools and technologies (e.g., gels, gobos, software)
3. Familiar with light and color theory
4. Familiar with basic aspects of electrics (e.g., plugging in equipment, dimmer board, load capabilities)
5. Familiar with basic lighting areas and angles (e.g., key light, back light, hot spot)
6. Familiar with lighting cue sheets and instrument schedules
7. Appropriate lighting practices for various performance spaces
8. Familiar with basic sound tools and technologies (e.g., microphones, wireless devices, amplifiers, monitors and speakers)
9. Uses of lighting and sound to further storytelling
10. Use of lighting and sound design to create the style, mood, and world of the play

11. Unifying lighting and sound design with the production's vision
12. How various technologies can be used in pre-production (e.g., computer-assisted design)
13. How various technologies can be used during production (e.g., backstage communication systems)
14. Use of technology for documentation or archiving of performances and portfolio creation

Discussion Questions

- Describe the major kinds of lighting instruments and their specific uses when lighting a theatrical event.
- Describe and draft a basic five-point light plot.
- Define intensity, color, direction, focus, and movement in the context of light design.
- Describe the concept of dimmer load and its importance in theatre safety.
- Why is it important for a lighting designer to discuss color choices with the set designer and costume designer before implementing colors into a design?
- Name and describe the uses of the different items of sound equipment in a theatrical event.
- You are teaching high school technical theatre students the value of sound in a nonmusical production. Choose a play and clearly express how music and sound decisions will enhance its production.
- How do sound effects, underscoring, and music help tell a play's story? Provide an example.
- Define pitch, volume, quality, direction and duration in a sound design context.
- You are instructing students who will be responsible for microphone packs for performers in a high school musical. What information do they need to know before they begin their responsibilities?
- What is the difference between a powered and a nonpowered mixer?

I. Knows script analysis as it applies to the design and technical aspects of theatre

1. Role and process of script analysis in the work of designers
2. Role and process of script analysis in the work of technicians

Discussion Questions

- What information in a script is necessary for theatrical designers to consider before they begin the design process?
- What kinds of research might a costume designer conduct in order to inform a design?
- How do costumes help support the structure of a play?
- What are some techniques used to identify the main theme(s) of a play?
- How can the imagery in the text of a play affect visual design?

J. Knows the key elements of scenic and property design and construction

1. Types of theatre spaces (e.g., proscenium, thrust, arena, black box, environmental)

2. Familiar with basic types of sets and set designs (e.g., box set, wing-and-drop, unit set)
3. Familiar with tools and processes for set design and construction, including safety considerations (e.g., rigging)
4. Familiar with tools and techniques for painting scenery
5. Use of set design to create the style, mood, and world of the play
6. Unifying set design with the production's vision
7. Property design, selection, and construction consistent with the world of the play

Discussion Questions

- Describe the fundamental material elements of scenic design, including renderings, ground plan, models, etc.
- Choose a play for which one might desire a representational scenic design. Explain your choice.
- Choose a play for which one might desire a presentational scenic design. Explain your choice.
- What size and type of material is typically used for flat construction?
- What are sponging, combing, and marbling?
- What is the difference between a box set and a unit set?

K. Knows key elements of costuming a production, and is familiar with stage makeup design and application

1. Basic elements of costume and makeup design
2. Basic techniques of costume and makeup design and production/application
3. Familiar with care, health, and safety considerations related to costumes and makeup
4. Use of costume and makeup design to reveal character, mood, and the world of the play
5. Unifying costume and makeup design with the production's vision

Discussion Questions

- Describe the fundamental material elements of costume design, including costume renderings, costume plots, etc.
- Articulate a basic approach to aging a face utilizing theatrical makeup.
- Create a shopping list of basic makeup tools every beginning actor should have in his or her makeup kit.
- Create a handout for first-time actors explaining proper costume care during a theatrical event.
- Describe the use of costume plates, standard actor measurements, and costume schedules.
- What are the basic safety rules of makeup in the theatre?

IV. History, Literature, and Criticism

A. Understands how to respond to, analyze, and evaluate theatrical works in a variety of genres and styles

1. Responding both affectively and cognitively to theatrical works and performances through written, verbal, and creative responses

2. Analyzing theatrical works and performances (including historical and literary elements) by using approaches appropriate to genre and style
3. Evaluating theatrical works and performances, including valuing and making judgments; recognizing personal viewpoints and philosophical perspectives; and understanding etiquette in various contexts (e.g., public reviews, classroom critiques)
4. Familiar with tools and processes for set design and construction, including safety considerations (e.g., rigging)

Discussion Questions

- Identify the most important components of a review of a theatrical production.
- Explain how to write reviews of student and professional productions.
- Describe how to evaluate acting, directing, and design in a theatrical performance.
- Explain the cultural value of critiquing and criticism to students.
- Compare and contrast acting styles in film, theatre, and radio (voice-over).

B. Understands the importance of theatre and its impact on society and history

1. Role of theatre in various periods and cultures
2. Theatre as it reflects and/or influences society and history, both past and present (e.g., importance of religion, class, or socioeconomic structures in various theatre traditions; role of theatre in questioning social norms; use of political satire in various theatre traditions)
3. History of theatre education

Discussion Questions

- Explain the role and significance of theatre in ancient Greek culture.
- Explain how people's desire for the theatre influenced the attitude of the Roman Catholic Church during the Middle Ages.
- Discuss the influence of Zen Buddhism on the development of Noh theatre in Japan.
- Identify the groups both for and against Elizabethan theatre (e.g., business leaders, church leaders, politicians, the people, royalty) and explain how they influenced theatrical production during the time period.
- Discuss how Restoration comedy in England can be seen as a reaction against the Puritan regime.
- Explain how the incorporation of social issues in Realism changed society in the late nineteenth and early twentieth centuries.
- Discuss how theatre helped influence political change in apartheid-era South Africa.

C. Understands the principles of theatre etiquette as a participant and a spectator

1. Appropriate behavior for participants (e.g., actors, directors, crew, front of house) during rehearsals, performances, and in the classroom
2. Appropriate audience behavior in different performance settings

Discussion Questions

- Describe the importance of audience etiquette during a live performance.
- Explain how an actor can best accept criticism from a director and incorporate it into his or her characterization.
- Explain why crew etiquette is important to the success of a production.
- Describe appropriate actor etiquette during rehearsal and performance.

D. Knows theatre traditions and conventions from a variety of cultures and perspectives

1. Historical and contemporary world theatre traditions (e.g., Africa, the Americas, Asia and the Pacific Rim, Europe)
2. Various performance perspectives, including feminist theatre, theatre from different ethnic groups (e.g., African American, Latinx, Yiddish), political theatre, religious theatre, Indigenous theatre)

Discussion Questions

- Discuss the ways in which contemporary theatre artists like Peter Brook and Tadashi Suzuki make use of historical theatrical traditions.
- Describe the development of feminist theatre in the United States.
- Identify the influence of religion on various theatrical traditions throughout history.
- Discuss the impact of theatre and performance on the emergence of identity politics in the late twentieth century (e.g., the women's rights movement, the civil rights movement, the LGBTQ movement).

E. Knows the development of theatre and theatrical conventions in key historical periods

1. Classical theatre (Greek and Roman)
2. Key periods of European theatre, including the Middle Ages and Renaissance, Elizabethan and Jacobean England, British Restoration, Spanish Golden Age, French Neoclassical theatre, and the development of realism
3. American theatre, including theatre in the United States and other theatre traditions in the Americas
4. Modernist and post-modernist theatre
5. Key periods and styles of non-western theatre (e.g., Noh, Kabuki, Kathakali, Xiqu)

Discussion Questions

- Compare and contrast Aeschylus, Sophocles, and Euripides.
- Discuss Aristotle's *Poetics* and the influence it has on theatre studies.
- Describe the major characteristics of *commedia dell'arte*.
- Describe the theatre and drama of the Spanish Golden Age.
- Explain the evolution and significance of French neoclassical principles.
- Describe the theatrical innovations that originated in the avant-garde movements of the late nineteenth and early twentieth centuries (e.g., surrealism, Dada).
- Identify leading theatrical trends in the twentieth century and discuss how they influence productions in the twenty-first century.
- Explain the development of the musical in the United States.
- Discuss the importance of storytelling in the history of African performance.
- Describe the three major forms of classical Japanese theatre: Noh, Bunraku, and Kabuki.
- Describe the major elements of Sanskrit drama and performance in India.
- Discuss the ways in which Western theatre and drama influenced the development of Asian theatre in the nineteenth and twentieth centuries.

F. Is familiar with current developments in theatre

1. Broadway, Off-Broadway, West End, and regional theatre
2. Theatre for young audiences
3. Theatre for social change
4. Major contemporary playwrights, directors, and production companies
5. Major developments in world theatre

Discussion Questions

- Discuss the influence of Broadway on contemporary theatre in the United States.
- Compare and contrast Broadway theatre in New York City with West End theatre in London.
- Identify three current innovators in theatre and explain their importance.
- Compare and contrast contemporary theatre in two different countries.
- Explain how theatre for social change is different from commercial theatre.
- Identify three local theatre companies in your area and describe their current seasons, discussing the impact of regional theatre on the community.

G. Understands how to respond to, analyze, and evaluate key works of dramatic literature from different historical periods and cultures

1. Major playwrights and key works of dramatic literature (e.g., Sophocles, Shakespeare, Molière, Ibsen, Chekhov, Hansberry, Beckett, Williams, Albee, Nottage)
2. How works relate to periods and cultures from which they come

3. Analyzing performance and literary elements in key works of dramatic literature

Discussion Questions

- Describe individual elements and typical features of plays from the European Middle Ages (e.g., *Everyman*, *Mankind*, *The Second Shepherds' Play*).
- Compare and contrast the writing styles and thematic concerns of the works of realistic playwrights (e.g., Henrik Ibsen, August Strindberg, Anton Chekhov).
- Discuss how one of Samuel Beckett's plays (e.g., *Waiting for Godot*, *Endgame*, or *Krapp's Last Tape*) demonstrates the elements of theatre of the absurd.
- Explain how the Greeks viewed foreigners, women, and mental illness as evidenced by Euripides' *Medea* or Aeschylus' *Agamemnon*.
- Explain how Arthur Miller's description of the setting in *Death of a Salesman* is a reflection of the conflict within Willy Loman.
- Discuss how Shakespeare used poetic techniques (e.g., levels of diction, rhythm, verse vs. prose, varied meters) to develop the characters in his plays.
- Choose two plays from different time periods and cultures and discuss how they were written for different styles of performance.

Theatre (5641) Sample Test Questions

The sample questions that follow represent a number of the types of questions and topics that appear on the test. They are not, however, representative of the entire scope of the test in either content or difficulty. Answers with explanations follow the questions.

Directions: The test consists of a variety of selected-response questions, where you select one or more answer choices.

1. The stage directions of a play call for depicting a large expanse of open sky. A scenic designer can best achieve this effect on a proscenium stage by employing which of the following scenic devices?

   (A) A scrim

   (B) A masking flat

   (C) A tab curtain

   (D) A cyclorama

2. As the play *Pygmalion* opens, a number of Londoners are standing under a canopy waiting for the rain to stop. Without speaking, the characters perform various actions that reveal their responses to the situation. Which of the following best describes what actors playing these characters must do during this opening scene?

   (A) Articulate

   (B) Pantomime

   (C) Soliloquize

   (D) Improvise

3. Which of the following lighting accessories is designed to reduce the excessive spreading of light outside an instrument's beam?

   (A) A gobo

   (B) A top hat

   (C) A barn door

   (D) A gel frame

4. Which of the following aspects of an actor's vocal production is most relevant when the actor is performing in a large auditorium?

   (A) Resonance

   (B) Timbre

   (C) Pitch

   (D) Projection

5. A teacher leads the class through an exercise wherein students must assign a color, a symbol, and an image that represent their understanding of a play's theme. Which of the following best describes the critical-thinking strategy that the teacher is facilitating?

   (A) Questioning

   (B) Generalizing

   (C) Sequencing

   (D) Comparing

6. Which of the following refers to theatrical performances in which the audience is not physically separated from the actors and instead becomes integrated into the performance space?

   (A) Environmental theatre

   (B) Arena theatre

   (C) Collaborative theatre

   (D) Active theatre

7. Which of the following theatre activities will best support learning a fundamental concept of a physics curriculum?

   (A) Measuring the length and width of the stage and then drawing the stage to scale

   (B) Creating a sound effect with a shift in pitch to imitate the movement of something exiting the stage

   (C) Determining the hanging distance of a lighting instrument so that the light will hit a particular spot on stage

   (D) Generating a box office report that includes a breakdown of audience characteristics by ticket price

8. Of the following courses, which provides the most valuable training for a person who plans to teach theatre and drama to elementary students?

   (A) Basic acting

   (B) Play production

   (C) Creative dramatics

   (D) Forensics

9. In script analysis, which of the following terms refers to the environmental and situational conditions that form the world of the play and are not open to interpretation?

   (A) Given circumstances

   (B) Character objectives

   (C) Subtext

   (D) Beats

10. Which of the following curricular units provides appropriate content for helping students prepare monologues for college entrance auditions?

    (A) Building an effective ensemble in rehearsal

    (B) Designing costumes to communicate character

    (C) Writing theatre reviews versus writing dramatic criticism

    (D) Casting by type versus casting against type

11. Which of the following is a design tool that cannot be used until after final designs have been approved by a director?

    (A) Ground plan

    (B) Scenic rendering

    (C) Painter's elevation

    (D) Scenic model

12. Which of the following actions constitutes a safety violation in a scene shop or backstage?

    (A) Wearing earplugs during supervised work on loud machinery such as saws or drills

    (B) Using wooden ladders to hang and focus stage lighting

    (C) Welding on wooden floors that have cracks between the boards or sections

    (D) Prohibiting crew members from eating and drinking in the shop while on scheduled breaks

13. A teacher is beginning an advanced directing unit and wants students to learn how to appropriately alter blocking choices for a thrust stage after performing a scene on a proscenium stage. Which of the following uses of media will best align with the goal of the unit?

    (A) Showing the same scene filmed on both kinds of stage and then comparing the staging in each version

    (B) Videotaping students performing a scene on a thrust stage and then discussing their various configurations

    (C) Recording groups of students rehearsing and performing various scenes on a proscenium stage and then comparing the groups' stagings

    (D) Playing an audio recording of a famous director discussing an approach to blocking each kind of stage and then applying the advice

14. An eighth-grade teacher wants to create an essay prompt to evaluate students' responses to a live performance of the play *Our Town*. Which of the following prompts best enables students to make aesthetic judgments in their essays?

    (A) "Write a character description of the Stage Manager in *Our Town*."

    (B) "Explain what you liked and did not like in the performance of *Our Town*."

    (C) "Discuss the universal themes in the play *Our Town*."

    (D) "Describe how the characters view the death of Emily in Act 3 of the play *Our Town*."

15. Which of the following is the best reason for a theatre teacher to have a student periodically create and listen to audio recordings and then to compare the student's most recent recording with an earlier one as part of a formative assessment in acting?

    (A) To encourage the student to experiment with different approaches to meeting the character's objectives

    (B) To add more sound production material to the student's technical portfolio

    (C) To analyze the student's progress in the area of vocal articulation

    (D) To evaluate how different seasons and times of day affect the quality of the student's voice

16. An actor is using emotional memory to develop a character. Which of the following questions is most directly related to this technique?

    (A) Which significant experiences from my own life are relevant to the character?

    (B) Which important actors have played this role in the past?

    (C) What prevents my character from achieving his or her objective?

    (D) What information does the play provide about my character's experiences before the play begins?

17. Which of the following playwrights explored the dynamics of power and gender through the lens of feminism by creating plays such as *Cloud 9* and *Top Girls* ?

    (A) Caryl Churchill

    (B) María Irene Fornés

    (C) Sarah Ruhl

    (D) Anna Deavere Smith

18. Which of the following pieces of equipment is a sound technician most likely to use?

    (A) Dimmer packs

    (B) Spike tape

    (C) C-clamps

    (D) XLR cables

19. A middle school theatre teacher wants to use improvisational games to build a supportive and cooperative classroom environment. Methods developed by which **TWO** of the following theatre practitioners are most appropriate for helping the teacher achieve the goal?

    (A) Viola Spolin

    (B) Vsevolod Meyerhold

    (C) Sanford Meisner

    (D) Uta Hagen

    (E) Keith Johnstone

20. In choosing a monologue for a theatre audition, an actor should avoid a passive speech and instead choose one that

    (A) emphasizes the character's emotional intensity

    (B) tells a story from the character's past

    (C) uses graphic language that will demand an audience's attention

    (D) demonstrates the pursuit of an immediate, simple objective

21. Which of the following statements about solo performance in United States theatre since the 1980s, such as the practice of Anna Deavere Smith and John Leguizamo, is most accurate?

    (A) Employing flexible grouping and regrouping practices

    (B) It has received specifically targeted government funding.

    (C) It has focused exclusively on humorous subject matter.

    (D) It has been produced less frequently than in the past.

22. The work of which of the following playwrights is best described as being darkly comic, antilogical, and skeptical about the human condition?

    (A) Neil Simon

    (B) Bertolt Brecht

    (C) Beth Henley

    (D) Samuel Beckett

23. In a production with a complete team, the property running crew is responsible for

    (A) tracking, placing, and maintaining all props during rehearsals and performances

    (B) creating and acquiring all props used in production

    (C) adding props to the rehearsal report when the director mentions them

    (D) transporting scenery from the shop to the theatre stage

24. A high school teacher is teaching a unit on Bunraku. Which of the following activities is most appropriate for helping students understand this style of performance?

    (A) Writing a monologue to convey a character's interior emotional state

    (B) Working together to stage an elaborate, scripted puppet show

    (C) Interviewing classmates and using the interviews as the basis for a play

    (D) Making a mask, putting it on, and acting out an exaggerated character for the class

25. A theatre teacher wants to foster autonomy among students who are organizing themselves into groups for a cooperative learning activity. Which of the following classroom procedures will best accomplish the teacher's goal?

    (A) Having students draw labeled wooden sticks for individual roles within the group

    (B) Numbering students randomly before revealing role titles that correlate to the numbers given

    (C) Allowing students to self-assign roles within their group and providing mediation if requested

    (D) Instructing students to rotate roles within the group so each student can experience all of them

26. Moment-to-moment direction given to an actor while a scene is being played is known as

    (A) side-coaching

    (B) soliloquizing

    (C) improvisation

    (D) give-and-take

27. A high school class is learning about costume design requirements specific to different types of theatrical spaces. They will be taking the school's recent production to a statewide competition that takes place in a much larger theatre. Which of the following is the most appropriate suggestion for the class to follow when designing costumes for a large proscenium stage rather than for a more intimate arena stage?

    (A) Making sure to use fabrics with brighter colors
    (B) Being certain to incorporate fabrics with more texture
    (C) Taking care to amplify the scale of the detail elements
    (D) Adhering to a simpler color palette throughout the design

28. Which of the following organizations creates opportunities for high school students to audition for scholarships to college theatre programs?

    (A) Actors' Equity Association
    (B) International Thespian Society
    (C) Theatre for Young Audiences/USA
    (D) American Alliance for Theatre and Education

29. Alienation—the use of techniques designed to remind the audience of the artificiality of a theatrical performance and prevent them from "escaping" into the world of the play—is most closely associated with which of the following types of theatre?

    (A) Theatre of Cruelty
    (B) Theatre of Fact
    (C) Epic theatre
    (D) Poor theatre

30. In addition to performing their designated responsibilities, members of the backstage running crew should obey which of the following general guidelines during performances?

    (A) Wear brightly colored clothing to increase visibility to the cast and other crew members.
    (B) Signal to the stage manager each time a task is finished.
    (C) Help the actors stay focused while they are offstage by asking them questions about their roles.
    (D) Use a low whisper anytime speech is necessary.

Answers

1. **Option (D) is correct.** A cyclorama (or cyc) is a curved curtain or wall used as the background of a stage set to suggest unlimited space and is often used to create the illusion of a sky.

2. **Option (B) is correct.** Pantomime is a dramatic activity in which actors rely on silent motions, gestures, facial expressions, and costumes to convey a story or activity.

3. **Option (B) is correct.** A top hat is used to reduce excessive spreading, or halation, around the primary beam emanating from a lighting instrument.

4. **Option (D) is correct.** Although resonance, timbre, and pitch are characteristics of the voice, projection is the aspect of vocal production that is most critical to performance in a large auditorium because it determines whether or not the actor will be heard by the entire audience.

5. **Option (B) is correct.** The students are generalizing their understanding of the theme by assigning more complex thematic ideas to simpler expressions such as a color, a symbol, and an image.

6. **Option (A) is correct.** Environmental theatre is the term used to designate performances in which the audience and actors share the same space.

7. **Option (B) is correct.** Creating a sound effect that demonstrates or represents the Doppler effect (or shift) would support a physics unit on the behavior of sound waves.

8. **Option (C) is correct.** The typical approach to incorporating theatre and drama into an elementary classroom is to use process techniques learned in the study of creative drama.

9. **Option (A) is correct.** The given circumstances—e.g., the characters involved in the play, the setting, any previous action—found in the script are considered part of the foundation of the play and are not open to interpretation. These circumstances may, however, influence the interpretation of many different aspects in a production. Elements such as character objectives, subtext, and beats are all subject to interpretation by directors, designers, actors, and any other reader of the text.

10. **Option (D) is correct.** A unit that discusses casting and the distinction between casting by type and against type will be helpful for students choosing monologues that best showcase the actor, regardless of the method of casting being used by those conducting the audition.

11. **Option (C) is correct.** A painter's elevation, which provides instruction from the scenic designer to the scene painter, is used after the final approval of the designs by the director. Building and painting scenery can only proceed after such approval.

12. **Option (C) is correct.** According to OSHA and USA Local standards, welding on wooden floors that have cracks presents a hazard that is considered a safety violation. If someone is welding in a location that has cracks in the flooring, combustible materials on the floor below could be exposed to sparks that might drop through the floor during the welding process.

13. **Option (A) is correct.** By using media to demonstrate the differences between blocking choices depending on stage configuration, the teacher will help students to consider how to alter proscenium blocking for a thrust stage.

14. **Option (B) is correct.** Asking students to express their personal feelings about the production requires them to make aesthetic judgments. They must consider the quality of the performance in crafting their essays.

15. **Option (C) is correct.** One way to assess the impact of vocal training on elements such as articulation is to record the student over time and compare these recordings to track progress and skills development.

16. **Option (A) is correct.** Emotional memory is a technique that calls for an actor to recall significant personal experiences to re-create past emotions when portraying a character onstage.

17. **Option (A) is correct.** Beginning in the 1970s, British dramatist Caryl Churchill explored the themes of politics, gender, and colonialism in her many plays, which include *Cloud 9*, *Top Girls*, *Light Shining in Buckinghamshire*, *Far Away*, and *A Number*.

18. **Option (D) is correct.** While sound technicians might occasionally use spike tape and c-clamps, they are most likely to use XLR cables, which connect audio equipment, in their specific duties.

19. **Options (A) and (E) are correct.** Spolin and Johnstone are both well known for creating improvisational theatre games that encourage supportive and cooperative relationships among participants.

20. **Option (D) is correct.** Choosing a monologue in which the character is pursuing a simple objective, and thus ensuring that the character is not passive, best demonstrates the actor's ability to develop a playable action.

21. **Option (A) is correct.** Since the development of solo performance as a distinct and prolific genre in the 1980s, such performances have often been focused on social, cultural, and political issues.

22. **Option (D) is correct.** The plays of Samuel Beckett employ jokes and clownish characters with a dark sensibility, they avoid Aristotelian concepts of cause-to-effect plotting, and they exhibit pessimism about the human condition.

23. **Option (A) is correct.** Property running crews are responsible only for the handling of the props during rehearsals and performances. In a production with a full team, the property construction crew is responsible, under properties head supervision, for building the props, but the running crew is responsible for their handling.

24. **Option (B) is correct.** Bunraku is a Japanese form of puppet theatre. While the puppets in Bunraku are meticulously crafted and manipulated by skilled operators, staging an elaborate puppet show in class would introduce students to the basis of this style of performance.

25. **Option (C) is correct.** This strategy allows students to choose roles themselves, offering students an opportunity to function independently without the teacher assigning or organizing role selection.

26. **Option (A) is correct.** Giving direction to actors while they are improvising or playing a scene is a common strategy called side-coaching.

27. **Option (C) is correct.** Enlarging the scale of the details of the costumes will allow the costumes to be seen, and their meanings to be read, from a greater distance.

28. **Option (B) is correct.** At the annual International Thespian Society (ITS) Festival, selected thespians who are graduating seniors can audition for scholarships. State chapters of ITS often include college scholarship auditions in their annual state festivals, and colleges and universities often use ITS events for recruitment.

29. **Option (C) is correct.** Epic theatre employs the "alienation effect," a variety of metatheatrical techniques meant to prevent the audience from becoming absorbed in the world of the play by reminding them of the artificiality of the theatrical performance, in order to encourage the audience to be active thinkers during a performance rather than passive feelers of emotion. Developed in the early twentieth century, and most famously theorized and championed by Bertolt Brecht, alienation has been employed by many playwrights and producers of theatre ever since.

30. **Option (D) is correct.** Members of the backstage running crew should speak only in a low whisper to avoid creating distraction backstage and prevent themselves from being audible to audiences.

Understanding Question Types

The *Praxis*® assessments include a variety of question types: constructed response (for which you write a response of your own); selected response, for which you select one or more answers from a list of choices or make another kind of selection (e.g., by selecting a sentence in a text or by selecting part of a graphic); and numeric entry, for which you enter a numeric value in an answer field. You may be familiar with these question formats from taking other standardized tests. If not, familiarize yourself with them so you don't spend time during the test figuring out how to answer them.

Understanding Selected-Response and Numeric-Entry Questions

For most questions, you respond by selecting an oval to select a single answer from a list of answer choices.

However, interactive question types may also ask you to respond by:

- Selecting more than one choice from a list of choices.
- Typing in a numeric-entry box. When the answer is a number, you may be asked to enter a numerical answer. Some questions may have more than one entry box to enter a response. Numeric-entry questions typically appear on mathematics-related tests.
- Selecting parts of a graphic. In some questions, you will select your answers by selecting a location (or locations) on a graphic such as a map or chart, as opposed to choosing your answer from a list.
- Selecting sentences. In questions with reading passages, you may be asked to choose your answers by selecting a sentence (or sentences) within the reading passage.
- Dragging and dropping answer choices into targets on the screen. You may be asked to select answers from a list of choices and to drag your answers to the appropriate location in a table, paragraph of text or graphic.
- Selecting answer choices from a drop-down menu. You may be asked to choose answers by selecting choices from a drop-down menu (e.g., to complete a sentence).

Remember that with every question you will get clear instructions.

Understanding Constructed-Response Questions

Some tests include constructed-response questions, which require you to demonstrate your knowledge in a subject area by writing your own response to topics. Essays and short-answer questions are types of constructed-response questions.

For example, an essay question might present you with a topic and ask you to discuss the extent to which you agree or disagree with the opinion stated. You must support your position with specific reasons and examples from your own experience, observations, or reading.

Review a few sample essay topics:

- *Brown v. Board of Education of Topeka*

  "We come then to the question presented: Does segregation of children in public schools solely on the basis of race, even though the physical facilities and other 'tangible' factors may be equal, deprive the children of the minority group of equal educational opportunities? We believe that it does."

  A. What legal doctrine or principle, established in *Plessy v. Ferguson* (1896), did the Supreme Court reverse when it issued the 1954 ruling quoted above?
  B. What was the rationale given by the justices for their 1954 ruling?

- *In his self-analysis, Mr. Payton says that the better-performing students say small-group work is boring and that they learn more working alone or only with students like themselves. Assume that Mr. Payton wants to continue using cooperative learning groups because he believes they have value for all students.*

  - Describe **TWO** strategies he could use to address the concerns of the students who have complained.
  - Explain how each strategy suggested could provide an opportunity to improve the functioning of cooperative learning groups. Base your response on principles of effective instructional strategies.

- *"Minimum-wage jobs are a ticket to nowhere. They are boring and repetitive and teach employees little or nothing of value. Minimum-wage employers take advantage of people because they need a job."*

  - Discuss the extent to which you agree or disagree with this opinion. Support your views with specific reasons and examples from your own experience, observations, or reading.

Keep these things in mind when you respond to a constructed-response question:

1. **Answer the question accurately.** Analyze what each part of the question is asking you to do. If the question asks you to describe or discuss, you should provide more than just a list.
2. **Answer the question completely.** If a question asks you to do three distinct things in your response, you should cover all three things for the best score. Otherwise, no matter how well you write, you will not be awarded full credit.
3. **Answer the question that is asked.** Do not change the question or challenge the basis of the question. You will receive no credit or a low score if you answer another question or if you state, for example, that there is no possible answer.
4. **Give a thorough and detailed response.** You must demonstrate that you have a thorough understanding of the subject matter. However, your response should be straightforward and not filled with unnecessary information.
5. **Take notes on scratch paper** so that you don't miss any details. Then you'll be sure to have all the information you need to answer the question.
6. **Reread your response.** Check that you have written what you thought you wrote. Be sure not to leave sentences unfinished or omit clarifying information.

General Assistance For The Test

Praxis® Interactive Practice Test

This full-length *Praxis*® practice test lets you practice answering one set of authentic test questions in an environment that simulates the computer-delivered test.

- Timed just like the real test
- Correct answers with detailed explanations
- Practice test results for each content category

ETS provides a free interactive practice test with each test registration. You can learn more here.

Doing Your Best

Strategy and Success Tips

Effective *Praxis* test preparation doesn't just happen. You'll want to set clear goals and deadlines for yourself along the way. Learn from the experts. Get practical tips to help you navigate your Praxis test and make the best use of your time. Learn more at Strategy and Tips for Taking a *Praxis* Test.

Develop Your Study Plan

Planning your study time is important to help ensure that you review all content areas covered on the test. View a sample plan and learn how to create your own. Learn more at Develop a Study Plan.

Helpful Links

Ready to Register – How to register and the information you need to know to do so.

Disability Accommodations – Testing accommodations are available for test takers who meet ETS requirements.

PLNE Accommodations (ESL) – If English is not your primary language, you may be eligible for extended testing time.

What To Expect on Test Day – Knowing what to expect on test day can make you feel more at ease.

Getting Your Scores – Find out where and when you will receive your test scores.

State Requirements – Learn which tests your state requires you to take.

Other Praxis Tests – Learn about other *Praxis* tests and how to prepare for them.

To search for the *Praxis* test prep resources that meet your specific needs, visit:

www.ets.org/praxis/testprep

To purchase official test prep made by the creators of the *Praxis* tests, visit the ETS Store:

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Family and Consumer Sciences (5123)



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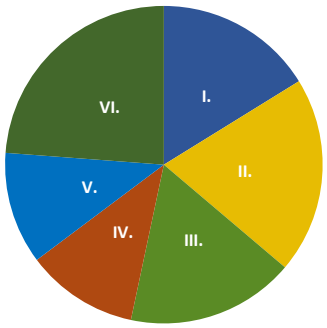
Family and Consumer Sciences (5123)

Test at a Glance

Test Name	Family and Consumer Sciences
Test Code	5123
Time	130 minutes
Number of Questions	130 selected response questions
Format	The test consists of a variety of selected-response questions, where you select one or more answer choices and other types of questions. You can review the possible question types in Understanding Question Types.
Test Delivery	Computer Delivered



Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
I. Family, Career, and Community Interrelationships	22	17%
II. Wellness, Nutrition, and Food Science	27	21%
III. Human Development and Interpersonal Relationships	23	18%
IV. Housing, Interior Design, Textiles, and Apparel	16	12%
V. Business Skills Across Career Pathways	16	12%
VI. Professional Teaching Practices	26	20%

About The Test

The Family and Consumer Sciences test is designed for prospective teachers of family and consumer sciences teachers from middle school to high school. The 130 selected-response questions assess subject knowledge as well as the methodology applicable to teaching family and consumer sciences. The test specifications are based on the Family and Consumer Sciences Standards 3.0. The test is broad in scope to provide the range in subject areas to which prospective family and consumer sciences teachers are exposed and the variety of programs for which they are prepared. The test is typically taken by examinees who have completed a bachelor's degree program with an emphasis on family and consumer sciences. Six content areas include family, career, and community interrelationships, wellness, nutrition, and food science; human development and interpersonal relationships; housing, interior design, textiles, and apparel business skills across career pathways, and professional teaching practices. This test may contain some questions that will not count toward your score.

Content Topics

This list details the topics that may be included on the test. All test questions cover one or more of these topics.

Note: The use of "e.g." to start a list of examples implies that only a few examples are offered and the list is not exhaustive.

Discussion Questions

In this section, discussion questions provide examples of content that may be included in the questions you receive on testing day. They are open-ended questions or statements intended to help test your knowledge of fundamental concepts and your ability to apply those concepts to classroom or real-world situations. Answers for the discussion questions are **not** provided; however, thinking about the answers will help improve your understanding of fundamental concepts and may help you answer a broad range of questions on the test. Most of the questions require you to combine several pieces of knowledge to formulate an integrated understanding and response. The questions are intended to help you gain increased understanding and facility with the test's subject matter. You may want to discuss these questions with a teacher or mentor.

I. Family, Career, and Community Interrelationships

A. Career Development through Family and Consumer Sciences

1. Understands how contextual factors within the individual, family, community, and workforce influence career planning
2. Knows employability, job-seeking, and job-keeping skills that are in demand in the labor market
3. Understands how a class/course in family and consumer sciences facilitates career pathway exploration and preparation in aligned occupations, industries, and fields
4. Knows how to integrate FCCLA programs and activities into instructional plans to teach family and consumer sciences standards, facilitate career development, and foster positive youth development
5. Knows how to build community partnerships and stakeholder involvement through civic engagement, public relations, and program marketing that result in a more effective and impactful instructional program

B. Consumer Economics and Family Resources

1. Knows culturally competent financial management principles and practices for managing diverse individual and family resources
2. Understands sustainability trends and issues affecting families and future generations

3. Knows systems of consumer protection that prevent fraudulent, unethical, and deceptive practices affecting families and the national agencies that provide human services
4. Understands how advancements in media and technology influence family and consumer decisions and the effect on quality of life
5. Is familiar with the interrelationships of consumers and economic systems at global, national, and local levels
6. Knows how to assess the influences of values, diverse needs, and goals of individuals, families, and communities in relation to consumer choices

C. Family Science

1. Understands family functioning and its effect on individuals and society
2. Understands the diversity of individuals and families and how to demonstrate cultural competence in supporting individuals, families, and communities
3. Understands individual and contextual factors that impact and influence the well-being of individuals and families
4. Understands teamwork and leadership skills in the family, workplace, and community

Discussion Question: Family, Career, and Community Interrelationships

- How do contextual factors influence career planning and the well-being of individuals and families?
- How do financial management principles affect individual and family resources?
- How do advancements in media influence consumer decisions and affect the quality of family life?
- What are some sustainability trends that are affecting the way people choose to live their lives and to think about future generations?

II. Wellness, Nutrition, and Food Science

A. Individual and Family Health and Wellness

1. Understands the dimensions of wellness and their interconnectedness
2. Understands individual and family wellness practices that promote overall health, well-being, and resiliency across the life span
3. Is familiar with the influence of global perspectives and local systems on the health and well-being of individuals and families
4. Knows how to facilitate students' reflection of their own well-being across the various dimensions of health (e.g., physical, mental, emotional, spiritual, and social) across the life span
5. Knows how to facilitate culturally responsive health promotion practices that promote wellness of the whole person
6. Knows how to share evidence-based health and nutrition information and prevent the spread of misinformation

B. The Role of Food in Individual, Family, and Community Health and Well-Being

1. Knows how to identify the impact of science, technology, engineering, arts, and mathematics (STEAM) on food practices, food availability, and related issues on a global society
2. Knows the role food plays in building family and community identity and relationships
3. Understands challenges and issues in the food system related to food safety, access and equity, and environmental sustainability
4. Understands how nutrients function within the body
5. Understands the nutritional needs of individuals when providing food education, including those with special dietary needs, disordered eating conditions, and cultural and religious practices

C. Food Production, Preparation, and Service Procedures

1. Knows food safety, testing, and sanitation management principles and procedures within the home, food service industry, and manufacturing throughout the food system
2. Knows how to acquire, handle, store, and prepare foods to meet consumer needs
3. Knows professional food preparation methods and techniques to produce a variety of safe food products and menu items that meet consumer needs
4. Knows menu planning and product development techniques that use standardized recipes that meet consumer needs

Discussion Question: Wellness, Nutrition, and Food Science

- What are the dimensions of wellness, and how are they interconnected?
- What are health practices that promote individual and family wellness?
- What are some nutritional needs of individuals?
- How do nutrients function within the body?
- What are some culturally responsive health practices that promote wellness?
- What are some professional food preparation methods that meet consumers' needs?

III. Human Development and Interpersonal Relationships

A. Human Development, Instruction, and Early Childhood Education

1. Understands the principles, practices, and theories of human development across the life span
2. Understands contextual influences that affect human development
3. Understands developmentally appropriate practices, playful learning, and alignment with curriculum for early childhood education

4. Understands how to maintain a safe and healthy learning environment for children to meet their socio-emotional, physical, and cognitive needs
5. Knows professional practices, standards and techniques related to working and/or building positive relationships with children, their families and communities

B. Parenting and Interpersonal Relationships

1. Understands the roles and responsibilities of parenting
2. Understands parenting practices and behaviors that optimize human development to strengthen individuals and families
3. Understands physical, social, emotional, and cognitive factors related to the parenting process including family structures
4. Understands characteristics of various types of interpersonal and intrapersonal relationships
5. Knows how to communicate needs and wants to build positive relationships that support individual and family well-being across the life span
6. Understands effective communication, conflict resolution, and problem-solving strategies within different contexts

Discussion Questions: Human Development and Interpersonal Relationships

- What are the contextual influences that affect human development?
- How does a safe learning environment foster a child's socio-emotional, physical, and cognitive development?
- What are the roles and responsibilities of parenting, and what are some factors related to the parenting process?
- How do individuals communicate their needs in order to build positive relationships that support their well being across their lifespan?

IV. Housing, Interior Design, Textiles, and Apparel

A. Housing and Interior Design

1. Is familiar with the role of housing and interior design in individual, family, and community life and well-being
2. Is familiar with housing and design concepts as they relate to theory, principles, and elements of design and sustainable design
3. Is familiar with how to consider housing, interior design, and furnishings regarding ecological, historical, socioeconomic, cultural, and global contexts

B. Textile and Apparel Skills

1. Is familiar with types of fiber and textile products and materials and their appropriate applications

2. Knows basic design and construction skills related to fashion, apparel, and textiles
3. Knows skills, techniques, and technology needed to produce, alter, or repair fashion, apparel, and textile products

Discussion Questions: Housing, Interior Design, Textiles and Apparel

- What principles of design theory are used in interior design?
- How do ecological, historical, socioeconomic, cultural, and global contexts affect housing and interior design options?
- What design and construction skills are related to fashion, textiles, and apparel?
- What are different types of fiber textiles?

V. Business Skills Across Career Pathways

A. Business Skills Across Career Pathways

1. Knows career pathways and entrepreneurial opportunities in family and consumer sciences
2. Knows how to integrate managerial skills, leadership skills, and ethical practices in order to optimize business objectives, employee well-being, and customer satisfaction
3. Understands components of quality customer service within the context of related career pathways
4. Is familiar with how to manage human resources within the FCS career pathways to achieve goals and objectives (e.g., recruiting, interviewing, selecting, hiring, and terminating employees)
5. Knows procedures that promote safety, security, and sustainability within the context of related career pathways

Discussion Questions: Business Skills Across Career Pathways

- What managerial and leadership skills and ethical practices are needed to optimize business objectives?
- How do leadership skills affect individuals in the workplace?
- What customer service skills can be applied in the workplace in order to ensure consumer satisfaction?

