Oregon 5th Grade Science Assessment Specifications

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Science Test Specification

Introduction

The primary purpose of Oregon's Test Specifications and Blueprints is to provide the consistency necessary for the development and administration of the Oregon Assessment of Knowledge and Skills (OAKS). OAKs provide critical data for Oregon's accountability system which meets Peer Review Requirements of the Elementary and Secondary Education Act. All Students in grades 3 through 8 are required to take the Smarter Balanced English Language Arts/Literacy and the Smarter Balanced Mathematics assessments. All students in grades 5 and 8 are required to take the science assessment. In high school, the Smarter Balanced English Language Arts/Literacy, Smarter Balanced Mathematics, and science are required assessments.

OAKS is also one way for students to demonstrate proficiency in the Essential Skills of reading, writing, and mathematics, which are necessary for earning a high school diploma. In addition, English Language Proficiency Assessment (ELPA) is required for non-English speaking students until they acquire sufficient skills in English to exit the program. Social Sciences is an optional assessment.

Test specifications provide guidelines for item writers, who are typically Oregon teachers, on what content may be tested and how items must be written. These specifications lead to test blueprints that outline test design and the number of questions to be tested in each score reporting category (SRC). The Test Specifications and Blueprints document is an important resource, not only for item writers and reviewers, but for educators administering OAKS and the general public who are interested in understanding the content and format of test items.

Background

The purposes of the Oregon Statewide Assessment Program are (1) to provide information on individual student achievement on performance standards set by the State Board of Education at grade and grade-group levels; (2) to provide information for federal ESSA requirements and for policy decisions by the legislature, the governor, the State Board of Education, and local school districts; (3) to support instructional program improvement efforts; and (4) to inform the public about student achievement in Oregon schools.

The Oregon Statewide Assessment is different from national norm-referenced tests used in many districts and states. The Oregon Statewide Assessment is a criterion-referenced assessment based on the Oregon Content Standards. As a result, the types of scores produced from the Oregon Statewide Assessment are somewhat different from those produced by national norm-referenced tests.

Oregon educators contribute to the test development and alignment process by serving on advisory committees called Content and Assessment Panels. Stakeholders in these committees are involved in each phase of the development of these specifications to assure that they accurately and clearly explain the overall design of the test and describe the specific content that might appear on the test to measure the knowledge and skills described in the content standards.

Oregon's knowledge and skills test questions use multiple choice and computer scored constructed response formats. Each multiple choice item has only one correct answer while

computer scored constructed response items may have many correct answers. A computer electronically collects and scores responses which are scored against the answer key to produce a raw score. The raw score is converted to a scale score called a Rasch unit or RIT score. Students receive a scale score based on the number of questions answered correctly compared to the total number of questions on the form—taking into account the difficulty of the questions. Students are not penalized for guessing.

The content of these specifications reflects the skill expectations outlined in the Content Standards adopted February 2009 by the State Board of Education. These standards were developed, in part, to correlate to the skills assessed on the science portion of the National Assessment of Educational Progress and align with the National Science Standards. As a result, Oregon uses similar terminology in its descriptions of the science subject score reporting categories (listed later in this document).

2018 Embedded Field Test

The 2018 OAKS Science Test will contain field test items aligned to the 2014 Oregon Science Standards (NGSS). These items are being tested for implementation in the 2019 OAKS Science Test and will not be utilized in any of the score reporting categories for 2018 OAKS Science Test. Total time on test is not expected to change.

Statewide and Local Assessments

Statewide assessments are multiple choice and computer scored constructed response tests of knowledge and skills that are developed and scored by the state. Local assessments include performance assessments that may be scored using statewide scoring guides that are administered and scored at the local level. Local assessments **are not included** in state accountability reports, e.g. Oregon Department of Education School and District Report Cards.

Electronic Administration

On the science knowledge and skills OAKS online tests, there are three opportunities to participate in fully-adaptive testing. In this format, the accuracy of the student responses to questions determines the next item or set of items the student will see.
Students are allowed to preview test questions if a set of questions link to a specific graphic or stimulus. Having the tests fully adaptive allows for more precision in measurement and less frustration for the students.

Electronic administration of the science test for each grade tested includes up to three test opportunities in English or English-Spanish formats. Students who need to have the test read to them may access the text to speech function of each test. The OAKS Online test delivery system allows students with visual impairments, who use Braille, to access the OAKS Online testing system. These students will have the same number of testing opportunities as other students and have access to the adaptive OAKS Online test. Paper- based Braille assessments will no longer be available. An online practice test of sample items is available for students who may need practice using a scrollbar, or who need practice with new item types.

The following pages contain a more detailed examination of the test content for science. The first column lists the content standard assessed for that particular score reporting category and academic vocabulary sometimes linked to that standard. The second column provides a description of the testable content and gives a more detailed explanation of how the standard will be assessed. Finally, the third column provides sample items that are very similar to the type of questions asked on a test related to that eligible content.

Core Standard 3.1 Structure and Function, Score Reporting Category 1/5

Living and non-living things vary in their characteristics and properties.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

3.1P.1 Compare and contrast the properties of states of matter.

*Academic Vocabulary**

- mass
- particle
- property
- state
- volume

Links to National Standards

2009 NAEP Framework: P4.3

National Science Education Standards: Physical Science Content Standard B, pgs. 123-127 and 149-154

AAAS Science Literacy Benchmarks

Explanation

Matter

- Matter exists in different states: commonly solid, liquid, and gas.

Examples of States of Matter

Solid: ice

Liquid: water

Gas: oxygen

Content Connections from Previous Grades

1.1P.1

Sample Items

Which of the following changes is caused by removing heat?

A. A solid changes to a gas
B. A liquid changes to a gas
C. A solid changes to a liquid
D. A liquid changes to a solid

Massachusetts Released item #9 pg. 24

Answer Key: D

Which of the following statements describes one way that solids are different from solids?

A. Solids have weight and liquids do not.
B. Solids take up space and liquids do not.
C. Solids have a definite shape liquids do not.
D. Solids have a definite volume and liquids do not.

Massachusetts Released Item #4 pg. 412

Answer Key: C

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 3.1 Structure and Function, Score Reporting Category 1/6

Living and non-living things vary in their characteristics and properties.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

3.1L.1 Compare and contrast the characteristics of offspring and parents.

*Academic Vocabulary**

- inherited
- learned
- species

Links to National Standards

2009 NAEP Framework: L4.6, L4.7

National Science Education Standards: Life Science Content Standard C, pgs. 127-129

AAAS Science Literacy Benchmarks

Explanation

Characteristics

- Parents and their offspring have similar characteristics (e.g. eye color, hair color, skin color, instincts, flower color, number of animal limbs)
- Parents and their offspring have unlike characteristics (e.g. favorite food, riding a bicycle)

Content Connections from Previous Grades

K.1L.1, 2.2L.1

Sample Items

Naomi has a pet dog. Which of the following characteristics did the dog most likely inherit from its parents?

A. Its weight
B. Its favorite food
C. The color of its fur
D. The place where it lives

Massachusetts Released item #10 pg. 244

Answer Key: C

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Core Standard 3.2 Interaction and Change, Score Reporting Category 2/5

Living and non-living things interact with energy and forces.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

3.2P.1 Describe how forces cause changes in an object's position, motion, and speed.

Academic Vocabulary*

- friction
- weight
- gravity
- mass

Links to National Standards

2009 NAEP Framework: P4.12, P4.13, and p4.14

National Science Education Standards: Physical Science Content Standard B, pgs. 123-127

AAS Science Literacy Benchmarks

Explanation

Force

- Forces cause changes in the speed or direction of an object in motion.
- The greater the force, the greater the change in motion will be.
- The amount of change is related to amount of force (push or pull) and the mass of the object on which the force is exerted.
- Objects will not change position without a force.
- Friction will cause an object to change speed

Examples

- Pushing or pulling
- Friction of different surfaces

Content Connections from Previous Grades

K.2P.1, 1.2P.1

Sample Items

Which of the following would cause an object to slow down?