VI. Professional Teaching Practices

A. Curriculum and Instruction

1. Is familiar with how the FCS Body of Knowledge and the American Association of Family & Consumer Sciences Code of Ethics frame professional practice in family and consumer sciences education
2. Is familiar with how to relate philosophical perspectives of family and consumer sciences and career and technical education to current and future professional practice (recruitment, mentoring, and ongoing professional development)
3. Understands how to integrate the FCS Body of Knowledge through curriculum development and/or instructional planning

4. Understands how to develop curricula and instructional planning that address the integrative content, recurring concerns, and evolving family, consumer, career, and community issues
5. Understands how to integrate family and consumer sciences content and grade-level core academic standards
6. Understands and applies the integrative nature of family and consumer sciences content
7. Understands how to employ family and consumer sciences classroom- and lab-management strategies that use resources responsibly and support a safe, culturally responsive, and accessible learning environment
8. Knows how to create an inclusive learning environment where students apply critical literacy to improve individuals, families, and communities (e.g., action research, service learning, problem-based learning)
9. Knows how to use a variety of authentic assessment techniques to gather and evaluate data to improve student learning
10. Knows how to use data (e.g., student achievement data, Perkins performance indicators, research, labor market info) for program improvements (e.g. professional learning communities, professional conferences, district advisory council, FCCLA) reflective of the FCS Body of Knowledge

B. Laboratory Management

1. Knows how to plan, organize, and maintain an efficient and safe environment in the laboratory
2. Understands procedures to acquire, take inventory, replenish, and prevent loss of laboratory supplies, tools, and equipment (e.g., purchasing policies, asset management, the role of bookkeeper, equipment, and material disposal)
3. Understands how to implement, model, and assess appropriate health, safety, sanitation, and sustainability practices based on current, industry-relevant standards
4. Understands how to designs labs that allow students to apply and reflect on what they have learned in the classroom within real-world settings
5. Understands how to assess group dynamics, protocol adherence, and lab production, as aligned to the FCS curriculum

Discussion Questions: Professional Teaching Practices

- How can an FCS teacher create an inclusive learning environment where students can apply critical literacy to improve their learning?
- How does an FCS teacher plan, organize, and maintain a safe environment in a lab?
- What are appropriate sanitation processes?
- How can authentic assessment techniques improve student learning?
- How does the FCS Body of Knowledge frame professional practice in FCS education?
- How should an FCS teacher integrate the FCS Body of Knowledge into instructional planning?

Family and Consumer Sciences (5123) Sample Test Questions

Sample Questions

The sample questions that follow represent a number of the types of questions and topics that appear on the test. They are not, however, representative of the entire scope of the test in either content or difficulty. Answers with explanations follow the questions.

Directions: Each of the questions or statements below is followed by suggested answers or completions. Select the one that is best in each case.

1. Which of the following pathways is housed within the Hospitality and Tourism Career Cluster?
   (A) Family and Community Services
   (B) Restaurants and Food/Beverage Services
   (C) Business Information Management
   (D) Food Products and Processing Systems

2. In which of the following ways can developmentally appropriate practices be integrated into early childhood education to support optimal learning and development?
   (A) Focusing primarily on academic skills and rote memorization
   (B) Strictly adhering to a standardized curriculum scope and sequence
   (C) Designing activities that match a child's cultural background, language skills, and cognitive abilities
   (D) Emphasizing structured lessons and limiting play in learning centers

3. Which of the following is the most accurate statement about the dimensions of wellness?
   (A) Attention must be given to all dimensions of wellness, but the attention does not have to be equally balanced.
   (B) Attention must be given to all dimensions of wellness, and the attention should be equally balanced.
   (C) Attention does not need to be given to all dimensions of wellness as long as there is a clear focus on a few dimensions.
   (D) The dimensions of wellness are not interconnected, so the attention given to all dimensions does not have to be equally balanced.

4. Which of the following must be identified at the beginning of a historic-house rehabilitation project?
   (A) Areas of the home that can be modernized and the original architectural details that can be retained
   (B) Areas of the home that are outdated and need a more aesthetically pleasing design and layout
   (C) Areas of the home that are secondary spaces but define the home's importance
   (D) Areas of the home that are essential in communicating its historic and architectural character

5. Which of the following illustrates the most accurate path of the food system life cycle in the United States?
   (A) Origin of resource; agricultural production; food processing, packaging, and distribution; preparation and consumption; end-of-life disposal
   (B) Agricultural production; origin of resource; food processing, packaging, and distribution; preparation and consumption; end-of-life disposal
   (C) Origin of resource; agricultural production; preparation and consumption; food processing, packaging, and distribution; end-of-life disposal
   (D) Agricultural production; food processing, packaging, and distribution; origin of resource; preparation and consumption; end-of-life disposal

6. Which of the following describes the best approach families can take to protect Earth's resources for future generations?
   (A) Finding ways to reduce local industries' stress on Earth's resources
   (B) Practicing ways to prudently use and regenerate Earth's resources
   (C) Reducing consumption of products that must be disposed of in the trash
   (D) Suggesting the incorporation of sustainability into family-training education

7. Which of the following statements is true about the impact of family meals?
   (A) Studies show that eating together has limited impact on weight control or family dynamics.
   (B) Family dinners are an opportunity to build self-esteem in children, and the food should be freshly prepared by an adult head of household.
   (C) When adults eat alone this promotes sensible eating habits; family meals tend to lead to overeating in young children.
   (D) When a family sits down together for a meal, it can help them handle the stresses of daily life.

8. According to Maslow, the physical needs for food, water, safety, security, and belongingness are best met by which of the following?
   (A) The classroom
   (B) The village
   (C) The home
   (D) The church

9. Which of the following best reflects an understanding of the diversity of individuals and families and demonstrates cultural competence in supporting families in the field of family and consumer science?
   (A) Recognizing that families come from different cultural backgrounds and respecting their unique beliefs and values in the family engagement process
   (B) Focusing solely on individual child development without taking into consideration the cultural perspectives of families
   (C) Implementing interventions without considering the cultural beliefs and values of families
   (D) Believing that all families have the same cultural perspectives and practices, and applying a one-size-fits-all approach to family engagement

10. Which of the following is a key professional practice for building positive relationships with young children?
    (A) Setting strict rules and boundaries to maintain discipline
    (B) Providing rewards and incentives for desired behaviors
    (C) Using active listening and showing genuine interest in children's thoughts and feelings
    (D) Maintaining a formal and authoritative demeanor during each interaction

11. Which of the following best describes a type of positive parenting that promotes a child's prosocial development?
    (A) Controlling a child's negative behavior by using immediate consequences
    (B) Influencing a child's temperament by modeling emotional modulation and expression
    (C) Promoting a child's creative growth by encouraging innovative thinking in areas of interest
    (D) Encouraging a child to be a leader when interacting with peers during scheduled activities

12. Which **THREE** of the following are Student Body units within FCCLA's national educational programs?
    (A) The Healthy You
    (B) The Financial You
    (C) The Fit You
    (D) The Resilient You
    (E) The Advocate You

13. Which of the following explains why it is necessary to consider evolving family, consumer, career, and community issues when developing a new curriculum?
    (A) To ensure that teaching approaches are static and consistent
    (B) To ensure that the primary focus is on academic accomplishments
    (C) To ensure that instruction is dynamic and involves technology
    (D) To ensure that education is relevant and practical for all students

14. A well-designed living space best supports a family's overall well-being by doing which of the following?

    (A) Allowing for increased noise, separation, and equality

    (B) Guaranteeing exclusion, efficiency, and safety

    (C) Promoting comfort, safety, security, and flexibility

    (D) Encouraging individuality, adaptability, and reduced interactions

15. Which of the following best identifies the primary collaborative action that members of a vertical professional learning community (PLC) need to take to help students prepare for future career opportunities?

    (A) Meeting with teachers in other content areas to discuss strategies for integrating career topics into their instruction

    (B) Reviewing a school's mission statement to confirm that helping students seek meaningful employment is aligned with competencies in other areas

    (C) Connecting with industry professionals in the community to develop a set of key indicators of success to include in the curriculum

    (D) Planning instruction that fills the gaps in the content taught at different grade levels to ensure that students master the knowledge and skills they need for future success

16. Which of the following is an example of a service learning activity that is appropriate for high school students?

    (A) Preparing food to donate to and serve at a local senior center

    (B) Choosing a research topic for a term paper based on a favorite novel

    (C) Organizing a staff-versus-students basketball game for a pep rally

    (D) Writing an original comedic skit and performing it in a school talent show

17. Which of the following best describes changes in human development in the psychosocial domain?
    (A) Peers become more important to middle school children as they explore new roles and form their individual identities.
    (B) Fine and gross motor skills in preschool children become more refined as the children grow, which increases their coordination and improves their ability to play games.
    (C) Children in elementary school develop the ability to think logically about the abstract world around them and to apply thinking skills that help them become more independent.
    (D) Language development in infants appears to grow at a relatively fast rate, allowing them to begin thinking logically about the concrete world in which they live.

18. Which of the following is an FCS teacher doing by performing frequent spot cleaning and sanitizing of a food lab during the day?
    (A) Assessing class adherence to laboratory protocols
    (B) Preventing loss of laboratory materials and supplies
    (C) Planning and maintaining an efficient laboratory
    (D) Modeling laboratory health and sanitation practices

19. Which of the following is the best title for someone who has recently reported the company they work for to the EPA for illegally dumping waste into a local pond?
    (A) A first-line worker
    (B) A whistleblower
    (C) An unethical manager
    (D) A concerned citizen

20. In a horizontally organized company, which **TWO** of the following management techniques will best foster constructive teamwork?
    (A) Having open discussions with employees before making decisions
    (B) Providing delayed responses to employees' questions and ongoing concerns
    (C) Selecting the most senior employees to lead innovative teams
    (D) Encouraging employees to step outside their area of expertise
    (E) Updating employees with the status of the latest new projects

21. Which of the following is an appropriate entrepreneurial activity for a student who majored in family and consumer science with a concentration in interior design?
    (A) Visiting a client who responded to a social media advertisement to personally present them with a computer-generated design solution
    (B) Working for an established floors and doors company to create unique items for modern churches
    (C) Participating in a team that creates accurate vintage-style furniture for specialized boutiques
    (D) Proofing the window-dressing sketches of interns before they present the sketches to their department managers

22. Which of the following acronyms is commonly used in the food service industry and classroom setting to ensure that foods that were received first are used first?
    (A) LIFO
    (B) FAT TOM
    (C) POS
    (D) FIFO

23. Which **THREE** of the following are primary ways for ordinary citizens to promote sustainable food systems?
    (A) Protecting and restoring the biodiversity of ecosystems
    (B) Modeling the impact of food systems on the environment
    (C) Using fossil fuel-based fertilizers to grow crops
    (D) Reducing dependence on nonrenewable resources
    (E) Making use of resources that produce little or no waste

24. Which of the following are the three main types of carbohydrates found in foods?
    (A) Sugars, starches, and fiber
    (B) Starches, protein, and vitamins
    (C) Sugars, vitamins, and fats
    (D) Fiber, protein, and fats

25. Which of the following is the best example of integrating core academic standards into the family and consumer sciences curriculum?
    (A) Encouraging students to taste, discuss, and judge food laboratory creations
    (B) Providing opportunities for students to respond to food-related questions
    (C) Having students work with fractions to enlarge and reduce recipe ingredients
    (D) Having students research recipes to prepare and serve in the kitchen

26. Which of the following best explains how family structures affect the social and emotional development of children?
    (A) Family structures have no significant impact on social and emotional development.
    (B) Different family structures can influence social and emotional development in unique ways.
    (C) Social and emotional development are solely determined by genetics and individual temperament.
    (D) Family structures primarily affect only the physical and emotional development of children.

27. Which of the following is the recommended location for safely thawing frozen food?
    (A) In the refrigerator
    (B) In cold water in the kitchen sink
    (C) In the microwave
    (D) On the counter at room temperature

28. Which of the following lists best defines an employability skill as defined by the Department of Labor?
    (A) Networking
    (B) Command of language
    (C) Work ethic
    (D) Independence

29. Which of the following best describes the most responsible use of technology?
    (A) When sending personal information, use only a Web site beginning with "https," because it is a secure Web site.
    (B) When researching information online, it is acceptable to use someone else's log-in without their knowledge.
    (C) When in a theater to see a play or movie, it is a good idea to keep a cell phone on and to check it often for calls or texts.
    (D) When using the Internet, cyberbullying of a person or group can be observed, but it is best not to actively participate.

30. Which of the following best describes a way that a business leader can involve employees in optimizing customer satisfaction?
    (A) Accepting the idea that a variety of opinions need to be heard throughout the organization's decision-making process
    (B) Encouraging employees to deliver outstanding customer service as a means of advancing their career
    (C) Consulting with third-party partners for additional strategies to use to improve customer satisfaction
    (D) Listening to and understanding problems that customers identify and responding promptly with solutions

31. Cross contamination is when pathogens spread from one food or surface to another. Which of the following stages in the flow of food is most likely to allow the transfer of pathogens to occur?
    (A) Holding
    (B) Preparing
    (C) Storing
    (D) Receiving

32. Which of the following theorists introduced the concept of scaffolding as a teaching technique to facilitate the development of cognitive skills through guided participation?

    (A) Lev Vygotsky

    (B) Jean Piaget

    (C) B. F. Skinner

    (D) Albert Bandura

33. Which of the following best relates to the second level of Abraham Maslow's hierarchy of human needs?

    (A) A teenager, Jed, decorates his bedroom walls with band posters.

    (B) A young woman who lives alone installs a security system.

    (C) A family displays their travel souvenirs throughout the home.

    (D) An older couple moves into a smaller home after retirement.

Answers

1. Option (B) is correct. Restaurants and Food/Beverage Services is the pathway listed under the Hospitality and Tourism Career Cluster.

2. Option (C) is correct. By taking into consideration a child's cultural background, language proficiency, and developmental level, educators can create a supportive and inclusive learning environment.

3. Option (A) is correct. The dimensions of wellness are interconnected and, therefore, all need to be given attention. However, the attention given to each dimension does not have to be equally balanced for overall health.

4. Option (D) is correct. The purpose for which the house was originally designed or used during its period of significance must be identified at the beginning of a historic-house rehabilitation project.

5. Option (A) is correct. The full life cycle of the United States food system illuminates the connection between consumption behaviors and production practices.

6. Option (B) is correct. Families can make Earth a better place by rethinking, redesigning, regenerating, and renewing its resources without compromising the needs of future generations.

7. Option (D) is correct. Eating together gives family members a chance to listen to each other and offer advice, which can help them handle stress.

8. Option (C) is correct. Physical needs as described by Maslow should be met first in a safe home by parents or caregivers.

9. Option (A) is correct. It is important to recognize and positively support the unique beliefs and traditions of families by putting a strong emphasis on the influence of cultures and languages and the importance of understanding family perspectives in relationship building.

10. Option (C) is correct. Using active listening and showing interest through open and respectful communication is a fundamental professional practice for building positive relationships with young children. This practice promotes healthy communication, collaboration, and mutual respect.

11. Option (B) is correct. A child's temperament is a part of the child's prosocial development. When a parent creates a positive relationship with a child and the child has a role model that displays appropriate expressions, feelings, and emotions, the child's ability to self-regulate is enhanced.

12. Options (A), (C), and (D) are correct. They are three of the four units within the Student Body program that help members make informed, responsible choices for their physical and mental health and that provide members with opportunities to teach others. The Healthy You empowers teens to make wise food and lifestyle choices. The Fit You empowers teens to take charge of their health and level of fitness. The Resilient You empowers teens to live in ways that build emotional health.

13. Option (D) is correct. By incorporating evolving concepts into curriculum and instructional development, educators are helping to prepare students for experiences they will encounter outside the classroom.

14. Option (C) is correct. A well-designed home should provide family members with an environment that promotes comfort, safety, security, and flexibility. This allows the family members to grow and develop and does not impede their well-being.

15. Option (D) is correct. A vertical PLC involves collaboration among teachers who teach the same content area across grade levels. One of the teachers' primary roles is to review content-related standards at each grade level and fill in the learning gaps that may be occurring.

16. Option (A) is correct. Preparing food and helping to serve it at a local community senior center is a great way for high school students to serve the community. In addition, any students who are in a culinary arts program will be able to meet the program's curriculum standards.

17. Option (A) is correct. Psychosocial development involves emotions, personality, self-esteem, and relationships. Peers become more important for adolescents, who are exploring new roles and forming their own identities.

18. Option (D) is correct. Microbial contamination happens when food has been contaminated by microorganisms, including bacteria, viruses, mold, fungi, and toxins. To control contamination in a food lab, surfaces should be sanitized regularly according to industry-relevant standards.

19. Option (B) is correct. A whistleblower is a person who reports the illegal activities of one's employer to different media outlets and law enforcement.

20. Options (A) and (D) are correct. Having open and forthright discussions and encouraging employees to learn about other aspects of a project for which they are responsible allows for all employees to feel a part of the decision-making process.

21. Option (A) is correct. Using a software program to generate design concepts suitable for a client's needs and visiting the client in person are the best actions a young entrepreneur can take to be a successful business owner.

22. Option (D) is correct. FIFO, which stands for "first in, first out," is an inventory method used when the first products purchased should be the first products used.

23. Options (A), (D), and (E) are correct. Protecting ecosystems is essential to restoring biodiversity and will have a positive impact for sustainable food systems. Once nonrenewable energy resources are used up, they cannot be replaced; therefore they should be avoided or used as little as possible. Food security is affected by food loss and waste. Using resources that produce large amounts of waste has a negative impact on food systems.

24. Option (A) is correct. Carbohydrates are one of the main nutrients in our diet. They help provide energy for our body. There are three main types of carbohydrates found in foods: sugars, starches, and fiber.

25. Option (C) is correct. Integration of core academic standards into the family and consumer sciences curriculum involves directly connecting academic concepts with practical applications that occur within an FCS classroom. Having students use fractions to follow, modify, and adapt recipes directly integrates math into the FCS curriculum.

26. Option (B) is correct. Family structures have an impact on the social and emotional development of children. Acknowledging the diverse ways in which family structures can shape a child's experiences and development will help parents and other caregivers better support the child.

27. Option (A) is correct. Placing frozen food in the refrigerator to thaw is the most ideal method. Thawed perishable food should be refrigerated within two hours or within one hour if exposed to temperatures above 90°F.

28. Option (C) is correct. The Department of Labor indicates that employability skills, such as professionalism or work ethic, oral and written communication, teamwork and collaboration skills, and critical thinking or problem-solving are transferrable and important to work readiness for all industries.

29. Option (A) is correct. The abbreviation "https" stands for hypertext transfer protocol secure. The "s" stands for secure and lets the user know that the site is using a secure sockets layer (SSL) certificate, which encrypts all communication and data as it passes from a browser to the Web site's server.

30. Option (D) is correct. The primary way for an organization to improve and maintain customer satisfaction is for a leader to involve the employees in listening to customers and to help employees develop strategies for meeting customers' needs.

31. Option (B) is correct. Cross contamination is most frequently caused by unwashed cutting boards, hands, or kitchen tools like knives and tongs. While cooking to safe temperatures will kill dangerous bacteria, most food contamination happens when the bacteria from a raw food item interact with food that doesn't need to be cooked. Because, without proper sanitation procedures, pathogens can move from hands or surfaces to raw food and may not be eliminated by cooking.

32. Option (A) is correct. Lev Vygotsky introduced the concept of scaffolding as a teaching technique within his sociocultural theory. It emphasizes the role of guided participation and structured support in facilitating the development of cognitive skills in learners.

33. Option (B) is correct. Safety needs represent the second tier in Maslow's hierarchy, and these needs include the security of body, employment, family, and health.

Understanding Question Types

The *Praxis*® assessments include a variety of question types: constructed response (for which you write a response of your own); selected response, for which you select one or more answers from a list of choices or make another kind of selection (e.g., by selecting a sentence in a text or by selecting part of a graphic); and numeric entry, for which you enter a numeric value in an answer field. You may be familiar with these question formats from seeing them on other standardized tests you have taken. If not, familiarize yourself with them so that you won't have to spend time during the test figuring out how to answer them.

Understanding Selected-Response and Numeric-Entry Questions

For most questions you will respond by selecting an oval to choose a single answer from a list of answer choices.

However, interactive question types may also ask you to respond by doing the following.

- Selecting more than one choice from a list of choices.
- Typing in a numeric-entry box. When the answer is a number, you may be asked to enter a numerical answer. Some questions may have more than one entry box to enter a response. Numeric-entry questions typically appear on mathematics-related tests.
- Selecting parts of a graphic. In some questions, you will select your answers by selecting a location (or locations) on a graphic such as a map or chart, as opposed to choosing your answer from a list.
- Selecting sentences. In questions with reading passages, you may be asked to choose your answers by selecting a sentence (or sentences) within the reading passage.
- Dragging and dropping answer choices into targets on the screen. You may be asked to select answers from a list of choices and to drag your answers to the appropriate location in a table, paragraph of text, or graphic.
- Selecting answer choices from a drop-down menu. You may be asked to choose answers by selecting choices from a drop-down menu (e.g., to complete a sentence).

Remember that with every question, you will get clear instructions.

Understanding Constructed-Response Questions

Some tests include constructed-response questions, which require you to demonstrate your knowledge in a subject area by writing your own response to topics. Essay questions and short-answer questions are types of questions that call for a constructed response.

For example, an essay question might present you with a topic and ask you to discuss the extent to which you agree or disagree with the opinion stated. For such questions, you must support your position with specific reasons and examples from your own experience, observations, or reading.

Following are a few sample essay topics to review:

- *Brown* v. *Board of Education of Topeka*

  "We come then to the question presented: Does segregation of children in public schools solely on the basis of race, even though the physical facilities and other 'tangible' factors may be equal, deprive the children of the minority group of equal educational opportunities? We believe that it does."

  A. What legal doctrine or principle, established in *Plessy* v. *Ferguson* (1896), did the Supreme Court reverse when it issued the 1954 ruling quoted above?
  B. What was the rationale given by the justices for their 1954 ruling?

- *In his self-analysis, Mr. Payton says that the better-performing students say small-group work is boring and that they learn more working alone or only with students like themselves. Assume that Mr. Payton wants to continue using cooperative learning groups because he believes they have value for all students.*

  - Describe **TWO** strategies he could use to address the concerns of the students who have complained.
  - Explain how each strategy suggested could provide an opportunity to improve the functioning of cooperative learning groups. Base your response on principles of effective instructional strategies.

- *"Minimum-wage jobs are a ticket to nowhere. They are boring and repetitive and teach employees little or nothing of value. Minimum-wage employers take advantage of people who need a job."*

  - Discuss the extent to which you agree or disagree with this opinion. Support your views with specific reasons and examples from your own experience, observations, or reading.

Keep the following things in mind when you respond to a constructed-response question.

1. **Answer the question accurately.** Analyze what each part of the question is asking you to do. If the question asks you to describe or discuss, you should provide more than just a list.
2. **Answer the question completely.** If a question asks you to do three distinct things in your response, you should cover all three things for the best score. Otherwise, no matter how well you write, you will not be awarded full credit.
3. **Answer the question that is asked.** Do not change the question or challenge the basis of the question. You will receive no credit or a low score if you answer another question or if you state, for example, that there is no possible answer.
4. **Give a thorough and detailed response.** You must demonstrate that you have a thorough understanding of the subject matter. However, your response should be straightforward and should not be filled with unnecessary information.
5. **Take notes on scratch paper so that you don't miss any details.** Then you'll be sure to have all the information you need to answer the question.
6. **Reread your response.** Check that you have written what you intended to write. Do not leave sentences unfinished or omit clarifying information.

General Assistance For The Test

Praxis® Interactive Practice Test

This full-length *Praxis*® practice test lets you practice answering one set of authentic test questions in an environment that simulates the computer-delivered test.

- Timed just like the real test
- Correct answers with detailed explanations
- Practice test results for each content category

ETS provides a free interactive practice test with each test registration. You can learn more here.

Doing Your Best

Strategy and Success Tips

Effective *Praxis* test preparation doesn't just happen. You'll want to set clear goals and deadlines for yourself along the way. Learn from the experts. Get practical tips to help you navigate your Praxis test and make the best use of your time. Learn more at Strategy and Tips for Taking a *Praxis* Test.

Develop Your Study Plan

Planning your study time is important to help ensure that you review all content areas covered on the test. View a sample plan and learn how to create your own. Learn more at Develop a Study Plan.

Helpful Links

Ready to Register – How to register and the information you need to know to do so.

Disability Accommodations – Testing accommodations are available for test takers who meet ETS requirements.

PLNE Accommodations (ESL) – If English is not your primary language, you may be eligible for extended testing time.

What To Expect on Test Day – Knowing what to expect on test day can make you feel more at ease.

Getting Your Scores – Find out where and when you will receive your test scores.

State Requirements – Learn which tests your state requires you to take.

Other Praxis Tests – Learn about other *Praxis* tests and how to prepare for them.

To search for the *Praxis* test prep resources that meet your specific needs, visit:

www.praxis.ets.org/storehome

To purchase official test prep made by the creators of the *Praxis* tests, visit the ETS Store:

www.praxis.ets.org/storehome



www.ets.org

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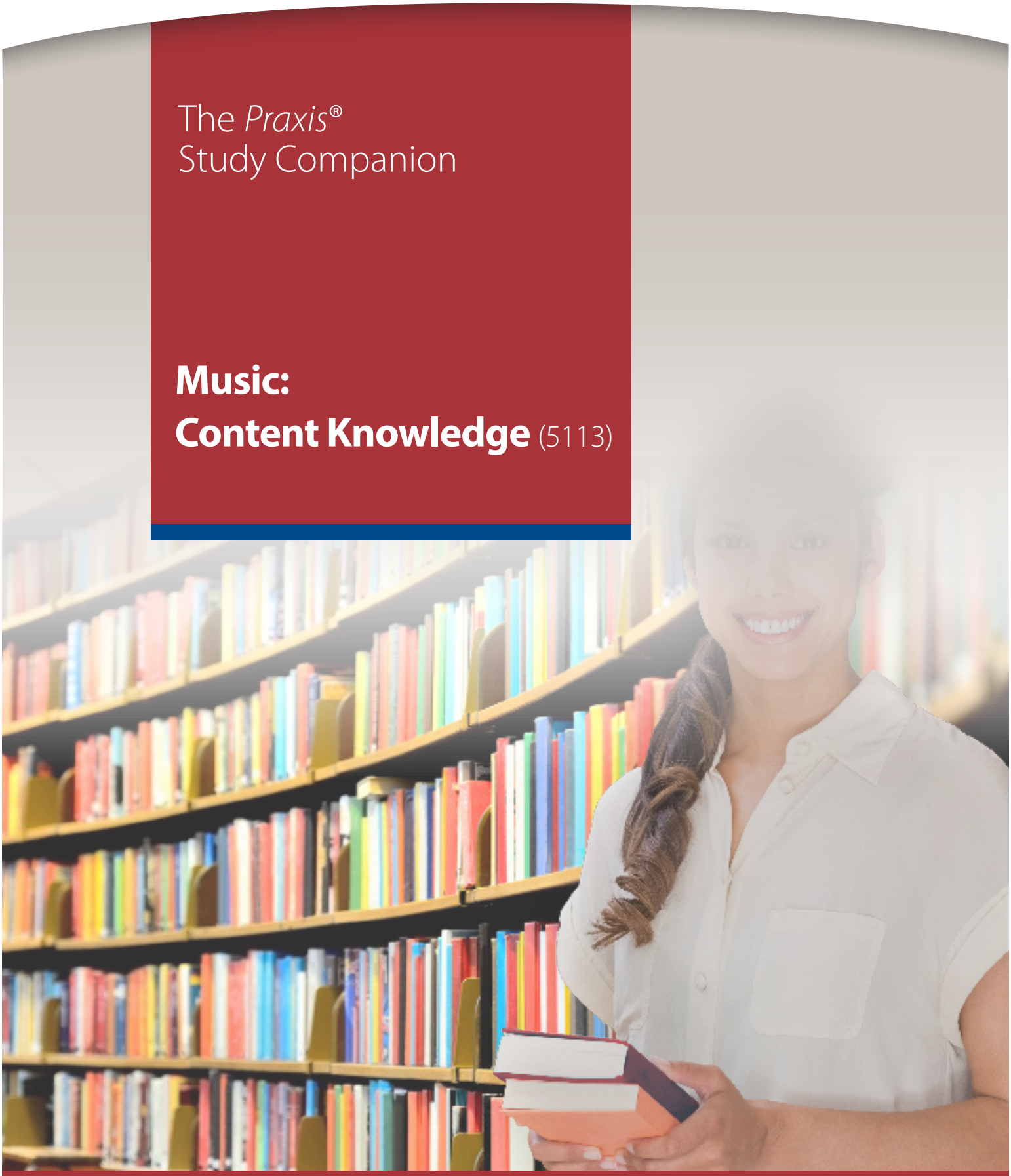
ETS PRAXIS

The *Praxis*®
Study Companion

Music:
Content Knowledge (5113)



www.ets.org/praxis

Welcome to the *Praxis*® Study Companion

Prepare to Show What You Know

You have been working to acquire the knowledge and skills you need for your teaching career. Now you are ready to demonstrate your abilities by taking a *Praxis*® test.

Using the *Praxis*® *Study Companion* is a smart way to prepare for the test so you can do your best on test day. This guide can help keep you on track and make the most efficient use of your study time.

The Study Companion contains practical information and helpful tools, including:

- An overview of the *Praxis* tests
- Specific information on the *Praxis* test you are taking
- A template study plan
- Study topics
- Practice questions and explanations of correct answers
- Test-taking tips and strategies
- Frequently asked questions
- Links to more detailed information

So where should you start? Begin by reviewing this guide in its entirety and note those sections that you need to revisit. Then you can create your own personalized study plan and schedule based on your individual needs and how much time you have before test day.

Keep in mind that study habits are individual. There are many different ways to successfully prepare for your test. Some people study better on their own, while others prefer a group dynamic. You may have more energy early in the day, but another test taker may concentrate better in the evening. So use this guide to develop the approach that works best for you.

Your teaching career begins with preparation. Good luck!

Know What to Expect

Which tests should I take?

Each state or agency that uses the *Praxis* tests sets its own requirements for which test or tests you must take for the teaching area you wish to pursue.

Before you register for a test, confirm your state or agency's testing requirements at www.ets.org/praxis/states.

How are the *Praxis* tests given?

Praxis tests are given on computer. Other formats are available for test takers approved for accommodations (see page 41).

What should I expect when taking the test on computer?

When taking the test on computer, you can expect to be asked to provide proper identification at the test center. Once admitted, you will be given the opportunity to learn how the computer interface works (how to answer questions, how to skip questions, how to go back to questions you skipped, etc.) before the testing time begins. Watch the What to Expect on Test Day video to see what the experience is like.

Where and when are the *Praxis* tests offered?

You can select the test center that is most convenient for you. The *Praxis* tests are administered through an international network of test centers, which includes Prometric® Testing Centers, some universities, and other locations throughout the world.

Testing schedules may differ, so see the *Praxis* web site for more detailed test registration information at www.ets.org/praxis/register.

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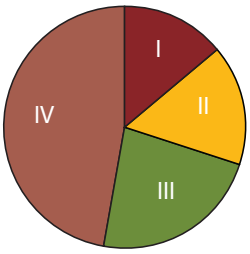
1. Learn About Your Test

Learn about the specific test you will be taking

Music: Content Knowledge (5113)

Test at a Glance	
Test Name	Music: Content Knowledge
Test Code	5113
Time	2 hours, divided into a listening section (Section 1) and a non-listening section (Section 2)
Number of Questions	120
Pacing and Special	In Section 1 of the test, you are asked questions about recorded musical excerpts. During the audio portions, you are given time to read the questions and possible answers shown on the screen. A clock at the top of the screen shows you how much time is remaining to answer all of the questions in Section 1. You then have 85 minutes to complete the 90 questions in Section 2.
Format	Selected-response questions; 30 of the 120 questions are based on recorded musical excerpts. This test will include questions with an audio component.
Test Delivery	Computer delivered



Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
I. Music History and Literature		
Category total:	18	15%
Section 1 (listening*):	9	
Section 2:	9	
II. Theory and Composition		
Category total:	19	16%
Section 1 (listening*):	9	
Section 2:	10	
III. Performance		
Category total:	27	22%
Section 1 (listening*):	12	
Section 2:	15	
IV. Pedagogy, Professional Issues, and Technology		
Category total:	56	47%
Section 1 (listening*):	N/A	
Section 2:	56	

*The questions in both Section 1 and Section 2 are counted in the main content categories I–IV. The special listening category counts only the questions (1–30) in Section 1. The special listening category is intended to provide test takers with a potentially helpful breakdown of information regarding the questions based on listening skills.

About This Test

The Music: Content Knowledge test is designed to assess a beginning music teacher's knowledge and understanding of music and music education. Examinees taking this test will typically have completed, or will have nearly completed, an undergraduate music education program. The test content assesses key indicators of the beginning educator's musical knowledge and professional readiness for K–12 music instruction required for individuals teaching courses to students in instrumental, vocal, or general music settings, or who will teach courses drawn from any combination of these three areas. Such knowledge is acquired through completion of an undergraduate music education degree program. The material in the test, therefore, is not appropriate for those hired in an adjunct capacity to teach a single element of the curriculum (e.g., those hired to teach only individual lessons or classes on a single instrument).

Materials appearing on the test reflect the diversity of examinees' music instruction specialties as well as the cultural and demographic inclusiveness of modern music instruction. These materials also reflect instrumental (woodwinds, brass, percussion, and strings), vocal, jazz, and general music instruction specialties across the K–12 grade range. Questions selected for the test represent an equitable distribution of topics, including topics unique to each specialty as well as those that are common across all specialties.

This test may contain some questions that will not count toward your score.

Content Topics

This list details the topics that may be included on the test. All test questions cover one or more of these topics.

The nature and distribution of topics included on the test were based on the results of a national survey given to music educators. Some of the resources consulted in developing the survey include:

- *National Association of School Music 2020–21 Handbook,* http://nasm.arts-accredit.org/
- College Music Society, http://www.music.org
- Society for Music Teacher Education, http://smte.us/
- Interstate New Teacher Assessment and Support Consortium
- *National Core Arts Standards for Music,* https://www.nationalartsstandards.org/

A nationally representative panel of music educators was convened to study the survey results and assist ETS's professional assessment staff in determining the distribution of topics on the test. Each ETS assessment specialist working on this test has extensive experience in music education. Additionally, ETS assessment specialists consult regularly with music teachers and music education professors from throughout the country to ensure the appropriateness of individual test questions and the validity of each new test edition.

The following is an outline of the topics covered on the test. Question content is based specifically on practitioners' judgments of what a new music teacher should know in order to begin a career as a music education professional. The bulleted phrases are included as examples of representative question content one may see on the test. Additional topics may also be included as appropriate.

Discussion Questions

In this section, discussion questions are open-ended questions or statements intended to help test your knowledge of fundamental concepts and your ability to apply those concepts to classroom or real-world situations. We do **not** provide answers for the discussion questions but thinking about the answers will help improve your understanding of fundamental concepts and may help you answer a broad range of questions on the test. Most of the questions require you to combine several pieces of knowledge to formulate an integrated understanding and response. They are written to help you gain increased understanding and facility with the test's subject matter. You may want to discuss these questions with a teacher or mentor.

Section 1: Listening Section

I. Music History and Literature

A. Understands the history of major developments in musical style and the significant characteristics of important musical styles and historical periods

1. Styles and historical periods represented in questions
   a. Medieval
   b. Renaissance
   c. Baroque
   d. Classical
   e. Romantic
   f. Impressionism
   g. Early 20th Century
   h. Mid 20th Century to present
   i. Jazz, rock, folk, and other popular genres
2. Characteristics of music related to style and period
   a. melody
   b. harmony
   c. rhythm and meter
   d. tempi, dynamics, and other expressive elements
   e. texture
   f. theory and compositional organization
   g. forms and genres
   h. historical contexts
   i. representative composers
   j. representative ensembles and performers

B. Is familiar with the style of a variety of world musics and their function in the culture of origin

1. North America
2. South America
3. Europe
4. Africa
5. Australia and the Pacific
6. Asia

Discussion Questions: Music History and Literature

- Given a recorded musical excerpt, can you identify the time period when it was composed?
- Given a recorded musical excerpt, can you identify the major characteristics of the style?
- Given a recorded musical excerpt from a work of an important composer, can you identify the composer?
- Given a recorded musical excerpt, can you identify the genre?
- Describe the differences between the madrigal and the motet.
- Describe the differences between the fugue and the toccata.
- Considering significant composers in history, what were the musical, cultural, and historical factors that influenced their compositional devices?
- Who composed *Prelude to the Afternoon of a Faun*?
- What were some important compositions of Richard Strauss?
- Compile a timeline of the historical periods, general styles, major composers, typical genres, and specific works.
- Given a historical period, can you name a representative work?
- Given an excerpt of popular music, can you describe its relationship to and influences from older styles?
- Given an excerpt of world music, can you identify its country or region of origin?
- What does a didgeridoo sound like?
- What do Latin American and Caribbean instruments, such as the guitarrón, look and sound like?
- In African music, what is the function of a griot?
- What are some stylistic and instrumentation differences between traditional Chinese opera and Japanese Noh music?
- What are some metric characteristics and phrase structures heard in the music of Mexico? Peru?
- What kind of traditional vocal styles might you hear in music from Ivory Coast? Tunisia? Tibet?

- What are the traditional social uses of the Seneca rabbit song?
- Identify one stylistic similarity and one difference between traditional Cajun music and bluegrass.
- In Ireland, in what setting would you likely hear a reel performed? In Germany, in what setting might you hear a polka?

II. Theory and Composition

A. Understands and analyzes music in aural form and demonstrates aural skills through recognition of melody, harmony, and rhythm

1. Pitch organization and harmony
   a. chords, progressions, ornamentation
   b. modes, scales, tone rows, etc.
2. Theme and melody
   a. contour and motive
3. Rhythm, meter, and tempo
4. Form and structure
5. Texture

B. Understands how musical sounds vary

1. Timbre of instruments and voices
2. Dynamics

Discussion Questions: Theory and Composition

- Given an excerpt of a melody being played, can you identify the intervals in the melody?
- Can you identify an augmented 6th chord in a recording of a chord progression? An inversion of a dominant 7th chord?
- Can you identify cadences in parallel or relative major or minor, subdominant, and dominant keys?
- What does a string section playing *con sordino* sound like? *Col legno*? *Pizzicato*?
- Can you identify the voice types such as soprano, alto, tenor, bass, mezzo-soprano, etc.?
- Can you identify scales and tonalities in recorded music?
- Given a recorded musical excerpt, can you identify from several printed excerpts the one that represents the main melodic phrase?
- Can you identify the phrase structure of given a recorded musical excerpt?
- Can you identify the intervals in an example of printed piano music? In a choral work? In a transposed instrumental score that includes C clefs?
- In regard to fugues, what is the difference between a real answer and a tonal answer?
- If you had to arrange a duet for flute and trombone, how might you use the ranges of the instruments to avoid potential balance problems?
- Can you identify triads and seventh chords and how they and their inversions function in tonal music?
- Can you identify scales and modes aurally and in printed form?
- Given a printed musical excerpt, can you identify the main melodic idea?
- Given a printed musical excerpt, can you identify important themes or motifs?
- How would you recognize examples of augmentation, diminution, retrograde, and inversion?
- Can you identify the performing forces used in Mahler's Eighth Symphony?
- Can you read various forms of music notation used throughout music history, including nontraditional modern music notation?
- Can you identify the sections of a traditional march?

III. Performance

A. Demonstrates critical listening skills by identifying errors in

1. Pitch
2. Intonation of instruments and voices
   a. tuning students on individual instruments
   b. tuning between two or more performers
   c. vowel uniformity
3. Rhythm
4. Performing as a unified section/ensemble
5. Balance and blend

6. Articulations
7. Dynamics

B. Understands basic conducting techniques

1. Beat patterns
2. Use of the baton and freehand technique
3. Eye contact and facial expressions
4. Tempo and tempo changes
5. Attacks, holds, and releases
6. Dynamics and expressive gestures
7. Cueing

C. Understands the interpretation of notation and expressive elements for performance in relation to score markings and style periods

1. Interpreting musical symbols used for pitch
2. Interpreting musical symbols used for rhythm
3. Dynamic markings
4. Articulation markings
5. Tempo markings
6. Composers' written comments
7. Timbre

D. Understands basic accompaniment techniques (e.g., on piano, guitar, voice)

1. Identifying appropriate harmonies to accompany tonal melodies
2. Basic accompanying patterns (e.g., arpeggiation, block chords, ostinato)

Discussion Questions: Performance

- Given a printed musical score and a recording of a performance based on it (which you listen to three times), can you identify the measure where an error in pitch occurs?
- If you are told the error occurs in a specific measure, would you notice that the music is being played *forte* when it is notated to be played *piano*?
- What factors would influence the choice of a conducting pattern for a given passage in 7/8 time?
- In a passage using syncopation, what would be the appropriate conducting technique?
- Given a diagram of a choral standing arrangement, could you discuss the acoustical implications?
- What are the most important acoustic principles in seating arrangements for instrumental ensembles?