A. Friction
B. Gravity
C. Pulling an object downhill
D. Pushing an object downhill

Answer Key: A

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Core Standard 3.2 Interaction and Change, Score Reporting Category 2/6

Living and non-living things interact with energy and forces.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

3.2L.1 Compare and contrast the life cycles of plants and animals.

Academic Vocabulary*

- larva
- germinate
- metamorphosis
- pollinate
- pupa
- reproduction
- stage

Links to National Standards

2009 NAEP Framework: L4.5

National Science Education Standards: Life Science Content Standard C, pgs. 127-129

AAS Science Literacy Benchmarks

Explanation

Life cycles

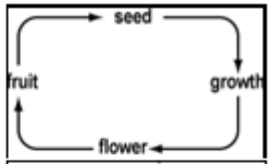
- Similar animals and plants have similar lifecycles (e.g. birds lay eggs, mammals have live young, plants produce seeds).
- Different plants and animals have different lifecycles (e.g. fish vs. birds, flower vs. pine tree).
- Plants and animals go through similar lifecycles. (e.g. fertilization).
- Plants and animals go through different lifecycles (e.g. plants produce seeds that can grow into new plants, birds lay eggs that hatch producing new birds).

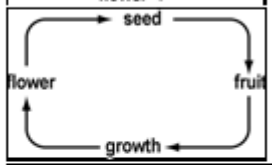
Content Connections from Previous Grades

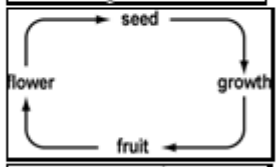
2.2L.1

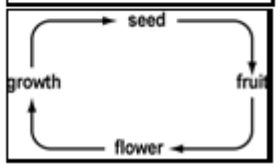
Sample Items

Which of the following drawings best shows the life cycle of berry bushes growing naturally in a forest?
Massachusetts Released item #20 pg. 422

A.


B.


C.


D.


Answer Key: A

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Core Standard 3.2 Interaction and Change, Score Reporting Category 2/7

Living and non-living things interact with energy and forces.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

3.2E.1 Identify Earth as a planet and describe its seasonal weather patterns of precipitation and temperature.

*Academic Vocabulary**

- patterns
- planet
- seasonal

Links to National Standards

2009 NAEP Framework: E4.7-4.9

National Science Education Standards: Earth and Space Science Content Standard D, pgs. 130-134

AAS Science Literacy Benchmarks

Explanation

The Earth orbits the sun

Weather on Earth

- The sun provides light and heat to maintain the temperature of the Earth.
- Weather changes from day to day and over the seasons
- Weather tends to follow somewhat predictable patterns that vary according to season, location and climate.
- Weather is outside conditions at a certain time and place.
- Climate is weather conditions over time.
- Precipitation can occur in a variety of forms

Seasonal weather elements

- temperature
- precipitation

Content Connections from Previous Grades

K.1E.1, 2.2E.2

Sample Items

One reason the Earth is considered a planet is because it

A. has a moon
B. orbits the sun
C. has seasons
D. has life

Answer Key: B

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 3.3 Scientific Inquiry, Score Reporting Category 3/8

Scientific inquiry is a process used to explore the natural world using evidence from observations and investigations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

3.3S.1 Plan a simple investigation based on a testable question, match measuring tools to their uses, and collect and record data from a scientific investigation.

Academic Vocabulary*

- claim
- hypothesis
- measure
- procedure
- variable

Links to National Standards

2009 NAEP Framework: Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 121-123

AAS Science Literacy Benchmarks

Explanation

Investigation

- Develop a practical plan for a simple investigation (with teacher guidance).
- Propose a testable question (with teacher guidance).
- Collect and record reasonable data.
- Use correct measuring tools to gather data.

Scientific Inquiry Skills

- prediction
- data recording

Content Connections from Previous Grades

1.3S.1, 1.3S.2, 2.3S.1

Sample Items

Steven's class meets in a classroom with a leaking faucet in the back. What tools does Steven need to conduct an experiment to find out how much water is wasted by this leak in one hour?

A. A ruler and a clock
B. A measuring cup and a ruler
C. A test tube and a burner
D. A measuring cup and a clock

Answer Key: D

Andrea's class meets in a classroom with many windows and heat vents. Students complain that it is too hot to too cold in certain seats. What too does Andrea need to conduct an experiment to find out the hottest and coldest places in the room?

A. Wind vane
B. Thermometer
C. Blanket
D. Beaker

Answer Key: B

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Core Standard 3.3 Scientific Inquiry, Score Reporting Category 3/8

Scientific inquiry is a process used to explore the natural world using evidence from observations and investigations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

3.3S.2 Use the data collected from a scientific investigation to explain the results and draw conclusions.

*Academic Vocabulary**

- conclusions
- explain
- scientific
- interpret

Links to National Standards

2009 NAEP Framework: Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 121-123

AAS Science Literacy Benchmarks

Explanation

Collect Data

- Use data to describe the results of an investigation.
- Use data to explain why the results are accurate.
- Use data to draw a conclusion.

Scientific Inquiry Skill Development

- Graphic organizers
- Logs, journals, pictures
- Data collections

Content Connections from Previous Grades

2.3S.2, 2.3S.3

Sample Items

WATERMELONS IN POUNDS PER ACRE					
Seed Type	Units of Fertilizer Used				
	0	1	2	3	4
Round	25	32	35	29	18
Wrinkled	15	25	33	30	19

What does the chart show about fertilizer use in this garden?

A. The more fertilizer the better.
B. Without fertilizer nothing grows.
C. Fertilizer affects both seed types exactly the same way.
D. Too much fertilizer can hurt growth.

Answer Key: D

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Core Standard 3.3 Scientific Inquiry, Score Reporting Category 3/8

Scientific inquiry is a process used to explore the natural world using evidence from observations and investigations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

3.3S.3 Explain why when a scientific investigation is repeated, similar results are expected.

*Academic Vocabulary**

- constant
- discrepancy
- reliable
- repetition

Links to National Standards

2009 NAEP Framework: Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 121-123

AAAS Science Literacy Benchmarks

Explanation

Investigate

- A repeated investigation will result in similar outcomes
- Accurate records of investigations must be kept
- Investigations which cannot be repeated are not reliable

Content Connections from Previous Grades

1.3S.3, 2.3S.2

Sample Items

Bounce Height at Different Temperatures

Amy wanted to find out if a small rubber ball would bounce higher or lower at different temperatures. The chart below shows her results.

Ball Temperature	Height of Bounce
32°F	1 foot
70°F	2 feet
120°F	3 feet

Which of the following statements BEST explains why another student got similar results for the same experiment? The student used

A. The same kind of rubber ball and the same temperatures, but a different surface for bouncing
B. A different kind of rubber ball and different temperatures, but the same surface for bounding.
C. The same kind of rubber ball, the same temperatures, and the same surface for bouncing.

Answer Key: C

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 3.4 Engineering Design, Score Reporting Category 4/8

Engineering design is a process that uses science to solve problems or address needs or aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

3.4D.1 Identify a problem that can be addressed through engineering design, propose a potential solution, and design a prototype.

*Academic Vocabulary**

- Engineering design
- limitations

Links to National Standards

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 134-138

AAAS Science Literacy Benchmarks

Explanation

Solutions to a problem

- Identify a problem and propose a solution. (Problem should be real and engaging.)
- A prototype is an initial design solution
- Develop a prototype to address the solution to the problem.

  Suggest possible solutions:

  - Try one out
  - Make adjustments or start over

Content Connections from Previous Grades

2.4D.3

Sample Items

Which problem below can be addressed through engineering design?

A. Determining what your favorite food is.
B. Making a boat that cannot sink.
C. Writing a story about an animal.
D. Reading a story in your textbook.