Section 2: Non-Listening Section

I. Music History and Literature

A. Understands the history of major developments in musical style and the significant characteristics of important musical styles and historical periods

1. Styles and historical periods
   a. Medieval
   b. Renaissance
   c. Baroque
   d. Classical
   e. Romantic
   f. Impressionism
   g. Early 20th Century
   h. Mid 20th Century to present
   i. Jazz, rock, folk, and other popular genres
2. Characteristics of music
   a. melody
   b. harmony
   c. rhythm and meter
   d. tempi, dynamics, and other expressive elements
   e. texture
   f. theory and compositional organization
   g. forms and genres
   h. historical contexts
   i. representative composers
   j. representative ensembles and performers

B. Is familiar with world musics and their function in the culture of origin

1. North America
2. South America
3. Europe
4. Africa
5. Australia and the Pacific
6. Asia

C. Knows various sources of printed and electronic information on music history and literature

1. Books
2. Journals and periodicals
3. Web resources

II. Theory and Composition

A. Understands, interprets, and analyzes music in written form

1. Pitch organization and harmony
   a. chords, progressions, ornamentation
   b. modes, scales, tone rows, etc.
2. Theme and melody
   a. contour and motive
3. Rhythm, meter, and tempo
4. Form and structure
5. Texture
   a. monophonic
   b. homophonic
   c. polyphonic
   d. heterophonic
6. How musical sounds vary
   a. timbre of instruments and voices
   b. dynamics

B. Knows and applies basic music theory concepts when composing, orchestrating, and arranging instrumental and vocal parts

1. Chords and voice leading
2. Ranges and transpositions
   a. intervals
   b. keys
   c. clefs
   d. instruments
   e. voices
3. Balance
4. Instrumentation and voicing of ensembles
5. Functions of instruments and voices within a score
6. Expressive elements

III. Performance

A. Understands basic conducting techniques

1. Beat patterns
2. Use of the baton and freehand technique
3. Eye contact and facial expressions
4. Tempo and tempo changes
5. Attacks, holds, and releases
6. Dynamics and expressive gestures
7. Cueing

B. Understands the interpretation of notation and expressive elements for performance in relation to score markings and style periods

1. Interpreting musical symbols used for pitch
2. Interpreting musical symbols used for rhythm
3. Dynamic markings
4. Articulation markings
5. Tempo markings
6. Composers' written comments
7. Timbre

C. Knows a variety of strategies on how to prepare a musical score for rehearsal and performance

1. Score study
2. Score research
3. Interpretive decisions
4. Score marking

D. Knows instrumental and choral/vocal warm-up techniques

1. Breathing
2. Physical warm-ups (e.g., stretching, posture)
3. Technical warm-ups (e.g., scales, arpeggios, chorales, vocalises)

E. Knows instrumental and choral tuning/ intonation techniques

1. Instrumental techniques
   a. tuning students on individual instruments
   b. tuning between two or more performers
2. Choral/vocal techniques
   a. lifting the palate
   b. vowel uniformity
   c. breath support and body posture

F. Understands basic accompaniment techniques (e.g., on piano, guitar, voice)

1. Identifying appropriate harmonies to accompany tonal melodies
2. Basic accompanying patterns (e.g., arpeggiation, block chords, ostinato)

G. Understands concert etiquette for performers and audiences and effective techniques for communicating with an audience in a performance setting

1. Developing program notes and educational materials for specific purposes and audiences
2. Appropriate remarks in performance situations

3. Techniques of developing appropriate publicity for the music program and for events taking place in the music program
4. Appropriate etiquette for various types of performance venues

H. Understands the practical relationship between acoustics and performance

1. Sound production
2. Tone quality
3. Rehearsal and performance space configurations and setups
4. Reverberation, sound reflection, refraction
5. Frequency
6. Amplitude, sound amplification
7. Harmonics, partials, overtones

IV. Pedagogy, Professional Issues, and Technology

Pedagogy

A. Knows instructional strategies for different class settings

1. Performance classes
   a. full-ensemble rehearsals
   b. sectional and small-group rehearsals
   c. individual lessons
   d. rehearsal planning
   e. rehearsal strategies
2. Elementary and secondary general music
   a. full class
   b. small group
   c. labs and independent projects

B. Incorporates local, state, and national standards in planning and instruction

1. Recognizes importance of linking pedagogy to appropriate standards
2. Ability to evaluate degree to which instruction links to standards

C. Understands classroom management techniques

1. Physical classroom environment
2. Rules and consequences
3. Appropriate actions to take for given situations
4. Legal implications
5. Planning and pacing
6. Procedures and routines
7. Principles of motivation applied to the music classroom
   a. intrinsic
   b. extrinsic

D. Understands how to plan and differentiate instruction

1. How the distinguishing characteristics of stages of student growth and development affect music learning
   a. physical
   b. cognitive
   c. social
2. Scope and sequence
3. Lesson and unit planning
4. Student ability

E. Knows teaching strategies to incorporate diverse learning modalities

1. Aural
2. Visual
3. Kinesthetic

F. Understands how to modify instruction to accommodate student needs

1. Students with disabilities
   a. physical
   b. cognitive
   c. behavioral
   d. emotional
2. Other student needs
   a. culture and beliefs
   b. gifted students
   c. English-language learners

G. Understands a variety of assessment strategies that inform the instructional process

1. Use of standardized tests for measuring aptitude and achievement
2. Portfolio assessment
3. Multiple-choice testing
4. Assessment using scoring rubrics
5. Assessing individual and group performance skills
6. Appropriate classroom assignment grading criteria
7. Appropriate course grading practices
8. Formative assessment—uses in guiding and evaluating students' progress
9. Assessments' role in program evaluation

10. Taxonomies of instructional/assessment objectives
11. Techniques to evaluate the effectiveness of music curricula
    a. program evaluation (e.g., goals and objectives, scope and sequence)

H. Understands how to select appropriate repertoire for the classroom and for performance ensembles with respect to a variety of factors

Selecting music with respect to

1. Diverse genres
2. Appropriate performance competencies for students' developmental levels
    a. primary
    b. elementary
    c. middle school
    d. high school
    e. vocal ranges
    f. instrumental ranges and transpositions
3. Cultural diversity
4. Community traditions and standards
5. State and local guidelines
6. Quality of literature
7. Knows appropriate sources of student repertoire
    a. Lists of recommended repertoire
    b. Conferences
    c. Colleagues and mentors
    d. Publisher resources

I. Knows how to teach vocal production and performance techniques with respect to a variety of factors

1. Vocal mechanism
2. Health and wellness issues for vocalists
3. Changing voice
4. Tessitura

J. Knows instrumental techniques (e.g., rudiments, bowings, embouchures) and how to teach them

1. Woodwind
2. String (includes guitar)
3. Brass
4. Percussion
5. Keyboard
6. General classroom instruments
7. Health and wellness issues for instrumentalists

K. Is able to address common vocal and instrumental performance challenges and their causes

1. Reading pitches and rhythms
2. Balance and blend
3. Intonation
4. Technical challenges
5. Style and interpretation
6. Physical causes
7. Comprehension causes

L. Understands organization and preparation of concert programming

1. Diversity of repertoire (includes consideration of vocal texts)
2. Consideration of difficulty levels with regard to available preparation and rehearsal time
3. Concert pacing and endurance issues
4. Programming considerations relative to special occasions and specific performance venues
5. Pedagogical philosophies related to programming
6. Awareness of consideration of building level and district expectations with regard to concert programming
7. Concert logistics planning (scheduling, facilities, publicity, communication with students/parents/administrators, printing programs)

M. Knows and promotes care and maintenance of instruments and materials

Care of instruments

1. Woodwinds
2. Strings (including guitar)
3. Brass
4. Percussion and keyboards
5. Classroom instruments (Orff and rhythm instruments, recorders)
6. Electronic instruments

Care of materials

7. Printed material (books, music, scores)
8. Recorded material (CDs, electronic files such as MP3s)
9. Risers and stands
10. Audiovisual and computer equipment

N. Is familiar with common pedagogical approaches

1. Suzuki
2. Dalcroze
3. Kodály
4. Orff Schulwerk
5. Edwin Gordon's Music Learning Theory
6. Comprehensive Musicianship
7. Laban
8. Phyllis Weikart

O. Understands strategies for developing sight-reading skills

1. Solfège and other systems
2. Audiation of pitch, interval, and rhythm
3. Mental practice and scanning methods

P. Knows basic improvisational techniques and how to teach them

1. Imitation
2. Variation
3. Improvisational techniques within various styles

Q. Knows basic composition and arranging techniques and how to teach them

1. Activities leading to composition (e.g., improvisation, completion exercises)
2. Pitch and rhythmic organization techniques
3. Form
4. Style
5. Thematic construction
6. Harmonization, accompaniment, and imitation
7. Vocal and instrumental ranges

R. Knows how to teach a variety of musical concepts through performance literature

1. Elements of music (e.g., melody, harmony, rhythm, form, timbre, texture) and expressive elements
2. Music theory
3. Music history
4. Music in relation to other subjects
5. Musical creativity and the aesthetics of music

S. Is aware of approaches for fostering musically expressive experiences

Fostering musical expression in

1. Performance
2. Improvisation
3. Composition

Techniques to teach aesthetics

4. Guided listening
5. Analysis, reflection, evaluation
6. Modeling

T. Understands how to integrate concepts used in the fine arts and other disciplines in music instruction

1. Music integrated with other subjects in the fine arts
2. Music integrated with subjects outside of the fine arts

Professional Issues

U. Understands professional ethics and legal issues specific to teaching music

1. Copyright laws
2. Confidentiality
3. Appropriate professional conduct

V. Is familiar with the music standards in the National Core Arts Standards

W. Is aware of professional organizations and resources in music education

1. Local, state, and national teacher and music teacher organizations
2. Mentors and colleagues
3. Books, journals, and periodicals
4. Reference works and Web resources

X. Is aware of current trends and issues in music education

Y. Is aware of the major contributions to the history and philosophy of music education and their implications for curriculum

Z. Understands philosophical reasons for inclusion of and advocacy for music in the curriculum

1. Utilitarian (e.g., comprehensive education)
2. Aesthetic (e.g., affective education)

AA. Recognizes that collaboration with colleagues is important for implementing the curriculum

1. Mentoring
2. Collegiality
3. Inclusion (e.g., Individualized Education Programs [IEP], students with special needs)

AB. Supports students' learning through two-way communication with parents/guardians

Formal and informal:

1. Parent-teacher conferences
2. Telephone
3. Written communications, including e-mail and departmental web sites

AC. Understands basic administrative responsibilities in a music program

1. Budget maintenance
2. Inventory
3. Scheduling

AD. Is aware of the external influences that affect the music program, curriculum, and student participation

1. Scheduling
2. Mandates
3. Budget constraints
4. Advocacy groups
5. Student and community economics and demographics

AE. Is aware of career opportunities available in music and how to introduce them to students

1. Performance
2. Business
3. Education
4. Technology
5. Medical

AF. Is aware of strategies for promoting physically healthy performance practices for students and teachers

1. Hearing protection
2. Health issues specific to teachers (e.g., using the voice in the classroom, work-related stress)

Technology

AG. Understands current technologies used for performance and recording production

1. Sound reinforcement
2. Analog, digital, and MIDI equipment
3. Virtual instruments

AH. Is familiar with technology and instructional software and ways to incorporate them in the classroom

1. Hardware
   a. cables and audio interfaces
   b. microphones
   c. music storage devices
   d. speakers and monitors
   e. tablets
2. Software
   a. cloud-based storage
   b. music assessment software
   c. music digital audio workstation software
   d. music notation software
   e. music pedagogy software
   f. music streaming applications
   g. presentation software
3. Multimedia

AI. Demonstrates knowledge of desktop music publishing software for pedagogical purposes

1. Input
2. Output
3. Playback
4. Posting

AJ. Knows the appropriate, ethical, and safe uses for music software and Internet technologies

1. Educational
2. Interactive
3. Internet posts
4. Filtering software
5. Copyright
6. Health and wellness issues related to use of technology

Discussion Questions: Pedagogy

- According to *The School Music Program: A New Vision*, what are some appropriate musical achievements for students in grades K–4?
- Choose one of the National Core Arts Standards for music and describe an appropriate student activity that would help achieve the outcome described in that standard.

- Describe the course objectives that you might develop for a nine-week general music course that meets three times a week that is required for all eighth grade students in a district. Then write a lesson plan for one classroom period that would help to fulfill one of the course objectives.
- Describe two effective techniques you have seen teachers use to control students' talking in class.
- What strategies would you use to help a student with dyslexia read sheet music?
- By approximately what grade level should students be able to play by ear simple melodies on a melodic instrument? Compare common pedagogical approaches.
- Describe appropriate course objectives for singing in general music classrooms at grades K–4, 5–8, and 9–12.
- Describe how a teacher might include opportunities for student learning in psychomotor, cognitive, and affective modalities.
- Describe three effective teaching techniques for correcting specific problems with woodwind embouchures, brass embouchures, stick grips, or bowing.
- What kinds of difficulties with harmony would you expect in *a capella* singing by an average high school chorus?
- Given a score for a Sousa march, can you identify the aspects that are likely to be most challenging for a less advanced high school band?
- Name four pieces that you would suggest including in a spring concert for beginning, intermediate, and advanced ensembles in your specialty. Name three musical concepts you could teach from each work.
- Name some arrangers who specialize in works that are appropriate for an elementary school ensemble (in your specialty).
- When is it more appropriate to use a whole song rather than a phrase-by-phrase approach by rote?
- Name some of the advantages and disadvantages of the fixed-do and the moveable-do methods of sight-singing.
- What are some musical experiences associated with the Suzuki method?
- What are some techniques and methods using dance and movement for instruction in music?
- What is an effective strategy for introducing the concept of solfège to a class?
- How are chord progressions and rhythmic ostinati used in improvisation?
- Give some example of ornamentations commonly used in jazz vocal improvisations.
- Describe various learning sequences for teaching improvisation.
- When teaching rhythm concepts, in what sequence should you introduce concepts such as subdivision in triple meter?
- Describe various learning sequences for teaching the concept of harmony.
- What kinds of difficulties with rhythm would you expect from a seventh-grade orchestra?
- Give an example of an instructional activity that relates to one of the levels described in Bloom's taxonomy of conceptual development.

Discussion Questions: Professional Issues

- Is it ever appropriate to make duplicates of sheet music using a copy machine? If so, under what circumstances?
- Would it be appropriate for a student ensemble to perform for a fee at a recreational festival that charges admission? Why or why not?
- What are some of the important publications of NAfME (formerly MENC) in your specialty?
- Which organization publishes *Opportunity-to-Learn Standards for Music Instruction: Grades PreK–12*?
- What are some organizations of special interest to choral educators, string educators, band directors?

- How would you summarize the viewpoints of music philosophers such as Susanne Langer, Leonard Meyer, Bennett Reimer, and David Elliott?
- What aspects of educational philosophy contribute to Bruner's spiral curriculum?
- Compare and contrast the value placed on music education by Plato and Aristotle. How does John Dewey's philosophy about the same topic compare?
- Describe the music library and instrument storage facilities that are associated with a quality high school orchestra program.

Discussion Questions: Technology

- Describe how you could use the Internet to teach a unit in a topic of your choosing to students in K–4, grades 5–8, and grades 9–12.
- Draw a diagram illustrating how you could set up a system for recording and playback that includes a CD player, CD recorder, and self-powered speakers. How might the setup differ if the speakers were not self-powered?
- What are the basic components of a digital audio workstation (DAW), and what are their functions (e.g., MIDI and audio tracks, mixers, plug-ins, audio interface)?
- How are music scores and parts created and edited using music publishing software programs?
- What are some best practices for setting up sound systems for different performance venues?

2. Understanding Question Types

Become comfortable with the types of questions you'll find on the Praxis *tests*

The Praxis® assessments include a variety of question types: constructed response (for which you write a response of your own); selected response, for which you select one or more answers from a list of choices or make another kind of selection (e.g., by selecting a sentence in a text or by selecting part of a graphic); and numeric entry, for which you enter a numeric value in an answer field. You may be familiar with these question formats from taking other standardized tests. If not, familiarize yourself with them so you don't spend time during the test figuring out how to answer them.

Understanding Selected-Response and Numeric-Entry Questions

For most questions, you respond by selecting an oval to select a single answer from a list of answer choices.

However, interactive question types may also ask you to respond by:

- Selecting more than one choice from a list of choices.
- Typing in a numeric-entry box. When the answer is a number, you may be asked to enter a numerical answer. Some questions may have more than one entry box to enter a response. Numeric-entry questions typically appear on mathematics-related tests.
- Selecting parts of a graphic. In some questions, you will select your answers by selecting a location (or locations) on a graphic such as a map or chart, as opposed to choosing your answer from a list.
- Selecting sentences. In questions with reading passages, you may be asked to choose your answers by selecting a sentence (or sentences) within the reading passage.
- Dragging and dropping answer choices into targets on the screen. You may be asked to select answers from a list of choices and to drag your answers to the appropriate location in a table, paragraph of text or graphic.
- Selecting answer choices from a drop-down menu. You may be asked to choose answers by selecting choices from a drop-down menu (e.g., to complete a sentence).

Remember that with every question you will get clear instructions.

Understanding Constructed-Response Questions

Some tests include constructed-response questions, which require you to demonstrate your knowledge in a subject area by writing your own response to topics. Essays and short-answer questions are types of constructed-response questions.

For example, an essay question might present you with a topic and ask you to discuss the extent to which you agree or disagree with the opinion stated. You must support your position with specific reasons and examples from your own experience, observations, or reading.

Review a few sample essay topics:

- *Brown* v. *Board of Education of Topeka*

  "We come then to the question presented: Does segregation of children in public schools solely on the basis of race, even though the physical facilities and other 'tangible' factors may be equal, deprive the children of the minority group of equal educational opportunities? We believe that it does."

  A. What legal doctrine or principle, established in *Plessy* v. *Ferguson* (1896), did the Supreme Court reverse when it issued the 1954 ruling quoted above?

  B. What was the rationale given by the justices for their 1954 ruling?

- In his self-analysis, Mr. Payton says that the better-performing students say small-group work is boring and that they learn more working alone or only with students like themselves. Assume that Mr. Payton wants to continue using cooperative learning groups because he believes they have value for all students.
  - Describe **TWO** strategies he could use to address the concerns of the students who have complained.
  - Explain how each strategy suggested could provide an opportunity to improve the functioning of cooperative learning groups. Base your response on principles of effective instructional strategies.

- "Minimum-wage jobs are a ticket to nowhere. They are boring and repetitive and teach employees little or nothing of value. Minimum-wage employers take advantage of people because they need a job."
  - Discuss the extent to which you agree or disagree with this opinion. Support your views with specific reasons and examples from your own experience, observations, or reading.

Keep these things in mind when you respond to a constructed-response question:

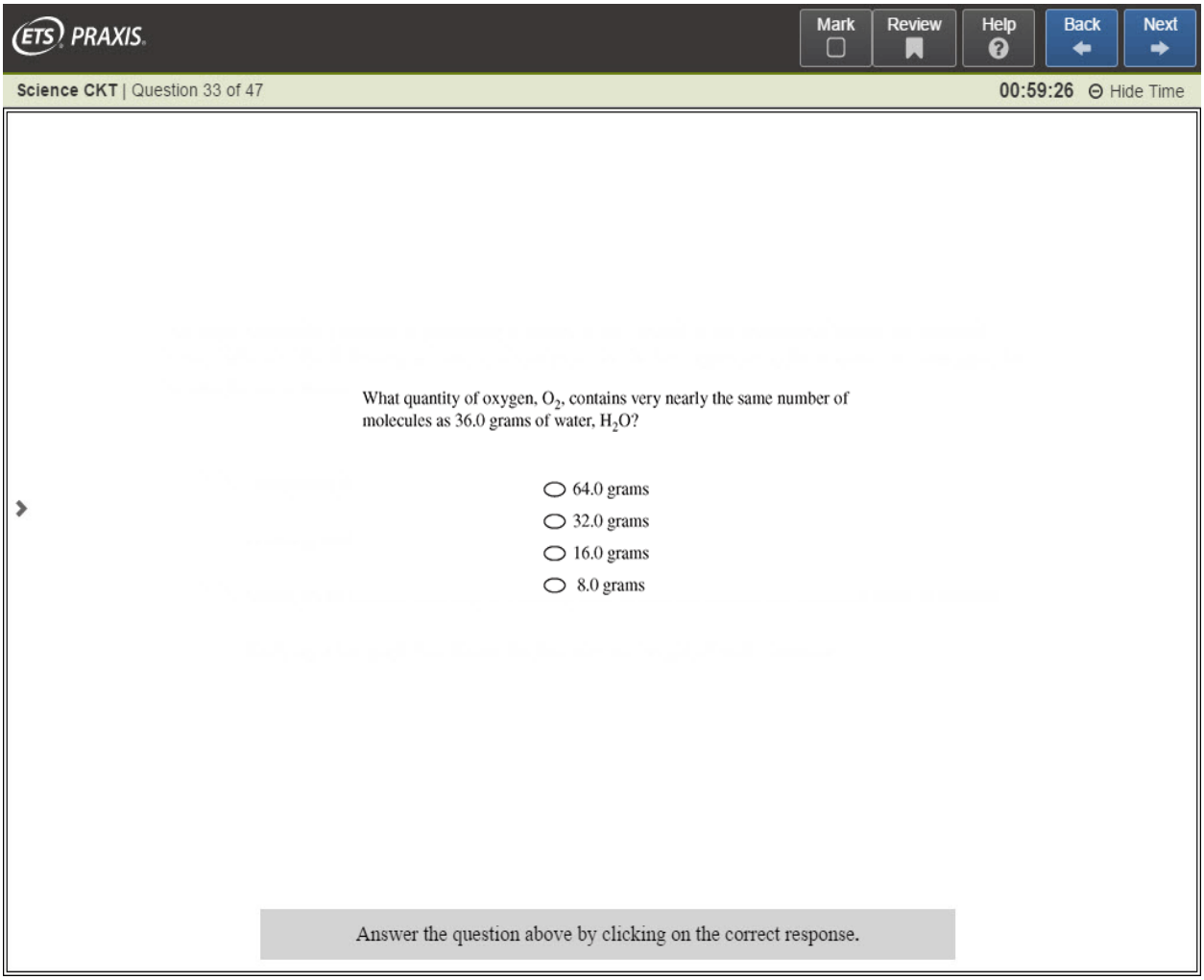
1. Answer the question accurately. Analyze what each part of the question is asking you to do. If the question asks you to describe or discuss, you should provide more than just a list.
2. Answer the question completely. If a question asks you to do three distinct things in your response, you should cover all three things for the best score. Otherwise, no matter how well you write, you will not be awarded full credit.
3. Answer the question that is asked. Do not change the question or challenge the basis of the question. You will receive no credit or a low score if you answer another question or if you state, for example, that there is no possible answer.
4. Give a thorough and detailed response. You must demonstrate that you have a thorough understanding of the subject matter. However, your response should be straightforward and not filled with unnecessary information.
5. Take notes on scratch paper so that you don't miss any details. Then you'll be sure to have all the information you need to answer the question.
6. Reread your response. Check that you have written what you thought you wrote. Be sure not to leave sentences unfinished or omit clarifying information.

3. Practice with Sample Test Questions

Answer practice questions and find explanations for correct answers

Sample Test Questions

This test is available on computer. The following sample question provides a preview of an actual screen used in a computer-delivered test. For the purposes of this study companion, sample questions are shown as they would appear in a paper-delivered test.



Sample Test Questions

The sample questions that follow represent a number of the types of questions and topics that appear on the test. They are not, however, representative of the entire scope of the test in either content or difficulty. Answers with explanations follow the questions. Audio files are provided only for questions 4 and 5. Recordings of the works referenced by these questions may be available commercially or through a library.

Directions for Section 1 (listening)**:** In this section of the test, you are asked questions about recorded musical excerpts. Each question, followed by four possible answers, appears on the screen. Each question is presented using a combination of screen text and audio. During the audio portions, you are given time to read the questions and possible answers shown on the screen.

A clock at the top of the screen shows you how much time is remaining to answer all of the questions in Section 1. **The clock only counts down after the audio finishes playing.** It does not count down while the audio is playing.

For most questions, the musical excerpt plays a single time. Some of the longer, more complicated questions have extra playings of the excerpt included in the audio.

You control the advance of the questions and are responsible for pacing your own test taking. The questions do not advance automatically. When ready to advance to the next question, click "Next."

For each question, you are encouraged to listen to the entire musical excerpt before selecting an answer. You may, however, select or change an answer when you feel ready to do so at any time during and after the audio. While the audio is still playing, the "Next" and "Back" navigation controls are deactivated to help prevent you from navigating away from the question prematurely.

You may return to a previous question in Section I to select or change your answer after you have advanced past that question. **The audio** for the question, however, **does not play again** so it is strongly suggested that you **select your answer before advancing to the next question.**

You may, if you wish, choose not to answer a question.

Unanswered questions, however, count as wrong answers, so it is to your advantage to **answer every question even if you have to guess.** If you plan to return to an unanswered question in Section 1, it is important to remember that **the audio will not play again.**

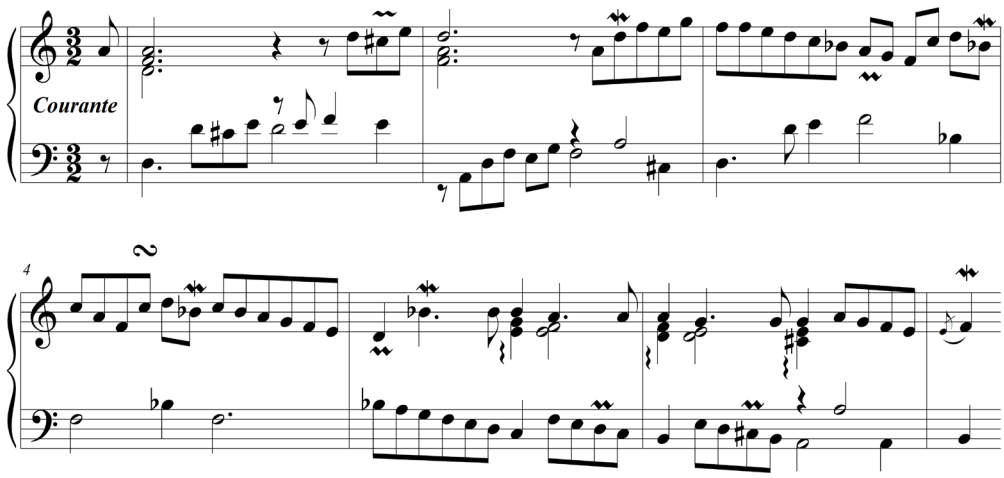
Be careful to pace your work so that you finish before the time expires for Section I. When the time expires, the computer will advance automatically to Section 2. Remember that **you cannot return to questions in Section 1 after you have advanced to Section 2.**

(Recorded example: excerpt from Ravel's "Laideronnette, Impératrice des Pagodes" from *Ma mère l'Oye*)

1. What is the scale or mode?
   - (A) Major
   - (B) Minor
   - (C) Pentatonic
   - (D) Chromatic

(Recorded example: excerpt from the gamelan music "Bubaran Hudan Mas")

2. What is the country of origin?
   - (A) India
   - (B) Indonesia
   - (C) Peru
   - (D) Japan



(Recorded example: excerpt from Elisabeth-Claude Jacquet de la Guerre's "*Courante" from Pièces de Clavecin: Suite in D minor*)

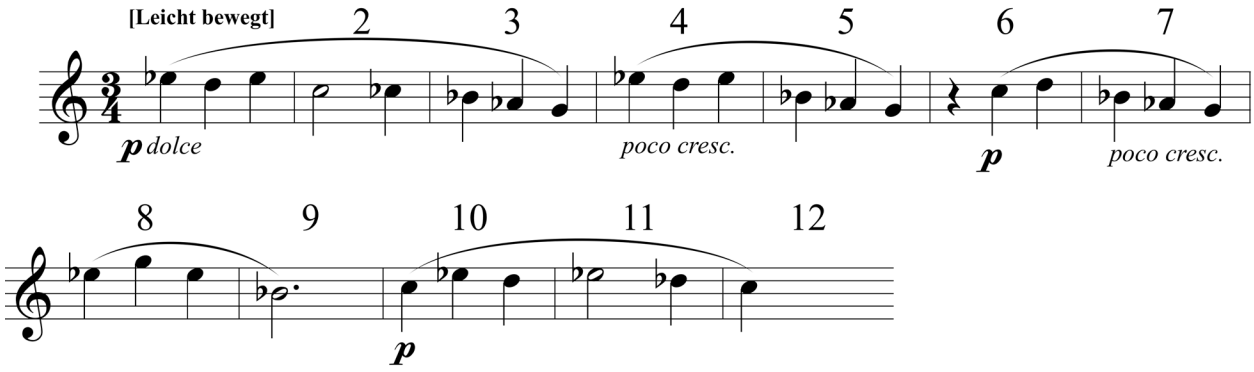
3. In which measure is the rhythm played incorrectly?

   (A) Measure 2

   (B) Measure 3

   (C) Measure 5

   (D) Measure 6



4. In which measure does the horn player perform an incorrect pitch? (The excerpt will be played two times. Use audio file for question 4 at www.ets.org/praxis/prepare/materials/5113.)

   (A) 2

   (B) 5

   (C) 10

   (D) 11

5. Which of the following chord progressions is played? (The progression will be played two times. Use audio file for question 5 at www.ets.org/praxis/prepare/materials/5113.)

   (A) i iv^7 $ii^{\varnothing 7}$ V^7 i

   (B) i $ii^{\varnothing 7}$ $ii^{\varnothing 6}_5$ i^6 V

   (C) i iv iv^6 V^7 i

   (D) i iv^7 ii V^6_5 VI^6

(Recorded example: excerpt from Mozart's opera *Die Zauberflöte*, aria "Der Hölle Rache" sung by the Queen of the Night character)

6. What is the style or period?

   (A) Renaissance

   (B) Baroque

   (C) Classical

   (D) Romantic

(Recorded example: excerpt from *In C*)

7. Who is the composer?

   (A) Terry Riley

   (B) Charles Ives

   (C) John Corigliano

   (D) Duke Ellington

Directions for Section 2: Each of the questions or statements below is followed by several answer choices. In each case, select the best answer on the screen.

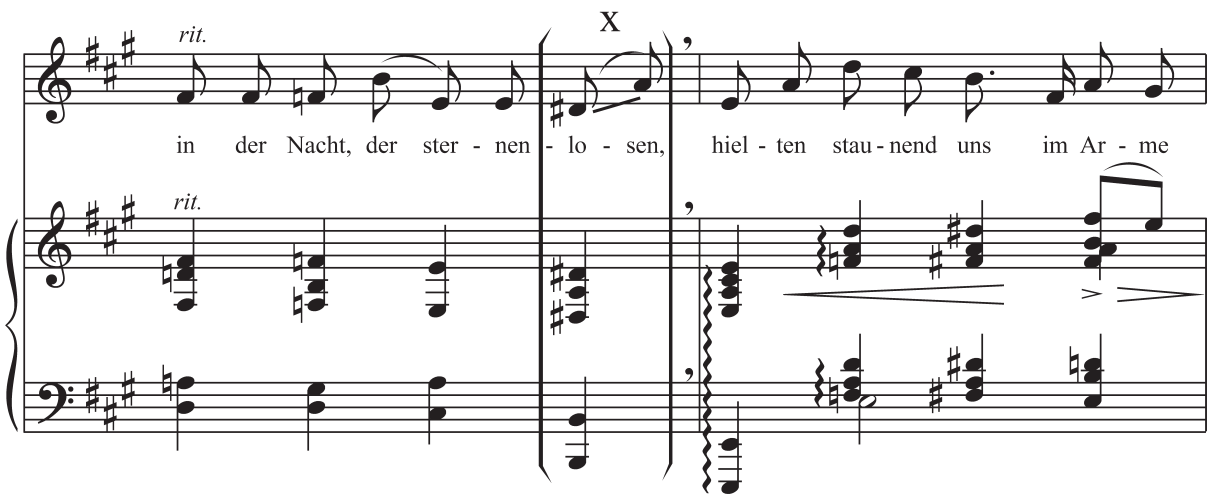
8. Which of the following lists the musical genres in the correct chronological order of their development?

   (A) Motet, string quartet, opera, symphonic poem

   (B) Motet, opera, string quartet, symphonic poem

   (C) Opera, motet, string quartet, symphonic poem

   (D) Opera, symphonic poem, motet, string quartet



9. The excerpt above is taken from a lied in A major by Alma Mahler. Which of the following best represents the bracketed harmony labeled X?

   (A) ii^7

   (B) vii°

   (C) Aug. 6

   (D) V^7 / V

10. Performance parts for which TWO of the following instruments are normally written at concert pitch?

   (A) Bassoon

   (B) Piccolo

   (C) English horn

   (D) Alto saxophone

   (E) Violin

11. Which of the following is the most likely cause of faulty intonation by singers in a high school choir?

   (A) Inadequate rehearsal time

   (B) Unsupported tone

   (C) Singing in a foreign language

   (D) Lack of an instrumental accompaniment

12. Prior to learning about meter, elementary students should be able to demonstrate their understanding of

   (A) weak and strong beats

   (B) syncopation

   (C) subdivision of the beat

   (D) tempo markings

13. Which of the following is an example of a critical-thinking skill?

    (A) Students label the parts of a chord.

    (B) Students notate rhythmic patterns in all of the common meters.

    (C) Students compare two different recordings of the same work.

    (D) Students transpose a trumpet part from written pitch to concert pitch.

14. Creating an ostinato on barred instruments to accompany a folk song is most closely associated with which of the following approaches?

    (A) Orff

    (B) Kodály

    (C) Dalcroze

    (D) Gordon

15. Which of the following ballets was written by Aaron Copland?

    (A) *Swan Lake*

    (B) *Romeo and Juliet*

    (C) *The Rite of Spring*

    (D) *Appalachian Spring*

16. Which of the following modes has a major tonic triad?

    (A) Aeolian

    (B) Phrygian

    (C) Mixolydian

    (D) Dorian

17. Which of the following venues could normally be expected to have the longest reverberation time?

    (A) Recital hall

    (B) Coffeehouse

    (C) Gothic-style cathedral

    (D) Opera house

18. Which of the following is a well-known, prolific researcher in music education, author of several standard texts on music education topics, and a coeditor of *The New Handbook of Research on Music Teaching and Learning*?

    (A) Lowell Mason

    (B) Bennett Reimer

    (C) Edwin E. Gordon

    (D) Richard Colwell

19. Conducting cues are customarily given when

(A) a soloist or a section must fade out on a long note

(B) a soloist or a section enters after a long rest

(C) the articulation changes from one style to another

(D) the meter changes from simple to compound

20. In MIDI technology, which of the following is a list of the performance parameters most directly affected by key velocity?

(A) Rhythm and timbre

(B) Pitch and stop times

(C) Dynamics and stop times

(D) Dynamics and timbre

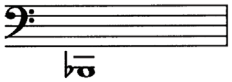
21. Which of the following is an appropriate instrument-care objective for beginning string orchestra students to master?

(A) Loosening the hair on the bow before returning it to the case

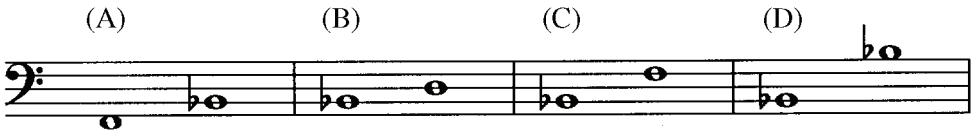
(B) Loosening the tuning pegs on the instrument before returning it to the case

(C) Wiping the rosin from the bow hair before returning it to the case

(D) Putting rosin on the bow before returning it to the case



22. Which of the following notates the next two partials for the harmonic series based on the fundamental tone given above?



(A) A

(B) B

(C) C

(D) D

23. Which of the following is most typically an objective of sectional rehearsals?

(A) Help students who are having difficulty learning their parts

(B) Help students in dealing with stage fright

(C) Address issues of poor ensemble blend

(D) Address passages in which the ensemble overpowers soloists

24. Which of the following composers has written most extensively for young bands?

(A) Karel Husa

(B) Anne McGinty

(C) John Philip Sousa

(D) Ellen Taaffe Zwilich

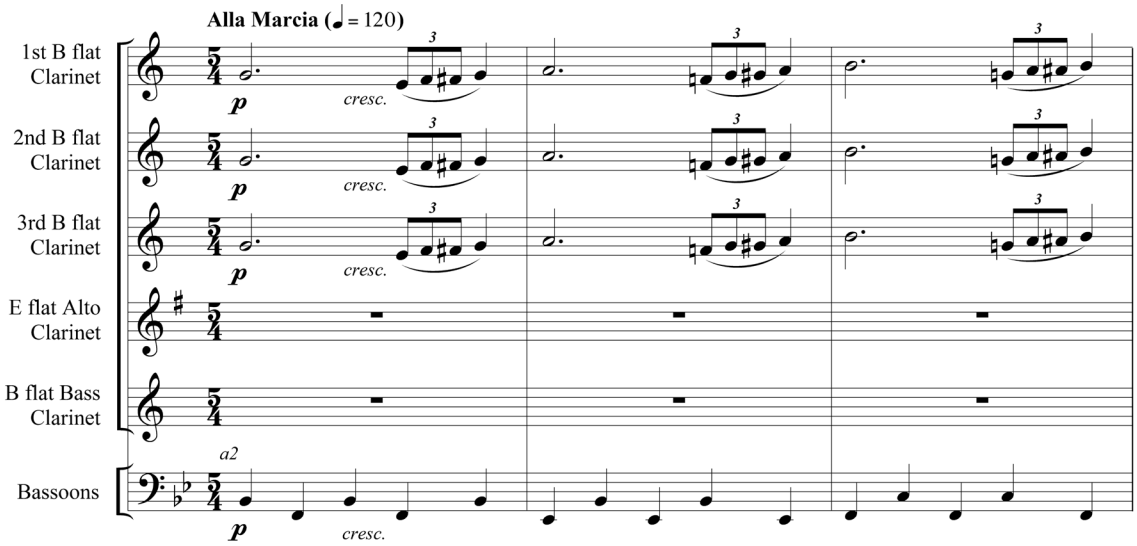
25. What interval does the clarinet overblow when the register key is used?

(A) Fourth

(B) Octave

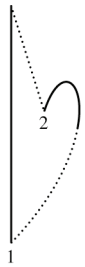
(C) Tenth

(D) Twelfth

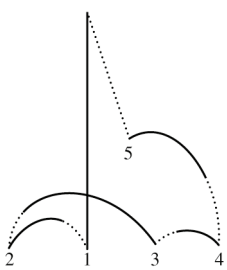


26. Which pattern is most appropriate for conducting the passage shown above?

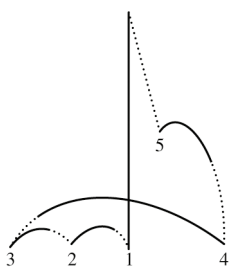
(A)



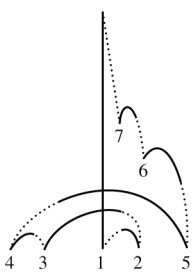
(B)



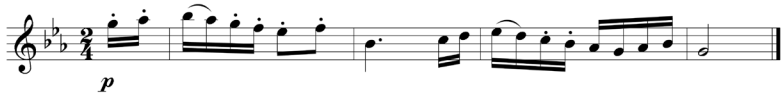
(C)

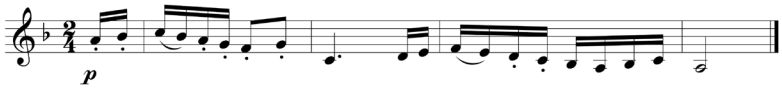


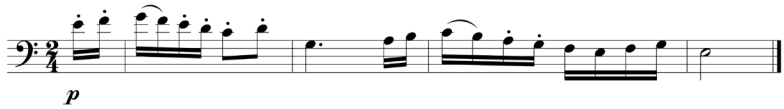
(D)

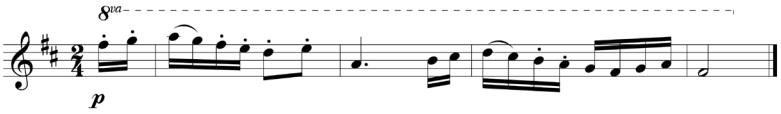


27. Which of the following excerpts can be played on the oboe and is within the scope of a high school oboist's proficiency?

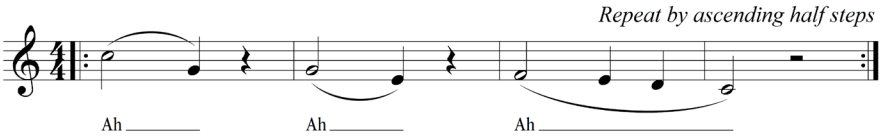
(A) 

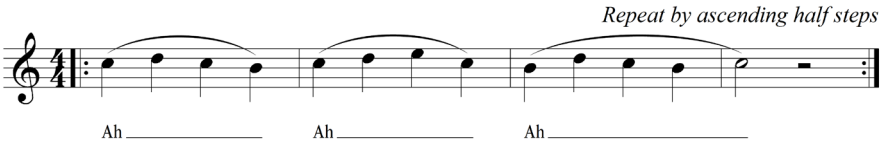
(B) 

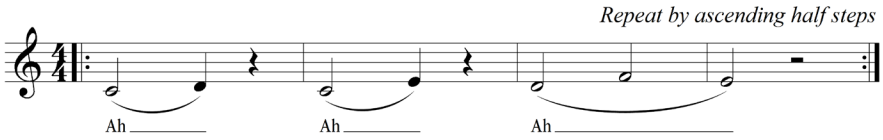
(C) 

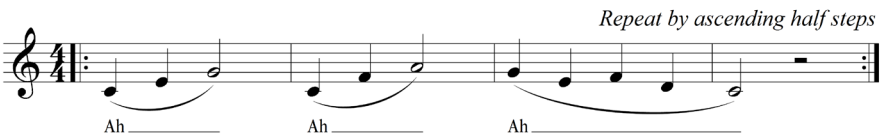
(D) 

28. Which of the following exercises would best develop a student's ability to sing consistently through the head, middle, and chest vocal registers?

(A) 

(B) 

(C) 

(D) 

29. The National Core Arts Standards are organized around four artistic processes: (1) Creating, (2) Performing/Presenting/Producing, (3) Responding, and (4) Connecting. According to the standards, how is "Connecting" defined?

(A) Relating artistic ideas and work with personal meaning and external context

(B) Understanding and evaluating how the arts convey meaning

(C) Realizing artistic ideas and work through interpretation and presentation

(D) Communicating artistic ideas using multimedia works

30. Which of the following programs would a music educator most likely use to create music theory work sheets?

(A) SONAR

(B) Audacity

(C) Pro Tools

(D) Finale

Answers to Sample Questions

1. Option (C) is correct. This question tests your knowledge of modes and scales used to organize pitches. In the excerpt heard in the recorded example, the main melody is based on the pentatonic scale of C-sharp, D-sharp, F-sharp, G-sharp, and A-sharp.

2. Option (B) is correct. This question tests your knowledge of characteristics and identifying features of world music genres. The excerpt heard in the recorded example features music by a characteristic Indonesian gamelan ensemble composed primarily of hanging gongs, gong chimes, and drums.

3. Option (C) is correct. This question tests your ability to identify errors in performance relative to a written musical score. The excerpt heard in the recorded example contains one error in rhythm: in measure 5, beat two, the two eighth notes in the bass are performed as a sixteenth note followed by a dotted eighth note.

4. Option (C) is correct. This question tests your ability to identify errors in performance relative to a written musical score. In measure 10, a D-flat (concert G-flat) is played on the third quarter note rather than the D-natural (concert G-natural) indicated in the printed music.

5. Option (A) is correct. This question tests your ability to hear chordal harmonies. The progression's unique characteristic is its use of the supertonic half diminished seventh in the third chord.

6. Option (C) is correct. This question tests your knowledge of the features that characterize music of various styles and historical periods. The texture, harmony, instrumentation of the accompaniment, and melodic style of the vocal line are all typical of music of the Classical period.

7. Option (A) is correct. This question tests your knowledge of features and stylistic elements that characterize the music of prominent American composers. Terry Riley's *In C* is characterized by layering of repeated, short melodic modules and ostinatos and is an important work that is representative of his creative output as a composer.

8. Option (B) is correct. This question tests your knowledge of important developments in the history of music. Choice B indicates the correct chronological order because the motet was developed in the thirteenth century, opera in the seventeenth century, the string quartet in the eighteenth century, and the symphonic poem in the nineteenth century.

9. Option (D) is correct. This question tests your ability to provide a Roman numeral analysis of a written score. The bracketed chord consists of the pitches B, D-sharp, and A (the fifth of the chord, F-sharp, is missing). This chord is best described as the dominant seventh in the key of E major, and E is V in the key of A major. Thus, the bracketed chord can best be labeled as the secondary dominant, V7/V.

10. Options (A) and (E) are correct. This question tests your knowledge of standard notation practices for specific instruments. Bassoon and violin parts are normally written at concert pitch.

11. Option (B) is correct. This question tests your knowledge of causes of and solutions to problems in vocal music performance. Of the options listed, unsupported tone is the most frequent cause of faulty intonation by high school singers. The other options listed are not more likely causes of faulty intonation.

12. Option (A) is correct. This question tests your knowledge of techniques and methods of sequencing musical instruction. Meter, the grouping of beats into repeated sets of two, three, or more beats, depends on the differentiation between weak and strong beats; thus, students must understand the differentiation before they learn about meter. The other options listed are concepts that are not fundamental for elementary students to master as a prerequisite to learning about meter.

13. Option (C) is correct. This question tests your ability to evaluate the complexity of skills in the cognitive domain. In the cognitive domain, evaluation represents a high-level critical-thinking skill. When students compare two different recordings of the same work, they must use the skill of evaluation. The other options listed describe skills that demand knowledge and application of knowledge, but not evaluation.

14. Option (A) is correct. This question tests your knowledge of common methodologies in music education and the pedagogical techniques associated with them. The singing of folk songs accompanied by improvised ostinatos on barred instruments is an important component in the curricular Orff approach. None of the other approaches listed include improvisation on barred instruments as a vital part of the music learning experience.

15. Option (D) is correct. This question tests your knowledge of important composers and masterworks found in music history. Aaron Copland composed Appalachian Spring in 1944 for the choreographer Martha Graham. Swan Lake, Romeo and Juliet, and The Rite of Spring were composed by Tchaikovsky, Prokofiev, and Stravinsky, respectively.

16. Option (C) is correct. This question tests your knowledge of modes used in analyzing and creating music. The Mixolydian mode has a major tonic triad. The modes listed in the other options have minor tonic triads.

17. Option (C) is correct. This question tests your knowledge of acoustics and performance spaces relevant for music education. Reverberation is most noticeable in large spaces such as cathedrals, which typically contain walls and floors constructed of hard, reflective surfaces.

18. Option (D) is correct. This question tests your knowledge of professional resources useful for music education and research. Richard Colwell is a prolific music education researcher and author.

19. Option (B) is correct. This question tests your knowledge of conducting techniques. During long rests, performers may lose count and will enter with more confidence if a cue is given.

20. Option (D) is correct. This question tests your knowledge of MIDI technology. Key velocity is analogous to the key and hammer action on a piano and is used most typically to describe the relative amount of energy used to play a note. High key velocities result in louder notes with a timbre typical of notes played with more force (assuming the sound's envelope is designed to modulate in accordance with the key velocity information, which is usually the case). Rhythms, start times, and stop times are usually determined by on and off commands. Pitch is controlled specifically by frequency modulation envelopes and commands.

21. Option (A) is correct. This question tests your knowledge of the care and maintenance of instruments. Loosening the horse hair prevents the bow from warping. The other options describe inappropriate behaviors that do not contribute to keeping the bow in playing condition.

22. Option (C) is correct. This question tests your knowledge on principles of the harmonic series. In the harmonic series, the next note (the first partial) after the fundamental occurs an octave higher than the fundamental. The next note in the series (the second partial) occurs a fifth higher from the first partial.

23. Option (A) is correct. This question tests your knowledge of how to organize and plan rehearsals for effective instruction. Sectional rehearsals are an effective way to identify and remedy problems such as students' rhythm and pitch accuracy, phrasing, dynamics, and articulations.

24. Option (B) is correct. This question tests your knowledge of resources appropriate for teaching instrumental music. Anne McGinty has composed and arranged many works for young bands. The composers listed in the other options have also written for winds, although their works are largely for advanced-level ensembles.

25. Option (D) is correct. This question tests your knowledge of instrumental music pedagogy. The clarinet overblows at an interval of a twelfth. The instruments listed in the other options overblow at an interval of an octave.

26. Option (C) is correct. This question tests your knowledge of conducting. The excerpt is written in 5/4 meter, organized into beat groupings of 3 + 2. The patterns shown in the other options show incorrect numbers of beats or grouping patterns.

27. Option (A) is correct. Option (A) fits comfortably within the range of the oboe, which spans from Bb3 to an approximate upper limit of A5, for professional level players. All of the other options shown extend above or below that range.

28. Option (A) is correct. This questions tests your knowledge of the three main vocal registers: head, middle, and chest. Option A, with the range of an octave, spans all three of these registers, while options B, C, and D are limited in range.

29. Option (A) is correct. This question tests your knowledge of the philosophical basis that supports the organization of the National Core Arts Standards. In this definition, both personal meaning and external context inform or are connected to artistic ideas and work.

30. Option (D) is correct. This question tests your knowledge of music software often used for instruction or music publishing. Finale is one of several widely used music notation programs that can be used to create customized music theory work sheets.

4. Determine Your Strategy for Success

Set clear goals and deadlines so your test preparation is focused and efficient

Effective *Praxis* test preparation doesn't just happen. You'll want to set clear goals and deadlines for yourself along the way. Otherwise, you may not feel ready and confident on test day.

1) Learn what the test covers.

You may have heard that there are several different versions of the same test. It's true. You may take one version of the test and your friend may take a different version a few months later. Each test has different questions covering the same subject area, but both versions of the test measure the same skills and content knowledge.

You'll find specific information on the test you're taking on page 5, which outlines the content categories that the test measures and what percentage of the test covers each topic. Visit www.ets.org/praxis/testprep for information on other *Praxis* tests.

2) Assess how well you know the content.

Research shows that test takers tend to overestimate their preparedness—this is why some test takers assume they did well and then find out they did not pass.

The *Praxis* tests are demanding enough to require serious review of likely content, and the longer you've been away from the content, the more preparation you will most likely need. If it has been longer than a few months since you've studied your content area, make a concerted effort to prepare.

3) Collect study materials.

Gathering and organizing your materials for review are critical steps in preparing for the *Praxis* tests. Consider the following reference sources as you plan your study:

- Did you take a course in which the content area was covered? If yes, do you still have your books or your notes?
- Does your local library have a high school-level textbook in this area? Does your college library have a good introductory college-level textbook in this area?

Practice materials are available for purchase for many *Praxis* tests at www.ets.org/praxis/testprep. Test preparation materials include sample questions and answers with explanations.

4) Plan and organize your time.

You can begin to plan and organize your time while you are still collecting materials. Allow yourself plenty of review time to avoid cramming new material at the end. Here are a few tips:

- Choose a test date far enough in the future to leave you plenty of preparation time. Test dates can be found at www.ets.org/praxis/register/dates_centers.
- Work backward from that date to figure out how much time you will need for review.
- Set a realistic schedule—and stick to it.

5) Practice explaining the key concepts.

Praxis tests with constructed-response questions assess your ability to explain material effectively. As a teacher, you'll need to be able to explain concepts and processes to students in a clear, understandable way. What are the major concepts you will be required to teach? Can you explain them in your own words accurately, completely, and clearly? Practice explaining these concepts to test your ability to effectively explain what you know.

6) Understand how questions will be scored.

Scoring information can be found on page 44.

7) Develop a study plan.

A study plan provides a road map to prepare for the *Praxis* tests. It can help you understand what skills and knowledge are covered on the test and where to focus your attention. Use the study plan template on page 37 to organize your efforts.

And most important—get started!

Would a Study Group Work for You?

Using this guide as part of a study group

People who have a lot of studying to do sometimes find it helpful to form a study group with others who are working toward the same goal. Study groups give members opportunities to ask questions and get detailed answers. In a group, some members usually have a better understanding of certain topics, while others in the group may be better at other topics. As members take turns explaining concepts to one another, everyone builds self-confidence.

If the group encounters a question that none of the members can answer well, the group can go to a teacher or other expert and get answers efficiently. Because study groups schedule regular meetings, members study in a more disciplined fashion. They also gain emotional support. The group should be large enough so that multiple people can contribute different kinds of knowledge, but small enough so that it stays focused. Often, three to six members is a good size.

Here are some ways to use this guide as part of a study group:

- **Plan the group's study program.** Parts of the study plan template, beginning on page 37, can help to structure your group's study program. By filling out the first five columns and sharing the worksheets, everyone will learn more about your group's mix of abilities and about the resources, such as textbooks, that members can share with the group. In the sixth column ("Dates I will study the content"), you can create an overall schedule for your group's study program.
- **Plan individual group sessions.** At the end of each session, the group should decide what specific topics will be covered at the next meeting and who will present each topic. Use the topic headings and subheadings in the Test at a Glance table on page 5 to select topics, and then select practice questions, beginning on page 19.
- **Prepare your presentation for the group.** When it's your turn to present, prepare something that is more than a lecture. Write two or three original questions to pose to the group. Practicing writing actual questions can help you better understand the topics covered on the test as well as the types of questions you will encounter on the test. It will also give other members of the group extra practice at answering questions.

- **Take a practice test together.** The idea of a practice test is to simulate an actual administration of the test, so scheduling a test session with the group will add to the realism and may also help boost everyone's confidence. Remember, complete the practice test using only the time that will be allotted for that test on your administration day.
- **Learn from the results of the practice test.** Review the results of the practice test, including the number of questions answered correctly in each content category. For tests that contain constructed-response questions, look at the Sample Test Questions section, which also contain sample responses to those questions and shows how they were scored. Then try to follow the same guidelines that the test scorers use.
- **Be as critical as you can.** You're not doing your study partner(s) any favors by letting them get away with an answer that does not cover all parts of the question adequately.
- **Be specific.** Write comments that are as detailed as the comments about the sample responses. Indicate where and how your study partner(s) are doing an inadequate job of answering the question. Writing notes in the margins of the answer sheet may also help.
- **Be supportive.** Include comments that point out what your study partner(s) got right.

Then plan one or more study sessions based on aspects of the questions on which group members performed poorly. For example, each group member might be responsible for rewriting one paragraph of a response in which someone else did an inadequate job.

Whether you decide to study alone or with a group, remember that the best way to prepare is to have an organized plan. The plan should set goals based on specific topics and skills that you need to learn, and it should commit you to a realistic set of deadlines for meeting those goals. Then you need to discipline yourself to stick with your plan and accomplish your goals on schedule.

5. Develop Your Study Plan

Develop a personalized study plan and schedule

Planning your study time is important because it will help ensure that you review all content areas covered on the test. Use the sample study plan below as a guide. It shows a plan for the *Core Academic Skills for Educators: Reading* test. Following that is a study plan template that you can fill out to create your own plan. Use the "About Your Test" and "Content Topics" information beginning on page 5 to help complete it.

Use this worksheet to:
1. **Define Content Areas:** List the most important content areas for your test as defined in chapter 1.
2. **Determine Strengths and Weaknesses:** Identify your strengths and weaknesses in each content area.
3. **Identify Resources:** Identify the books, courses, and other resources you plan to use for each content area.
4. **Study:** Create and commit to a schedule that provides for regular study periods.

Praxis Test Name (Test Code): Core Academic Skills for Educators: Reading (5713)
Test Date: 9/15/21

Content covered	Description of content	How well do I know the content? (scale 1–5)	What resources do I have/need for the content?	Where can I find the resources I need?	Dates I will study the content	Date completed
Key Ideas and Details						
Close reading	Draw inferences and implications from the directly stated content of a reading selection	3	Middle school English textbook	College library, middle school teacher	7/15/21	7/15/21
Determining Ideas	Identify summaries or paraphrases of the main idea or primary purpose of a reading selection	3	Middle school English textbook	College library, middle school teacher	7/17/21	7/17/21
Determining Ideas	Identify summaries or paraphrases of the supporting ideas and specific details in a reading selection	3	Middle and high school English textbook	College library, middle and high school teachers	7/20/21	7/21/21
Craft, Structure, and Language Skills						
Interpreting tone	Determine the author's attitude toward material discussed in a reading selection	4	Middle and high school English textbook	College library, middle and high school teachers	7/25/21	7/26/21
Analysis of structure	Identify key transition words and phrases in a reading selection and how they are used	3	Middle and high school English textbook, dictionary	College library, middle and high school teachers	7/25/21	7/27/21
Analysis of structure	Identify how a reading selection is organized in terms of cause/effect, compare/contrast, problem/solution, etc.	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/21	8/1/21
Author's purpose	Determine the role that an idea, reference, or piece of information plays in an author's discussion or argument	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/21	8/1/21

(continued on next page)

Content covered	Description of content	How well do I know the content? (scale 1–5)	What resources do I have/need for the content?	Where can I find the resources I need?	Dates I will study the content	Date completed
Language in different contexts	Determine whether information presented in a reading selection is presented as fact or opinion	4	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/21	8/1/21
Contextual meaning	Identify the meanings of words as they are used in the context of a reading selection	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/21	8/1/21
Figurative Language	Understand figurative language and nuances in word meanings	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/8/21	8/8/21
Vocabulary range	Understand a range of words and phrases sufficient for reading at the college and career readiness level	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/15/21	8/17/21
Integration of Knowledge and Ideas						
Diverse media and formats	Analyze content presented in diverse media and formats, including visually and quantitatively, as well as in words	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/22/21	8/24/21
Evaluation of arguments	Identify the relationship among ideas presented in a reading selection	4	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/24/21	8/24/21
Evaluation of arguments	Determine whether evidence strengthens, weakens, or is relevant to the arguments in a reading selection	3	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/27/21	8/27/21
Evaluation of arguments	Determine the logical assumptions upon which an argument or conclusion is based	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/28/21	8/30/21
Evaluation of arguments	Draw conclusions from material presented in a reading selection	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/30/21	8/31/21
Comparison of texts	Recognize or predict ideas or situations that are extensions of or similar to what has been presented in a reading selection	4	High school textbook, college course notes	College library, course notes, high school teacher, college professor	9/3/21	9/4/21
Comparison of texts	Apply ideas presented in a reading selection to other situations	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	9/5/21	9/6/21

My Study Plan

Use this worksheet to:

1. **Define Content Areas:** List the most important content areas for your test as defined in chapter 1.
2. **Determine Strengths and Weaknesses:** Identify your strengths and weaknesses in each content area.
3. **Identify Resources:** Identify the books, courses, and other resources you plan to use for each content area.
4. **Study:** Create and commit to a schedule that provides for regular study periods.

Praxis Test Name (Test Code): _____

Test Date: _____

Content covered	Description of content	How well do I know the content? (scale 1–5)	What resources do I have/need for this content?	Where can I find the resources I need?	Dates I will study this content	Date completed

(continued on next page)

Content covered	Description of content	How well do I know the content? (scale 1–5)	What resources do I have/need for the content?	Where can I find the resources I need?	Dates I will study the content	Date completed

6. Review Smart Tips for Success

Follow test-taking tips developed by experts

Learn from the experts. Take advantage of the following answers to questions you may have and practical tips to help you navigate the *Praxis* test and make the best use of your time.

Should I guess?

Yes. Your score is based on the number of questions you answer correctly, with no penalty or subtraction for an incorrect answer. When you don't know the answer to a question, try to eliminate any obviously wrong answers and then guess at the correct one. Try to pace yourself so that you have enough time to carefully consider every question.

Can I answer the questions in any order?

You can answer the questions in order or skip questions and come back to them later. If you skip a question, you can also mark it so that you can remember to return and answer it later. Remember that questions left unanswered are treated the same as questions answered incorrectly, so it is to your advantage to answer every question.

Are there trick questions on the test?

No. There are no hidden meanings or trick questions. All of the questions on the test ask about subject matter knowledge in a straightforward manner.

Are there answer patterns on the test?

No. You might have heard this myth: the answers on tests follow patterns. Another myth is that there will never be more than two questions in a row with the correct answer in the same position among the choices. Neither myth is true. Select the answer you think is correct based on your knowledge of the subject.

Can I write on the scratch paper I am given?

Yes. You can work out problems on the scratch paper, make notes to yourself, or write anything at all. Your scratch paper will be destroyed after you are finished with it, so use it in any way that is helpful to you. But make sure to select or enter your answers on the computer.

Smart Tips for Taking the Test

1. **Skip the questions you find extremely difficult.** Rather than trying to answer these on your first pass through the test, you may want to leave them blank and mark them so that you can return to them later. Pay attention to the time as you answer the rest of the questions on the test, and try to finish with 10 or 15 minutes remaining so that you can go back over the questions you left blank. Even if you don't know the answer the second time you read the questions, see if you can narrow down the possible answers, and then guess. Your score is based on the number of right answers, so it is to your advantage to answer every question.

2. **Keep track of the time.** The on-screen clock will tell you how much time you have left. You will probably have plenty of time to answer all of the questions, but if you find yourself becoming bogged down, you might decide to move on and come back to any unanswered questions later.

3. **Read all of the possible answers before selecting one.** For questions that require you to select more than one answer, or to make another kind of selection, consider the most likely answers given what the question is asking. Then reread the question to be sure the answer(s) you have given really answer the question. Remember, a question that contains a phrase such as "Which of the following does NOT …" is asking for the one answer that is NOT a correct statement or conclusion.

4. **Check your answers.** If you have extra time left over at the end of the test, look over each question and make sure that you have answered it as you intended. Many test takers make careless mistakes that they could have corrected if they had checked their answers.

5. **Don't worry about your score when you are taking the test.** No one is expected to answer all of the questions correctly. Your score on this test is not analogous to your score on the *GRE*® or other tests. It doesn't matter on the *Praxis* tests whether you score very high or barely pass. If you meet the minimum passing scores for your state and you meet the state's other requirements for obtaining a teaching license, you will receive a license. In other words, what matters is meeting the minimum passing score. You can find passing scores for all states that use the *Praxis* tests at http://www.ets.org/s/praxis/pdf/passing_scores.pdf or on the web site of the state for which you are seeking certification/licensure.

6. **Use your energy to take the test, not to get frustrated by it.** Getting frustrated only increases stress and decreases the likelihood that you will do your best. Highly qualified educators and test development professionals, all with backgrounds in teaching, worked diligently to make the test a fair and valid measure of your knowledge and skills. Your state painstakingly reviewed the test before adopting it as a licensure requirement. The best thing to do is concentrate on answering the questions.

7. Check on Testing Accommodations

See if you qualify for accommodations to take the Praxis *test*

What if English is not my primary language?

Praxis tests are given only in English. If your primary language is not English (PLNE), you may be eligible for extended testing time. For more details, visit www.ets.org/praxis/register/plne_accommodations/.

What if I have a disability or other health-related need?

The following accommodations are available for *Praxis* test takers who meet the Americans with Disabilities Act (ADA) Amendments Act disability requirements:

- Extended testing time
- Additional rest breaks
- Separate testing room
- Writer/recorder of answers
- Test reader
- Sign language interpreter for spoken directions only
- Perkins Brailler
- Braille slate and stylus
- Printed copy of spoken directions
- Oral interpreter
- Audio test
- Braille test
- Large print test book
- Large print answer sheet
- Listening section omitted

For more information on these accommodations, visit www.ets.org/praxis/register/disabilities.

Note: Test takers who have health-related needs requiring them to bring equipment, beverages, or snacks into the testing room or to take extra or extended breaks must request these accommodations by following the procedures described in the *Bulletin Supplement for Test Takers with Disabilities or Health-Related Needs* (PDF), which can be found at http://www.ets.org/s/disabilities/pdf/bulletin_supplement_test_takers_with_disabilities_health_needs.pdf.

You can find additional information on available resources for test takers with disabilities or health-related needs at www.ets.org/disabilities.

8. Do Your Best on Test Day

Get ready for test day so you will be calm and confident

You followed your study plan. You prepared for the test. Now it's time to prepare for test day.

Plan to end your review a day or two before the actual test date so you avoid cramming. Take a dry run to the test center so you're sure of the route, traffic conditions, and parking. Most of all, you want to eliminate any unexpected factors that could distract you from your ultimate goal—passing the *Praxis* test!

On the day of the test, you should:

- be well rested
- wear comfortable clothes and dress in layers
- eat before you take the test
- bring an acceptable and valid photo identification with you
- bring an approved calculator only if one is specifically permitted for the test you are taking (see Calculator Use, at http://www.ets.org/praxis/test_day/policies/calculators)
- be prepared to stand in line to check in or to wait while other test takers check in

You can't control the testing situation, but you can control yourself. Stay calm. The supervisors are well trained and make every effort to provide uniform testing conditions, but don't let it bother you if the test doesn't start exactly on time. You will have the allotted amount of time once it does start.

You can think of preparing for this test as training for an athletic event. Once you've trained, prepared, and rested, give it everything you've got.

What items am I restricted from bringing into the test center?

You cannot bring into the test center personal items such as:

- handbags, knapsacks, or briefcases
- water bottles or canned or bottled beverages
- study materials, books, or notes
- pens, pencils, scrap paper, or calculators, unless specifically permitted for the test you are taking (see Calculator Use, at http://www.ets.org/praxis/test_day/policies/calculators)
- any electronic, photographic, recording, or listening devices

Personal items are not allowed in the testing room and will not be available to you during the test or during breaks. You may also be asked to empty your pockets. At some centers, you will be assigned a space to store your belongings, such as handbags and study materials. Some centers do not have secure storage space available, so please plan accordingly.

Test centers assume no responsibility for your personal items.

If you have health-related needs requiring you to bring equipment, beverages or snacks into the testing room or to take extra or extended breaks, you need to request accommodations in advance. Procedures for requesting accommodations are described in the Bulletin Supplement for Test Takers with Disabilities or Health-related Needs (PDF).

Note: All cell phones, smart phones (e.g., Android® devices, iPhones®, etc.), and other electronic, photographic, recording, or listening devices are strictly prohibited from the test center. If you are seen with such a device, you will be dismissed from the test, your test scores will be canceled, and you will forfeit your test fees. If you are seen *using* such a device, the device will be confiscated and inspected. For more information on what you can bring to the test center, visit www.ets.org/praxis/test_day/bring.

Are You Ready?

Complete this checklist to determine whether you are ready to take your test.

- ❒ Do you know the testing requirements for the license or certification you are seeking in the state(s) where you plan to teach?
- ❒ Have you followed all of the test registration procedures?
- ❒ Do you know the topics that will be covered in each test you plan to take?
- ❒ Have you reviewed any textbooks, class notes, and course readings that relate to the topics covered?
- ❒ Do you know how long the test will take and the number of questions it contains?
- ❒ Have you considered how you will pace your work?
- ❒ Are you familiar with the types of questions for your test?
- ❒ Are you familiar with the recommended test-taking strategies?
- ❒ Have you practiced by working through the practice questions in this study companion or in a study guide or practice test?
- ❒ If constructed-response questions are part of your test, do you understand the scoring criteria for these questions?
- ❒ If you are repeating a *Praxis* test, have you analyzed your previous score report to determine areas where additional study and test preparation could be useful?

If you answered "yes" to the questions above, your preparation has paid off. Now take the *Praxis* test, do your best, pass it—and begin your teaching career!

9. Understand Your Scores

Understand how tests are scored and how to interpret your test scores

Of course, passing the *Praxis* test is important to you so you need to understand what your scores mean and what your state requirements are.

What are the score requirements for my state?

States, institutions, and associations that require the tests set their own passing scores. Visit www.ets.org/praxis/states for the most up-to-date information.

If I move to another state, will my new state accept my scores?

The *Praxis* tests are part of a national testing program, meaning that they are required in many states for licensure. The advantage of a national program is that if you move to another state that also requires *Praxis* tests, you can transfer your scores. Each state has specific test requirements and passing scores, which you can find at www.ets.org/praxis/states.

How do I know whether I passed the test?

Your score report will include information on passing scores for the states you identified as recipients of your test results. If you test in a state with automatic score reporting, you will also receive passing score information for that state.

A list of states and their passing scores for each test are available online at www.ets.org/praxis/states.

What your *Praxis* scores mean

You received your score report. Now what does it mean? It's important to interpret your score report correctly and to know what to do if you have questions about your scores.

Visit http://www.ets.org/s/praxis/pdf/sample_score_report.pdf to see a sample score report.
To access *Understanding Your Praxis Scores*, a document that provides additional information on how to read your score report, visit www.ets.org/praxis/scores/understand.

Put your scores in perspective

Your score report indicates:

- Your score and whether you passed
- The range of possible scores
- The raw points available in each content category
- The range of the middle 50 percent of scores on the test

If you have taken the same *Praxis* test or other *Praxis* tests over the last 10 years, your score report also lists the highest score you earned on each test taken.

Content category scores and score interpretation

Questions on the *Praxis* tests are categorized by content. To help you in future study or in preparing to retake the test, your score report shows how many raw points you earned in each content category. Compare your "raw points earned" with the maximum points you could have earned ("raw points available"). The greater the difference, the greater the opportunity to improve your score by further study.

Score scale changes

ETS updates *Praxis* tests on a regular basis to ensure they accurately measure the knowledge and skills that are required for licensure. When tests are updated, the meaning of the score scale may change, so requirements may vary between the new and previous versions. All scores for previous, discontinued tests are valid and reportable for 10 years, provided that your state or licensing agency still accepts them.

These resources may also help you interpret your scores:

- *Understanding Your Praxis Scores* (PDF), found at www.ets.org/praxis/scores/understand
- *The Praxis Passing Scores* (PDF), found at www.ets.org/praxis/scores/understand
- State requirements, found at www.ets.org/praxis/states

Appendix: Other Questions You May Have

Here is some supplemental information that can give you a better understanding of the *Praxis* tests.

What do the *Praxis* tests measure?

The *Praxis* tests measure the specific knowledge and skills that beginning teachers need. The tests do not measure an individual's disposition toward teaching or potential for success, nor do they measure your actual teaching ability. The assessments are designed to be comprehensive and inclusive but are limited to what can be covered in a finite number of questions and question types. Teaching requires many complex skills that are typically measured in other ways, including classroom observation, video recordings, and portfolios.

Ranging from Agriculture to World Languages, there are more than 80 *Praxis* tests, which contain selected-response questions or constructed-response questions, or a combination of both.

Who takes the tests and why?

Some colleges and universities use the *Praxis* Core Academic Skills for Educators tests (Reading, Writing, and Mathematics) to evaluate individuals for entry into teacher education programs. The assessments are generally taken early in your college career. Many states also require Core Academic Skills test scores as part of their teacher licensing process.

Individuals entering the teaching profession take the *Praxis* content and pedagogy tests as part of the teacher licensing and certification process required by many states. In addition, some professional associations and organizations require the *Praxis* Subject Assessments for professional licensing.

Do all states require these tests?

The *Praxis* tests are currently required for teacher licensure in approximately 40 states and United States territories. These tests are also used by several professional licensing agencies and by several hundred colleges and universities. Teacher candidates can test in one state and submit their scores in any other state that requires *Praxis* testing for licensure. You can find details at www.ets.org/praxis/states.

What is licensure/certification?

Licensure in any area—medicine, law, architecture, accounting, cosmetology—is an assurance to the public that the person holding the license possesses sufficient knowledge and skills to perform important occupational activities safely and effectively. In the case of teacher licensing, a license tells the public that the individual has met predefined competency standards for beginning teaching practice.

Because a license makes such a serious claim about its holder, licensure tests are usually quite demanding. In some fields, licensure tests have more than one part and last for more than one day. Candidates for licensure in all fields plan intensive study as part of their professional preparation. Some join study groups, others study alone. But preparing to take a licensure test is, in all cases, a professional activity. Because a licensure exam surveys a broad body of knowledge, preparing for a licensure exam takes planning, discipline, and sustained effort.

Why does my state require the *Praxis* tests?

Your state chose the *Praxis* tests because they assess the breadth and depth of content—called the "domain"—that your state wants its teachers to possess before they begin to teach. The level of content knowledge, reflected in the passing score, is based on recommendations of panels of teachers and teacher educators in

each subject area. The state licensing agency and, in some states, the state legislature ratify the passing scores that have been recommended by panels of teachers.

How were the tests developed?

ETS consulted with practicing teachers and teacher educators around the country during every step of the *Praxis* test development process. First, ETS asked them what knowledge and skills a beginning teacher needs to be effective. Their responses were then ranked in order of importance and reviewed by hundreds of teachers.

After the results were analyzed and consensus was reached, guidelines, or specifications, for the selected-response and constructed-response tests were developed by teachers and teacher educators. Following these guidelines, teachers and professional test developers created test questions that met content requirements and *ETS Standards for Quality and Fairness*.*

When your state adopted the research-based *Praxis* tests, local panels of teachers and teacher educators evaluated each question for its relevance to beginning teachers in your state. During this "validity study," the panel also provided a passing-score recommendation based on how many of the test questions a beginning teacher in your state would be able to answer correctly. Your state's licensing agency determined the final passing-score requirement.

ETS follows well-established industry procedures and standards designed to ensure that the tests measure what they are intended to measure. When you pass the *Praxis* tests your state requires, you are proving that you have the knowledge and skills you need to begin your teaching career.

How are the tests updated to ensure the content remains current?

Praxis tests are reviewed regularly. During the first phase of review, ETS conducts an analysis of relevant state and association standards and of the current test content. State licensure titles and the results of relevant job analyses are also considered. Revised test questions are then produced following the standard test development methodology. National advisory committees may also be convened to review and revise existing test specifications and to evaluate test forms for alignment with the specifications.

How long will it take to receive my scores?

Scores for tests that do not include constructed-response questions are available on screen immediately after the test. Scores for tests that contain constructed-response questions or essays aren't available immediately after the test because of the scoring process involved. Official score reports are available to you and your designated score recipients approximately two to three weeks after the test date for tests delivered continuously, or two to three weeks after the testing window closes for other tests. See the test dates and deadlines calendar at www.ets.org/praxis/register/dates_centers for exact score reporting dates.

Can I access my scores on the web?

All test takers can access their test scores via My *Praxis* Account free of charge for one year from the posting date. This online access replaces the mailing of a paper score report.

The process is easy—simply log into My *Praxis* Account at www.ets.org/praxis and click on your score report. If you do not already have a *Praxis* account, you must create one to view your scores.

Note: You must create a *Praxis* account to access your scores, even if you registered by mail or phone.

**ETS Standards for Quality and Fairness* (2014, Princeton, N.J.) are consistent with the *Standards for Educational and Psychological Testing*, industry standards issued jointly by the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education (2014, Washington, D.C.).

To search for the *Praxis* test prep resources
that meet your specific needs, visit:

www.ets.org/praxis/testprep

To purchase official test prep made by the creators
of the *Praxis* tests, visit the ETS Store:

www.ets.org/praxis/store

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ETS PRAXIS

The *PRAXIS*® Study Companion

Physics (5266)



ETS Professional Educator PROGRAMS

www.ets.org/praxis

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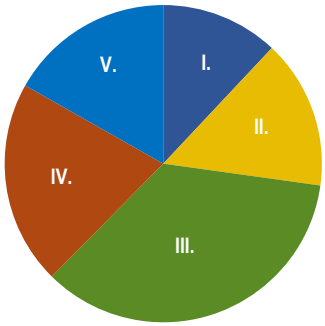
Physics (5266)

Test at a Glance

The *Praxis*® Physics test is designed to measure knowledge and competencies important for safe and effective beginning practice as a teacher of physics. Test takers have typically completed a bachelor's degree program with appropriate coursework in physics and education.

Test Name	Physics
Test Code	5266
Time	2 hours 30 minutes
Number of Questions	125 selected-response questions
Format	The test consists of a variety of selected-response questions, where you select one or more answer choices and other types of questions. You can review the possible question types in Understanding Question Types.
Test Delivery	Computer Delivered



Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
I. Nature and Impact of Science and Engineering	15	12%
II. Principles and Models of Matter and Energy	19	15%
III. Mechanics	44	35%
IV. Electricity and Magnetism	26	21%
V. Waves	21	17%
Half or more of the questions integrate a Science and Engineering Practice, and approximately one-quarter to one-third of the questions assess content applied to a Task of Teaching of Science.		

About The Test

The Physics test content topics span the physics curriculum, including content related to (I) Nature and Impact of Science and Engineering, (II) Principles and Models of Matter and Energy, (III) Mechanics, (IV) Electricity and Magnetism, and (V) Waves.

The assessment is designed and developed through work with practicing physics teachers, teacher educators, and higher education physics specialists to reflect the science knowledge teachers need to teach the physics curriculum and to reflect state and national standards, including the National Science Teaching Association Preparation Standards for physics. Content and practices measured reflect the Disciplinary Core Ideas (DCIs) and Science and Engineering Practices (SEPs) established by the National Research Council in A Framework for K-12 Science Education and included in the Next Generation Science Standards.

The 125 selected-response questions measure concepts, terms, phenomena, methods, applications, data analysis, and problem solving in science. A full list of the topics covered is provided in Content Topics.

Test takers do not need to use a calculator in taking this test. The periodic table of the elements is available as a Help screen, along with a table of information that presents various physical constants and a few conversion factors among SI units. Whenever necessary, additional values of physical constants are included with the text of a question.

Test takers can expect half or more of the questions on the test to integrate physics content knowledge with one or more of the SEPs, listed under Science and Engineering Practices.

Test takers will also find that approximately one-quarter to one-third of the percent of questions call for application of physics content and processes within a teaching scenario or an instructional task. Such questions—designed to measure applications of physics knowledge to the kinds of decisions and evaluations a teacher must make during work with students, curriculum, and instruction—situate physics content questions in tasks critical for teaching. Below, in Tasks of Teaching Science, is a list of tasks that are a routine part of physics instruction. These tasks, identified based on research on science instruction, have been confirmed by a national committee of teachers and teacher educators as important for effective teaching of secondary science.

This test may contain some questions that will not count toward your score.

Content Topics

This list details the topics that may be included on the test. All test questions cover one or more of these topics.

Discussion Questions

In this section, discussion questions are open-ended questions or statements intended to help test your knowledge of fundamental concepts and your ability to apply those concepts to classroom or real-world situations. We do **not** provide answers for the discussion questions but thinking about the answers will help improve your understanding of fundamental concepts and may help you answer a broad range of questions on the test. Most of the questions require you to combine several pieces of knowledge to formulate an integrated understanding and response. They are written to help you gain increased understanding and facility with the test's subject matter. You may want to discuss these questions with a teacher or mentor.

I. Nature and Impact of Science and Engineering

A. Nature of Science

1. Nature of scientific knowledge
   a. Involves a variety of investigation methods
   b. Based on experimental evidence that is reproducible
   c. Major concepts develop and change over time in light of new evidence
   d. Constructing and testing hypotheses
   e. Explain natural phenomena by using existing models and theories
   f. Developing, using, evaluating, and revising models
   g. Involves process skills, including observing, categorizing, comparing, generalizing, inferring, concluding, and communicating
2. Experimental design, data collection, and analysis
   a. Standard units of measurement, dimensional analysis, and unit conversion
   b. Scientific notation
   c. Vector and scalar quantities including vector addition (graphical and mathematical)
   d. Experimental design, including developing and using models, identifying variables, planning data collection, and supporting the testing of the hypothesis
   e. Processing data using mathematical and computational thinking, organizing data, and reporting data
   f. Error analysis, including accuracy and precision, means, and percent error
   g. Identifying sources and effects of error
   h. Interpreting and drawing conclusions from data
3. Laboratory procedures
   a. Appropriate preparation, use, storage, and disposal of materials

b. Appropriate use of laboratory and measurement equipment, including selection, calibration, and maintenance

c. Safety procedures and precautions for the laboratory

B. Science, Engineering, Technology, Society, and the Environment

1. Interdependence of science, engineering, and technology
   a. Engineering advances lead to important discoveries in science (e.g., telescopes, lasers, super collider)
   b. Science and technology drive each other forward (e.g., in communications with wireless devices, in medicine with imaging, in transportation with superconductors and magnetic levitation)
   c. Ethics, values, and social and cultural circumstances impact how scientific advances are utilized
2. Application of the engineering design process to the physics classroom
   a. Defining problems, including identifying the criteria and the constraints
   b. Designing solutions, including proposing and evaluating in terms of criteria, constraints, and limitations
   c. Optimizing the design, including systematic modification and refinement
3. Real-world environmental and societal problems impacted by technology or subject to solution through engineering design
   a. Environmental (e.g., climate change, ozone layer depletion, noise pollution)
   b. Sustainability (e.g., production, reduction, reusing, and recycling of consumer goods)
   c. Energy (e.g., renewable and nonrenewable energy resources)

Discussion Questions: Nature and Impact of Science and Engineering

- Be able to present a scientific argument with supporting data.
- Be able to explain the difference between a hypothesis and a theory.
- Be able to determine and control the parameters of measuring devices.
- Be familiar with expressing numbers in scientific notation.
- Be proficient with the use of significant figures.
- Be able to determine the number of significant digits from various measurement instruments.
- Be able to develop mathematical and graphical representations of experimental data.
- Be able to explain what is meant by the greenhouse effect.
- Be able to identify the environmental reasons underlying the development of new refrigerants.
- Be able to describe the procedures to be followed when discarding consumer products.

- Be able to identify the factors that must be taken into consideration when discarding nuclear waste.
- Be familiar with the applications of lasers in daily life.