Answer Key: B

Shelby decided to make a new type of ship that will not sink. She drew out plans for her new ship. What is the next step in the engineering design process that she should follow?

A. Create a prototype
B. Determine the price
C. Build a full model
D. Adjust her plans

Answer Key: A

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Core Standard 3.4 Engineering Design, Score Reporting Category 4/8

Engineering design is a process that uses science to solve problems or address needs or aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

3.4D.2 Describe how recent inventions have significantly changed the way people live. .

Academic Vocabulary*

- convenience
- invention
- lifestyle
- necessity
- technology

Links to National Standards

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 134-138

AAAS Science Literacy Benchmarks

Explanation

Effect of recent inventions

- People alone or in groups are always inventing new ways to solve problems and get work done.
- Inventions have changed the way people communicate, cook, play, travel, etc.

Examples of inventions

- iPods
- Cell phones
- Fuel efficient cars
- Microwave ovens
- Washers and dryers
- LED light bulbs
- Halogen light bulbs

Content Connections from Previous Grades

2.4D.3

Sample Items

Which of the following inventions has changed the way people communicate?

A. iPods
B. Electric cars
C. Cell phones
D. Wind turbines

Answer Key: C

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Core Standard 3.4 Engineering Design, Score Reporting Category 4/8

Engineering design is a process that uses science to solve problems or address needs or aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

3.4D.3 Give examples of inventions that enable scientists to observe things that are too small or too far away.

*Academic Vocabulary**

- magnify

Links to National Standards

2009 NAEP Framework: Science Practices, pgs 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 134-138

AAAS Science Literacy Benchmarks

Explanation

Effect of recent inventions

- Technology enables scientists and others to observe things that are too small or too far away to be seen otherwise

Examples of observation tools/inventions

- Hubble space telescope
- International Space Station
- Microscopes/magnifying glass
- Binoculars
- Telescope

Sample Items

Which of the following is BEST to use to look at a plant cell?

A. Telescope
B. Binoculars
C. Microscope
D. Magnifying glass

Answer Key: C

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Core Standard 4.1 Structure and Function, Score Reporting Category 1/5

Living and non-living things can be classified by their characteristics and properties.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

4.1P.1 Describe the properties of forms of energy and how objects vary in the extent to which they absorb, reflect and conduct energy

Academic Vocabulary*

- attract
- circuit
- electromagnetic
- field
- magnetic
- opaque
- radiation
- reflect
- refract
- repel
- sound
- thermal
- translucent
- transparent
- vibration
- waves

Links to National Standards

2009 NAEP Framework: P4.7-P4.10

National Science Education Standards: Physical Science Content Standard B, pgs. 123-127

AAAS Science Literacy Benchmarks

Explanation

Forms of energy

- chemical
- electrical
- heat
- light
- mechanical
- nuclear

Properties of Energy

- Heat will transfer from a hotter object to a cooler object until both are the same temperature.
- Sound and light can be absorbed, redirected, bounced back, or allowed to pass through.
- Light travels in straight lines. When light strikes substances and objects through which it cannot pass, shadows result.
- When light travels (obliquely) from one substance to another (air and water) it changes direction.
- Heat results when substances burn, when certain kinds of materials rub against each other and when electricity flows through wires.
- Some materials conduct heat, light, electricity, etc. better than others. Metals are good conductors of heat and electricity.
- Some materials are good insulators

Content Connections from Previous Grades

2.2P.1

Sample Items

When you hook up a battery to a complete circuit, what flows through the wires from one pole of the battery to the other?

A. Heat
B. Electricity
C. Light
D. Sound

Answer Key: B

Pieces of scrap iron are attracted to a metal disk. The metal disk is most likely functioning as which of the following?

A. A battery
B. An engine
C. An insulator
D. An electromagnet

Answer Key: D

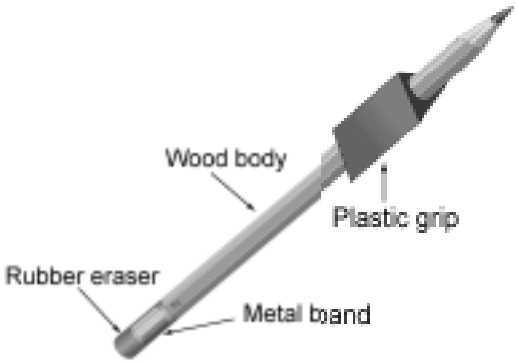
Sample Items Continued

Which object in a room is the best conductor of heat?

A. An area rug
B. A wood table
C. A glass mirror
D. A metal spoon

Maryland Released #20 pg. 22

Answer Key: D



Which part of the pencil is the best conductor of electricity?

A. Metal band
B. Plastic grip
C. Rubber eraser
D. Wood body

Massachusetts Released Item #9 pg. 413

Answer Key: A

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Core Standard 4.1 Structure and Function, Score Reporting Category 1/6

Living and non-living things can be classified by their characteristics and properties.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

4.1L.1 Compare and contrast characteristics of fossils and living organisms.

*Academic Vocabulary**

- extinct
- geology
- paleontology
- prehistoric
- sedimentary

Links to National Standards

2009 NAEP Framework: L4.7

National Science Education Standards: Life Science Content Standard C, pgs. 127-129

AAAS Science Literacy Benchmarks

Explanation

- Fossils can be compared to one another and to living organisms according to their similarities and differences.
- Some organisms that lived long ago are similar to existing organisms, but some are quite different.

Content Connections from Previous Grades

1.1L.1

Sample Items

Which of the following physical characteristics did Tamara most likely use to sort the organisms into the two groups?

Group 1	Group 2
alligator	bat
goldfish	deer
snake	mouse
tuna	rabbit

A. Number of legs
B. Size of the body
C. Shape of the feet
D. Type of the body covering

Massachusetts Released item #34 pg. 429

Answer Key: D

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Core Standard 4.1 Structure and Function, Score Reporting Category 1/7

Living and non-living things can be classified by their characteristics and properties.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

4.1E.1 Identify properties, uses, and availability of Earth materials.

*Academic Vocabulary**

- Raw materials

Links to National Standards

2009 NAEP Framework: E4.4-4.6

National Science Education Standards: Earth and Space Science Content Standard D, pgs. 130-134

AAAS Science Literacy Benchmarks

Explanation

- Earth materials (e.g. rocks, minerals, soil) have various properties
- People use and transform Earth materials into useful objects
- Some Earth materials are easily available and other Earth materials are limited in quantity
- Some materials can be reused, recycled, or redesigned
- Some Earth materials have properties that make them useful in their present form or can be designed and modified to solve human problems and enhance quality of life. (building, fuels, transportation).

Content Connections from Previous Grades

1.1E.1

Sample Items

Mrs. Baker's class went on a walking field trip to a river near the school. They stopped at four places along the way and collected samples of earth materials. Here is a table of what they found. From the information in the table, answer the questions that follow.

SAMPLE NUMBER	DESCRIPTION OF SAMPLE	WHERE FOUND
1	reddish material that felt "slimy" and stuck to the hands, made a tight ball when squeezed	in a pile near a sign reading "AJAX CLAY PIT"
2	shiny black hard chunks the size of a fist, seemed less dense than most rocks	near a train filled with coal in open-topped cars
3	clean mixture of sand, gravel and small pebbles	in the river bottom
4	dark brown mixture of sand, clay, and decaying plants, moist enough to make a ball when squeezed together	in a flat area near the walking path

Which sample of material might be used for energy to make electricity?

A. 1
B. 2
C. 3
D. 4

Answer Key: B

Which material would be part of the ingredients used to make cement sidewalks?

A. 1
B. 2
C. 3
D. 4

Answer Key: C

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 4.2 Interaction and Change, Score Reporting Category 2/5

Living and non-living things undergo changes that involve force and energy.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

4.2P.1 Describe physical changes in matter and explain how they occur.