II. Principles and Models of Matter and Energy

A. Conceptual Understanding of Atomic and Nuclear Structure and Processes

1. Atomic and subatomic structures
   a. Atomic components (protons, neutrons, and electrons)
   b. Bohr model
2. Relationship between atomic spectra and electron energy levels
   a. Electron energy transitions in atoms
   b. Absorption and emission spectra
3. Characteristics and effects of nuclear processes
   a. Radioactivity and radioactive decay processes, including half-life
   b. Alpha particles, beta particles, and gamma radiation
   c. Fission and fusion (conservation of mass energy, charge, and nucleons)
4. Basic quantum physics
   a. Wave-particle duality of matter and electromagnetic energy
   b. Photoelectric effect

B. Relationships Between Energy and Matter

1. Temperature, forms of energy, heating, and heat capacity
   a. Temperature as a measure of average kinetic energy
   b. Distinguish between temperature, heating, and thermal energy
   c. Heat capacity, specific heat, and latent heat
   d. Thermal mechanisms of energy transfer (conduction, convection, radiation)
   e. Meaning and use of different temperature scales (Kelvin, Celsius, Fahrenheit)
2. Conceptual relationships of thermodynamics to physical processes
   a. Conservation of energy for thermal processes (first law)
   b. Entropy does not decrease in a closed system (second law)
   c. Absolute zero (third law)
   d. Thermal equilibrium (zeroth law)

Discussion Questions: Principles and Models of Matter and Energy

- Be familiar with the assumptions of the Bohr model of the atom.
- Be familiar with the Bohr expression for the frequency of the light emitted or absorbed when an electron makes a transition between two energy levels.
- Be able to distinguish between nuclear fission and nuclear fusion.
- Be able to explain why energy is released during the fusion of two deuterium nuclei.

- Be able to determine the amount of radioactive substance left after a specified number of half-lives have elapsed.
- Be able to identify the daughter nucleus that results from the alpha decay of a nucleus of an atom.
- Be able to describe the relationship between the frequency of light incident on a metal and the energy of the ejected photoelectrons.
- Be able to describe the difference between heat and temperature.
- Be able to explain how the concepts of mass and energy are integrated.
- Be able to determine the amount of thermal energy needed for a given amount of ice at zero degrees Celsius to change to a gaseous state at 100 degrees Celsius.
- Be able to explain why metal feels cooler to the touch than wood at the same temperature.
- Be able to make calculations involving the ideal gas law.
- Be able to calculate the work done during the isothermal expansion of an ideal gas.
- Be able to describe the relationship between internal energy and the first law of thermodynamics.
- Be able to describe the relationship between entropy and the second law of thermodynamics.

III. Mechanics

A. Basic Concepts and Applications of Forces and Motion

1. Description of motion
   a. Properties of scalar quantities (e.g., distance, mass, speed, time, energy)
   b. Properties of vector quantities (e.g., displacement, velocity, acceleration, force, momentum)
   c. Linear motion
   d. Two-dimensional motion (e.g., projectile motion)
   e. Graphical analysis of motion
   f. Circular motion
   g. Simple harmonic motion
2. Frames of reference and their applications
   a. Frames of reference (coordinate systems, inertial reference frames)
   b. Relative velocity
3. Newton's laws of motion
   a. First law (mass, inertia, inertial reference frame)
   b. Second law (net force, mass, acceleration)
   c. Third law
4. Gravitation
   a. Newton's law of universal gravitation
   b. Satellites and orbital motion
   c. Acceleration due to gravity and gravitational field
5. Weight, mass, and density
   a. Relationship between weight and mass

   b. Relationship between density and mass
6. Kepler's laws of orbital motion
   a. First law (elliptical orbits)
   b. Second law (equal areas in equal times)
   c. Third law (relationship between orbital period and mean orbital radius)
7. Basic fluid mechanics
   a. Fluid statics (buoyancy, density, pressure)
   b. Fluid dynamics (Bernoulli's principle and the continuity equation)

B. Advanced Concepts and Applications in Mechanics

1. Friction
   a. Normal force and frictional force
   b. Coefficients of static and kinetic friction Mechanisms of evolution
2. Uniform circular motion
   a. Net force directed toward the center
   b. Centripetal acceleration
3. Harmonic motion
   a. Restoring force (Hooke's law)
   b. Period, frequency, amplitude
   c. Pendulums and spring oscillation
4. Energy
   a. Mechanical energy (kinetic and potential)
   b. Conservation of energy, including energy transfers and transformations
   c. Work and power
5. Linear momentum and impulse
   a. Center of mass
   b. Linear momentum and its conservation
   c. Change in momentum (impulse)
6. Rotational motion
   a. Angular displacement, velocity, and acceleration
   b. Angular momentum and conservation of angular momentum
   c. Rotational inertia (moment of inertia)
   d. Torque
   e. Static equilibrium
7. Collisions
   a. Elastic and inelastic collisions
   b. Conservation of momentum
   c. Conservation of mechanical energy
   d. Collisions in one and two dimensions

Discussion Questions: Mechanics

- Be able to determine distance, displacement, average speed, average velocity, and average acceleration for an object in motion.
- Be able to determine the magnitude and direction of the resultant of two vectors.
- Be able to calculate the magnitude and direction of the vector from the cross product of two vectors A and B.
- Be able to describe in graphical form the position, velocity, and acceleration of an object that is thrown vertically upward and returns to its starting point.

- Be able to determine displacement, distance, velocity, and acceleration from graphs of position versus time, velocity versus time, and acceleration versus time.
- Be able to calculate the horizontal and vertical components of velocity for a projectile.
- Be able to identify, compare, and sum the forces acting on a block that is accelerating or moving at constant velocity on a rough horizontal surface, including the reaction forces.
- Be able to explain why gymnasts performing on a balance beam raise their arms to regain their balance.
- Be familiar with the coefficients of static, kinetic, and rolling friction.
- Be able to determine the coefficient of kinetic friction for a box sliding down an inclined plane at constant speed.
- Be able to calculate the centripetal force acting on an object moving at constant speed in a circular path.
- Be able to calculate the period and frequency of a simple pendulum or a spring in simple harmonic motion.
- Be able to plot the potential energy, kinetic energy, and total mechanical energy of a linear harmonic oscillator as a function of position.
- Be able to describe the changes that occur to the moment of inertia, angular momentum, and rotational kinetic energy of a student who extends their arms outward from an initial downward position while rotating about a vertical axis on a frictionless platform.
- Be able to apply the principles of conservation of momentum and energy to predict the results of collisions between objects in one or two dimensions.
- Be able to use the law of conservation of energy to predict the energy transformations of a bungee-cord jumper.
- Be able to calculate the gravitational force between two masses separated by a certain distance.
- Be able to determine the acceleration and period of a satellite in circular orbit about Earth.
- Be able to describe the relationship between a planet's period about the Sun and its mean distance from the Sun.
- Be able to calculate the buoyant force acting on an object.

IV. Electricity and Magnetism

A. Electricity

1. Electrostatics
   a. Electric charge and induced charge
   b. Conservation of charge, including charge transfer
   c. Coulomb's law and point charges
   d. Electric forces and electric fields
   e. Electric potential, energy, and potential difference
2. Conductors and insulators
   a. Electrical properties
   b. Material examples
3. Properties and relationships involving electric current and capacitance

a. Current, resistance, potential difference, and resistivity
b. Ohm's law
c. Energy and power
d. Direct current and alternating current
e. Capacitance and capacitors

4. Analysis of simple and combination circuits
   a. Series, parallel, and combination circuits
   b. Ohm's law
   c. Equivalent resistance and capacitance
   d. Kirchhoff's laws
   e. Power
5. Generation of electrical potential
   a. Sources (Batteries, photocells, generators)
   b. Electromotive force (EMF)

B. Magnetism

1. Magnetic fields, forces, and materials
   a. Magnetic field and magnetic flux
   b. Magnetic force
   c. Magnets (bar magnets and poles, permanent magnets, electromagnets)
   d. Transformers, motors, and generators
   e. Direction of fields and forces (right-hand rules)
   f. Magnetic field generated by steady current (Biot-Savart law)
   g. Force between current-carrying wires
   h. Force on moving charges in magnetic fields (Lorentz force)
2. Basic conceptual relationships between electric fields and magnetic fields
   a. Magnetic field caused by changing electric field (Ampere's law)
   b. Direction of induced current caused by changing magnetic field (Lenz's law)
   c. Induced EMF (Faraday's law of induction)
   d. EMF (due to motion of conductor)

Discussion Questions: Electricity and Magnetism

- Be able to calculate the electrostatic force between two point charges separated by a certain distance.
- Be able to determine the electric field and electric potential at a point midway between two point charges.
- Be able to determine the electric potential energy of a simple configuration of point charges.
- Be able to calculate the power dissipated by a resistor in a circuit.
- Be able to describe how the resistivity of a wire depends on its length and cross-sectional area.
- Be able to calculate the equivalent capacitance of two capacitors connected in series or two capacitors connected in parallel.
- Be able to calculate the capacitance of a parallel-plate capacitor.
- Be familiar with the effect of a dielectric on the capacitance of a parallel-plate capacitor.
- Be able to calculate the equivalent resistance of two resistors

connected in series or two resistors connected in parallel.
- Be able to calculate the current in a circuit consisting of series and parallel combinations of resistors.
- Be able to describe how to measure the resistance of a resistor in a circuit using a voltmeter and an ammeter.
- Be able to determine the magnitude and direction of the electric field needed to allow an electron to travel eastward undeflected in Earth's magnetic field.
- Be able to determine the magnitude and direction of the resultant magnetic field at a point midway between two long, parallel wires carrying currents in opposite directions and separated by a certain distance.
- Be able to determine the magnitudes and directions of the magnetic forces on two long, parallel current-carrying wires.
- Be able to determine the direction of the current induced in a metal rod that is aligned east-west and is dropped in Earth's magnetic field.

V. Waves

A. Conceptual Understanding of Wave Characteristics and Phenomena

1. Types of waves and their characteristics
   a. Transverse and longitudinal
   b. Mechanical and electromagnetic
   c. Relationships between amplitude, wavelength, frequency, period, speed of propagation, and energy
   d. Superposition and phase
   e. Intensity
   f. Spherical and plane waves
   g. Standing waves
2. Wave phenomena
   a. Reflection, refraction (including Snell's law), and total internal reflection
   b. Diffraction, interference and Young's double-slit interference experiment
   c. Polarization
   d. Scattering, absorption, dispersion, and transmission
   e. Resonance and natural frequencies, harmonics
   f. Doppler effect (moving source or observer)

B. Electromagnetic Waves, Sound, and Geometric Optics

1. Electromagnetic waves and the electromagnetic spectrum
   a. Electromagnetic waves (electric and magnetic fields, speed of light, energy)
   b. Electromagnetic spectrum (radio waves, microwaves, infrared, visible, ultraviolet, x-rays, gamma rays)
   c. The visible spectrum (red, orange, yellow, green, blue, violet)
   d. Applications of the Doppler effect involving electromagnetic waves

2. Sound
   a. Compression waves
   b. Speed of sound (sonic boom and sound barrier)
   c. Pitch (frequency) and loudness (intensity)
   d. Beats
   e. Resonance (open and closed pipes; strings)
   f. Applications of Doppler effect involving sound
3. Geometric optics
   a. Ray tracing
   b. Focal point, image distance, image size and magnification, real versus virtual image, image orientation
   c. Lenses (converging and diverging)
   d. Mirrors (plane, convex, concave)
   e. Simple instruments (magnifying glass, telescope, microscope, prisms)

Discussion questions: Waves

- Be able to explain why the sky appears blue.
- Be able to explain why colors are observed when sunlight falls on a soap bubble or an oil slick.
- Be able to calculate the fundamental frequency and harmonics of an organ pipe that is closed at one end.
- Be familiar with the procedures for ray tracing.
- Be able to locate and describe the image formed when an object is placed 50 centimeters in front of a thin converging lens of focal length 20 centimeters.

Science and Engineering Practices

The SEPs represent eight practices that scientists and engineers—and students and teachers—use to investigate the world and to design and build systems. Many test questions will integrate one or more of these practices.

1. Asking questions (for science) and defining problems (for engineering)
   - Ask questions that arise from careful observation of phenomena, models, or unexpected results, to clarify and/or seek additional information.
   - Ask questions that arise from examining models or a theory, to clarify and/or seek additional information and relationships.
   - Ask questions to determine relationships, including quantitative relationships, between independent and dependent variables.
   - Ask questions to clarify and refine a model, an explanation, or an engineering problem.
   - Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.
   - Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.
   - Define a design problem that can be solved through the development of an object, tool, process or system

and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions.

2. Developing and using models
   - Evaluate merits and limitations of two different models of the same proposed tool, process, mechanism, or system in order to select or revise a model that best fits the evidence or design criteria.
   - Design a test of a model to ascertain its reliability.
   - Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.
   - Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.
   - Develop a complex model that allows for manipulation and testing of a proposed process or system.
   - Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.
3. Planning and carrying out investigations
   - Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.
   - Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.
   - Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.
   - Select appropriate tools to collect, record, analyze, and evaluate data.
   - Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.
   - Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables.
4. Analyzing and interpreting data
   - Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.

- Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.
- Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.
- Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations.
- Evaluate the impact of new data on a working explanation and/or model of a proposed process or system.
- Analyze data to identify design features or characteristics of the components of a proposed process or system to optimize it relative to criteria for success.

5. Using mathematics and computational thinking
   - Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system.
   - Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations.
   - Apply techniques of algebra and functions to represent and solve scientific and engineering problems.
   - Use simple limit cases to test mathematical expressions, computer programs, algorithms, or simulations of a process or system to see if a model "makes sense" by comparing the outcomes with what is known about the real world.
   - Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m^3, acre-feet, etc.).
6. Constructing explanations (for science) and designing solutions (for engineering)
   - Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.
   - Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.
   - Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
   - Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.
   - Design, evaluate, and/or refine a solution to a complex real-world

problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and tradeoff considerations.

7. Engaging in argument from evidence
   - Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (e.g., trade-offs), constraints, and ethical issues.
   - Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments.
   - Respectfully provide and/or receive critiques on scientific arguments by probing reasoning and evidence and challenging ideas and conclusions, responding thoughtfully to diverse perspectives, and determining what additional information is required to resolve contradictions.
   - Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence.
   - Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge, and student-generated evidence.
   - Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and/or logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations).
8. Obtaining, evaluating, and communicating information
   - Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
   - Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem.
   - Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source.
   - Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible.
   - Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically).

Tasks of Teaching Science

This list includes instructional tasks that teachers engage in that are essential for effective Physics teaching. Many test questions will measure content through application to one or more of these tasks.

Scientific Instructional Goals, Big Ideas, and Topics

1. Selecting or sequencing appropriate instructional goals or big ideas for a topic
2. Identifying the big idea or instructional goal of an instructional activity
3. Choosing which science ideas or instructional activities are most closely related to a particular instructional goal
4. Linking science ideas to one another and to particular activities, models, and representations within and across units

Scientific Investigations and Demonstrations

5. Selecting investigations or demonstrations, including virtual, that facilitate understanding of disciplinary core ideas, scientific practices, or crosscutting concepts
6. Evaluating investigation questions for quality (e.g., testable, empirical)
7. Determining the variables, techniques, or tools that are appropriate for use by students to address a specific investigation question
8. Critiquing scientific procedures, data, observations, or results for their quality, accuracy, or appropriateness
9. Supporting students in generating questions for investigation or identifying patterns in data and observations

Scientific Resources (texts, curriculum materials, journals, and other print and media-based resources)

10. Evaluating instructional materials and other resources for their ability to address scientific concepts; engage students with relevant phenomena; develop and use scientific ideas; promote students' thinking about phenomena, experiences, and knowledge; take account of students' ideas and background; and assess student progress
11. Choosing resources that support the selection of accurate, valid, and appropriate goals for science learning

Student Ideas (including common misconceptions, alternate conceptions, and partial conceptions)

12. Analyzing student ideas for common misconceptions regarding intended scientific learning
13. Selecting diagnostic items and eliciting student thinking about scientific ideas and practices to identify common student misconceptions and the basis for those misconceptions
14. Developing or selecting instructional moves, approaches, or representations that provide evidence about common student misconceptions and help students move toward a better understanding of the idea, concept, or practice

Scientific Language, Discourse, Vocabulary, and Definitions

15. Selecting scientific language that is precise, accurate, grade-appropriate, and illustrates key scientific concepts
16. Anticipating scientific language and vocabulary that may be difficult for students
17. Modeling the use of appropriate verbal and written scientific language in critiquing arguments or explanations, in describing observations, or in using evidence to support a claim, etc.
18. Supporting and critiquing students' participation in and use of verbal and written scientific discourse and argumentation

Scientific Explanations (includes claim, evidence, and reasoning)

19. Critiquing student-generated explanations or descriptions for their generalizability, accuracy, precision, or consistency with scientific evidence
20. Selecting explanations of natural phenomena that are accurate and accessible to students

Scientific Models and Representations (analogies, metaphors, simulations, illustrations, diagrams, data tables, performances, videos, animations, graphs, and examples)

21. Evaluating or selecting scientific models and representations that predict or explain scientific phenomena or address instructional goals
22. Engaging students in using, modifying, creating, and critiquing scientific models and representations that are matched to an instructional goal
23. Evaluating student models or representations for evidence of scientific understanding
24. Generating or selecting diagnostic questions to evaluate student understanding of specific models or representations
25. Evaluating student ideas about what makes for good scientific models and representations

Physics (5266) Sample Test Questions

The sample questions that follow represent a number of the types of questions and topics that appear on the test. They are not, however, representative of the entire scope of the test in either content or difficulty. Answers with explanations follow the questions.

Directions: Each of the questions or incomplete statements below is followed by suggested answers or completions. Select the one that is best in each case.

1. A teacher is preparing a classroom demonstration. Of the following, which **TWO** should the teacher use as examples of material with high electrical conductivity?

   (A) Copper
   (B) Distilled water
   (C) Hard rubber
   (D) Stainless steel

2. Based on Snell's law, which **THREE** of the following are true about a ray of visible light that travels obliquely from air into glass?

   (A) The wavelength of the light increases.
   (B) The speed of the light decreases.
   (C) The frequency of the light remains the same.
   (D) The light ray bends toward the normal.

3. Which of the following is true about the production of electricity by means of nuclear power?

   (A) It causes carbon dioxide to be emitted in large amounts into the atmosphere.
   (B) Radioactive waste is produced as a by-product and must be disposed of safely.
   (C) It is much less efficient than other methods of producing electricity.
   (D) It involves nuclear fusion as the primary energy source for producing electricity.

4. A teacher explains that in the photoelectric effect, light incident on the surface of a metal results in the emission of electrons from the surface. Which of the following student statements after the lesson indicates the best understanding about the photoelectric effect?

   (A) The incident light must be above a threshold frequency for electrons to be emitted.
   (B) The work function of the metal surface must be equal to zero for electrons to be emitted.
   (C) The number of electrons emitted is independent of the intensity of the incident light.
   (D) The energy of the emitted electrons increases with an increase in the wavelength of the incident light.

5. A large rock is dropped from rest from the edge of a cliff that is 200 m above the surface of the ocean. How long does it take for the rock to hit the water? (Note: Ignore air resistance and assume $g = 10$ m/s^2).

   (A) $2\sqrt{5}$ s
   (B) 5 s
   (C) $2\sqrt{10}$ s
   (D) 20 s

6. Object 1 has kinetic energy K_1. Object 2 has 4 times the mass and $1/4$ the speed of object 1. What is the kinetic energy K_2 of object 2?

   (A) $K_2 = \frac{1}{16}K_1$
   (B) $K_2 = \frac{1}{4}K_1$
   (C) $K_2 = K_1$
   (D) $K_2 = 4K_1$

7. The electrostatic force between two point charges, q_1 and q_2, is F_1. If the distance R between the two charges is decreased to 1/3 R, what is the force F_2 between the charges?

   (A) $F_2 = 9F_1$
   (B) $F_2 = 3F_1$
   (C) $F_2 = F_1$
   (D) $F_2 = \frac{1}{9}F_1$

8. What is the speed of a wave if the wave crests are 4 meters apart and the period of the wave is 2 seconds?

   (A) 0.5 m/s
   (B) 2 m/s
   (C) 4 m/s
   (D) 8 m/s

9. Which of the following scientists first proposed the concept of matter waves?

   (A) Bohr
   (B) Einstein
   (C) Planck
   (D) de Broglie

10. The Bohr model was successful at explaining which of the following?

    (A) Electromagnetic induction
    (B) Wave-particle duality
    (C) Expansion of the universe
    (D) Emission and absorption spectra of hydrogen

11. A person, starting at point A, walks $300\ \text{m}$ directly north. The person then turns and walks $400\ \text{m}$ directly east, stopping at point B. What is the displacement of the person between points A and B?

    (A) $100\ \text{m}$
    (B) $350\ \text{m}$
    (C) $500\ \text{m}$
    (D) $700\ \text{m}$

12. A block of mass m is sliding at constant speed v down a ramp inclined at an angle θ with respect to level ground. The magnitude of the frictional force acting on the block is equal to which of the following? (Note: g is the acceleration due to gravity.)

    (A) 0
    (B) $m\upsilon$
    (C) mg
    (D) $mg\sin\theta$

13. According to kinetic molecular theory, the average translational kinetic energy of the particles of an ideal gas is proportional to which of the following properties of the gas?

    (A) Pressure
    (B) Absolute temperature
    (C) Volume
    (D) Entropy

14. A projectile is launched upward at a $45°$ angle relative to level ground. In the absence of air resistance, which of the following statements is true about the projectile at all points along its path of motion?

    (A) The net force acting on the projectile is equal to zero.
    (B) The only force acting on the projectile is the force of gravity.
    (C) The speed of the projectile is constant.
    (D) The acceleration of the projectile is equal to zero.

15. A simple pendulum that has a period T on Earth's surface is transported to the surface of a planet where the force of gravity is twice as great as the force of gravity on Earth. What is the period of the pendulum on the planet? (Note: Assume air resistance is negligible on both planets.)

    (A) $2T$
    (B) T
    (C) $\frac{T}{\sqrt{2}}$
    (D) $\frac{T}{2}$

16. After a lesson about electromagnetic induction, students are asked to name a device that transforms mechanical energy into electrical energy. Which of the following student responses indicates a good understanding about electromagnetic induction?

    (A) A transformer
    (B) A generator
    (C) A motor
    (D) A solar cell

17. Of the following regions of the electromagnetic spectrum, which has waves with the highest frequencies?

    (A) X-ray
    (B) Radio
    (C) Visible
    (D) Ultraviolet

X	*Y*
2.0	0.50
3.0	0.33
4.0	0.25
5.0	0.20

18. In a lab experiment, students were asked to determine the relationship between two variables *X* and *Y*. Based on the experimental data in the preceding table, which of the following student conclusions about the relationship between the two variables is correct?

    (A) *X* and *Y* have a direct linear relationship.
    (B) *X* and *Y* have an inverse linear relationship.
    (C) *X* and *Y* have a direct nonlinear relationship.
    (D) *X* and *Y* have an inverse nonlinear relationship.

19. The transfer of thermal energy through a vacuum by means of electromagnetic wave propagation is known as

    (A) radiation
    (B) convection
    (C) absorption
    (D) conduction

20. A satellite of mass *m* is in a circular orbit of radius *R* around Earth. What is the orbital speed of the satellite? (Note: M_E is the mass of Earth and *G* is the universal constant.)

    (A) 0

    (B) $\sqrt{\frac{GM_E}{R}}$

    (C) $\sqrt{\frac{GmM_E}{R^2}}$

    (D) $\sqrt{GM_ER}$

21. In a lesson about Kepler's laws, a teacher explains that Earth takes 1 year to make a complete revolution around the Sun and that Jupiter has an orbital radius slightly greater than 5 times the orbital radius of Earth. The students are asked to predict how long it takes Jupiter to make a complete revolution around the Sun. Which of the following student responses is best?

    (A) $\sqrt{5}$ years
    (B) 5 years
    (C) $5\sqrt{5}$ years
    (D) 25 years

22. How much power is dissipated by a 4.0-ohm resister connected in series to a 12-volt battery?

    (A) 3.0 watts
    (B) 12 watts
    (C) 36 watts
    (D) 72 watts

23. A 2-ohm resistor and a 4-ohm resistor are connected in parallel to an ideal 12-volt battery to form a closed circuit. What is the current supplied by the battery?

    (A) 2 amps
    (B) 6 amps
    (C) 9 amps
    (D) 16 amps

24. Which of the following phenomena is an example of the Doppler effect?

    (A) Diffraction of electrons
    (B) Emission and absorption spectra of hydrogen
    (C) Blackbody radiation
    (D) Redshift of light from distant galaxies

25. Of the following devices, which would be the best choice for a teacher to use in a lesson about the photoelectric effect?

    (A) Camera
    (B) Telescope
    (C) LED lightbulb
    (D) Automatic door opener

26. The first law of thermodynamics is a relationship involving which of the following quantities?

    (A) Internal energy, heat, and work
    (B) Force, mass, and acceleration
    (C) Voltage, current, and resistance
    (D) Pressure, volume, and temperature

27. After a lesson about buoyancy, students are asked to indicate a property of an object that determines whether the object will float or sink in water. Which of the following student responses identifies a property of the object that determines its buoyancy?

    (A) Density
    (B) Inertia
    (C) Volume
    (D) Weight

28. After a lesson about angular momentum, which of the following student claims about the angular momentum of a rotating object is true?

    (A) The angular momentum is always conserved.
    (B) The angular momentum decreases as the speed of rotation of the object increases.
    (C) The angular momentum depends on the mass of the rotating object.
    (D) The angular momentum is equal to the kinetic energy of a rotating object.

29. A block of mass *m*, moving to the right with speed v along a frictionless surface, collides with and sticks to a second block of mass $2m$ that is initially at rest. With what speed and in what direction do the blocks move after the collision?

    (A) $\frac{1}{3}v$ to the right
    (B) $\frac{1}{3}v$ to the left
    (C) $\frac{1}{2}v$ to the right
    (D) $\frac{1}{2}v$ to the left

30. An electron moving with velocity **v** enters a region in which the magnetic field **B** is perpendicular to the velocity of the electron. The magnetic force on the electron in the region is

    (A) equal to zero
    (B) parallel to **v**
    (C) parallel to **B**
    (D) perpendicular to both **v** and **B**

31. According to which of the following laws does a changing magnetic flux through a closed circuit induce an electromotive force in that circuit?

    (A) Gauss's law
    (B) Coulomb's law
    (C) Faraday's law
    (D) Lorentz force law

32. An organ pipe of length *L*, open at both ends, will vibrate at a fundamental frequency equal to which of the following? (Note: v_s is the speed of sound in air.)

(A) $\frac{v_s}{4L}$

(B) $\frac{v_s}{2L}$

(C) $\frac{v_s}{L}$

(D) $\frac{2v_s}{L}$

Physics (5266) Answers

1. **Options (A) and (D) are correct.** Copper and stainless steel (an alloy of iron) are both good conductors of electricity.

Content	IV A
Science and Engineering	3
Task of Teaching	1

2. **Options (B), (C) and (D) are correct.** The index of refraction of a medium is defined as the ratio of the speed of light in a vacuum to the speed of light in that medium. Glass has a higher index of refraction than air, which means that the speed of the visible light is less in the glass. The frequency is not affected by the medium and remains the same. According to Snell's law, the light ray will bend toward the normal. Since the speed of the light is equal to the wavelength multiplied by the frequency, the wavelength does not increase but decreases.

Content	V A
Science and Engineering	2

3. **Option (B) is correct.** Radioactive waste is a by-product of a nuclear power plant and must be disposed of safely. Nuclear power plants use nuclear fission as the primary energy source.

Content	I B

4. **Option (A) is correct.** There is a minimum frequency of the incident light, known as the threshold frequency, below which electrons will not be emitted.

Content	II A
Science and Engineering	6

5. **Option (C) is correct.** From kinematics, the distance traveled *y* is found from $y = y_0 + v_0 t + \frac{1}{2} g t^2$. Since $v_0 = 0$ and assuming that the distance traveled *y* is 200 m and that the initial starting point y_0 is 0, then $y = 200\ \text{m} = \frac{1}{2} g t^2$. Solving for *t* gives $t = \sqrt{\frac{2 \times 200\ \text{m}}{10\ \text{m/s}^2}} = \sqrt{40}\ \text{s} = 2\sqrt{10}\ \text{s}$.

Content	III A
Science and Engineering	5

6. **Option (B) is correct.** $K_2 = \frac{1}{2} m_2 v_2^2 = \frac{1}{2} 4 m_1 \times \left(\frac{1}{4} v_1\right)^2 = \frac{1}{8} m_1 \times v_1^2 = \frac{1}{4} K_1$

Content	III B
Science and Engineering	1
Task of Teaching	1

7. **Option (A) is correct.** According to Coulomb's law, the electrostatic force between the two point charges separated by a distance *R* is $F_1 = \frac{1}{4\pi\varepsilon_0} \times \frac{q_1 q_2}{R^2}$. If the distance is decreased to 1/3 *R*, the force between the charges is $F_2 = \frac{1}{4\pi\varepsilon_0} \times \frac{q_1 q_2}{(R/3)^2} = 9F_1$.

Content	IV A
Science and Engineering	1

8. **Option (B) is correct.** The speed is found from $v = \lambda \times f$, where λ is the wavelength or distance between wave crests and *f* is the frequency of the wave. The frequency is found from the period from $f = \frac{1}{\text{period}} = \frac{1}{2\ \text{s}} = 0.5\ \text{s}^{-1}$. Thus the speed of the wave is $v = \lambda \times f = 4\ \text{m} \times 0.5\ \text{s}^{-1} = 2\ \text{m/s}$

Content	V A
Science and Engineering	5

9. **Option (D) is correct.** Louis de Broglie first proposed that all matter has wave properties.

Content	I A

10. **Option (D) is correct.** The Bohr model of the atom, which introduced the concept of discrete atomic energy levels, was able to explain the emission and absorption spectra of hydrogen.

Content	II A
Science and Engineering	2

11. **Option (C) is correct.** The person's path from point A to point B consists of two sides of a 3-4-5 right triangle of lengths $300\ \text{m}$ and $400\ \text{m}$. The displacement of the person is equal to the length of the hypotenuse of the triangle, which is $500\ \text{m}$, since $(300\ \text{m})^2 + (400\ \text{m})^2 = (500\ \text{m})^2$ for the triangle.

Content	III A
Science and Engineering	5

12. **Option (D) is correct.** The block is moving at constant speed down the ramp, which means that the net force on the block is equal to zero. Thus, the frictional force must be equal in magnitude to the component of the weight of the block that is directed along the ramp, or $mg\sin\theta$.

Content	III B
Science and Engineering	5

13. **Option (B) is correct.** For an ideal gas, the average translational kinetic energy of the gas particles is proportional to absolute temperature, since it is equal to $\frac{3}{2}kT$, where k is Boltzmann's constant and T is the absolute temperature.

Content	II B
Science and Engineering	6

14. **Option (B) is correct.** In the absence of air resistance, gravity is the only force acting on the projectile at all points along its path of motion.

Content	III A
Science and Engineering	7

15. **Option (C) is correct.** The correct answer is (C). The period T of a simple pendulum is given by $T = 2\pi\sqrt{\frac{L}{g}}$, in which L is the length of the pendulum and g is the acceleration due to gravity. On the planet, the period of the pendulum is T_{planet} and acceleration due to gravity is g_{planet}. Thus, on the planet the period of the pendulum is found from $T_{\text{planet}} = 2\pi\sqrt{\frac{L}{g_{\text{planet}}}} = 2\pi\sqrt{\frac{L}{2g}} = \frac{T}{\sqrt{2}}$.

Content	III B
Science and Engineering	1

16. **Option (B) is correct.** A generator converts mechanical energy into electrical energy by means of electromagnetic induction.

Content	IV B
Science and Engineering	4

17. **Option (A) is correct.** Of the listed regions of the electromagnetic spectrum, waves in the x-ray region have the highest frequencies.

Content	V B

18. **Option (D) is correct.** The relationship between X and Y is expressed in the equation $Y = k\frac{1}{x}$, where k is a constant. A plot of the data will yield a curve that indicates a nonlinear relationship.

Content	I A
Science and Engineering	4
Task of Teaching	2

19. **Option (A) is correct.** Radiation is the transfer of thermal energy through a vacuum by means of electromagnetic waves.

Content	II B

20. **Option (B) is correct.** For circular motion in a gravitational field, the centripetal force on the satellite is equal to the gravitational force on the satellite, which is found from $F = \frac{mv^2}{R} = \frac{GmM_E}{R^2}$. Solving for the orbital speed gives $v = \sqrt{\frac{GM_E}{R}}$.

Content	III A
Science and Engineering	5

21. **Option (C) is correct.** According to Kepler's third law, the square of the orbital period T of a planet is proportional to the cube of its semimajor axis R. The constant of proportionality is the same for all of the planets. Thus,

$$T_{\text{Jupiter}} = T_{\text{Earth}} \times \left(\frac{R_{\text{Jupiter}}}{R_{\text{Earth}}}\right)^{\frac{3}{2}} \cong 1\,\text{year} \times \left(\frac{5}{1}\right)^{\frac{3}{2}} = 5\sqrt{5}\ \text{years}.$$

Content	III A
Science and Engineering	5
Task of Teaching	6

22. **Option (C) is correct.** The power P dissipated is found from $P = iR^2$, where $i = \frac{V}{R}$. Thus,

$$P = \left(\frac{V}{R}\right)^2 R = \frac{V^2}{R} = \frac{12\ \text{V} \times 12\ \text{V}}{4.0\ \text{ohms}} = 36\ \text{watts}.$$

Content	IV A
Science and Engineering	1

23. **Option (C) is correct.** According to Ohm's law, the current supplied by the battery is given by $I = \frac{12\ \text{V}}{R_{eq}}$, where R_{eq} is the equivalent resistance. The resistors are connected in parallel, and the battery is ideal with zero internal resistance. This means that $R_{eq} = \frac{2\ \text{ohms} \times 4\ \text{ohms}}{2\ \text{ohms} + 4\ \text{ohms}} = \frac{4}{3}\ \text{ohms}$. Thus, $I = \frac{12\ \text{V}}{4/3\ \text{ohms}} = 9\ \text{amps}$.

Content	IV A
Science and Engineering	5

24. **Option (D) is correct.** The Doppler effect is used to explain the shift toward longer wavelengths of the spectral lines from distant, receding galaxies.

Content	V B
Science and Engineering	5

25. **Option (D) is correct.** When a person passes through a beam of infrared light, the beam of light is interrupted from reaching a sensor that is based on the photoelectric effect. This results in a process that opens the door.

Content	I B
Science and Engineering	1

26. **Option (A) is correct.** The first law of thermodynamics is a statement of the law of conservation of energy and relates the following quantities: internal energy, heat, and work.

Content	II B

27. **Option (A) is correct.** From Archimedes' principle, it is the density of an object that determines whether the object will float or sink in water. Objects with a density less than the density of water will float.

Content	III A
Science and Engineering	5

28. **Option (C) is correct.** The equation for the angular momentum L of the rotating object is $L = mvr$. Hence the angular momentum depends on the mass m. As the speed of rotation v increases, the angular momentum increases rather than decreases. The angular momentum is not equal to the kinetic energy. Angular momentum is not conserved unless the net external torque acting on the object is zero.

Content	III B
Science and Engineering	7
Task of Teaching	7

29. **Option (A) is correct.** Linear momentum is conserved because there are no external forces acting on the system. The magnitude of the momentum before the collision is mv and is directed to the right. Thus, the magnitude of the momentum after the collision must also be mv and be directed to the right. The combined mass of the two blocks is $3m$, which means their speed is equal to $\frac{1}{3}v$.

Content	III B
Science and Engineering	7

30. **Option (D) is correct.** According to the Lorentz force law, the magnetic force **F** on the electron is equal to the vector product $-e\mathbf{v} \times \mathbf{B}$, which means that **F** is perpendicular to both **v** and **B**.

Content	IV B

31. **Option (C) is correct.** Faraday's law of electromagnetic induction states that the induced electromotive force in a closed circuit is equal to the rate of change of the magnetic flux through it.

Content	IV B

32. **Option (B) is correct.** For an open organ pipe vibrating at the fundamental frequency f, both ends of the pipe must be antinodes. This means that the length L of the pipe must be equal to half the wavelength λ of the sound, or $L = \frac{\lambda}{2}$.

Thus, $f = \frac{v_s}{\lambda} = \frac{v_s}{2L}$.

Content	V B
Science and Engineering	5

Understanding Question Types

The *Praxis*® assessments include a variety of question types: constructed response (for which you write a response of your own); selected response, for which you select one or more answers from a list of choices or make another kind of selection (e.g., by selecting a sentence in a text or by selecting part of a graphic); and numeric entry, for which you enter a numeric value in an answer field. You may be familiar with these question formats from taking other standardized tests. If not, familiarize yourself with them so you don't spend time during the test figuring out how to answer them.

Understanding Selected-Response and Numeric-Entry Questions

For most questions, you respond by selecting an oval to select a single answer from a list of answer choices.

However, interactive question types may also ask you to respond by:

- Selecting more than one choice from a list of choices.
- Typing in a numeric-entry box. When the answer is a number, you may be asked to enter a numerical answer. Some questions may have more than one entry box to enter a response. Numeric-entry questions typically appear on mathematics-related tests.
- Selecting parts of a graphic. In some questions, you will select your answers by selecting a location (or locations) on a graphic such as a map or chart, as opposed to choosing your answer from a list.
- Selecting sentences. In questions with reading passages, you may be asked to choose your answers by selecting a sentence (or sentences) within the reading passage.
- Dragging and dropping answer choices into targets on the screen. You may be asked to select answers from a list of choices and to drag your answers to the appropriate location in a table, paragraph of text or graphic.
- Selecting answer choices from a drop-down menu. You may be asked to choose answers by selecting choices from a drop-down menu (e.g., to complete a sentence).

Remember that with every question you will get clear instructions.

Understanding Constructed-Response Questions

Some tests include constructed-response questions, which require you to demonstrate your knowledge in a subject area by writing your own response to topics. Essays and short-answer questions are types of constructed-response questions.

For example, an essay question might present you with a topic and ask you to discuss the extent to which you agree or disagree with the opinion stated. You must support your position with specific reasons and examples from your own experience, observations, or reading.

Review a few sample essay topics:

- *Brown v. Board of Education of Topeka*

  "We come then to the question presented: Does segregation of children in public schools solely on the basis of race, even though the physical facilities and other 'tangible' factors may be equal, deprive the children of the minority group of equal educational opportunities? We believe that it does."

  A. What legal doctrine or principle, established in *Plessy v. Ferguson* (1896), did the Supreme Court reverse when it issued the 1954 ruling quoted above?
  B. What was the rationale given by the justices for their 1954 ruling?

- *In his self-analysis, Mr. Payton says that the better-performing students say small-group work is boring and that they learn more working alone or only with students like themselves. Assume that Mr. Payton wants to continue using cooperative learning groups because he believes they have value for all students.*

  - Describe **TWO** strategies he could use to address the concerns of the students who have complained.
  - Explain how each strategy suggested could provide an opportunity to improve the functioning of cooperative learning groups. Base your response on principles of effective instructional strategies.

- *"Minimum-wage jobs are a ticket to nowhere. They are boring and repetitive and teach employees little or nothing of value. Minimum-wage employers take advantage of people because they need a job."*

  - Discuss the extent to which you agree or disagree with this opinion. Support your views with specific reasons and examples from your own experience, observations, or reading.

Keep these things in mind when you respond to a constructed-response question:

1. **Answer the question accurately.** Analyze what each part of the question is asking you to do. If the question asks you to describe or discuss, you should provide more than just a list.
2. **Answer the question completely.** If a question asks you to do three distinct things in your response, you should cover all three things for the best score. Otherwise, no matter how well you write, you will not be awarded full credit.
3. **Answer the question that is asked.** Do not change the question or challenge the basis of the question. You will receive no credit or a low score if you answer another question or if you state, for example, that there is no possible answer.
4. **Give a thorough and detailed response.** You must demonstrate that you have a thorough understanding of the subject matter. However, your response should be straightforward and not filled with unnecessary information.
5. **Take notes on scratch paper** so that you don't miss any details. Then you'll be sure to have all the information you need to answer the question.
6. **Reread your response.** Check that you have written what you thought you wrote. Be sure not to leave sentences unfinished or omit clarifying information.

General Assistance For The Test

Praxis® Interactive Practice Test

This full-length *Praxis*® practice test lets you practice answering one set of authentic test questions in an environment that simulates the computer-delivered test.

- Timed just like the real test
- Correct answers with detailed explanations
- Practice test results for each content category

You can learn more and purchase the practice test here.

Doing Your Best

Strategy and Success Tips

Effective *Praxis* test preparation doesn't just happen. You'll want to set clear goals and deadlines for yourself along the way. Learn from the experts. Get practical tips to help you navigate your Praxis test and make the best use of your time. Learn more at Strategy and Tips for Taking a *Praxis* Test.

Develop Your Study Plan

Planning your study time is important to help ensure that you review all content areas covered on the test. View a sample plan and learn how to create your own. Learn more at Develop a Study Plan.

Helpful Links

Ready to Register – How to register and the information you need to know to do so.

Disability Accommodations – Testing accommodations are available for test takers who meet ETS requirements.

PLNE Accommodations (ESL) – If English is not your primary language, you may be eligible for extended testing time.

What To Expect on Test Day – Knowing what to expect on test day can make you feel more at ease.

Getting Your Scores – Find out where and when you will receive your test scores.

Getting Your Scores – Find out where and when you will receive your test scores.

State Requirements – Learn which tests your state requires you to take.
Other Praxis Tests – Learn about other *Praxis* tests and how to prepare for them.

To search for the *Praxis* test prep resources that meet your specific needs, visit:

www.ets.org/praxis/testprep

To purchase official test prep made by the creators of the *Praxis* tests, visit the ETS Store:

www.ets.org/praxis/store



www.ets.org

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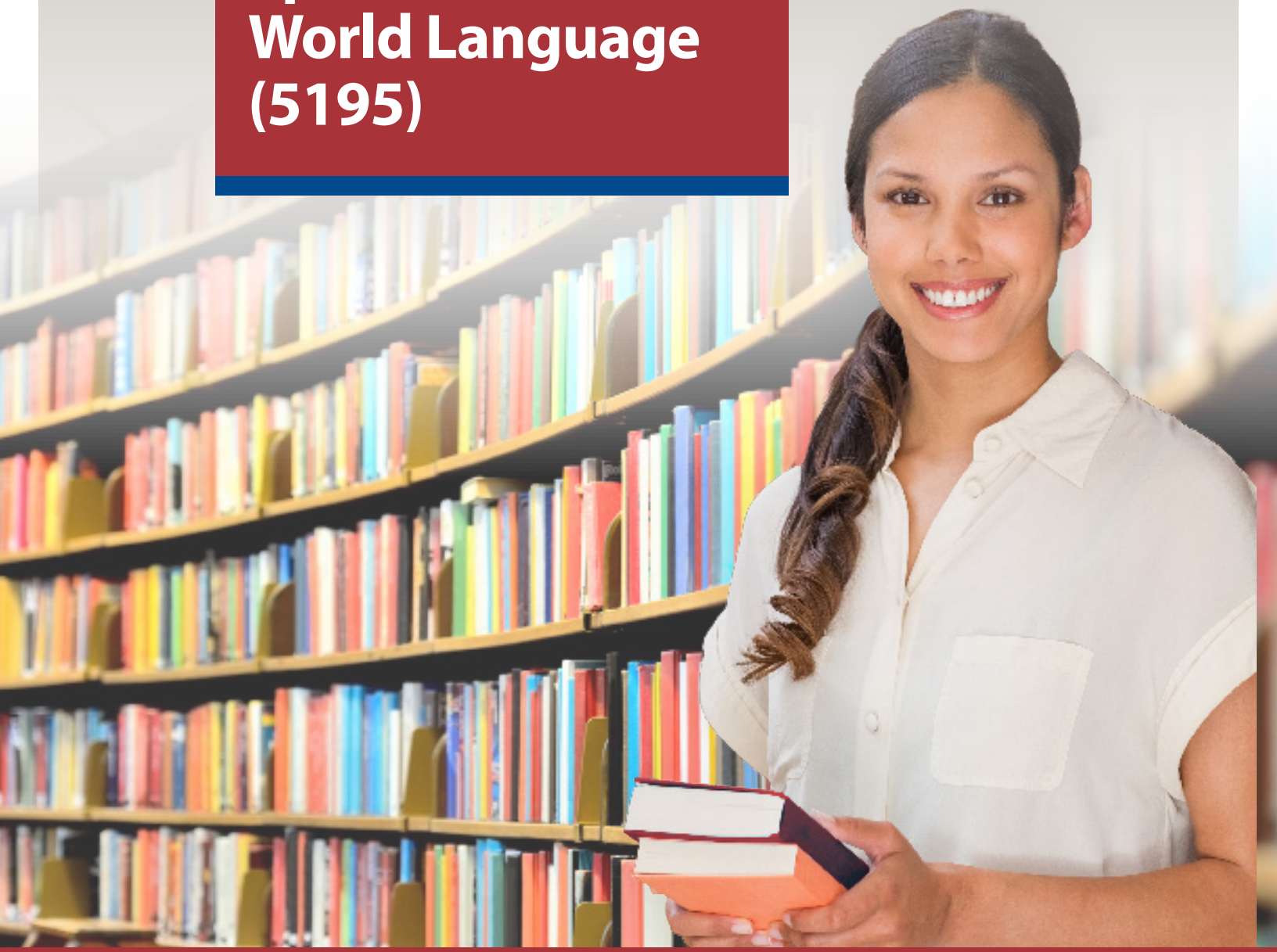
ETS PRAXIS

The *Praxis*®
Study Companion

Spanish: World Language (5195)



www.ets.org/praxis

Welcome to *The Praxis® Study Companion*

Prepare to Show What You Know

You have been working to acquire the knowledge and skills you need for your teaching career. Now you are ready to demonstrate your abilities by taking a *Praxis®* test.

Using the *Praxis Study Companion* is a smart way to prepare for the test so you can do your best on test day. This guide can help keep you on track and make the most efficient use of your study time.

The Study Companion contains practical information and helpful tools, including:

- An overview of the *Praxis* tests
- Specific information on the *Praxis* test you are taking
- A template study plan
- Study topics
- Practice questions and explanations of correct answers
- Test-taking tips and strategies
- Frequently asked questions
- Links to more detailed information

So where should you start? Begin by reviewing this guide in its entirety and note those sections that you need to revisit. Then you can create your own personalized study plan and schedule based on your individual needs and how much time you have before test day.

Keep in mind that study habits are individual. There are many different ways to successfully prepare for your test. Some people study better on their own, while others prefer a group dynamic. You may have more energy early in the day, but another test taker may concentrate better in the evening. So use this guide to develop the approach that works best for you.

Your teaching career begins with preparation. Good luck!

Know What to Expect

Which tests should I take?

Each state or agency that uses the *Praxis* tests sets its own requirements for which test or tests you must take for the teaching area you wish to pursue.

Before you register for a test, confirm your state or agency's testing requirements at www.ets.org/praxis/states.

How are the *Praxis* tests given?

Praxis tests are given on computer. Other formats are available for test takers approved for accommodations (see page 48).

What should I expect when taking the test on computer?

When taking the test on computer, you can expect to be asked to provide proper identification at the test center. Once admitted, you will be given the opportunity to learn how the computer interface works (how to answer questions, how to skip questions, how to go back to questions you skipped, etc.) before the testing time begins. Watch the What to Expect on Test Day video to see what the experience is like.

Where and when are the *Praxis* tests offered?

You can select the test center that is most convenient for you. The *Praxis* tests are administered through an international network of test centers, which includes Prometric® Testing Centers, some universities, and other locations throughout the world.

Testing schedules may differ, so see the *Praxis* web site for more detailed test registration information at www.ets.org/praxis/register.

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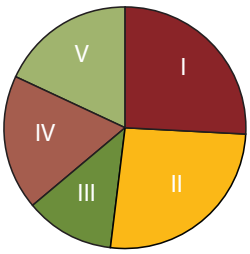
1. Learn About Your Test

Learn about the specific test you will be taking

Spanish: World Language (5195)

Test at a Glance	
Test Name	Spanish: World Language
Test Code	5195
Time	Approximately 3 hours, including the Listening with Cultural Knowledge Practice and the optional Writing Practice with the built-in character toolbar for the Writing section
Number of Questions	75 selected-response questions and 6 constructed-response questions
Format	Listening with Cultural Knowledge Practice (not scored); 6 selected-response questions (10 minutes) Section 1. Listening with Cultural Knowledge; 36 selected-response questions (50 minutes) Section 2. Reading with Cultural Knowledge; 39 selected-response questions (50 minutes) Writing Practice (not scored); one optional practice constructed-response exercise using the built-in character toolbar (5 minutes) Section 3. Writing, with 3 constructed-response tasks (50 minutes) Section 4. Speaking, with 3 constructed-response tasks (15 minutes) **Note:** This test will include questions with an audio component in the Listening and Speaking sections.
Test Delivery	Computer delivered



Content Categories	Approximate Number of Questions	Approximate Percentage of Examination
I. Interpretive Listening, including embedded linguistic content	30 selected response	26%
II. Interpretive Reading, including embedded linguistic content	30 selected response	26%
III. Cultural Knowledge (Tested in Sections 1 and 2)	15 selected response	12%
IV. Interpersonal and Presentational Writing	3 written responses (constructed response)	18%
V. Presentational and Interpersonal Speaking	3 spoken responses (constructed response)	18%

About This Test

This test is designed to measure the knowledge, skills, and abilities of examinees who have had preparation in a program for teaching Spanish in grades K through 12. Because programs in teaching Spanish are offered at both the undergraduate and graduate levels, this test is appropriate for examinees at either level. All sections of this test are at the Advanced-Low level, as described in the proficiency guidelines of the American Council on the Teaching of Foreign Languages (ACTFL).

This test integrates listening, reading, writing, and speaking skills, as well as linguistic and cultural knowledge, through active participation in a variety of questions in the interpretive modes (in the Listening and Reading sections) and in the interpersonal and presentational modes (in the Writing and Speaking sections). The Listening and Reading sections of the test are composed of selected-response questions, whereas the Writing and Speaking sections are composed of constructed-response tasks.

All questions and answer choices are in Spanish and are based on various genres of authentic material, whether written or in audio format, from various Spanish-speaking regions of the world.

This is a computer-based test with sections of various lengths and time constraints. All sections of the test are separately timed. While the time allotted in the Reading and Writing sections is managed by the candidate, timing is computer controlled throughout the Listening and Speaking sections. Prior to beginning the Listening section, the candidate will participate in a practice exercise reflecting the type of questions in the Listening section. Similarly, there is a writing practice exercise prior to the Writing section to acquaint candidates with a special character toolbar that they will be using to type their individual responses in Spanish.

This test may contain some questions that do not count toward your score.

Discussion Questions

Interspersed throughout the study topics are discussion questions, presented as open-ended questions or statements. These discussion areas are intended to help test your knowledge of fundamental concepts and your ability to apply those concepts to situations in the classroom or the real world. Most of the areas require you to combine several pieces of knowledge to formulate an integrated understanding and response. If you spend time on these areas, you will gain increased understanding and facility with the subject matter covered on the test. You may want to discuss these areas and your answers with a teacher or mentor.

Note that this study companion *does **not** provide answers for the discussion area questions*, but thinking about the answers to them will help improve your understanding of fundamental concepts and will probably help you answer a broad range of questions on the test.

Content Topics

An overview of the areas covered on the test, along with their subareas, follows.

I. Content Categories I, II, IV, and V – Language, Linguistics, and Comparisons (88%)

A. Demonstrating language proficiency in the target language (at the Advanced Low level, as described in the American Council on the Teaching of Foreign Languages [ACTFL] Proficiency Guidelines)

The beginning Spanish teacher:

1. Knows how to communicate in the target language with native speakers unaccustomed to interacting with nonnative speakers, with sufficient accuracy, clarity, and precision to convey the intended message
2. Knows how to communicate in the interpersonal mode (speaking) by participating actively in informal and formal conversations on topics covering home, school, leisure activities, and current events
3. Knows how to communicate in the interpersonal mode (writing) in written exchanges on daily topics
4. Comprehends in the interpretive mode (listening) main ideas and supporting details of audio segments, such as news items, short stories, social notices, and reports on familiar topics that deal with factual information

5. Comprehends in the interpretive mode (reading) main ideas and supporting details of printed texts, such as news items, short stories, social notices, and reports on familiar topics that deal with factual information
6. Knows how to negotiate meaning in order to sustain an interaction
7. Knows how to move beyond literal comprehension in the interpretive mode (listening) by inferring the meaning of unfamiliar words and phrases in new contexts, inferring and interpreting the author's intent, and offering a personal interpretation of the message
8. Knows how to move beyond literal comprehension in the interpretive mode (reading) by inferring the meaning of unfamiliar words and phrases in new contexts, inferring and interpreting the author's intent, and offering a personal interpretation of the message
9. Understands the gist of normal conversational speech on a variety of topics
10. Knows how to communicate in the presentational mode (writing) by writing routine social correspondence, as well as coherent narratives, descriptions, and summaries about familiar topics of a factual nature in paragraph length in present, past, and future tense
11. Knows how to communicate orally in the presentational mode (speaking) by delivering oral presentations on familiar literary or cultural topics and incorporating extra linguistic support to facilitate oral presentations that are extemporaneous or prepared but not read

B. Understanding linguistics—linguistic features of the target language

The beginning Spanish teacher:

1. Understands the rules of the sound system of the target language (i.e., recognizing phonemes and allophones)
2. Recognizes key cohesive devices (conjunctions and adverbs) used in connected discourse
3. Understands high-frequency idiomatic expressions and can infer meaning of words and sentences
4. Knows how to explain the rules that govern the formation of words and sentences in the target language
5. Knows how to exemplify the rules with examples from the target language, such as the verb structures and verb tenses, pronouns, agreement (such as subject/verb, adjective/noun), word order, and interrogatives, both in terms of regularities and irregularities
6. Knows how to identify and use the pragmatic and sociolinguistic conventions and register (formal and informal forms of address)

C. Comparing the target language with English

The beginning Spanish teacher:

1. Knows how to identify similarities and differences between the target language and English
2. Knows how to contrast syntactical patterns of simple sentences and questions in the target language with those of English

Discussion questions: Content Categories I, II, IV, and V – Language, Linguistics, and Comparisons

- What strategies should be used when interpreting implicit meaning in a listening or reading stimulus in a given context?
- What criteria determine the use of appropriate register in interpersonal speaking and writing communication?
- How can one familiarize oneself with regional linguistic variations often encountered in authentic documents?
- What strategies could be implemented to master the use of vocabulary, idiomatic expressions, and grammatical structures (i.e., verb tenses, pronouns, adjectives, adverbs, etc.) of the target language?

II. Content Category III – Cultures, Literatures, and Cross-disciplinary Concepts (12%)

A. Demonstrating cultural understanding—connections among the perspectives of the target culture and its practices and products

The beginning Spanish teacher:

1. Knows the three Ps:
    a. perspectives (such as attitudes, ideas, and values)
    b. practices (patterns of behavior and social interaction, such as greetings, turn taking, and rites of passage)
    c. products (such as foods, architecture, literature, art, and music)
2. Recognizes the value and role of authentic literary and cultural texts—such as songs, poems, rhymes and chants, children's books, narrative text, and novels—and usage of those texts to interpret and reflect on the perspectives of the target culture

Discussion questions: Content Category III – Cultures, Literatures, and Cross-disciplinary Concepts

- What are some important cultural aspects (i.e., social, cultural, artistic, etc.) that help inform one's understanding of the target culture?

Cultural Knowledge Topics

Lifestyles and Societies

In these questions, your knowledge of the way of life and customs in Spanish-speaking countries and regions will be tested.

- Contemporary lifestyles
- Food and beverages representative of the Hispanic cultures
- Social behaviors and customs (e.g., *quinceañeras*, salutations, etc.)
- Commonly celebrated religious and public holidays
- Family relationships
- Education

Sociolinguistic Elements of Spanish

These questions test your knowledge and understanding of appropriate language and expressions. They may require you to make inferences regarding social situations or the audience addressed by a selection, based on linguistic cues in that selection.

- Customary usage of certain words or expressions to indicate register, such as the use of usted as opposed to tú
- Idiomatic expressions and common sayings

Literature and the Arts

For these questions, you should acquaint yourself with the most commonly known works, authors, and artistic trends in all Spanish-speaking countries:

- Major trends, periods, and movements in Spanish, Latin American, and United States. Hispanic literature. Examples: the Spanish Golden Age, the Generación del 27, el Modernismo, el boom latinoamericano, Chicano literature.
- Significant figures, works, and trends in the plastic arts (painting and sculpture). Examples: Velázquez, Goya, Picasso, Frida Kahlo, Botero.
- Architecture in Spain and Latin America. Examples: Arab, Gothic and Baroque architecture, pre-Columbian architecture, colonial architecture.
- Music and Dance. Examples: the works of Manuel de Falla, flamenco, typical instruments such as the guitar, dances such as the tango and the cumbia.

History

In these questions, your knowledge of basic historical facts and background of Spain and Spanish-speaking countries and regions will be tested.

- Pre-Columbian civilizations
- Jewish, Muslim, and Christian civilizations in Spain
- Exploration of the New World
- Most important events and principal historic figures of Spain and other Spanish-speaking countries
- Contemporary world politics and economics as they relate to Spain and other Spanish-speaking countries and regions (e.g., trade agreements)

Geography

Sometimes a culture question may involve locating Spanish-speaking countries or regions or identifying major geographical features such as major cities, rivers, or mountains in

- Europe
- North America
- Central America and the Caribbean
- South America
- Spanish-speaking areas within the United States

Once again, test takers are reminded that these are simply lists of possible topics, events, and areas that may appear in the Cultural Knowledge part of the test.

Linguistic Knowledge

One of the group of six questions based on each Listening or Reading selection may test your linguistic knowledge. Questions related to linguistic knowledge include grammar, syntax, use of register, or pronunciation using a citation from the selection. You will not find the answer to these questions directly in the selections, but will need to rely on your knowledge of the Spanish language to respond.

The following list may be helpful in your preparation for the linguistic-knowledge component of the test, but please keep in mind that this is to serve as a guide and is not intended to be an exhaustive description of Spanish grammar and language use.

- Understanding the rules of Spanish-language phonology and phonetics
- Recognizing basic regional differences in the Spanish language
- Understanding aspects of Spanish grammar such syntax, major verb tenses and moods
- Understanding high-frequency idiomatic expressions

In particular, you should be acquainted with the following concepts and their application in Spanish:

- Use of nouns, adjectives, adverbs, and articles (e.g., gender and number agreement with nouns, possessive and demonstrative adjectives, definite and indefinite articles, including use with dates, seasons, and time)
- Use of the positive, comparative, and superlative forms of adjectives and adverbs
- Use of indefinite and negative expressions
- Use of prepositions
- Use of pronouns (e.g., demonstrative, possessive, direct and indirect object, reflexive)
- Use of the auxiliary verb *haber* + the past participle
- Use of regular and irregular verbs in all tenses and moods

Test Sections

The Listening Practice section, Section 1 (Listening), and Section 4 (Speaking) are recorded. For Section 4, you must answer the questions when instructed to do so on the recording. Descriptions of the test sections are provided below.

Listening Practice Section - Interpretive Mode: Listening with Cultural Knowledge

This section allows you to listen to an audio selection in Spanish and to practice answering questions based on that selection in the time allotted. This Listening Practice section is timed separately from the Listening section that folllows, and the time you spend practicing will not be counted toward the time allotted to answering the questions in the Listening section. The questions in this section will NOT be scored and will NOT affect your results in any way.

Section 1 - Interpretive Mode: Listening with Cultural Knowledge

The selections in Section 1 are recorded.

In this section, you will hear a variety of selections, such as radio broadcasts, narratives, and dialogues, in Spanish. Each selection is followed by six questions. Each selection will be played twice. You will hear the selection and then you will have 60 seconds to preview the questions before the selection plays a second time. For each question, choose the response that is best, relative to the selection. The last two questions may test your knowledge of culture and linguistics. You may take notes as you listen. Your notes will not be graded.

After listening to a selection the second time, you will see six questions presented one at a time. You will have 20 seconds to answer each question. A clock at the top of the screen will indicate how much time is remaining to answer the question. The entire Listening section lasts approximately 50 minutes.

When the response time has ended, you will automatically be taken to the next question. You will not be able to return to previous questions.

Section 2 - Interpretive Mode: Reading with Cultural Knowledge

In this section, you will be presented with a variety of selections, such as newspaper articles, excerpts of literary passages, and other materials, in Spanish. Each selection is followed by six questions. The last two questions may test your knowledge of culture and linguistics. In addition, you will be presented with some visual stimuli (e.g., photographs or works of art), each accompanied by a single cultural knowledge question.

You may take notes as you read, but **only** on the scratch paper that will be provided. Your notes will not be graded.

Each of the questions is followed by four suggested answers. Select the one that is best in each case.

Cultural Knowledge

- The culture questions are in Spanish and are part of Section 1 (Listening) and Section 2 (Reading).
- Questions focus on connections among the perspectives of the target culture and its practices and products.

Section 3 - Interpersonal and Presentational Writing

There are three tasks in this section. Be sure to complete each task. Please pace yourself as you work.

Type your answers in Spanish in the space provided. For Spanish-specific characters (e.g., *ñ*, *é*, *í*, *¿*, etc.), use the built-in character toolbar (**click here** to view a demo of the toolbar). You should give as complete a response as possible. Your written Spanish should be acceptable to a wide range of native speakers.

Note: *To run the built-in character toolbar tutorial from the preceding link, you need Java Runtime Environment version 1.8_66 installed on your computer. If you do not have Java Runtime Environment version 1.8_66, you can download it for free or you can visit the Java website to install it. To avoid issues with the download, be sure to uninstall all Java versions in your system and reboot your computer before downloading version 1.8_66. When you click on the tutorial link below, a security prompt asks you to allow the program to run. This is normal. The toolbar tutorial runs the same version of Java that is on the actual test to ensure that the tutorials accurately reflect the testing experience. When the prompt appears, click Allow (or Keep).*

Additionally, if your security settings are set very high, a second security prompt asks you to run the application. Again, this is normal. When this prompt appears, click Run.

If you are unsure if your computer has Java Runtime Environment version 1.8_66, navigate to Start/Control Panel/Java. From the Java Control Panel popup window, select the Java tab, then the View button. The Java Runtime Environments Setting window displays the currently installed versions of Java.

You may use the scratch paper that will be provided to take notes on each task. These notes will not be used in evaluating your response.

Your writing will be evaluated on the following:

- Overall comprehensibility to a native speaker of Spanish who is not accustomed to the writing of nonnative learners
- Accuracy and appropriateness of content
- Presentation of ideas in a related and logical manner
- Appropriateness of vocabulary
- Accuracy of grammar and mechanics (including spelling and diacritical marks)
- Cohesiveness (including use of varied sentence structure and transitional expressions where appropriate)
- Appropriateness for a given task and/or reader (register)
- The extent to which each task is completed

Interpersonal Writing: Response to an E-mail, Memo, or Letter

Directions: Read the following e-mail and write an appropriate response in the space provided. Manage your time to allow for planning, writing, and revising your response. The length of your response should be **at least 60 words**.

Presentational Writing: Opinion/Position Essay

Directions: Read the following question and use the space provided to write an essay on the topic given. Make sure that your essay includes reasons and/or examples to support your opinion. Manage your time to allow for planning, writing, and revising your response. The length of your response should be **at least 120 words**.

Presentational Writing: Integrated Skills

Directions: Based on the information in the passage, complete the following task. Write your response in the space provided. Manage your time to allow for planning, writing, and revising your response. The length of your response should be **at least 120 words**.

Section 4 - Presentational and Interpersonal Speaking

This section includes three tasks and is designed to measure different aspects of your ability to speak Spanish. Although you need not speak for the entire time allotted, you should give as complete a response as possible.

For each speaking task in the test, you will be given time to prepare your response and time to record your response. A tone will indicate when to begin speaking, and a clock on your screen will indicate how much time you have left.

Begin speaking only when the voice on the recording directs you to respond; you will not be given credit for anything recorded during the preparation time. As you speak, your response will be recorded. Your score for these tasks will be based only on what is on the recording. It is important that you speak loudly enough and clearly enough into the microphone. Your speaking will be evaluated on the following:

- Overall comprehensibility to a native speaker of Spanish who is not accustomed to interacting with nonnative speakers
- Accuracy and appropriateness of the content
- Presentation of ideas in a related and logical manner
- Appropriateness of vocabulary
- Accuracy of grammar and pronunciation
- Fluency of delivery and cohesiveness (including use of varied sentence structure and transitional expressions where appropriate)
- Appropriateness for a given task and/or listener
- The extent to which each task is completed

If you do not know specific vocabulary, try to express yourself as well as you can, using circumlocution if necessary. If you make a mistake and correct it soon afterward, it will not be considered a mistake. You may take notes **only** on the scratch paper that will be provided. These notes will not be used in evaluating your responses.

Presentational Speaking: Integrated Skills

Directions: You will be asked to speak on a topic related to the passage you have already read. First, you will have 15 seconds to read these directions, and then you will hear the topic and the requirements for your response. You will have 3 minutes to review the passage and prepare your response. Then you will have 2 minutes to record your response. A tone will indicate when you should begin speaking.

Presentational Speaking: Express an Opinion or Make an Oral Presentation

Directions: You will be asked to give an oral presentation on a specific topic. First, you will have 15 seconds to read these directions, and then you will hear the topic for your presentation. You will have 2 minutes to prepare your response. Then you will have 2 minutes to record your response. A tone will indicate when you should begin speaking. You should respond as fully and as appropriately as possible.

Interpersonal Speaking: Simulated Conversation

Directions: You will participate in a simulated conversation within a context. First, you will have 30 seconds to read the outline of the conversation. In each pair of lines, the first line gives you an idea of what you will hear, and the second, bolded line gives you an idea of what you will be expected to say. You will have five turns to participate in the conversation. A tone will indicate when to begin speaking. Each time it is your turn to speak, you will have 25 seconds to respond. You should participate in the conversation as fully and as appropriately as possible.

2. Understanding Question Types

Become comfortable with the types of questions you'll find on the Praxis *tests*

The *Praxis*® assessments include a variety of question types: constructed response (for which you write a response of your own); selected response, for which you select one or more answers from a list of choices or make another kind of selection (e.g., by selecting a sentence in a text or by selecting part of a graphic); and numeric entry, for which you enter a numeric value in an answer field. You may be familiar with these question formats from taking other standardized tests. If not, familiarize yourself with them so you don't spend time during the test figuring out how to answer them.

Understanding Selected-Response and Numeric-Entry Questions

For most questions, you respond by selecting an oval to select a single answer from a list of answer choices.

However, interactive question types may also ask you to respond by:

- Selecting more than one choice from a list of choices.
- Typing in a numeric-entry box. When the answer is a number, you may be asked to enter a numerical answer. Some questions may have more than one entry box to enter a response.
- Selecting parts of a graphic. In some questions, you will select your answers by selecting a location (or locations) on a graphic such as a map or chart, as opposed to choosing your answer from a list.
- Selecting sentences. In questions with reading passages, you may be asked to choose your answers by selecting a sentence (or sentences) within the reading passage.
- Dragging and dropping answer choices into targets on the screen. You may be asked to select answers from a list of choices and to drag your answers to the appropriate location in a table, paragraph of text or graphic.
- Selecting answer choices from a drop-down menu. You may be asked to choose answers by selecting choices from a drop-down menu (e.g., to complete a sentence).

Remember that with every question you will get clear instructions.

Understanding Constructed-Response Questions

Constructed-response questions require you to demonstrate your knowledge in a subject area by writing your own response to topics. Essays and short-answer questions are types of constructed-response questions.

For example, an essay question might present you with a topic and ask you to discuss the extent to which you agree or disagree with the opinion stated. You must support your position with specific reasons and examples from your own experience, observations, or reading.

Review a few sample essay topics:

- *Brown* v. *Board of Education of Topeka*

  "We come then to the question presented: Does segregation of children in public schools solely on the basis of race, even though the physical facilities and other 'tangible' factors may be equal, deprive the children of the minority group of equal educational opportunities? We believe that it does."

A. What legal doctrine or principle, established in *Plessy* v. *Ferguson* (1896), did the Supreme Court reverse when it issued the 1954 ruling quoted above?

B. What was the rationale given by the justices for their 1954 ruling?

- *In his self-analysis, Mr. Payton says that the better-performing students say small-group work is boring and that they learn more working alone or only with students like themselves. Assume that Mr. Payton wants to continue using cooperative learning groups because he believes they have value for all students.*
  - Describe **TWO** strategies he could use to address the concerns of the students who have complained.
  - Explain how each strategy suggested could provide an opportunity to improve the functioning of cooperative learning groups. Base your response on principles of effective instructional strategies.

- *"Minimum-wage jobs are a ticket to nowhere. They are boring and repetitive and teach employees little or nothing of value. Minimum-wage employers take advantage of people because they need a job."*
  - Discuss the extent to which you agree or disagree with this opinion. Support your views with specific reasons and examples from your own experience, observations, or reading

Keep these things in mind when you respond to a constructed-response question:

1. **Answer the question accurately.** Analyze what each part of the question is asking you to do. If the question asks you to describe or discuss, you should provide more than just a list.
2. **Answer the question completely.** If a question asks you to do three distinct things in your response, you should cover all three things for the best score. Otherwise, no matter how well you write, you will not be awarded full credit.
3. **Answer the question that is asked.** Do not change the question or challenge the basis of the question. You will receive no credit or a low score if you answer another question or if you state, for example, that there is no possible answer.
4. **Give a thorough and detailed response.** You must demonstrate that you have a thorough understanding of the subject matter. However, your response should be straightforward and not filled with unnecessary information.
5. **Take notes on scratch paper** so that you don't miss any details. Then you'll be sure to have all the information you need to answer the question.
6. **Reread your response.** Check that you have written what you thought you wrote. Be sure not to leave sentences unfinished or omit clarifying information.

3. Practice with Sample Test Questions

Answer practice questions and find explanations for correct answers

Sample Test Questions

All selections in Section 1 are based on authentic recordings of native speakers. Therefore, the transcriptions reflect real spoken language and may contain hesitations, repetitions, and minor errors.

Section 1: Listening with Cultural Knowledge

Directions: This section is designed to measure how well you understand spoken Spanish and the cultures of Spanish-speaking countries.

You will listen to several selections in Spanish. Each selection will be played twice. You will hear the selection and then you will have 60 seconds to preview the questions before the selection plays a second time. For each question, choose the response that is best, relative to the selection. The last two questions may test your knowledge of culture and linguistics. You may take notes as you listen. Your notes will not be graded.

After listening to a selection the second time, you will see six questions presented one at a time. You will have 20 seconds to answer each question. A clock at the top of the screen will indicate how much time is remaining to answer the question. The entire Listening section lasts approximately 50 minutes.

When the response time has ended, you will automatically be taken to the next question. **You will not be able to return to previous questions.**

You may now begin.

Script:

Las preguntas 1-6 están basadas en la siguiente informe

Narrator: *Escuche este informe sobre el nopal.*

Reporter: *Desde la época de los aztecas el nopal, este espinoso cactus en forma de raqueta, es uno de los protagonistas de la cultura mexicana, su gastronomía e incluso su medicina. Ahora se perfila como generador de energía eléctrica. Desde mayo un proyecto piloto en Milpa Alta, al sur de la Ciudad de México, transforma en energía los residuos provenientes de la cáscara y las espinas.*

Man 1: *Es la parte del desecho que se está utilizando ya para que con las bacterias empiece a hacer la transformación de lo que va a ser el biogás, de lo que va a ser el mejorador de suelos, y la reutilización del agua residual.*

Reporter: *Milpa Alta es uno de los mayores productores de nopal con 200.000 toneladas al año y diariamente produce hasta 10 toneladas de desechos. En el biodigestor, financiado por el gobierno capitalino, los residuos se trituran y mezclan con un inóculo de varias bacterias y tras una digestión anaerobia a 55°C, sale el lodo y el biogás. En noviembre esperan producir poco más de una tonelada de lodo y 170 m^3 de biogás, suficiente para encender 9.600 focos ahorradores.*

Man 2: *La visión a futuro… bueno, nosotros como Secretaría es buscar que este tipo de proyectos se repliquen en otros mercados o en otros sitios de disposición de recursos.*

Reporter: *El nopal, cuyo interior es una pulpa babosa, es la base en México para preparar sopas, ensaladas, asados, mermeladas y hasta golosinas. También se hacen medicinas contra la hipertensión y problemas intestinales, geles cutáneos y jugos dietéticos.*

NARRATOR: *Now you will have 60 seconds to preview the questions you will need to answer.*

(60 seconds)

NARRATOR: *Now listen again.*

[ENTIRE REPORT IS REPEATED]

NARRATOR: *Now answer questions 1–6.*

(2 minutes)

1. Según el informe, para qué se está usando el nopal en el proyecto mencionado?
   (A) Para purificar el aire
   (B) Para generar electricidad
   (C) Para producir comida para animales
   (D) Para transformar los bosques del país

2. Según el informe, ¿qué parte del nopal se usa para el proyecto?
   (A) Las raíces
   (B) La pulpa
   (C) La cascara
   (D) Las semillas

3. Según uno de los participantes, ¿qué se espera del proyecto en el futuro?
   (A) Que sea subvencionado por la Ciudad de México
   (B) Que se siga su ejemplo en otros lugares
   (C) Que sea rentable dentro de unos años
   (D) Que se venda el producto a nivel internacional

4. ¿Qué otra utilidad del nopal se menciona en el informe?
   (A) Su uso en la construcción
   (B) Su rol en la ganadería
   (C) Su valor para la perfumería
   (D) Su importancia en la cocina

5. Según el informe y sus conocimientos culturales, ¿qué se puede afirmar del nopal??
   (A) Es un producto muy apreciado en el mundo de la moda.
   (B) Es una planta clave en la cultura mexicana.
   (C) Es una fuente excelente de colorantes naturales.
   (D) Es una hortaliza con un precio prohibitivo en México.

6. En la frase “de lo que va a ser el mejorador de suelos”, la forma verbal “va a ser” se puede sustituir sin cambiar su significado por
   (A) fuera
   (B) sería
   (C) fue
   (D) será

Section 2: Reading with Cultural Knowledge

Directions: This section is designed to measure how well you understand written Spanish and the cultures of Spanish-speaking countries.

You will read several selections in Spanish. To see each selection in its entirety you will need to scroll up and down. Each selection is accompanied by six questions. The last two questions may test your knowledge of culture and linguistics. In addition, you will be presented with 3 visual stimuli (e.g., photographs or works of art), each accompanied by a single cultural knowledge question. For each question, choose the response that is best, relative to the reading selection or visual stimulus.

The entire Reading section lasts 50 minutes. A clock at the top of the screen will indicate how much time is remaining.

Some selections include words underlined in blue. Click on the words to see a definition or an explanation.

You can move to the next question by clicking **Next**. You can skip questions and go back to them later as long as there is time remaining. If you want to return to previous questions, click **Back**.

For later review you can mark a question by clicking **Mark**, which will place a check mark next to the question on the Review screen. Clicking **Mark** again will remove the check mark. A question will remain marked until you unmark it, even if you change the answer.

You can click **Review** at any time, and the Review screen will show you which questions you have answered and which you have not answered. The Marked column shows all of the questions you have marked for review. From the Review screen, you may go directly to any question.

You may now begin.

Las preguntas 7-12 están basadas en el siguiente artículo sobre el misterio de las pinturas negras.

Perú: el misterio de las pinturas negras descubiertas en Machu Picchu

Por lo pronto ofrecen más preguntas que respuestas. El hallazgo de unas pinturas rupestres inéditas en las proximidades de la ciudadela de Machu Picchu significa un nuevo desafío para los arqueólogos del Ministerio de Cultura de Perú.

Las pinturas fueron descubiertas hace un par de meses por el equipo multidisciplinario de investigaciones que trabaja en el lugar en búsqueda de nuevos elementos que permitan entender más sobre la ciudadela inca erigida a 2.400 metros sobre el nivel del mar.

"La novedad es que la pintura está cerca del monumento y el hecho de que está hecha en color negro", dijo a BBC Mundo Fernando Astete, director del parque arqueológico nacional de Machu Picchu.

El experto explicó que en el pasado ya se habían encontrado en el parque petroglifos y pinturas rupestres en unos 20 sitios distintos, pero que esta es la primera vez que descubren unas imágenes tan cerca de la ciudadela.

"Fueron halladas en el camino principal de acceso hacia allí, en un lugar conocido como Pachamama, en el camino del inca que va de Intipunco a Machu Picchu, a unos 10 minutos del monumento", agregó.

Indicó que hasta ahora, las pinturas que habían encontrado en el parque de Machu Picchu eran de color ocre, más amarillento o más naranja, "que es bastante profuso en la iconografía inca".

Sin embargo, esta es la primera vez que encuentran imágenes hechas en color negro.

"En la pintura se ve una silueta humana, un camélido y algunos otros elementos que aún están por definir. Están todos pintados en color negro. Más o menos de unos 15 centímetros", dijo.

Aunque este descubrimiento ha generado multitud de especulaciones sobre si se trata de imágenes preincaicas o si puede modificar lo que se cree sobre Machu Picchu, Astete se mostró cauteloso y prefirió no adelantar ningún tipo de opinión.

"No podemos aún determinar si son más antiguas. En arqueología trabajamos por asociación. Machu Picchu es un recinto inca, las tumbas que han sido encontradas allí son incas, entonces consideramos que las pinturas también pueden ser incas, pero hay que concluir las investigaciones para determinar su antigüedad", apunta.

El misterio de las pinturas negras de Machu Picchu tendrá que esperar aún un tiempo antes de ofrecer sus respuestas.

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7. Según el artículo, ¿qué se puede afirmar de las pinturas descubiertas?
   (A) Que su descubrimiento ocurrió por casualidad
   (B) Que se descubrieron junto con unas joyas
   (C) Que suponen un desafío para los arqueólogos
   (D) Que son las primeras pinturas descubiertas en el lugar

8. Según el artículo, ¿qué es extraordinario sobre las pinturas halladas?
   (A) Su coloración
   (B) Su iconografía
   (C) Su textura
   (D) Su tamaño

9. ¿Qué están intentado determinar los expertos?
   (A) La autenticidad de las pinturas
   (B) La propiedad de las pinturas
   (C) El valor monetario de las pinturas
   (D) El periodo al que pertenecen las pinturas

10. Según el artículo, ¿cuál de las siguientes descripciones explica mejor la manera de trabajar de los arqueólogos involucrados en esta investigación?

    (A) Cooperan con equipos de arqueólogos internacionales.

    (B) Clasifican los objetos para transportarlos a museos.

    (C) Analizan sistemáticamente los objetos en el laboratorio.

    (D) Examinan el lugar con cuidado para llegar a conclusiones.

11. Según el artículo y sus conocimientos culturales, Machu Picchu es

    (A) un parque natural metropolitano

    (B) un importante bosque sagrado

    (C) una antigua ciudad inca

    (D) una mina de oro abandonada

12. ¿Cuál es el significado del verbo “adelantar” en la oración “Astete se mostró cauteloso y prefirió no adelantar ningún tipo de opinión”?

    (A) Progresar

    (B) Sobrepasar

    (C) Expresar

    (D) Alargar

La siguiente pregunta está basada en esta imagen.



13. Esta obra de arte es representativa de un estilo artístico muy ligado a México. ¿Qué nombre tiene dicha tendencia artística?

    (A) Impresionismo

    (B) Muralismo

    (C) Cubismo

    (D) Surrealismo

Section 3 is designed to measure how well you can express yourself in written Spanish.

Section 3: Writing

Directions: The Writing section includes three tasks that measure different aspects of your writing ability.

For each task, you will be given specific directions.

You will have 50 minutes to complete all of the tasks. A clock at the top of the screen will indicate how much time is remaining.

You can move from one question to the next by clicking **Next**. You can skip questions and go back to them later as long as there is time remaining. If you want to return to previous questions, click **Back**.

For later review you can mark a question by clicking **Mark**, which will place a check mark next to the question on the Review screen. Clicking **Mark** again will remove the check mark. A question will remain marked until you unmark it, even if you change the answer.

You can click **Review** at any time, and the Review screen will show you which questions you have answered and which you have not answered. The Mark column shows all of the questions you have marked for review. From the Review screen, you may go directly to any question.

Interpersonal Writing: Response to an E-mail, Memo, or Letter
(Suggested time—15 minutes)

Directions: Read the following e-mail and write an appropriate response in the space provided. Manage your time to allow for planning, writing, and revising your response. The length of your response should be **at least 60 words**.

Imagine que ha recibido el siguiente correo electrónico de la directora del Departamento de Lenguas Modernas de la universidad donde usted da clases de español. Escriba su respuesta dando la información que se pide.