*Academic Vocabulary**

- boiling
- condensation
- evaporation
- freezing
- melting
- precipitation

Links to National Standards

2009 NAEP Framework: P4.3and P4.6

National Science Education Standards: Physical Science Content Standard B, pgs. 123-127

AAAS Science Literacy Benchmarks

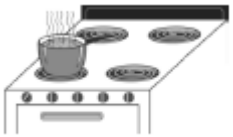
Explanation

- Heating and cooling cause changes in the properties of materials
- Heating and cooling of materials can result in a change of state (e.g. heat added to ice changes to liquid water and then water vapor)
- Things can be done to materials to change some of their properties, but not all materials respond the same way

Content Connections from Previous Grades

1.1P.1, 3.1P.1

Sample Items



Which change of state is shown?

A. Liquid to gas
B. Solid to gas
C. Gas to liquid
D. Solid to liquid

Answer Key: A

Eduardo pours himself a glass of cola with ice in it. Identify which objects are solid, liquid and gas.

A. The cola is the solid, the ice is the liquid, and the bubbles are the gas.
B. The ice is the solid, the bubbles are the liquids, and the cola is the gas.
C. The bubbles are the solids, the cola is the liquid, and the ice is the gas.
D. The ice is the solid, the cola is the liquid, and the bubbles are the gas.

Answer Key: D

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Core Standard 4.2 Interaction and Change, Score Reporting Category 2/6

Living and non-living things undergo changes that involve force and energy.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

4.2L.1 Describe the interactions of organisms and the environment where they live.

*Academic Vocabulary**

- Predator/prey
- decomposer
- Producer/consumer
- Parasite/host
- Ecosystem
- Habitat
- Photosynthesis
- Herbivore/carnivore
- omnivore

Links to National Standards

2009 NAEP Framework: L4.3-4.4

National Science Education Standards: Lfe Science Content Standard C, pgs. 127-129

AAAS Science Literacy Benchmarks

Explanation

Organisms and the environment

- Interactions between organisms can be shown using simple food chains and food webs.
- Animals eat plants or other animals for food.
- Organisms interact with their environments
- Organisms interact with each other
- Organisms can survive only in environments in which their needs are met.
- Organisms interact in various ways including providing food and shelter to one another.
- Some interactions are beneficial; others are detrimental to the organism
- Competition for food and other resources (e.g. water and shelter) are examples of interactions.

Content Connections from Previous Grades

2.1L.1

Sample Items

What most likely caused the plant to bend this way?

A. fertilizer
B. gravity
C. heat
D. light

Massachusetts Released item #20 pg. 422

Answer Key: D

Some young fish develop in estuaries. While these fish develop, they hide in water plants. When the fish reach a certain age, they leave for the ocean.

Which organism in the estuary relies on the sun to make food?

A. Horseshoe crab
B. Hard clam
C. Salt grass
D. osprey

Massachusetts Released Item #11 pg. 17

Answer Key: C

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 4.2 Interaction and Change, Score Reporting Category 2/7

Living and non-living things undergo changes that involve force and energy.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

4.2E.1 Compare and contrast the changes in the surface of Earth that are due to slow and rapid processes.

*Academic Vocabulary**

- tsunami
- fault
- hurricanes
- tornadoes
- glacier

Links to National Standards

2009 NAEP Framework: E4.3

National Science Education Standards: Earth and Space Science Content Standard D, pgs. 130-134

AAAS Science Literacy Benchmarks

Explanation

- Some changes in the Earth's surface are abrupt (e.g. earthquakes, landslides and volcanic eruptions) while other changes happen very slowly (e.g. erosion, weathering).
- The Earth's surface is shaped and reshaped by the motion of waves, wind, water, and ice

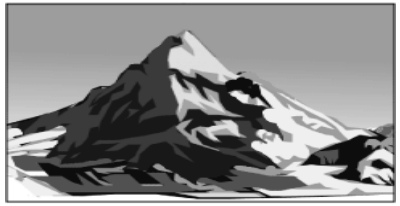
Content Connections from Previous Grades

None

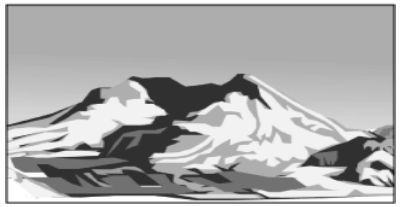
Sample Items

Which of the following events most likely caused the change in this area?

Before Event



After Event



A. A flood
B. A hurricane
C. A volcanic eruption
D. A strong earthquake

Massachusetts Released item #29 pg. 426

Answer Key: C

Which of the following is most likely to make a rock crack and crumble?

A. Dew evaporating on the rock
E. Leaves decaying on the rock
F. Snow melting in the crack in the rock
G. Water freezing in the crack in the rock

Massachusetts Released Item #3 pg. 411

Answer Key: D

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 4.3 Scientific Inquiry, Score Reporting Category 3/8

Scientific inquiry is a process of investigation through questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

4.3S.1 Based on observations identify testable questions, design a scientific investigation, and collect and record data consistent with a planned scientific investigation.

*Academic Vocabulary**

- data
- control
- hypothesis
- inquiry
- procedure
- variable

Links to National Standards

2009 NAEP Framework: Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 121-123

AAAS Science Literacy Benchmarks

Explanation

Investigation

- Develop testable questions.
- Design an investigation
- Collect and record reasonable and accurate data.

Results are show in

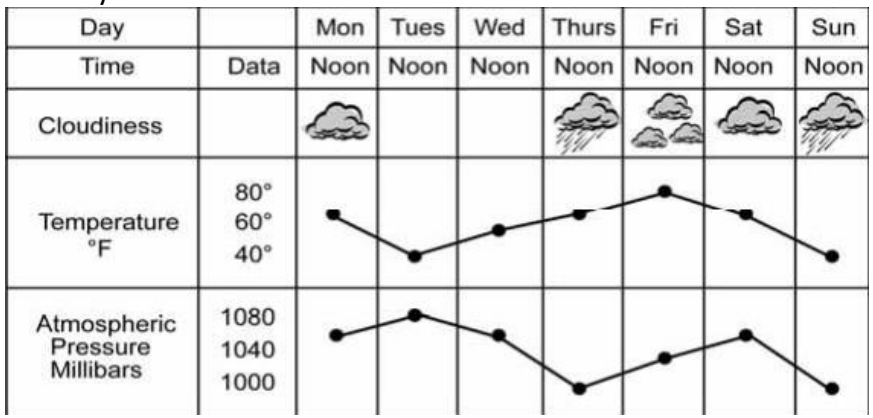
- Logs
- Journals
- Graphs
- Pictures
- Graphic organizers
- Diagrams
- Charts

Content Connections from Previous Grades

2.3S.1, 2.3S.3, 3.3S.1

Sample Items

Sun City



Which approach would be MOST important to collecting a second week of weather data for Sun City?

A. The same person should collect the weather data
B. The same scientific instruments should be used to collect the data
C. The weather data should be collected at a different location
D. The data collector needs to wait until it is 40 degrees Fahrenheit on Monday.

Answer Key: B

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Core Standard 4.3 Scientific Inquiry, Score Reporting Category 3/8

Scientific inquiry is a process of investigation through questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

4.3S.2 Summarize the results from a scientific investigation and use the results to respond to the question being tested.