Asunto: Nuevo profesor de español
De: Gabriela Marinero
Fecha: 15 de septiembre
Para: Profesores de español

Estimado/a colega:

Ya sabe usted que vamos a contratar a un nuevo profesor de español. Como usted es miembro del comité que va a realizar la búsqueda, le ruego que me escriba a la mayor brevedad exponiendo las principales cualidades que cree debemos buscar en los candidatos a este puesto. Me puede mandar su respuesta por correo electrónico.

Un saludo,

Gabriela Marinero,
Directora
Departamento de Lenguas Modernas

Presentational Writing: Opinion/Position Essay

(Suggested time—15 minutes)

Directions: Read the following question and use the space provided to write an essay on the topic given. Make sure that your essay includes reasons and/or examples to support your opinion. Manage your time to allow for planning, writing, and revising your response. The length of your response should be **at least 120 words**.

En la mayor parte de los países hay más hombres que mujeres en puestos de responsabilidad. ¿Cree usted que se debería reservar cierto porcentaje de estos puestos para las mujeres?

- **Explique y defienda su postura con ejemplos específicos.**

Presentational Writing: Integrated Skills

(Suggested time—20 minutes
Reading: 5 minutes
Writing: 15 minutes)

Directions: Based on the information in the passage, complete the following task. Write your response in the space provided. Manage your time to allow for planning, writing, and revising your response. The length of your response should be **at least 120 words**.

El siguiente artículo trata del desarrollo sustentable y sostenible.

Desarrollo sustentable y sostenible en relación con el calentamiento global

El calentamiento global es un fenómeno que se produce por la emisión de gases de efecto invernadero, los cuales aumentan la temperatura del planeta, ocasionando cambios climáticos como sequías, huracanes y fuertes tormentas a nivel global. Por este motivo, es un tema de gran preocupación hoy en día. Así, organismos, instituciones y organizaciones internacionales se apresuran a tomar decisiones y medidas preventivas que permitan frenar el efecto negativo del calentamiento global. Estas decisiones y medidas tienen consecuencias inmediatas y futuras para el bienestar del planeta y sus habitantes. Por eso, es bastante común escuchar los términos "desarrollo sustentable" y "desarrollo sostenible" en relación con este tema.

Desarrollo sustentable

Según Naciones Unidas, el desarrollo sustentable incluye procesos para preservar, cuidar y proteger los recursos naturales del planeta para beneficio de las generaciones actuales y futuras, sin considerar las necesidades culturales, políticas y sociales específicas del ser humano.

Desarrollo sostenible

En contraste, Naciones Unidas considera que el desarrollo sostenible contiene procesos saludables para satisfacer las necesidades sociales y económicas de la sociedad. Además, atiende a factores culturales y medioambientales de la generación actual, pero a la vez trata de no poner en riesgo a las próximas generaciones.

Las diferencias entre los dos conceptos no son muy evidentes y muchas veces se consideran palabras sinónimas. No obstante, la particularidad de ambos tipos de desarrollo se ubica en la intervención humana. Por eso, ambos términos se aplican a la responsabilidad social necesaria para vivir en equilibrio con el medio ambiente.

Iniciativas y acciones para cuidar el medio ambiente

En los últimos años se ha popularizado el término "economía circular". Durante mucho tiempo, los seres humanos han reciclado poco. Cuando un producto dejaba de ser útil, se desechaba y se sustituía por otro. La economía circular se enfoca en el reciclaje y la reutilización de objetos usados y cualquier producto que pueda ser reutilizado de una u otra forma. Además, las reparaciones y arreglos vuelven a ser importantes.

De esta forma, aprovechando todo al máximo, se generan menos residuos. Por ello, el reciclaje de botellas de plástico o vidrio, cartón y otros elementos como aceites y excedentes agrícolas pueden ser muy beneficiosos para el medio ambiente y también para una creciente industria circular basada en la reutilización de recursos.

Más allá de las diferencias entre desarrollo sostenible y sustentable, lo importante es el cuidado del medio ambiente. Hemos de tener en cuenta que cada individuo puede hacer mucho desde su humilde situación, por ejemplo, reciclar, gastar menos agua durante la ducha, usar transporte público o vehículos poco contaminantes.

WRITING TASK

Basándose en la información del artículo que ha leído y utilizando sus propias palabras, escriba un ensayo en el que explique por qué es importante abordar el cambio climático con procesos que sean sustentables y sostenibles.

Section 4 is designed to measure how well you can express yourself in spoken Spanish.

Section 4: Speaking

Directions: The Speaking section includes three tasks that measure different aspects of your speaking ability. This section lasts approximately 15 minutes.
For each task you will be given specific directions, including the amount of time allowed for preparation and speaking. Answer each task according to the directions. It is to your advantage to say as much as you can in the time allowed.

Relax and speak as clearly and confidently as you can. Maintain a consistent distance from the microphone and speak directly into it. Keep your voice at a consistent level of loudness (neither too soft nor too loud).

Presentational Speaking: Integrated Skills (Approximate time—5 minutes)

Directions: You will be asked to speak on a topic related to the passage you have already read. First, you will have 15 seconds to read these directions, and then you will hear the topic and the requirements for your response. You will have 3 minutes to review the passage and prepare your response. Then you will have 2 minutes to record your response. A tone will indicate when you should begin speaking.

El siguiente artículo trata del desarrollo sustentable y sostenible.

Desarrollo sustentable y sostenible en relación con el calentamiento global

El calentamiento global es un fenómeno que se produce por la emisión de gases de efecto invernadero, los cuales aumentan la temperatura del planeta, ocasionando cambios climáticos como sequías, huracanes y fuertes tormentas a nivel global. Por este motivo, es un tema de gran preocupación hoy en día. Así, organismos, instituciones y organizaciones internacionales se apresuran a tomar decisiones y medidas preventivas que permitan frenar el efecto negativo del calentamiento global. Estas decisiones y medidas tienen consecuencias inmediatas y futuras para el bienestar del planeta y sus habitantes. Por eso, es bastante común escuchar los términos “desarrollo sustentable” y “desarrollo sostenible” en relación con este tema.

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circular basada en la reutilización de recursos. Más allá de las diferencias entre desarrollo sostenible y sustentable, lo importante es el cuidado del medio ambiente. Hemos de tener en cuenta que cada individuo puede hacer mucho desde su humilde situación, por ejemplo, reciclar, gastar menos agua durante la ducha, usar transporte público o vehículos poco contaminantes.

SPEAKING TASK

Now read the scenario. (On the exam, you will also hear the scenario.)

Basándose en el artículo que ha leído, defienda la idea de que los resultados de las acciones locales contra el cambio climático pueden ayudar a la humanidad.

Presentational Speaking: Express an Opinion or Make an Oral Presentation

(Approximate time—5 minutes)

Directions: You will be asked to give an oral presentation on a specific topic. First, you will have 15 seconds to read these directions, and then you will hear the topic for your presentation. You will have 2 minutes to prepare your response. Then you will have 2 minutes to record your response. A tone will indicate when you should begin speaking. You should respond as fully and as appropriately as possible.

La vida hoy en día obliga a las personas a llevar una vida más sedentaria que en el pasado. Muchos opinan que es importante llevar una vida activa y destinar un tiempo al ejercicio físico.

- **¿Qué opina usted sobre este tema? Explique y defienda su postura con ejemplos específicos.**

Interpersonal Speaking: Simulated Conversation

(Approximate time—5 minutes)

Directions: You will participate in a simulated conversation within a context. First, you will have 30 seconds to read the outline of the conversation. In each pair of lines, the first line gives you an idea of what you will hear, and the second, bolded line gives you an idea of what you will be expected to say. You will have five turns to participate in the conversation. A tone will indicate when to begin speaking. Each time it is your turn to speak, you will have 25 seconds to respond. You should participate in the conversation as fully and as appropriately as possible.

Imagínese Ud. que recibe una llamada telefónica de una amiga de España. La amiga tiene una noticia que contarle.

[Amiga:]	Le saluda y le dice por qué le está llamando.
Usted:	**Reaccione a la noticia y responda a la pregunta.**
[Amiga:]	Continúa la conversación y le hace una pregunta.
Usted:	**Haga varias recomendaciones.**
[Amiga:]	Continúa la conversación y le hace otra pregunta.
Usted:	**Ofrezca detalles.**
[Amiga:]	Continúa la conversación y le hace otra pregunta.
Usted:	**Responda dando detalles.**
[Amiga:]	Continúa la conversación y le hace otra pregunta.
Usted:	**Responda a la pregunta.**

(**Note:** In the computer-delivered test, the responses will be numbered 3–7.)

Script for the Simulated Conversation

Imagínese Ud. que recibe una llamada telefónica de una amiga de España. La amiga tiene una noticia que contarle.

Amigo: Hola, ¿a que no sabes qué? En el trabajo me han dado unas semanas de vacaciones y he decidido ir a visitarte a Estados Unidos en octubre. Sí, imagínate, tanto tiempo sin vernos. Mira, quería saber cuál sería la mejor manera de llegar desde el aeropuerto hasta tu casa. ¿Me puedes recomendar algunas opciones?

(25 seconds to respond)

Amigo: ¡Estupendo! Voy a ver qué me conviene y te aviso. Oye, me gustaría visitar la ciudad. ¿Qué lugares de interés hay que pueda visitar cerca de tu casa?

(25 seconds to respond)

Amigo: Uuuuuy… ya veo. Otra cosa, necesito hacer las maletas para el viaje. ¿Me puedes dar detalles del tiempo que suele hacer por tu ciudad para esa fecha?

(25 seconds to respond)

Amigo: Como va a ser la fiesta de Halloween cuando esté yo allí, ¿me podrías contar qué podríamos hacer juntos ese día?

(25 seconds to respond)

Amigo: Bueno, y por último, ¿qué te gustaría que te llevara de regalo de España?

(25 seconds to respond)

Answers to Sample Questions

Section 1

1. The correct answer is (B) because the reporter states that besides all the other uses they have in Mexico for this cactus, it is now being used to generate electricity. Choices (A), (C), and (D) are not correct answers because none of the uses mentioned in them are discussed in the report.

2. The correct answer is (C) because the man being interviewed states that waste from the peel and thorns of the cactus are used in this project. Choices (A), (B), and (D) are not correct answers because none of those parts of the cactus (the roots, the flesh, and the seeds) are mentioned in the report.

3. The correct answer is (B) because the man states that their vision for the future of the project is to implement ventures like this in other markets. Choice (A) is not the correct answer because Mexico City is the location of the factory where the nopal is being transformed into energy and its government is already financing the project. Choice (C) is not the correct answer because being profitable is not one of the objectives of the project. The project's main objective is producing energy from a sustainable source. Choice (D) is not the correct answer because exporting the product overseas is not discussed in the report.

4. The correct answer is (D) because the reporter mentioned the fact that the nopal is a widely used product in Mexican cooking. Soups, salads, roasts, and so forth are mentioned as examples to illustrate that in the report. Choices (A), (B), and (C) are not correct answers because they are not mentioned in the report.

5. The correct answer is (B) because the reporter states the fact that the nopal has been one of the most valued components of Mexican culture since Aztec times. Choice (A) is not the correct answer because fashion is not mentioned in the report. Choice (C) is not the correct answer because among the many uses mentioned in the report, being a natural coloring agent is not one of them. Choice (D) is not the correct answer because it can be inferred from the report that the nopal is a pretty affordable vegetable since it is widely used in Mexico.

6. The correct answer is (D) because the verb "ser" is also in the future tense. Choices (A), (B), and (C) are not correct answers because they are in the present subjunctive, the conditional, and the simple past tense, respectively. None of those choices are equivalent to the verb form in the stem.

Section 2

7. The correct answer is (C). The article clearly states that the discovery of the rock art presented a challenge to the archaeologists. Choice (A) is incorrect because the article says that the rock art was discovered through a systematic search conducted by a multidisciplinary team. There is no mention in the article of whether there were other objects associated with the rock art and no mention of jewels, so choice (B) is incorrect. Choice (D) is incorrect because the article clearly states that there were previous discoveries of other rock paintings in that location.

8. The correct answer is (A). The article explains that there had been other rock paintings discovered in the area, but these paintings are unique because of their black color. Choice (B) is incorrect because although the images in the paintings are described, the author says nothing about whether the images have features belonging to an iconography. Choice (C) is incorrect because no mention is made in the article about the texture of the rock paintings. The article does not mention the size of the rock paintings, so choice (D) is incorrect.

9. The correct answer is (D). The article explains that the scientific community is still trying to determine whether the art was created during the Inca period or during a previous period. Choice (A) is incorrect because the article does not mention that the experts are researching if the rock art is authentic or not. No mention is made about who owns the rock paintings, so choice (B) is not correct. Choice (C) is incorrect because no mention is made in the article about the monetary value of the rock paintings.

10. The correct answer is (D). The article states that archeologists have to do thorough investigations before they can reach any conclusions. Choice (A) is not correct because there is no mention in the article about cooperating with any international team of archaeologists. Choices (B) and (C) are not correct either because they are not mentioned in the article.

11. The correct answer is (C). Machu Picchu is regarded as a world marvel. Its history is well-known and its foundation as a refuge for the fleeing Incas is also a widely known account. Choices (A), (B), and (D) are incorrect because the article contains no mention of Machu Picchu being a metropolitan park, forest, or an abandoned mine. Moreover, Machu Picchu is not known as either of those places.

Answers to Sample Questions

12. The correct answer is (C). *Adelantar* is a verb that means "to accelerate" or "to make haste." But it is also used in place of "to express," which is the meaning that is used in the sentence. Choice (A) is incorrect because the verb *adelantar*, in this context, does not mean "to progress." Choice (B) is incorrect because the verb *adelantar* does not mean, in this context, "to exceed or outperform someone." Choice (D) is incorrect because the verb *adelantar* does not mean "to extend."

13. The correct answer is (B) because the photo depicts a mural painted on a wall. The Mexican mural movement started in the 1930s and is a significant art expression in the country. (A) is not the correct answer because characteristics of Impressionistic paintings include, among others, emphasis on light and the inclusion of movement. (C) is not the correct answer; cubism is characterized by the reduction and fragmentation of natural forms into abstract, often geometric, structures. (D) is not the correct answer since surrealism style uses visual imagery from the subconscious mind to create art without the intention of logical comprehensibility.

PRAXIS WORLD LANGUAGES SCORING GUIDELINES FOR WRITING – Response to E-Mail, Memo, or Letter AND Opinion/Position Essay

		Features/Dimensions		
Score	**General Description**	**Task Completion**	**Topic Development**	**Writing Skills**
3 High	A response at this level is characterized by most of the following features/ dimensions:	• **Fully** addresses and completes the task	• Directly relates to the topic; topic well developed • All or almost all supporting details or examples are appropriate and effective	• Response is well organized and generally coherent • Demonstrates a mid-high or high degree of control of a variety of structures; a few grammatical errors occur with no evident patterns • Varied vocabulary appropriate for the content and used with precision • Very few errors in conventions of the written language (orthography: spelling, accent marks, and punctuation; sentence structure) • Register is appropriate (accurate social and/ or cultural references included)
2 Mid-High	A response at this level is characterized by most of the following features/ dimensions:	• Addresses and completes the task	• Relates to the topic • Most supporting details or examples are well defined	• Response is organized, but some parts are not fully developed • Demonstrates a moderate degree of control of a variety of structures; some grammatical errors occur • Appropriate vocabulary with occasional errors such as making up words or code-switching • Some errors in conventions of the written language (orthography: spelling, accent marks, and punctuation; sentence structure), but they do not impede communication • Register is usually appropriate (generally accurate social and/or cultural references included)
1 Mid-Low	A response at this level is characterized by most of the following features/ dimensions:	• Addresses and completes the task	• Moderately relates to the topic • Some supporting details or examples are vague or not well defined	• Response is inadequately organized/not sequenced correctly • Demonstrates a lack of control of a variety of structures; frequent grammatical errors occur • Limited vocabulary; frequent errors such as making up words or code-switching • Frequent errors in conventions of the written language (orthography: spelling, accent marks, and punctuation; sentence structure) • Register is inappropriate (inaccurate social and/or cultural references are included)
0 Low	A response at this level is characterized by most of the following features/ dimensions:	• Partially addresses and/or partially completes the task	• Minimally relates to the topic • Most supporting details or examples are irrelevant or not effective	• Response is disorganized • Demonstrates a lack of control of most structures; numerous grammatical errors impede communication • Insufficient vocabulary; constant interference from another language • Pervasive errors in conventions of the written language (orthography: spelling, accent marks, and punctuation; sentence structure) impede communication • Minimal to no attention to register (inaccurate social and/or cultural references are included)

PRAXIS WORLD LANGUAGES SCORING GUIDELINES FOR WRITING – Integrated Skills

		Features/Dimensions		
Score	**General Description**	**Task Completion**	**Topic Development**	**Writing Skills**
3 High	A response at this level is characterized by most of the following features/ dimensions:	• **Fully** addresses and completes the task	• Directly relates to the topic; topic well developed • All or almost all supporting details or examples are appropriate and effective • Clearly demonstrates a high degree of understanding of the content in the text	• Response is well organized and generally coherent • Demonstrates a mid-high or high degree of control of a variety of structures; a few grammatical errors occur with no evident patterns • Varied vocabulary appropriate for the content and used with precision • Very few errors in conventions of the written language (orthography: spelling, accent marks, and punctuation; sentence structure) • Register is appropriate (accurate social and/ or cultural references included)
2 Mid-High	A response at this level is characterized by most of the following features/ dimensions:	• Addresses and completes the task	• Relates to the topic • Most supporting details or examples are well defined • Demonstrates a moderate degree of understanding of the content in the text	• Response is organized, but some parts are not fully developed • Demonstrates a moderate degree of control of a variety of structures; some grammatical errors occur • Appropriate vocabulary with occasional errors such as making up words or code-switching • Some errors in conventions of the written language (orthography: spelling, accent marks, and punctuation; sentence structure), but they do not impede communication • Register is usually appropriate (generally accurate social and/or cultural references included)
1 Mid-Low	A response at this level is characterized by most of the following features/ dimensions:	• Addresses and completes the task	• Moderately relates to the topic • Some supporting details or examples are vague or not well defined • Demonstrates a low degree of understanding of the content in the text	• Response is inadequately organized/not sequenced correctly • Demonstrates a lack of control of a variety of structures; frequent grammatical errors occur • Limited vocabulary; frequent errors such as making up words or code-switching • Frequent errors in conventions of the written language (orthography: spelling, accent marks, and punctuation; sentence structure) • Register is inappropriate (inaccurate social and/or cultural references are included)
0 Low	A response at this level is characterized by most of the following features/ dimensions:	• Partially addresses and/or partially completes the task	• Minimally relates to the topic • Most supporting details or examples are irrelevant or not effective • Demonstrates a poor degree of understanding of the content in the text	• Response is disorganized • Demonstrates a lack of control of most structures; numerous grammatical errors impede communication • Insufficient vocabulary; constant interference from another language • Pervasive errors in conventions of the written language (orthography: spelling, accent marks, and punctuation; sentence structure) impede communication • Minimal to no attention to register (inaccurate social and/or cultural references are included)

PRAXIS WORLD LANGUAGES SCORING GUIDELINES FOR SPEAKING – Integrated Skills

		Features/Dimensions		
Score	**General Description**	**Task Completion**	**Topic Development**	**Language Use**
3 High	A response at this level is characterized by most of the following features/ dimensions:	• **Fully** addresses and completes the task	• Directly relates to the topic; topic well developed • All or almost all supporting details or examples are appropriate and effective • Clearly demonstrates a high degree of understanding of the content in the text	• Demonstrates a mid-high or high degree of control of a variety of structures; a few grammatical errors occur with no evident patterns • Varied vocabulary appropriate for the content and used with precision • High level of fluency • Very good pronunciation • Well-organized, generally coherent response • Register is appropriate (acurate social and/or cultural references included)
2 Mid-High	A response at this level is characterized by most of the following features/ dimensions:	• Addresses and completes the task	• Relates to the topic • Most supporting details or examples are well-defined • Demonstrates a moderate degree of understanding of the content in the text	• Demonstrates a moderate degree of control of a variety of structures; some grammatical errors occur • Appropriate vocabulary with occasional errors such as making up words or code-switching • Moderate level of fluency with occasional hesitation; some successful self-correction • Good pronunciation • Organized response with some coherence • Register is usually appropriate (generally acurate social and/or cultural references included)
1 Mid-Low	A response at this level is characterized by most of the following features/ dimensions:	• Addresses and completes the task	• Moderately relates to the topic • Some supporting details or examples are vague or not well-defined • Demonstrates a low degree of understanding of the content in the text	• Demonstrates a lack of control of a variety of structures; frequent grammatical errors occur • Limited vocabulary; frequent errors such as making up words or code-switching • Low level of fluency with frequent hesitation • Fair pronunciation with interference from another language • Disorganized response with little coherence • Register is inappropriate (inacurate social and/or cultural references included)
0 Low	A response at this level is characterized by most of the following features/ dimensions:	• Partially addresses and/or partially completes the task	• Minimally relates to the topic • Most supporting details or examples are irrelevant or not effective • Demonstrates a poor degree of understanding of the content in the text	• Demonstrates a lack of control of numerous structures; numerous grammatical errors impede communication • Insufficient vocabulary; constant interference from another language • Poor fluency with labored expression • Poor pronunciation, which affects comprehension • Disorganized response with no coherence • Minimal to no attention to register (inacurate social and/or cultural references included)

PRAXIS WORLD LANGUAGES SCORING GUIDELINES FOR SPEAKING – Presentational Speaking (Express an Opinion or Make an Oral Presentation)

		Features/Dimensions		
Score	**General Description**	**Task Completion**	**Topic Development**	**Language Use**
3 High	A response at this level is characterized by most of the following features/ dimensions:	• **Fully** addresses and completes the task	• Directly relates to the topic; well developed treatment of the topic • All or almost all supporting details or examples are appropriate and effective	• Demonstrates a mid-high or high degree of control of a variety of structures; very few grammatical errors occur with no evident patterns • Varied vocabulary appropriate for the content and used with precision • High level of fluency • Very good pronunciation • Well-organized, generally coherent response • Register is appropriate (accurate social and/ or cultural references included)
2 Mid-High	A response at this level is characterized by most of the following features/ dimensions:	• Addresses and completes the task	• Relates to the topic • Most supporting details or examples are well defined	• Demonstrates a moderate degree of control of a variety of structures; some grammatical errors occur • Appropriate vocabulary with occasional errors such as making up words or code-switching • Moderate level of fluency with occasional hesitation; some successful self-correction • Good pronunciation • Organized response with some coherence • Register is usually appropriate (generally accurate social and/or cultural references included)
1 Mid-Low	A response at this level is characterized by most of the following features/ dimensions:	• Addresses and completes the task	• Moderately relates to the topic • Some supporting details or examples are vague or not well defined	• Demonstrates a lack of control of a variety of structures; frequent grammatical errors occur • Limited vocabulary; frequent errors such as making up words and code-switching • Low level of fluency with frequent hesitation • Fair pronunciation with interference from another language • Disorganized response with little coherence • Register is inappropriate (inaccurate social and/or cultural references included)
0 Low	A response at this level is characterized by most of the following features/ dimensions:	• Partially addresses and/or partially completes the task	• Minimally relates to the topic • Most supporting details or examples are irrelevant or not effective	• Demonstrates a lack of control of numerous structures; numerous grammatical errors impede communication • Insufficient vocabulary; constant interference from another language • Poor fluency with labored expression • Poor pronunciation, which affects comprehension • Disorganized response with no coherence • Minimal to no attention to register (inaccurate social and/or cultural references included)

PRAXIS WORLD LANGUAGES SCORING GUIDELINES FOR SPEAKING – Simulated Conversation

		Features/Dimensions		
Score	**General Description**	**Task Completion**	**Topic Development**	**Language Use**
3 High	A response at this level is characterized by most of the following features/ dimensions:	• **Fully** addresses and completes the task • Responds **fully** to **all** or **almost all** of the parts/ prompts of the conversation	• Responses relate directly to the topic and include a well-developed treatment of all or almost all the elements in the thread of the conversation	• Demonstrates a mid-high or high degree of control of a variety of structures; very few grammatical errors occur with no evident patterns • Varied vocabulary appropriate for the content and used with precision • High level of fluency • Very good pronunciation • Well-organized, generally coherent response • Register is appropriate (accurate social and/ or cultural references included)
2 Mid-High	A response at this level is characterized by most of the following features/ dimensions:	• Addresses and completes the task • Responds to all or almost all of the parts/ prompts of the conversation	• Responses relate to the topic and include most elements in the thread of the conversation	• Demonstrates a moderate degree of control of a variety of structures; some grammatical errors occur • Appropriate vocabulary with occasional errors, such as making up words or code-switching • Moderate level of fluency with occasional hesitation; some successful self-correction • Good pronunciation • Organized responses with some coherence • Register is usually appropriate (generally accurate social and/or cultural references included)
1 Mid-Low	A response at this level is characterized by most of the following features/ dimensions:	• Addresses and completes some parts of the task • Responds to most parts/ prompts of the conversation	• Responses relate moderately to the topic and include some elements in the thread of the conversation	• Demonstrates a lack of control of a variety of structures; frequent grammatical errors occur • Limited vocabulary; frequent errors such as making up words and code-switching • Low level of fluency with frequent hesitation • Fair pronunciation with interference from another language • Disorganized response with little coherence • Register is inappropriate (inaccurate social and/or cultural references included)
0 Low	A response at this level is characterized by most of the following features/ dimensions:	• Partially addresses and/ or partially completes the task • Responds inappropiately to some parts/ prompts of the conversation	• Responses relate minimally to the topic and include few elements in the thread of the conversation	• Demonstrates a lack of control of numerous structures; numerous grammatical errors impede communication • Insufficient vocabulary; constant interference from another language • Poor fluency with labored expression • Poor pronunciation, which affects comprehension • Disorganized response with no coherence • Minimal to no attention to register (inaccurate social and/or cultural references included)

Constructed-Response: Writing - Score of 3

Scoring of Constructed-Responses

Holistic scoring of test taker response is done by content experts who have been through a rigorous training and qualifying process. Each response is independently scored by two raters using a task-specific rubric.

Writing Task #1: Interpersonal Writing: Response to an E-mail, Memo, or Letter

Sample Response That Received a Score of 3

Asunto: Nuevo profesor de Español

De: Miguel Comillas

Fecha: 20 de septiembre

Para: Gabriela Marinero

Estimada señora Marinero,

Gracias para preguntar por mi opinión sobre el nuevo profesor de Espanol para nuestra escuela. En mi opinión, la cualidad más importante para dar clases de Español en nuestra escuela es saber mucho de la lengua y la cultura. Un maestro bien preparado con estos conocimientos puede enseñar en cualquier nivel o grado de la escuela y tambien ayudar a mejorar el nivel general de espanol en la escuela. Tambien creo que debería ser una persona con muchas ganas y mucha energía para animar a todos los niños en la escuela a aprender Español.

Si necesita más información, por favor mande un mensaje.

Un saludo,

Miguel Comillas

Maestro de segundo grado de español

Commentary on Response That Received a Score of 3

The e-mail contains the elements and the content of a good e-mail response. It fully addresses and completes the task in the prompt with supporting and appropriate details that directly relate to the topic. The e-mail is a well-organized, coherent response that demonstrates a solid control of a variety of structures, varied vocabulary, very few errors in writing, and an appropriate register. Overall the response provides evidence of a high degree of language competence with respect to the task. The response earned a score of 3.

Sample Response That Received a Score of 2

Estimado Gabriela Marinero:

Creo que al comité debe empezar a buscar tan pronto como es posible. Para el nuevo maestro, es importante buscar un persona que quiere trabajar en equipo porque clases de Espanol hay muchas actividades en grupo para estudiante y maestros. También debe ser bilingue para ayudar con estudiantes de bilingue.

Gracias por preguntar por mis ideas. Y si tiene preguntas, me puede enviar otro mensaje.

Sinceramente,

Luis Cabrera

Maestro de Español

Commentary on Response That Received a Score of 2

The e-mail contains the elements and the content of a fair e-mail response. It addresses and completes the task in the prompt with supporting details that relate to the topic. The e-mail is an organized response, although some parts may not be fully developed. It demonstrates a moderate control of a variety of structures, appropriate vocabulary, some errors in writing, and a register that is usually appropriate. Overall the response provides evidence of a mid-high degree of language competence in respect to the task. The response earned a score of 2.

Sample Response That Received a Score of 1

Hola Gabriela,

Yo creo que Espanol es importante en escuela. Muchos quieren estudiar. Cualidades importantes es saber muy espanol. Puede escribir y hablar bueno para entender. Maestro nuevo es para estudiantes jovenes, por eso gusto los ninos tambien. Si quieres mas, me manda un mensaje.

Muchos saludo

Carmen Salamanca

Commentary on Response That Received a Score of 1

The e-mail contains the elements and the content of a weak e-mail response. It addresses and completes the task in the prompt with some supporting details that moderately relate to the topic. The e-mail is an inadequately organized response that demonstrates a lack of control of a variety of structures, limited vocabulary, frequent errors in writing, and an inappropriate register. Overall the response provides evidence of a mid-low degree of language competence in respect to the task. The response earned a score of 1.

Sample Response That Received a Score of 0

Hola

Gracia para rpeguntas muy bien y importente. Comite busca miembro en escuela de espanol por dar clases. Estudiante quieren aprende buen espanol para todos momentos. Voy peguntar characteristicas.

Gracias,

Commentary on Response That Received a Score of 0

The e-mail contains the elements and the content of an unacceptable e-mail response. It partially addresses and partially completes the task in the prompt with irrelevant supporting details that minimally relate to the topic. The e-mail is a disorganized response that demonstrates a lack of control of most structures, insufficient vocabulary, pervasive errors in writing, and minimal attention to register. Overall the response provides evidence of a low degree of language competence in respect to the task. The response earned a score of 0.

Writing Task #2: Presentational Writing: Opinion/Position Essay

Sample Response That Received a Score of 3

Creo que sería muy buena idea reservar puestos de responsabilidad para las mujeres en todos los países y para todos los niveles.

En primer lugar, tradicionalmente los puestos responsables son solo para los hombres. Las mujeres están en puestos siempre ocupados por mujeres. Dependiendo del país el único "puesto" que ocupan las mujeres es el de madre en las familias con las responsabilidades de la casa y los hijos. Pero incluido en los países donde las mujeres trabajan y tienen trabajos mas o menos importantes, en la mayoría de los casos no pueden a ocupar posiciones de mayor responsibilidad. Si lo hacen, es en números muy pequeños.

Eso debería cambiar porque no representa el total de la población. En general, las mujeres son la mitad de los habitantes en el mundo, pero eso no se refleja en los trabajar importantes con más responsabilidad. Eso quiere decir que sus ideas, opiniones, necesidades, etc. no están representadas en los países o organizaciones. Y eso tiene que cambiar para que el mundo sea más justo para todos.

Commentary on Response That Received a Score of 3

The opinion essay contains the elements and the content of a good opinion essay response. It fully addresses and completes the task in the prompt with supporting and appropriate details that directly relate to the topic. The opinion essay is a well-organized, coherent response that demonstrates a solid control of a variety of structures, varied vocabulary, very few errors in writing, and an appropriate register. Overall the response provides evidence of a high degree of language competence with respect to the task. The response earned a score of 3.

Sample Response That Received a Score of 2

En estos momentos, mujeres tienen trabajos de responsibilidad en muchos paises. No es necesario tener porcentage de trabajos especiales porque todo cambia en el pasado. Cuando yo era nino, mi mama no tuvo trabajo en una oficina porque ella cuidó mi familia, limpiaba y cocinaba mucho en la casa. Pero ahora mis hermanas y mis amigas todas trabajan en periodicos, en la universidad o en una empresa como gerentes. Ellas estudian en la universidad para medicina, abogado, profesora, etc. Todas tienen responsibilidad y hacen decisiones importantes en su trabajo. También emplean hombres y mujeres para trabajar en sus oficinas, universidades, etc. Y trabajan con muchas mujeres. Las mujeres ahora no solo trabajan en la casa, pero tambien en empleos poderosos como hombres. Hay mucho cambio.

Commentary on Response That Received a Score of 2

The opinion essay contains the elements and the content of a fair opinion essay response. It addresses and completes the task in the prompt with supporting details that relate to the topic. The opinion essay is an organized response, although some parts may not be fully developed. It demonstrates a moderate control of a variety of structures, appropriate vocabulary, some errors in writing, and a register that is usually appropriate. Overall the response provides evidence of a mid-high degree of language competence in respect to the task. The response earned a score of 2.

Sample Response That Received a Score of 1

Si, yo creo mujeres necesitas mas trabajo importantes en el mundo. Muchos hombres trabajan en companias y gobiernos pero no muchas mujers. Es importante que mujeres educacion para trabajar en estos. Los gerentes tambien deben emplean estos mujeres para trabajar en sus companias por tener muchos mujers. Los leges tinen cambiar para haser posible. Cuando mas mujeres hay en los trabajos, mas mujeres emplean empleos majores. Trabajos majores tienen mas responsibilidad en todos lugares para ayudar con mujers y hombres tiennen muchos trabajos. Opinion tambienn hay que cambiar para tener estos cambios en trabajos. Muchos personas piensan mujeres no trabajan como hombres porque tiene familias y ganan menos dinero para eso. Muchos cambios es necesario.

Commentary on Response That Received a Score of 1

The opinion essay contains the elements and the content of a weak opinion essay response. It addresses and completes the task in the prompt with some supporting details that moderately relate to the topic. The opinion essay is an inadequately organized response that demonstrates a lack of control of a variety of structures, limited vocabulary, frequent errors in writing, and an inappropriate register. Overall the response provides evidence of a mid-low degree of language competence in respect to the task. The response earned a score of 1.

Sample Response That Received a Score of 0

Yo opinaar que ttrabajo es muy dificil por mujers para muchos veces. Hombres trabajaba siempre, mujeres trabajarias tambien siempre pero el trabajos muy mal. Trabajo es responsibilidad importante porque tienen gannan mucho dinero o no pagan los bills. Haser dinero es muy trabajar, pero poco vacacions en su vida. Yo piensar que hijos importanes por mujeres y los hombres tambien. muchos higos no pueden, tienen tiempo trabajar en la casa y en trabajos. Por trabajando en no es muy mejor.

Commentary on Response That Received a Score of 0

The opinion essay contains the elements and the content of an unacceptable opinion essay response. It partially addresses and partially completes the task in the prompt with irrelevant supporting details that minimally relate to the topic. The opinion essay is a disorganized response that demonstrates a lack of control of most structures, insufficient vocabulary, pervasive errors in writing, and minimal attention to register. Overall the response provides evidence of a low degree of language competence in respect to the task. The response earned a score of 0.

Writing Task #3: Presentational Writing: Integrated Skills Essay

Sample Response That Received a Score of 3

Es muy important abordar el cambio climático en los años siguientes para que nosotros podemos sobrevivir con un medioambiente seguro. Mucha gente no quieren saber o ignoran la realidad del medioambiente pero es necesario popularizar procesos sustenatbles y sostenibles. Yo quiero que las generaciones del futuro sean saludables y que tienen oportunidades para divertirse. Pero los cambios climáticos como los huracanes y fuertes tormentas y los fuegos en California en los Estados Unidos son muy peligrosos y tienen un efecto muy negativo en las vidas de la gente que viven en regiones más suceptibles a cambios climáticos.

Los efectos negativos del calentamiento global incluyen efectos con la comida, los recursos para el salud y con los animales. Los animales sufren mucho de sequías, huracanes, tormentas y fuegos. Necesitamos los animales para completar el círculo ambiental que es necesario para tener un balance. Hay un efecto de seguridad

también porque muchas personas que no están acostumbradas o preparadas a los disastres pierden sus cosas, sus casas y a veces hay una gran pérdida de vidas humanos.

Ya es hora de tener en cuenta el impacto que nuestras acciones tienen en el cambo climático. Creo que parte de la causa del cambio climático es que todos nosotros no queremos escuchar que es nuestra culpa. El uso de los ""productos singulares"" es muy conveniente pero es muy malo para el clima y el medio ambiente. Será un esfuerzo muy grande y con todos juntos para abordar el cambio climático con procesos sustentables y sostenibles.

Commentary on Response That Received a Score of 3

The integrated-skills essay contains the elements and the content of a good essay response. It fully addresses and completes the task in the prompt with supporting and appropriate details. It demonstrates an understanding of the content of the passage and directly relates to the topic. The essay is a well-organized, coherent response that demonstrates a solid control of a variety of structures, varied vocabulary, very few errors in writing, and an appropriate register. Overall the response provides evidence of a high degree of language competence in respect to the task. The response earned a score of 3.

Sample Response That Received a Score of 2

El cambio climático es un problema global. Por eso, necesitamos enfocar en soluciones globales.

Es importante vivir en una manera mas sostenible porque hay un limite en los recursos de la tierra. Por ejemplo, los bosques están siendo destruidos. Hay bosques que tienen mucho más de cien años de edad y para que se reproduscan es necesario que pasen varios generaciónes. Tenemos que preservarlos para nuestro propio beneficio. La Amazona es un bosque muy importante porque muchas medicinas han sido inventadas por plantas y materiales encontradas en este bosque.

En este manera, protgenemos la planeta para las generaciones actuales y futuras. Es importante que aseguremos las recursos para el futuro.

Estas acciones pueden evitar y desaumentar los conflictos globales. Muchos conflictos globales vienen de conflictos sobre los recursos naturales del planeta. Si protegemos los recursos, el futuro será mejor.

Commentary on Response That Received a Score of 2

The integrated-skills essay contains the elements and the content of a fair integrated-skills essay response. It addresses and completes the task in the prompt with supporting details. It demonstrates a moderate understanding of the content of the passage and relates to the topic. The integrated-skills essay is an organized response, although some parts may not be fully developed. It demonstrates a moderate control of a variety of structures, appropriate vocabulary, some errors in writing, and a register that is usually appropriate. Overall the response provides evidence of a mid-high degree of language competence in respect to the task. The response earned a score of 2.

Sample Response That Received a Score of 1

La gente son la rovina del mundo. Estamos poniendo todo en riesgo de extinción porque la gente en poder no quieren ver los problemas que estamos causando. El calentamiento global no es una nueva conversación, estamos hablando de un cambio climático por muchos años ya. Cada desarrollo son proceso que tienen buena intenciones para salvar el clima. El problema con el desarrollo sustentable es que no es realista en el mundo que vivimos hoy. Aparece una intención de un soñador y no hay tiempo para sueños. El desarrollo sostenible piensa a salvar hoy sin pensar al futuro. Yo creo que sin la atención política y sociales no hay oportunidad de cambiamento. Sí no aprendimos la urgencia del mundo en llamas no existe un futuro ni hoy y ni mañana.

Commentary on Response That Received a Score of 1

The integrated-skills essay contains the elements and the content of a weak integrated-skills essay response. It addresses and completes the task in the prompt with vague supporting details. It demonstrates a low understanding of the content of the passage and moderately relates to the topic. The integrated-skills essay is an inadequately organized response that demonstrates a lack of control of a variety of structures, limited vocabulary, frequent errors in writing, and an inappropriate register. Overall the response provides

evidence of a mid-low degree of language competence in respect to the task. The response earned a score of 1.

Sample Response That Received a Score of 0

La cambia climatic is real por de lo humanos. Tienemo hacen proces sutetable y sotenibes para cuidar el clima. Todos hacen reciclan e economy circular. Individios pueden mucho como reuso, gasta menos aguas, no usa plasticos o agua y más.

Commentary on Response That Received a Score of 0

The integrated-skills essay contains the elements and the content of an unacceptable integrated-skills essay response. It partially addresses and partially completes the task in the prompt with irrelevant supporting details. It demonstrates a poor understanding of the content of the passage and minimally relates to the topic. The integrated-skills essay is a disorganized response that demonstrates a lack of control of most structures, insufficient vocabulary, pervasive errors in writing, and minimal attention to register. Overall the response provides evidence of a low degree of language competence in respect to the task. The response earned a score of 0.

Speaking Task #1: Presentational Speaking: Integrated Skills

Sample Response That Received a Score of 3

Hemos visto en los últimos años el daño que puede hacer el calentamiento global. Tenem, escuchamos muchas historias y escuchamos muchas opiniones de cómo eso, eh, como el problema está más en las corporaciones y, y las compañías que están gastando muchísimo, muchísimo petróleo y cosas así, pero en realidad, yo creo que la solución está, la solución se encuentra en el individuo. Ok, cada individuo, nosotros tenemos una responsabilidad, es una responsabilidad a nuestra generación tanto como a la generación que nos va a seguir. Para ser buen papá, mamá, hijo, nieto, abuelo, lo que sea, tenemos que cuidar el medio ambiente para protegernos a nosotros mismos tanto, tanto a nosotros mismos como a nuestros familiares, a nuestros amigos, a todo el mundo. OK, y la verdad es que si todos nosotros tomamos pasos prácticos como no usar tanta agua, no usar tanta luz, este, compartir vehículos, tomar transporte público. Si todos estamos haciendo cosas chiquitas va a cambiar el mundo. Entonces yo creo que tenemos que empezar por cambiar la cultura de nuestra casa, nuestro hogar, es enseñar a nuestros hijos cómo se debe hacer, es influenciar a nuestra pareja para estar consciente de las cos, cómo estamos afectando el mundo de una ma, el planeta de una manera negativa. Y después de la casa, lo llevamos al trabajo, impactamos la cultura del trabajo. Y después, de allí va creciendo, podemos impactar la cultura de la ciudad, un estado, un país, un continente y después el mundo, pero cada persona tiene el deber de estar enfocado.

Commentary on Response That Received a Score of 3

The integrated-skills speaking response contains the elements and the content of a good presentation. It fully addresses and completes the task in the prompt with supporting and appropriate details. It demonstrates understanding of the content of the passage and directly relates to the topic. The presentation is a well-organized, coherent response that demonstrates a solid control of a variety of structures, varied vocabulary, very good pronunciation, a high level of fluency, and an appropriate register. Overall the response provides evidence of a high degree of language competence in respect to the task. The response earned a score of 3.

Sample Response That Received a Score of 2

Hola, me llamo Alesandra. Muchas gracias por la invitación de hablar aquí hoy. Pues estoy aquí para decir que sí, que yo creo que los resultados de las acciones locales contra el cambio climático sí pueden ayudar a la humanidad. Hay cosas que, muchas cosas que pueden también y están bien para … que seas sanos y que hacemos las cosas para la salud. Por ejemplo, una cosa que podemos hacer contra el cambio climático es caminar más y tomar la bicicleta cuando podemos, y eso sí ayuda contra el cambio climático porque cuando caminamos al trabajo o para ir a la tienda que no usamos coches y cosas que contaminan el medio ambiente, pero también caminar más está bien para la salud y muchas personas no hacen ejercicio y eso no está bien para la salud. Y otras cosas también, si cocinamos más en casa y, y usamos verduras que a lo mejor podemos crecer en nuestros jardines y no comprar cosas que vienen de, del otro parte del mundo. Por ejemplo, muchas veces cuando compramos algo en la tienda una fruta viene de Chile, pero yo vivo en Estados Unidos, y entonces algo así puede ser también una cosa buena porque …

Commentary on Response That Received a Score of 2

The integrated-skills response contains the elements and the content of a fair presentation. It addresses and completes the task in the prompt with supporting details. It demonstrates a moderate understanding of the content of the passage and relates to the topic. The presentation is an organized, somewhat coherent response that demonstrates a moderate control of a variety of structures, appropriate vocabulary, good pronunciation, a moderate level of fluency, and a register that is usually appropriate. Overall the response provides evidence of a mid-high degree of language competence in respect to the task. The response earned a score of 2.

Sample Response That Received a Score of 1

Gracias por tenerme en este programa de televisión. Hoy voy a hablar sobre la importancia de cada persona en el rol de ayudar a la planeta, especialmente en de prevener el came, el calentamiento global. Primero, es importante que cada persona tener la idea de su rol en este ayudar la planeta. Primero, es importante que cada persona tienes la habilidad de reciclar en su propia casa y también reusar cosas de su vida normal. Esto es porque si cada persona hacer su propia, hace su propio parte en la misión de desarrollo sustentible y desarrollo sostenible, que si cada persona tiene este rol no es, ah, … tenemos más desarrollo para el mundo. También es, no es razonable anticipar que el gobierno va a tener todos los recursos para hacer nomás que necesita para ayudar a la planeta. Esto es porque cada persona usa objetos diferentes y usa la energía y cada persona tienes una parte del usado de todas esas cosas. Entonces tiene una responsabilidad de hacer acciones locales para ayudar a la planeta y si todos hacen estas cosas, ah… el mundo va a ser mucho mejor porque va a ser más mejor para el futuro.

Commentary on Response That Received a Score of 1

The integrated-skills response contains the elements and the content of a weak presentation. It addresses and completes the task in the prompt with vague supporting details. It demonstrates a low understanding of the content of the passage and moderately relates to the topic. The presentation is a disorganized, mostly incoherent response that demonstrates a lack of control of a variety of structures, limited vocabulary, fair pronunciation, a low level of fluency, and an inappropriate register. Overall the response provides evidence of a mid-low degree of language competence in respect to the task. The response earned a score of 1.

Sample Response That Received a Score of 0

En la programa hablar a … los cambio climático en nuestro comunidads. Si proteger recuros ayudo… sus comunidads por … ahora y la personas de futuro. Is importante porque los personas que vivan en futuro tener calenmiento global. Ahora … la planeta tienen recusos sostenable para de agua y bosque. Los personas vivan en el bosque no … pueden porque estar cortando y no … viven o tener comidas. Yo hacer trasporte en público y reciclamos…

Commentary on Response That Received a Score of 0

The integrated-skills response contains the elements and the content of an unacceptable presentation. It partially addresses and partially completes the task in the prompt with irrelevant supporting details. It demonstrates a poor understanding of the content of the passage and minimally relates to the topic. The presentation is a disorganized, incoherent response that demonstrates a lack control of numerous structures, insufficient vocabulary, poor pronunciation, poor fluency, and minimal attention to register. Overall the response provides evidence of a low degree of language competence in respect to the task. The response earned a score of 0.

Speaking Task #2: Presentational Speaking: Express an Opinion or Make an Oral Presentation

Sample Response That Received a Score of 3

Opino que es muy importante y necesario llevar una vida activa y destinar un tiempo al ejercicio físico. En el pasado las personas no tenían tantas enfermedades como tenemos ahora porque parte de su vida envolvía la actividad física. Ahora eso es falso porque muchas personas trabajan sentados en oficinas delante de las computadoras todo el día. No hay ejercicio. Por lo tanto, hay muchos problemas de salud y enfermedades del corazón.

El ejercicio físico es necesario para evitar los problemas relacionados con la edad y con la vida sin ejercicio. Es

importante mantenerse activo para que el cuerpo y todos los órganos funcionen de la mejor manera. Si hacemos ejercicio, no solo vamos a mantener un peso adecuado pero también vamos a tener un corazón fuerte, que ayuda con el trabajo físico. Además, el cerebro también está saludable cuando el cuerpo se mantiene activo.

Commentary on Response That Received a Score of 3

The presentational speaking response contains the elements of a good presentation. It fully addresses and completes the task in the prompt with supporting and appropriate details that directly relate to the topic. The presentation is a well-organized, coherent response that demonstrates a solid control of a variety of structures, varied vocabulary, very good pronunciation, a high level of fluency, and an appropriate register. Overall the response provides evidence of a high degree of language competence in respect to the task. The response earned a score of 3.

Sample Response That Received a Score of 2

Hoy muchos personas vivan, viven, trabajan y no mueven mucho. Ejercicio fisico no es necesario en la vida moderna porque todo los actividades se puede hacer muy comodamente. En el trabajo, la mayoria parte de tiempo, las personas estan sentadas en la oficina y trabajan con su computadora. Despues de trabajo, las personas estan sentados, sentadas en su carro para ir a la casa, a supermercado, a centro comercial y mas. En casa, las personas pasan mucho tiempo viendo television y sentados en el sofa para descansando.

Yo pienso es necesario pasar tiempo todos los dias para moverse y hacer ejercicio porque no hay suficiente deportes en nuestras vidas. En el pasado muchos personas tenian ejercicio en su rutina de trabajo, en su casa y en su vida para ir diferentes lugares, pero ahora no. Con los carros, personas viajan, no caminan. Es importante caminar, nadar, hacer deportes todos los dias para tener saludable fisico y mental.

Commentary on Response That Received a Score of 2

The presentational speaking response contains the elements of a fair presentation. It addresses and completes the task in the prompt with supporting details that relate to the topic. The presentation is an organized, somewhat coherent response that demonstrates a moderate control of a variety of structures, appropriate vocabulary, good pronunciation, a moderate level of fluency, and a register that is usually appropriate. Overall the response provides evidence of a mid-high degree of language competence in respect to the task. The response earned a score of 2.

Sample Response That Received a Score of 1

Creo que es necesario tener vida activa y muy deportes en sus vidas porque es mucho beneficios. Deportes es bueno porque para el cuerpo y el cabeza. Tambien deportes son bien para tener divertir. Yo jugo futbol americano con amigos todos los semanas y divertirnos mucho. Encontramos en el parque, jugamos una o dos hora y despues tomamos cerveza. Empecemos jugar años pasados cuando estuviamos en universidad. Ahora todos trabajemos mucho pero juguemos tambien. El deporte me gusto para fuerte y deportista. Tambien gusto porque el trabaja muy dificil y estres. Cuando deporte, hago cansando pero relajando tambien.

Commentary on Response That Received a Score of 1

The presentational speaking response contains the elements of a weak presentation. It addresses and completes the task in the prompt with vague supporting details that moderately relate to the topic. The presentation is a disorganized, mostly incoherent response that demonstrates a lack of control of a variety of structures, limited vocabulary, fair pronunciation, a low level of fluency, and an inappropriate register. Overall the response provides evidence of a mid-low degree of language competence in respect to the task. The response earned a score of 1.

Sample Response That Received a Score of 0

Llevo vida activar son bueno. Todos persona saber es bien por deportes fisico. Escuela es primer aprendo deporte muchos como futbol, basketball, beisbol, nadar, y mas. Ahora practicar muy mucho frecuencia porque todo los dias me gusto en la campo y la playa para conocer personas. Deportes bien, bueno. Todos personas puede deporte. Quiero ser bueno deportes.

Commentary on Response That Received a Score of 0

The presentational speaking response contains the elements of an unacceptable presentation. It partially addresses and partially completes the task in the prompt with irrelevant supporting details that minimally relate to the topic. The presentation is a disorganized, incoherent response that demonstrates a lack of control of numerous structures, insufficient vocabulary, poor pronunciation, poor level of fluency, and minimal attention to register. Overall the response provides evidence of a low degree of language competence in respect to the task. The response earned a score of 0.

Speaking Task #3: Interpersonal Speaking: Simulated Conversation

Sample Response That Received a Score of 3

1. ¡Hola! Me alegro que puedes venir. En el aeropuerto, lo mejor es tomar el tren porque funciona todo el día. Además, es bastante rápido y te lleva hasta el centro de la ciudad. Cuando llegas a la ciudad, desde la estación puedes tomar un taxi para llegar a mi casa.
2. En Nueva York hay muchísimos sitios para ver y visitar. Lo primero, te recomiendo un tour en autobús por toda la ciudad para ver a todos los sitios famosos. En unas horas verás muchas cosas. Entonces, puedes volver a donde más te guste otros días.
3. Pues el tiempo no va a ser muy bueno, pero tampoco creo va a hacer demasiado frío. Necesitas sacos y alguna chaqueta. Por la lluvia no te preocupes porque yo tengo paraguas si lo necesitas o también se puede comprar uno barato.
4. Sí, va a ser muy divertido si estás aquí en Halloween. En mi casa siempre hay fiesta y vienen todos mis amigos con vestidos de diferentes personajes para celebrar. Tienes que pensar en un personaje para la fiesta. La vamos a pasar muy bien.
5. Pues si puedes, me gusta que me traigas algo que me gustó mucho cuando visité España: los dulces de Navidad. Turrón y mazapanes, ¿se llaman así, verdad? Me encantaron.

Commentary on Response That Received a Score of 3

The speaking responses in the simulated conversation contain the elements and the content of a good conversation. The responses fully address and complete the task in all or almost all of the exchanges. The responses demonstrate an understanding of the content in the exchanges and directly relate to the topic. The exchanges demonstrate a well-organized and coherent set of responses, a solid control of a variety of structures, varied vocabulary, very good pronunciation, a high level of fluency, and an appropriate register. Overall the responses provide evidence of a high degree of language competence in response to the task. The responses earned a score of 3.

Sample Response That Received a Score of 2

1. ¡Qué sorpresa que vienes! Puede tomar tren o autobús desde el aeropuerto. Los dos son frecuentes y llega al centro. El autobús para muy cerca de mi casa, así que podras caminar un poco.
2. Podemos ir al parque de Central Park que es muy bonita y muy grande. Mi amigos gusta, gustan mucho el parque. También puede ir a un show de Broadway un día. Hay shows muy buenos.
3. Aquí hay más frío que en España así que recomiendo que tienes abrigo, varios sweaters y botas para lluvia. Es frío en octubre.
4. En mi edificio, niños vienen con disfraces para pedir chocolate y caramelo. Nosotros podemos disfrazar y salir a una fiesta después. Es muy divertido.
5. Me gusta mucho el jamon de España, pero no se si es permiso para viajar a los Estados Unidos. Hasta pronto.

Commentary on Response That Received a Score of 2

The speaking responses in the simulated conversation contain the elements and the content of a fair conversation. The responses address and complete the task in all or almost all of the exchanges. The responses demonstrate a moderate understanding of the content in the exchanges and relate to the topic. The exchanges demonstrate an organized and somewhat coherent set of responses, a moderate control of a variety of structures, appropriate vocabulary, good pronunciation, a moderate level of fluency, and a register that is usually appropriate. Overall the responses provide evidence of a mid-high degree of language competence in respect to the task. The responses earned a score of 2.

Sample Response That Received a Score of 1

1. Tengo vacaciones también y estoy emocionando para, para que tu vienes. Tomar un taxi es expensivo pero mejor y rapido.
2. Puedo, puede visita lugars interesante and diferente. Muchos momento importante en ciudad por ver.
3. Lluvia, llove todo tiempo. Debe tengar uno paragua y botas.
4. Quiero, niños quiere caramelo. Mi disfrazo y tu tambien para divertir.
5. Yo me gustar comida de España por mi por favor.

Commentary on Response That Received a Score of 1

The speaking responses in the simulated conversation contain the elements and the content of a weak conversation. The responses address and complete the task in most of the exchanges. The responses demonstrate a low understanding of the content in the exchanges and moderately relate to the topic. The exchanges demonstrate a disorganized, mostly incoherent set of responses, a lack of control of a variety of structures, limited vocabulary, fair pronunciation, a low level of fluency, and an inappropriate register. Overall the responses provide evidence of a mid-low degree of language competence in respect to the task. The responses earned a score of 1.

Sample Response That Received a Score of 0

1. Pues viajo Estados Unidos es buen.
2. Mi casa tengo grande y bonito.
3. Yo gusto mi ciudad .....
4. Halloween mi holiday favorito, favorita. muchos candies me gusto.
5. Estuvo en España mucho años atras.

Commentary on Response That Received a Score of 0

The speaking responses in the simulated conversation contain the elements and the content of an unacceptable conversation. The responses partially address and partially complete the task in most of the exchanges. The responses demonstrate a poor understanding of the content in the exchanges and minimally relate to the topic. The exchanges demonstrate a disorganized, incoherent set of responses, a lack of control of numerous structures, insufficient vocabulary, poor pronunciation, poor level of fluency, and minimal attention to register. Overall the responses provide evidence of a low degree of language competence in respect to the task. The responses earned a score of 0.

4. Determine Your Strategy for Success

Set clear goals and deadlines so your test preparation is focused and efficient

Effective *Praxis* test preparation doesn't just happen. You'll want to set clear goals and deadlines for yourself along the way. Otherwise, you may not feel ready and confident on test day.

1) Learn what the test covers.

You may have heard that there are several different versions of the same test. It's true. You may take one version of the test and your friend may take a different version a few months later. Each test has different questions covering the same subject area, but both versions of the test measure the same skills and content knowledge.

You'll find specific information on the test you're taking on page 5, which outlines the content categories that the test measures and what percentage of the test covers each topic. Visit www.ets.org/praxis/testprep for information on other *Praxis* tests.

2) Assess how well you know the content.

Research shows that test takers tend to overestimate their preparedness—this is why some test takers assume they did well and then find out they did not pass.

The *Praxis* tests are demanding enough to require serious review of likely content, and the longer you've been away from the content, the more preparation you will most likely need. If it has been longer than a few months since you've studied your content area, make a concerted effort to prepare.

3) Collect study materials.

Gathering and organizing your materials for review are critical steps in preparing for the *Praxis* tests. Consider the following reference sources as you plan your study:

- Did you take a course in which the content area was covered? If yes, do you still have your books or your notes?
- Does your local library have a high school-level textbook in this area? Does your college library have a good introductory college-level textbook in this area?

Practice materials are available for purchase for many *Praxis* tests at www.ets.org/praxis/testprep. Test preparation materials include sample questions and answers with explanations.

4) Plan and organize your time.

You can begin to plan and organize your time while you are still collecting materials. Allow yourself plenty of review time to avoid cramming new material at the end. Here are a few tips:

- Choose a test date far enough in the future to leave you plenty of preparation time. Test dates can be found at www.ets.org/praxis/register/dates_centers/.
- Work backward from that date to figure out how much time you will need for review.
- Set a realistic schedule—and stick to it.

5) Practice explaining the key concepts.

Praxis tests with constructed-response questions assess your ability to explain material effectively. As a teacher, you'll need to be able to explain concepts and processes to students in a clear, understandable way. What are the major concepts you will be required to teach? Can you explain them in your own words accurately, completely, and clearly? Practice explaining these concepts to test your ability to effectively explain what you know.

6) Understand how questions will be scored.

Scoring information can be found on page 51.

7) Develop a study plan.

A study plan provides a road map to prepare for the *Praxis* tests. It can help you understand what skills and knowledge are covered on the test and where to focus your attention. Use the study plan template on page 44 to organize your efforts.

And most important—get started!

Would a Study Group Work for You?

Using this guide as part of a study group

People who have a lot of studying to do sometimes find it helpful to form a study group with others who are working toward the same goal. Study groups give members opportunities to ask questions and get detailed answers. In a group, some members usually have a better understanding of certain topics, while others in the group may be better at other topics. As members take turns explaining concepts to one another, everyone builds self-confidence.

If the group encounters a question that none of the members can answer well, the group can go to a teacher or other expert and get answers efficiently. Because study groups schedule regular meetings, members study in a more disciplined fashion. They also gain emotional support. The group should be large enough so that multiple people can contribute different kinds of knowledge, but small enough so that it stays focused. Often, three to six members is a good size.

Here are some ways to use this guide as part of a study group:

- **Plan the group's study program.** Parts of the study plan template, beginning on page 44, can help to structure your group's study program. By filling out the first five columns and sharing the worksheets, everyone will learn more about your group's mix of abilities and about the resources, such as textbooks, that members can share with the group. In the sixth column ("Dates I will study the content"), you can create an overall schedule for your group's study program.
- **Plan individual group sessions.** At the end of each session, the group should decide what specific topics will be covered at the next meeting and who will present each topic. Use the topic headings and subheadings in the Test at a Glance table on page 5 to select topics, and then select practice questions, beginning on page 14.
- **Prepare your presentation for the group.** When it's your turn to present, prepare something that is more than a lecture. Write two or three original questions to pose to the group. Practicing writing actual questions can help you better understand the topics covered on the test as well as the types of questions you will encounter on the test. It will also give other members of the group extra practice at answering questions.

- **Take a practice test together.** The idea of a practice test is to simulate an actual administration of the test, so scheduling a test session with the group will add to the realism and may also help boost everyone's confidence. Remember, complete the practice test using only the time that will be allotted for that test on your administration day.
- **Learn from the results of the practice test.** Review the results of the practice test, including the number of questions answered correctly in each content category. For tests that contain constructed-response questions, look at the Sample Test Questions section, which also contain sample responses to those questions and shows how they were scored. Then try to follow the same guidelines that the test scorers use.
- **Be as critical as you can.** You're not doing your study partner(s) any favors by letting them get away with an answer that does not cover all parts of the question adequately.
- **Be specific.** Write comments that are as detailed as the comments about the sample responses. Indicate where and how your study partner(s) are doing an inadequate job of answering the question. Writing notes in the margins of the answer sheet may also help.
- **Be supportive.** Include comments that point out what your study partner(s) got right.

Then plan one or more study sessions based on aspects of the questions on which group members performed poorly. For example, each group member might be responsible for rewriting one paragraph of a response in which someone else did an inadequate job.

Whether you decide to study alone or with a group, remember that the best way to prepare is to have an organized plan. The plan should set goals based on specific topics and skills that you need to learn, and it should commit you to a realistic set of deadlines for meeting those goals. Then you need to discipline yourself to stick with your plan and accomplish your goals on schedule.

5. Develop Your Study Plan

Develop a personalized study plan and schedule

Planning your study time is important because it will help ensure that you review all content areas covered on the test. Use the sample study plan below as a guide. It shows a plan for the *Core Academic Skills for Educators: Reading* test. Following that is a study plan template that you can fill out to create your own plan. Use the "Learn about Your Test" and "Test Specifications" information beginning on page 5 to help complete it.

Use this worksheet to:
1. **Define Content Areas:** List the most important content areas for your test as defined in chapter 1.
2. **Determine Strengths and Weaknesses:** Identify your strengths and weaknesses in each content area.
3. **Identify Resources:** Identify the books, courses, and other resources you plan to use for each content area.
4. **Study:** Create and commit to a schedule that provides for regular study periods.

Praxis Test Name (Test Code): Core Academic Skills for Educators: Reading (5713)
Test Date: 9/15/21

Content covered	Description of content	How well do I know the content? (scale 1–5)	What resources do I have/need for the content?	Where can I find the resources I need?	Dates I will study the content	Date completed
Key Ideas and Details						
Close reading	Draw inferences and implications from the directly stated content of a reading selection	3	Middle school English textbook	College library, middle school teacher	7/15/21	7/15/21
Determining Ideas	Identify summaries or paraphrases of the main idea or primary purpose of a reading selection	3	Middle school English textbook	College library, middle school teacher	7/17/21	7/17/21
Determining Ideas	Identify summaries or paraphrases of the supporting ideas and specific details in a reading selection	3	Middle and high school English textbook	College library, middle and high school teachers	7/20/21	7/21/21
Craft, Structure, and Language Skills						
Interpreting tone	Determine the author's attitude toward material discussed in a reading selection	4	Middle and high school English textbook	College library, middle and high school teachers	7/25/21	7/26/21
Analysis of structure	Identify key transition words and phrases in a reading selection and how they are used	3	Middle and high school English textbook, dictionary	College library, middle and high school teachers	7/25/21	7/27/21
Analysis of structure	Identify how a reading selection is organized in terms of cause/effect, compare/contrast, problem/solution, etc.	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/21	8/1/21
Author's purpose	Determine the role that an idea, reference, or piece of information plays in an author's discussion or argument	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/21	8/1/21

(continued on next page)

Content covered	Description of content	How well do I know the content? (scale 1–5)	What resources do I have/need for the content?	Where can I find the resources I need?	Dates I will study the content	Date completed
Language in different contexts	Determine whether information presented in a reading selection is presented as fact or opinion	4	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/21	8/1/21
Contextual meaning	Identify the meanings of words as they are used in the context of a reading selection	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/1/21	8/1/21
Figurative Language	Understand figurative language and nuances in word meanings	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/8/21	8/8/21
Vocabulary range	Understand a range of words and phrases sufficient for reading at the college and career readiness level	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/15/21	8/17/21
Integration of Knowledge and Ideas						
Diverse media and formats	Analyze content presented in diverse media and formats, including visually and quantitatively, as well as in words	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/22/21	8/24/21
Evaluation of arguments	Identify the relationship among ideas presented in a reading selection	4	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/24/21	8/24/21
Evaluation of arguments	Determine whether evidence strengthens, weakens, or is relevant to the arguments in a reading selection	3	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/27/21	8/27/21
Evaluation of arguments	Determine the logical assumptions upon which an argument or conclusion is based	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/28/21	8/30/21
Evaluation of arguments	Draw conclusions from material presented in a reading selection	5	High school textbook, college course notes	College library, course notes, high school teacher, college professor	8/30/21	8/31/21
Comparison of texts	Recognize or predict ideas or situations that are extensions of or similar to what has been presented in a reading selection	4	High school textbook, college course notes	College library, course notes, high school teacher, college professor	9/3/21	9/4/21
Comparison of texts	Apply ideas presented in a reading selection to other situations	2	High school textbook, college course notes	College library, course notes, high school teacher, college professor	9/5/21	9/6/21

My Study Plan

Use this worksheet to:

1. **Define Content Areas:** List the most important content areas for your test as defined in chapter 1.
2. **Determine Strengths and Weaknesses:** Identify your strengths and weaknesses in each content area.
3. **Identify Resources:** Identify the books, courses, and other resources you plan to use for each content area.
4. **Study:** Create and commit to a schedule that provides for regular study periods.

Praxis Test Name (Test Code): _____

Test Date: _____

Content covered	Description of content	How well do I know the content? (scale 1–5)	What resources do I have/need for this content?	Where can I find the resources I need?	Dates I will study this content	Date completed

(continued on next page)

Content covered	Description of content	How well do I know the content? (scale 1–5)	What resources do I have/need for the content?	Where can I find the resources I need?	Dates I will study the content	Date completed

6. Review Smart Tips for Success

Follow test-taking tips developed by experts

Learn from the experts. Take advantage of the following answers to questions you may have and practical tips to help you navigate the *Praxis* test and make the best use of your time.

Should I guess?

Yes. Your score is based on the number of questions you answer correctly, with no penalty or subtraction for an incorrect answer. When you don't know the answer to a question, try to eliminate any obviously wrong answers and then guess at the correct one. Try to pace yourself so that you have enough time to carefully consider every question.

Can I answer the questions in any order?

You can answer the questions in order or skip questions and come back to them later. If you skip a question, you can also mark it so that you can remember to return and answer it later. Remember that questions left unanswered are treated the same as questions answered incorrectly, so it is to your advantage to answer every question.

Are there trick questions on the test?

No. There are no hidden meanings or trick questions. All of the questions on the test ask about subject matter knowledge in a straightforward manner.

Are there answer patterns on the test?

No. You might have heard this myth: the answers on tests follow patterns. Another myth is that there will never be more than two questions in a row with the correct answer in the same position among the choices. Neither myth is true. Select the answer you think is correct based on your knowledge of the subject.

Can I write on the scratch paper I am given?

Yes. You can work out problems on the scratch paper, make notes to yourself, or write anything at all. Your scratch paper will be destroyed after you are finished with it, so use it in any way that is helpful to you. But make sure to select or enter your answers on the computer.

Smart Tips for Taking the Test

1. **Skip the questions you find extremely difficult.** Rather than trying to answer these on your first pass through the test, you may want to leave them blank and mark them so that you can return to them later. Pay attention to the time as you answer the rest of the questions on the test, and try to finish with 10 or 15 minutes remaining so that you can go back over the questions you left blank. Even if you don't know the answer the second time you read the questions, see if you can narrow down the possible answers, and then guess. Your score is based on the number of right answers, so it is to your advantage to answer every question.

2. **Keep track of the time.** The on-screen clock will tell you how much time you have left. You will probably have plenty of time to answer all of the questions, but if you find yourself becoming bogged down, you might decide to move on and come back to any unanswered questions later.

3. **Read all of the possible answers before selecting one.** For questions that require you to select more than one answer, or to make another kind of selection, consider the most likely answers given what the question is asking. Then reread the question to be sure the answer(s) you have given really answer the question. Remember, a question that contains a phrase such as "Which of the following does NOT …" is asking for the one answer that is NOT a correct statement or conclusion.

4. **Check your answers.** If you have extra time left over at the end of the test, look over each question and make sure that you have answered it as you intended. Many test takers make careless mistakes that they could have corrected if they had checked their answers.

5. **Don't worry about your score when you are taking the test.** No one is expected to answer all of the questions correctly. Your score on this test is not analogous to your score on the *GRE*® or other tests. It doesn't matter on the *Praxis* tests whether you score very high or barely pass. If you meet the minimum passing scores for your state and you meet the state's other requirements for obtaining a teaching license, you will receive a license. In other words, what matters is meeting the minimum passing score. You can find passing scores for all states that use the *Praxis* tests at http://www.ets.org/s/praxis/pdf/passing_scores.pdf or on the web site of the state for which you are seeking certification/licensure.

6. **Use your energy to take the test, not to get frustrated by it.** Getting frustrated only increases stress and decreases the likelihood that you will do your best. Highly qualified educators and test development professionals, all with backgrounds in teaching, worked diligently to make the test a fair and valid measure of your knowledge and skills. Your state painstakingly reviewed the test before adopting it as a licensure requirement. The best thing to do is concentrate on answering the questions.

7. Check on Testing Accommodations

See if you qualify for accommodations to take the Praxis *test*

What if English is not my primary language?

Praxis tests are given only in English. If your primary language is not English (PLNE), you may be eligible for extended testing time. For more details, visit www.ets.org/praxis/register/plne_accommodations/.

What if I have a disability or other health-related need?

The following accommodations are available for *Praxis* test takers who meet the Americans with Disabilities Act (ADA) Amendments Act disability requirements:

- Extended testing time
- Additional rest breaks
- Separate testing room
- Writer/recorder of answers
- Test reader
- Sign language interpreter for spoken directions only
- Perkins Brailler
- Braille slate and stylus
- Printed copy of spoken directions
- Oral interpreter
- Audio test
- Braille test
- Large print test book
- Large print answer sheet
- Listening section omitted

For more information on these accommodations, visit www.ets.org/praxis/register/disabilities.

Note: Test takers who have health-related needs requiring them to bring equipment, beverages, or snacks into the testing room or to take extra or extended breaks must request these accommodations by following the procedures described in the *Bulletin Supplement for Test Takers with Disabilities or Health-Related Needs* (PDF), which can be found at http://www.ets.org/s/disabilities/pdf/bulletin_supplement_test_takers_with_disabilities_health_needs.pdf.

You can find additional information on available resources for test takers with disabilities or health-related needs at www.ets.org/disabilities.

8. Do Your Best on Test Day

Get ready for test day so you will be calm and confident

You followed your study plan. You prepared for the test. Now it's time to prepare for test day.

Plan to end your review a day or two before the actual test date so you avoid cramming. Take a dry run to the test center so you're sure of the route, traffic conditions, and parking. Most of all, you want to eliminate any unexpected factors that could distract you from your ultimate goal—passing the *Praxis* test!

On the day of the test, you should:

- be well rested
- wear comfortable clothes and dress in layers
- eat before you take the test
- bring an acceptable and valid photo identification with you
- bring an approved calculator only if one is specifically permitted for the test you are taking (see Calculator Use, at http://www.ets.org/praxis/test_day/policies/calculators)
- be prepared to stand in line to check in or to wait while other test takers check in

You can't control the testing situation, but you can control yourself. Stay calm. The supervisors are well trained and make every effort to provide uniform testing conditions, but don't let it bother you if the test doesn't start exactly on time. You will have the allotted amount of time once it does start.

You can think of preparing for this test as training for an athletic event. Once you've trained, prepared, and rested, give it everything you've got.

What items am I restricted from bringing into the test center?

You cannot bring into the test center personal items such as:

- handbags, knapsacks, or briefcases
- water bottles or canned or bottled beverages
- study materials, books, or notes
- pens, pencils, scrap paper, or calculators, unless specifically permitted for the test you are taking (see Calculator Use, at http://www.ets.org/praxis/test_day/policies/calculators)
- any electronic, photographic, recording, or listening devices

Personal items are not allowed in the testing room and will not be available to you during the test or during breaks. You may also be asked to empty your pockets. At some centers, you will be assigned a space to store your belongings, such as handbags and study materials. Some centers do not have secure storage space available, so please plan accordingly.

Test centers assume no responsibility for your personal items.

If you have health-related needs requiring you to bring equipment, beverages or snacks into the testing room or to take extra or extended breaks, you need to request accommodations in advance. Procedures for requesting accommodations are described in the Bulletin Supplement for Test Takers with Disabilities or Health-related Needs (PDF).

Note: All cell phones, smart phones (e.g., Android® devices, iPhones®, etc.), and other electronic, photographic, recording, or listening devices are strictly prohibited from the test center. If you are seen with such a device, you will be dismissed from the test, your test scores will be canceled, and you will forfeit your test fees. If you are seen *using* such a device, the device will be confiscated and inspected. For more information on what you can bring to the test center, visit www.ets.org/praxis/test_day/bring.

Are You Ready?

Complete this checklist to determine whether you are ready to take your test.

- ❒ Do you know the testing requirements for the license or certification you are seeking in the state(s) where you plan to teach?
- ❒ Have you followed all of the test registration procedures?
- ❒ Do you know the topics that will be covered in each test you plan to take?
- ❒ Have you reviewed any textbooks, class notes, and course readings that relate to the topics covered?
- ❒ Do you know how long the test will take and the number of questions it contains?
- ❒ Have you considered how you will pace your work?
- ❒ Are you familiar with the types of questions for your test?
- ❒ Are you familiar with the recommended test-taking strategies?
- ❒ Have you practiced by working through the practice questions in this study companion or in a study guide or practice test?
- ❒ If constructed-response questions are part of your test, do you understand the scoring criteria for these questions?
- ❒ If you are repeating a *Praxis* test, have you analyzed your previous score report to determine areas where additional study and test preparation could be useful?

If you answered "yes" to the questions above, your preparation has paid off. Now take the *Praxis* test, do your best, pass it—and begin your teaching career!

9. Understand Your Scores

Understand how tests are scored and how to interpret your test scores

Of course, passing the *Praxis* test is important to you so you need to understand what your scores mean and what your state requirements are.

What are the score requirements for my state?

States, institutions, and associations that require the tests set their own passing scores. Visit www.ets.org/praxis/states for the most up-to-date information.

If I move to another state, will my new state accept my scores?

The *Praxis* tests are part of a national testing program, meaning that they are required in many states for licensure. The advantage of a national program is that if you move to another state that also requires *Praxis* tests, you can transfer your scores. Each state has specific test requirements and passing scores, which you can find at www.ets.org/praxis/states.

How do I know whether I passed the test?

Your score report will include information on passing scores for the states you identified as recipients of your test results. If you test in a state with automatic score reporting, you will also receive passing score information for that state.

A list of states and their passing scores for each test are available online at www.ets.org/praxis/states.

What your *Praxis* scores mean

You received your score report. Now what does it mean? It's important to interpret your score report correctly and to know what to do if you have questions about your scores.

Visit http://www.ets.org/s/praxis/pdf/sample_score_report.pdf to see a sample score report.
To access *Understanding Your Praxis Scores*, a document that provides additional information on how to read your score report, visit www.ets.org/praxis/scores/understand.

Put your scores in perspective

Your score report indicates:

- Your score and whether you passed
- The range of possible scores
- The raw points available in each content category
- The range of the middle 50 percent of scores on the test

If you have taken this *Praxis* test or other *Praxis* tests in the last 10 years, your score report also lists the highest score you earned on each test taken.

Content category scores and score interpretation

Questions on the *Praxis* tests are categorized by content. To help you in future study or in preparing to retake the test, your score report shows how many raw points you earned in each content category. Compare your "raw points earned" with the maximum points you could have earned ("raw points available"). The greater the difference, the greater the opportunity to improve your score by further study.

Score scale changes

ETS updates *Praxis* tests on a regular basis to ensure they accurately measure the knowledge and skills that are required for licensure. When tests are updated, the meaning of the score scale may change, so requirements may vary between the new and previous versions. All scores for previous, discontinued tests are valid and reportable for 10 years, provided that your state or licensing agency still accepts them.

These resources may also help you interpret your scores:

- *Understanding Your Praxis Scores* (PDF), found at www.ets.org/praxis/scores/understand
- *The Praxis Passing Scores* (PDF), found at www.ets.org/praxis/scores/understand
- State requirements, found at www.ets.org/praxis/states

Appendix: Other Questions You May Have

Here is some supplemental information that can give you a better understanding of the *Praxis* tests.

What do the *Praxis* tests measure?

The *Praxis* tests measure the specific knowledge and skills that beginning teachers need. The tests do not measure an individual's disposition toward teaching or potential for success, nor do they measure your actual teaching ability. The assessments are designed to be comprehensive and inclusive but are limited to what can be covered in a finite number of questions and question types. Teaching requires many complex skills that are typically measured in other ways, including classroom observation, video recordings, and portfolios.

Ranging from Agriculture to World Languages, there are more than 80 *Praxis* tests, which contain selected-response questions or constructed-response questions, or a combination of both.

Who takes the tests and why?

Some colleges and universities use the *Praxis* Core Academic Skills for Educators tests (Reading, Writing, and Mathematics) to evaluate individuals for entry into teacher education programs. The assessments are generally taken early in your college career. Many states also require Core Academic Skills test scores as part of their teacher licensing process.

Individuals entering the teaching profession take the *Praxis* content and pedagogy tests as part of the teacher licensing and certification process required by many states. In addition, some professional associations and organizations require the *Praxis* Subject Assessments for professional licensing.

Do all states require these tests?

The *Praxis* tests are currently required for teacher licensure in approximately 40 states and United States territories. These tests are also used by several professional licensing agencies and by several hundred colleges and universities. Teacher candidates can test in one state and submit their scores in any other state that requires *Praxis* testing for licensure. You can find details at www.ets.org/praxis/states.

What is licensure/certification?

Licensure in any area—medicine, law, architecture, accounting, cosmetology—is an assurance to the public that the person holding the license possesses sufficient knowledge and skills to perform important occupational activities safely and effectively. In the case of teacher licensing, a license tells the public that the individual has met predefined competency standards for beginning teaching practice.

Because a license makes such a serious claim about its holder, licensure tests are usually quite demanding. In some fields, licensure tests have more than one part and last for more than one day. Candidates for licensure in all fields plan intensive study as part of their professional preparation. Some join study groups, others study alone. But preparing to take a licensure test is, in all cases, a professional activity. Because a licensure exam surveys a broad body of knowledge, preparing for a licensure exam takes planning, discipline, and sustained effort.

Why does my state require the *Praxis* tests?

Your state chose the *Praxis* tests because they assess the breadth and depth of content—called the "domain"—that your state wants its teachers to possess before they begin to teach. The level of content knowledge, reflected in the passing score, is based on recommendations of panels of teachers and teacher educators in

each subject area. The state licensing agency and, in some states, the state legislature ratify the passing scores that have been recommended by panels of teachers.

How were the tests developed?

ETS consulted with practicing teachers and teacher educators around the country during every step of the *Praxis* test development process. First, ETS asked them what knowledge and skills a beginning teacher needs to be effective. Their responses were then ranked in order of importance and reviewed by hundreds of teachers.

After the results were analyzed and consensus was reached, guidelines, or specifications, for the selected-response and constructed-response tests were developed by teachers and teacher educators. Following these guidelines, teachers and professional test developers created test questions that met content requirements and *ETS Standards for Quality and Fairness*.*

When your state adopted the research-based *Praxis* tests, local panels of teachers and teacher educators evaluated each question for its relevance to beginning teachers in your state. During this "validity study," the panel also provided a passing-score recommendation based on how many of the test questions a beginning teacher in your state would be able to answer correctly. Your state's licensing agency determined the final passing-score requirement.

ETS follows well-established industry procedures and standards designed to ensure that the tests measure what they are intended to measure. When you pass the *Praxis* tests your state requires, you are proving that you have the knowledge and skills you need to begin your teaching career.

How are the tests updated to ensure the content remains current?

Praxis tests are reviewed regularly. During the first phase of review, ETS conducts an analysis of relevant state and association standards and of the current test content. State licensure titles and the results of relevant job analyses are also considered. Revised test questions are then produced following the standard test development methodology. National advisory committees may also be convened to review and revise existing test specifications and to evaluate test forms for alignment with the specifications.

How long will it take to receive my scores?

Scores for tests that do not include constructed-response questions are available on screen immediately after the test. Scores for tests that contain constructed-response questions or essays aren't available immediately after the test because of the scoring process involved. Official score reports are available to you and your designated score recipients approximately two to three weeks after the test date for tests delivered continuously, or two to three weeks after the testing window closes for other tests. See the test dates and deadlines calendar at www.ets.org/praxis/register/dates_centers/ for exact score reporting dates.

Can I access my scores on the web?

All test takers can access their test scores via My *Praxis* Account free of charge for one year from the posting date. This online access replaces the mailing of a paper score report.

The process is easy—simply log into My *Praxis* Account at www.ets.org/praxis and click on your score report. If you do not already have a *Praxis* account, you must create one to view your scores.

Note: You must create a *Praxis* account to access your scores, even if you registered by mail or phone.

**ETS Standards for Quality and Fairness* (2014, Princeton, N.J.) are consistent with the *Standards for Educational and Psychological Testing*, industry standards issued jointly by the American Educational Research Association, the American Psychological Association, and the National Council on Measurement in Education (2014, Washington, D.C.).

Your teaching career is worth preparing for, so start today!

Let the Praxis® Study Companion guide you.

To search for the *Praxis* test prep resources that meet your specific needs, visit:

www.ets.org/praxis/testprep

To purchase official test prep made by the creators of the *Praxis* tests, visit the ETS Store:

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