*Academic Vocabulary**

- conclusion
- error
- outlier
- prediction
- summarize

Links to National Standards

2009 NAEP Framework: Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 121-123

AAAS Science Literacy Benchmarks

Explanation

Explanation of the Results

- use data to explain results
- use results to answer the question being tested

Results are show in

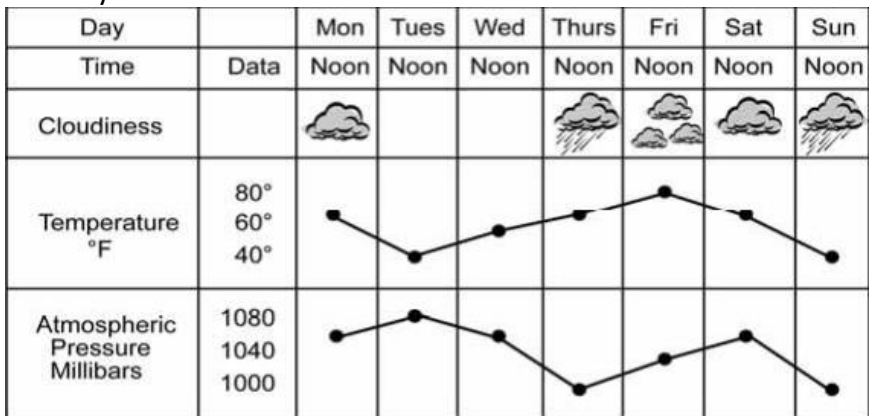
- Logs
- Journals
- Graphs
- Pictures
- Graphic organizers
- Diagrams
- Charts

Content Connections from Previous Grades

3.3S.2

Sample Items

Sun City



Which question can be answered through investigation of the collected data of Sun City's weather?

A. Does it ever rain when the temperature is below 50 degrees Fahrenheit?
B. How much cloudiness was there during the week?
C. What was the average atmospheric pressure for the week?
D. Does the temperature and atmospheric pressure always drop when it rains?

Answer Key: C

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Core Standard 4.3 Scientific Inquiry, Score Reporting Category 3/8

Scientific inquiry is a process of investigation through questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

4.3S.3 Explain that scientific claims about the natural world use evidence the natural world use evidence that can be confirmed and support a logical argument.

*Academic Vocabulary**

- conclusion
- inference
- theory
- hypothesis

Links to National Standards

2009 NAEP Framework: Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 121-123

AAAS Science Literacy Benchmarks

Explanation

- Scientists rely on evidence to back up claims.
- Claims without evidence cannot be scientifically confirmed.
- Evidence helps support a logical argument for a scientific claim.

Examples of Evidence include

- observations
- data
- collections

Content Connections from Previous Grades

K.1E.1, 2.3S.2

Sample Items

Sun City

Which of the following would be considered a way to gather evidence to support a claim?

A. Collect data from an investigation
B. Listen to people on the radio
C. Talk to a friend
D. Watch a new program.

Answer Key: A

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Core Standard 4.4 Engineering Design, Score Reporting Category 4/8

Engineering Design is a process of using science principles to solve problems generated by needs and aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

4.4D.1 Identify a problem that can be addressed through engineering design using science principles

*Academic Vocabulary**

- Science principles
- Engineering design

Links to National Standards

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 134-138

AAAS Science Literacy Benchmarks

Explanation

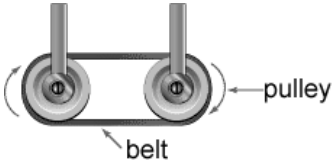
- State a problem and generate criteria for an acceptable solution using science principles
- Suggest possible solutions to a problem.
- Design is both a product and a process.

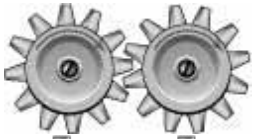
Content Connections from Previous Grades

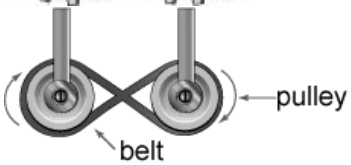
2.4D.3, 3.4D.1

Sample Items

Alexa wanted to build a machine for her technology class. To think of ideas, she drew four sketches of moving parts for her machine. Which design will work?

A.


B.


C.


D.


Massachusetts Released item #25, pg. 424

Answer Key: A

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Core Standard 4.4 Engineering Design, Score Reporting Category 4/8

Engineering design is a process of using science principles to solve problems generated by needs and aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

4.4D.2 Design, construct, and test a prototype of a possible solution to a problem using appropriate tools, materials, and resources.

Academic Vocabulary*

- mass

Links to National Standards

2009 NAEP Framework: Science Practices, pgs 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 134-138

AAAS Science Literacy Benchmarks

Explanation

Prototype

- Identify relevant design features (e.g. size, shape, weight) for building a given prototype of a solution to a given problem.
- Describe different ways in which a problem can be represented. (e.g sketches, diagrams, graphic organizers, and lists)
- Identify and explain the appropriate materials and tools (e.g., hammer, screwdriver, pliers, tape measure, screws, nails, and other mechanical fasteners) to construct and test a given prototype safely.

Content Connections from Previous Grades

1.4D.3, 2.4D.3, 3.4D.1

Sample Items

Juan wants to build a wooden model of a house for a school project. What tools should he use?

A. Cement and Bricks
B. Pliers and Wrenches
C. Scale and Weights
D. Nails and Hammer

Answer Key: D

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Core Standard 4.4 Engineering Design, Score Reporting Category 4/8

Engineering design is a process of using science principles to solve problems generated by needs and aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

4.4D.3 Explain how the solution to one problem may create other problems.

*Academic Vocabulary**

- consequence
- outcome

Links to National Standards

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 134-138

AAAS Science Literacy Benchmarks

Explanation

Solutions

- A solution to a problem may lead to further problems. (e.g., in Klamath Falls, Oregon, midges were introduced to take care of mosquitoes but they have caused problems of their own.)
- Solutions involve trade-offs. (e.g., Electric cars are more fuel efficient, but their batteries contain materials hazardous to the environment.

Content Connections from Previous Grades

3.4D.2

Sample Items

Chemical pesticides are sometimes sprayed on crops to kill insects that eat the crops. People have different viewpoints about the use of pesticides on crops. What might be a concern about using pesticides on the crops?

A. Will the food ripen?
B. Will the food stay fresh?
C. Will the food harm humans?
D. Will the food harm bugs in the home?

Massachusetts Released item #1 pg. 3

Answer Key: C

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 5.1 Structure and Function, Score Reporting Category 1/6

Living and non-living things are composed of related parts that function together to form systems.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

5.1L.1 Explain that organisms are composed of parts that function together to form a living system.

*Academic Vocabulary**

- locomotion
- systems
- skeleton

Links to National Standards

National Science Education Standards: Life Science Content Standard C, pgs. 155-158

AAAS Science Literacy Benchmarks

Explanation

Organism parts

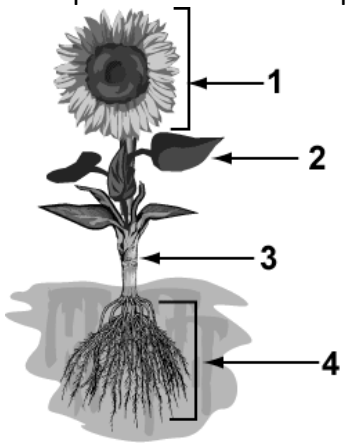
- Organisms are systems composed of parts
- Systems have parts (e.g. brain, bones, roots, leaves) that function together and some of those parts are other systems.
- Organs function together to form systems.
- Major systems are necessary for an organism to function together as a whole. (e.g. digestive, respiration, circulatory, skeletal, muscular, reproductive, and nervous systems.)

Content Connections from Previous Grades

none

Sample Items

Four parts of a sunflower plant are identified by numbers in the picture below.



Which numbered part of the sunflower plant is mainly responsible for reproduction?

A. Part 1
B. Part 2
C. Part 3
D. Part 4

Massachusetts Released item #10 pg. 414

Answer Key: A

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 5.1 Structure and Function, Score Reporting Category 1/7

Living and non-living things are composed of related parts that function together to form systems.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

3.1E.1 Describe the Sun-Earth-Moon system.

Academic Vocabulary*

- axis
- eclipse
- equator
- lunar
- moon phase
- orbit
- planet vs. moon

Links to National Standards

2009 NAEP Framework: E4.1-4.2 and E8.1

National Science Education Standards: Earth and Space Science Content Standard D. pgs. 158-161

AAAS Science Literacy Benchmarks

Explanation

Sun

- The sun is the central and largest body in the solar system.
- Earth revolves around the sun. (year)

Earth

- Earth rotates on its axis (day/night)
- Tilt of the Earth + position in the orbital path results in seasons (introductory level)
- Earth is the third planet from the sun in a system of eight planets

Moon

- Changes occur in the observable shape of the moon over the course of a month.
- The moon orbits the Earth. (month)

Content Connections from Previous Grades

K.2E.1, 2.2E.1, 3.2E.1

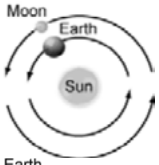
Sample Items

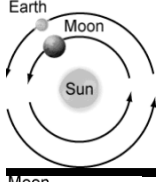
Which statement best describes Earth's movement in relation to the sun?

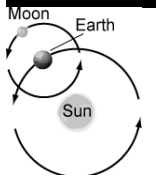
A. The sun orbits around the Earth
B. The sun and Earth go around each other
C. The Earth goes around the sun
D. The sun and Earth go around other planets

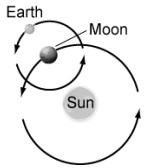
Answer Key: C

Which of the following drawings BEST represents the motion of a planet and its moon around the sun?

A. 

B. 

C. 

D. 

Massachusetts Released Item #9 pg. 414

Answer Key: C

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 5.2 Interaction and Change, Score Reporting Category 2/5

Force, energy, matter, and organisms interact within living and non-living systems.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

5.2P.1 Describe how friction, gravity, and magnetic forces affect objects on or near Earth.

*Academic Vocabulary**

- attract
- gravity
- height
- mass
- orbit
- repel
- satellite

Links to National Standards

2009 NAEP Framework: P4.14-4.15

National Science Education Standards: Physical Science Content Standard B, pgs. 149-155

AAAS Science Literacy Benchmarks

Explanation

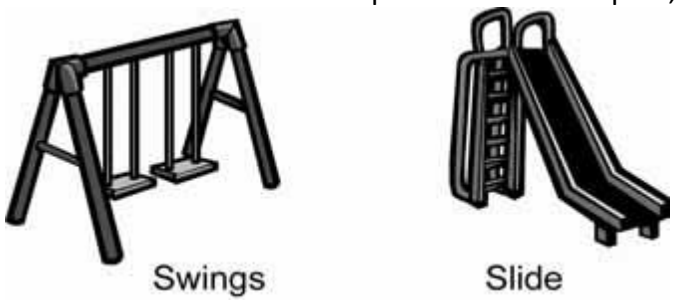
- Friction causes objects to slow down or prevents movement of objects.
- Earth pulls all objects on or near it with a force called gravity.
- The closer an object is to the Earth, the stronger the gravitational pull.
- Magnets have poles that repel and attract each other. (e.g. N pole repels N pole; S pole attract N pole)
- The Earth has a magnetic field.

Content Connections from Previous Grades

1.2P.1, 2.2P.1, 3.2P.1

Sample Items

Two students met at a local park. While at the park, the students played on the swings and a slide



Each student has a different mass, yet they both reached the same height while swinging.
Which of these statements explains why the students reached the same height while swinging?

A. The students had the same speed while on the swing.
B. The students used different amounts of force while swinging.
C. The students were on the swing for the same amount of time.
D. The students used the same amounts of force while swinging

Massachusetts Released item #10 pg. 12

Answer Key: B

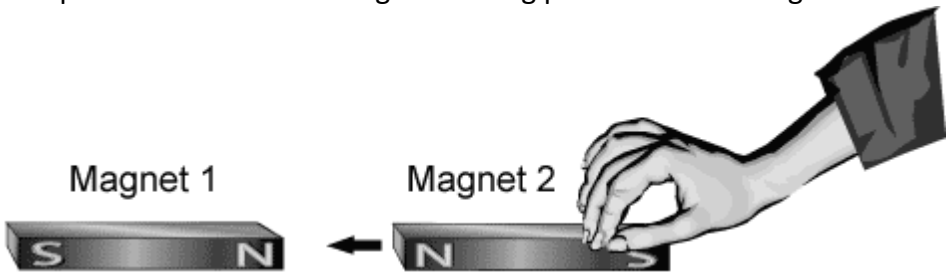
Both students played on the slide. Student 1 wore shorts, and Student 2 wore long pants.
Which of these explanations best identifies why Student 2 moved down the slide more smoothly than Student 1?

A. Less gravity.
B. Less friction.
C. More weight.
D. More acceleration.

Massachusetts Released Item #11 pg. 12

Answer Key: B
(continued on next page)

The picture below shows magnet 2 being pushed toward magnet 1.



Which of the following will most likely happen to magnet 1 as magnet 2 is moved closer?

A. Magnet 1 will move under magnet 2
B. Magnet 1 will move toward magnet 2
C. Magnet 1 will move on top of magnet 2
D. Magnet 1 will move away from magnet 2

Massachusetts Release Item #33 pg. 428

Answer Key: D

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 5.2 Interaction and Change, Score Reporting Category 2/6

Force, energy, matter, and organisms interact within living and non-living systems.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

5.2L.1 Explain the interdependence of plants, animals, and environment, and how adaptation influences survival.

Academic Vocabulary*

- ecology
- adaptation
- interdependence
- extinct
- endangered
- energy
- predator/prey
- metamorphosis
- hibernation

Links to National Standards

2009 NAEP Framework: L4.3-4.4 and L8.6

National Science Education Standards: Life Science Content Standard C, pgs. 155-158

AAAS Science Literacy Benchmarks

Explanation

Ecosystems

- Balance must be maintained within the ecosystem or some species may not survive.
- Interdependence of organisms can be shown using a food web.
- Organisms play certain roles within the environment (e.g. producers, consumers, and decomposers).
- Different kinds of organisms have characteristics that enable them to survive in different environments.

Interdependence

- Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing. EX: fins, feathers, feet
- Organisms are part of and depend on the environment in which they live
- Individuals live and die but not all individuals need to survive to ensure species survival
- Adaptation influences survival

Content Connections from Previous Grades
4.2L.1

Sample Items

Some young fish develop in estuaries. While these fish develop, they hide in water plants. When the fish reach a certain age, they leave for the ocean.
If the water plants were removed from the estuary, the young fish would

A. Decrease in number
B. Move to a new estuary
C. Find another food source
D. Swim to the ocean earlier

Massachusetts Released item #14 pg. 17

Answer Key: A

The pictures below show the change in the fur of an arctic hare from summer to winter.

Fur in summer Fur in winter

Which of the following statements best describes how this change helps arctic hares?

A. It lowers their body temperature
B. It protects their eyes from sunlight
C. It helps them move on slippery ice.
D. It makes them less visible to predators.

Massachusetts Released Item #8 pg. 413

Answer Key: D

(continued on next page)

Some types of trees are able to survive the heat of a forest fire. Which of the following characteristics would best help a tree survive a fire?

A. Large leaves
B. Shallow roots
C. Thick bark
D. Thin trunks

Massachusetts Released Item #1 pg. 409

Answer Key: C

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 5.2 Interaction and Change, Score Reporting Category 2/7

Force, energy, matter, and organisms interact within living and non-living systems.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

5.2E.1 Explain how the energy from the sun affects Earth's weather and climate.

*Academic Vocabulary**

- Air pressure
- anemometer
- current
- evaporation
- condensation
- precipitation
- atmosphere
- barometer
- thermometer

Links to National Standards

2009 NAEP Framework: E8.11 and E8.13

National Science Education Standards: Earth and Space Content Standard D, pgs. 158-161

AAAS Science Literacy Benchmarks

Explanation

- Weather is the temperature, precipitation, and other factors and the present time and place
- Climate is an average of temperature, precipitation and other factors over time.
- Weather and climate vary from place to place and season to season.
- The components of weather (3.2E.1)

The Sun

- The sun provides the light and heat necessary to maintain the temperature of the Earth.
- Energy received at the Earth's surface varies from place to place, hour to hour and season to season.
- The tilt of the Earth and how it affects the seasons and weather. (5.1E.1)

Content Connections from Previous Grades

K.1E.1, 2.2E.2, 3.2E.1

Sample Items

Different parts of the Earth receive different amounts of sunlight. Which area on Earth receives the most sunlight?

A. Near the Equator
B. North Pole
C. South Pole
D. Tropic of Cancer

Answer Key: A

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 5.3 Scientific Inquiry, Score Reporting Category 3/8

Scientific inquiry is a process of investigation based on science principles and questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

5.3S.1 Based on observations and science principles, identify questions that can be tested, design an experiment or investigation, and identify appropriate tools. Collect and record multiple observations while conducting investigations or experiments to test a scientific question or hypothesis.

Academic Vocabulary*

- observation
- theory
- variable

Links to National Standards

2009 NAEP Framework Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 143-148

AAAS Science Literacy Benchmarks

Explanation

Investigation

- Clarify questions and direct them towards objects and phenomena that can be described, explained, and predicted by scientific investigations.
- Develop questions and/or hypothesis that can be tested.
- Plan an investigation or experiment, determining the most objective way to answer the question and/or test the hypothesis.
- Use appropriate tools and techniques to gather observations
    - E.g. Select an instrument that measures desired quantity; length, volume, weight, time interval, or temperature.
- Record observations with accurate pictures, numbers, or written statements.
- Collect multiple observations to increase the reliability of the data.

Explanation Continued

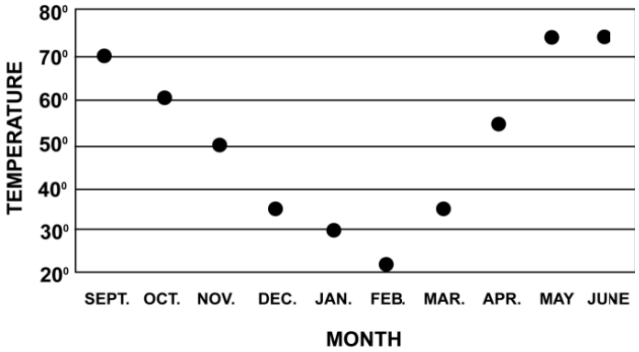
- Gather qualitative and quantitative observations

Content Connections from Previous Grades

3.3S.3, 4.3S.1

Sample Items

A class recorded the outdoor temperatures at noon on the first day of the month all year. They made this chart.



What was the temperature on the first day of March?

A. 30 degrees
B. 75 degrees
C. 35 degrees
D. 40 degrees

Answer Key: C

If you compared the temperature on the first day of October with the first day of January, you would find the temperature?

A. went down.
B. stayed the same.
C. rose slightly.
D. rose a lot.

Answer Key: A

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 5.3 Scientific Inquiry, Score Reporting Category 3/8

Scientific inquiry is a process of investigation based on science principles and questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

5.3S.2 Identify patterns in data that support a reasonable explanation for the results of an investigation or experiment and communicate findings using graphs, charts, maps, models, and oral and written reports.

*Academic Vocabulary**

- display
- transcribe

Links to National Standards

2009 NAEP Framework Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 143-148

AAAS Science Literacy Benchmarks

Explanation

Data

- Use logical reasoning to explain the results of an investigation.
- Record reasonable data and identify patterns.
- Communicate findings of data using graphs, charts, maps, models, etc.

Content Connections from Previous Grades

3.3S.3, 4.3S.2

Sample Items

Jessica and Daniel wanted to see whether plants would grow better in soil or sand. Jessica planted 5 plants in soil, and Danel planted 5 plants in sand. They gave all 10 plants equal amounts of water and exposed them to equal amounts of sunlight. After 2 weeks they recorded the growth of each plant.

SOIL	
Plant	Increase in height (cm)
1	2.0
2	1.9
3	2.2
4	2.1
5	1.9

SAND	
Plant	Increase in height (cm)
1	0.5
2	0.6
3	0.4
4	0.7
5	0.6

What conclusion can they draw from this experiment?

A. Plants grow just as well in soil as in sand.
B. Plants grow taller in sand than in soil.
C. Plants do not grow in either sand or soil.
D. Plants grow taller in soil than in sand

Answer Key: D

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 5.3 Scientific Inquiry, Score Reporting Category 3/8

Scientific Inquiry is a process of investigation based on science principles and questioning, collecting, describing, and examining evidence to explain natural phenomena and artifacts.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

5.3S.3 Explain the reasons why similar investigations may have different results

*Academic Vocabulary**

- alternative
- control
- error
- outlier
- range
- variables

Links to National Standards

2009 NAEP Framework Science Practices, pgs. 65-75

National Science Education Standards: Science as Inquiry Content Standard A, pgs. 143-148

AAAS Science Literacy Benchmarks

Explanation

- All investigations have error
- Accurate records are necessary in investigations.
- Similar investigations with different results need to be examined for inaccuracies (e.g. measurement error, procedural error, anomalies).

Content Connections from Previous Grades

3.3S.2, 3.3S.3

Sample Items

Two students were each doing an investigation. They were investigating the effect of sunlight on pea seedlings.

- One student placed one seedling near a window in the sun and another on a counter away from the window.
- The second student placed one seedling outside in the sun and the other on a counter away from the window.

All the seedlings started out at 5cm. They measured the seedlings at the end of 4 days and observed the following:

Location	Student 1	Student 2
Sun	10 cm	12 cm
No Sun	7 cm	7 cm

Why do you think the students got different results?

A. The sun was not as bright outside.
B. The locations were not exactly the same.
C. The seedlings were not the same size at the beginning.
D. The peas were measured at different times during the day.

Answer Key: B

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 5.4 Engineering Design, Score Reporting Category 3/8

Engineering design is a process of using science principles to make modifications in the world to meet human needs and aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

5.4D.1 Using science principles, describe a solution to a need or problem given criteria and constraints.

*Academic Vocabulary**

- feasibility
- prototype

Links to National Standards

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 161-166

AAAS Science Literacy Benchmarks

Explanation

Solution

- Identify a problem that reflects needs and wants.
- Describe different solutions given criteria and constraints

Content Connections from Previous Grades

3.4D.1, 4.4D.1

Sample Items

A student developed a method to water plants that needed an additional 100ml. of water once a week.

Which of the following criteria was essential for developing the DESIGN?

A. Soil type
B. Plant type
C. Size of watering device
D. Water needed for a month

Answer Key: C

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Core Standard 5.4 Engineering Design, Score Reporting Category 4/8

Engineering design is a process of using science principles to make modifications in the world to meet human needs and aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

5.4D.2 Design and build a prototype of a proposed engineering solution and identify factors such as cost, safety, appearance, environmental impact, and what will happen if the solution fails.

*Academic Vocabulary**

- constraints
- engineering design
- environmental impact

Links to National Standards

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 161-166

AAAS Science Literacy Benchmarks

Explanation

Engineering Design Solution

- Engineering design failure, and how that is used to further refine design.
- Examples:
  - Windmill designs
  - Newspaper towers
  - Toothpick bridges
  - Paper airplane
- Design a prototype for a solution.
- Evaluate a prototype identifying factors such as cost, safety, appearance, or environmental impact.

Content Connections from Previous Grades
4.4D.2, 4.4D.3

Sample Items

A student is working on creating a new car design. The student designs, builds, and tests a prototype of their design and finds out that the car uses a lot of fuel, but can't travel very far. What should the student do next?

A. Identify possible design improvements and rebuild
B. Identify criteria, constraints, and priorities
C. Define a problem that addresses a need
D. Describe relevant scientific principles and knowledge

Answer Key: A

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Core Standard 5.4 Engineering Design, Score Reporting Category 4/8

Engineering design is a process of using science principles to make modifications in the world to meet human needs and aspirations.

It is essential that these standards be addressed in contexts that promote scientific inquiry, use of evidence, critical thinking, making connections, and communication.

Content Standard

5.4D.3 Explain that inventions may lead to other inventions and once an invention exists, people may think of novel ways of using it.

Academic Vocabulary*

- novel

Links to National Standards

2009 NAEP Framework: Science Practices, pgs. 76-82

National Science Education Standards: Science and Technology Content Standard E, pgs. 161-166

AAAS Science Literacy Benchmarks

Explanation

Inventions

- Inventions may be used in ways for which they were not originally designed.
- Inventions lead to new ideas.
- Inventions lead to new inventions.

Examples

Flying pie plate-Frisbee

Space Program-Velcro, Tang

Content Connections from Previous Grades

4.4D.3

Sample Items

Lenses were created to correct near and far sightedness. Which of the following inventions was first created based on the use of lenses to correct eyesight?

A. Microscope
B. Lasers
C. Microwave oven
D. X-ray machine

Answer Key: A

*Academic Vocabulary is a list of terms related to the content standard and may be used in test items without explanation. Vocabulary and concepts within the Explanation are assessable and not exclusive.

Item Specifications

Oregon Assessment of Knowledge and Skills (OAKS) is a multiple choice and computer scored constructed response statewide assessment. It is a required assessment that provides the base for the state accountability system.

Criteria for All OAKS Test Questions

Test items must:

- be appropriate for students in terms of grade-level difficulty, cognitive complexity, reading level, interests and experience.
- be free of age, gender, ethnic, religious, socioeconomic, or disability stereotypes or bias.
- provide clear and complete instructions to students.
- ensure each Score Reporting Category will have items with a range of difficulty and complexity levels.
- ensure each multiple choice test item will measure only one Score Reporting Category.

Graphics Criteria

Graphics are used in OAKS to provide both necessary and supplemental information. Some graphics contain information that is necessary for answering the question, while other graphics illustrate or support the context of the question.

- Graphic displays, their corresponding items and answer choices will appear on the same screen for online items.
- Shading and color will be minimized. It will be used to make a figure's size, shape or dimensions clear, and not solely for artistic effect.
- Graphics used for computer scored constructed response items are displayed within a work space and allow students to manipulate answer graphics and answer choices.

Item Style and Format Criteria for Multiple Choice Items

- Test items will be in the form of questions or sentences that require completion.
- Each item will have three, four or five answer choices. Students will be told in the test directions to choose the best answer from among the choices.
- Answer choices will be arranged one of three ways beneath the test item: vertically, horizontally, or in two columns (i.e., A and B in the left column, C and D in the right column).
- Neither "None of the above" nor "All of the above" will be used as one of the answer choices. "There is not enough information" is an allowed answer choice, but infrequently used.
- Test items may be worded in the negative ("Which of these is NOT …"), but this structure will be used only when it offers substantial advantages for the item construction.

- Items should be free of absolute wording, such as "always" and "never," and have qualifying words (e.g., least, most, except) printed in small caps for emphasis.
- Masculine pronouns should NOT be used to refer to both sexes. Plural forms should be used whenever possible to avoid gender-specific pronouns (For example, instead of "The student will make changes so that he ..," it is best to use "The students will make changes so that they...").
- An equal balance of male and female names should be used including names representing different ethnic groups.
- Test items aligned to standards may contain extraneous information.
- Stacked English-Spanish test items are used on electronic tests for the English-Spanish OAKS.

Item Style and Format Criteria for Computer Scored Constructed Response

- Test items will be in the form of questions or instructions that require at least one object to be created or matched to an existing picture,
- Each item may have many correct answer choices.
- Test items may be worded so that not all answer choices are used to construct the correct response.
- An equal balance of male and female names should be used including names representing different ethnic groups.
- Test items aligned to standards may contain extraneous information but only to enhance the students' understanding of the question.
- Side-by-side English-Spanish test items are under development.
- Students using Braille will not receive constructed response items but will receive similar content items appropriate for students using Braille.

Criteria for SCIENCE OAKS Test Reporting

Student information from 2017-18 OAKS Online Science will be reported through six Score Reporting Categories (SRC) including three Science Core Standards and three Science subjects as sub categories. Scientific Inquiry (SRC 3) and Engineering Design (SRC 4) scores will be combined and reported together as SRC 8 (Science Processes) for 2017-18.

- **Structure and Function (SRC 1):** Understand living and non-living things have characteristics, form and function, and are composed of components that function together to form systems.
- **Interaction and Change (SRC 2):** Understand components in a system can interact in dynamic ways, within or without that system, and may result in change.
- **Physical Science (SRC 5):** Understand structures and properties of matter, forms of energy, and changes that occur in the physical world.
- **Life Science (SRC 6):** Understand structures, functions, and interactions of living organisms and the environment.

- **Earth and Space Science (SRC 7):** Understand physical properties of the Earth and how those properties change. Understand Earth's relationship to other objects in the Universe.
- **Scientific Inquiry (SRC 3) and Engineering Design (SRC 4) reported as (SRC 8):** Understand science process concepts and skills that characterize the nature and practice of science. Scientific Inquiry is a systematic process that includes proposing testable hypotheses, collecting, analyzing, and interpreting data to produce evidence-based explanations and new explorations. Engineering Design is a process of formulating problem statements, identifying criteria and constraints, testing solutions, and incorporating modifications based on test data and communicating the recommendations.

The Test Items

- Each Structure and Function or Interaction and Change test item will also report out to one subject Score Reporting Category but only count once for a student's total score.
- Each Core Score Reporting Category will have items with a range of difficulty levels. This range of difficulty will be approximately the same across the Core reporting categories.
- Test items are designed to be appropriate for students in the assigned test grade in terms of reading level, interests, and experience.
- Test items will be stated in the clearest manner possible.

Criteria for SCIENCE OAKS Modules

A portion of each test will be incorporated into modules. A module is defined as a stimulus containing scientific information, accompanied by two to five knowledge and skills questions. The remaining test items on each test will be discrete/stand-alone knowledge and skills items. Students will not refer to a stimulus when answering those questions.

- The stimulus for each module will vary in length, format and character. It could be one or a combination of any of the following: data table, diagram, chart, drawing, photo or reading text.
- Each Knowledge and Skills test item within a module measures one Core Score Reporting Category (SRC). Within a module, though, items may measure different SRCs.
- Each stimulus will be free of age, gender, and other bias, as evaluated by the Oregon Assessment Sensitivity Panel.
- Although the stimulus for each module will provide scientific information, students will be required to draw on prior knowledge to answer many of the items. In other words, there may not be sufficient information in the stimulus to answer all associated test questions. The stimulus may simply provide a context for some test questions.
- Each module will often include a title, which will serve to identify the accompanying items as a set.

Science Test Blueprint

Introduction

The blueprints used to construct Knowledge and Skills Tests for Science prescribe the:

- Score Reporting Categories (SRC) included on each test,
- the cognitive demand and difficulty level of items as distributed on a test form,
- the number and percentages of test items from each SRC included on each test, and
- the total number and percentages of operational and field test items included for each test.

Teachers and other educators have historically played a vital role in the development of these specifications and blueprints by serving on Content and Assessment Panels and other review groups. These groups have advised the Department as content standards have been developed, and have helped establish priorities on which standards to assess and the weighting of the strands within each content area assessment.

Alignment of Test Items to Content Standards

Test items are carefully aligned to content standards at the appropriate grade level through a rigorous process at two points in the test item development process:

1. At item development workshops, item writers are provided with adopted content standards to which they must write test items; during a peer review process, this alignment is verified by another grade level item developer.
2. Alignment of items to the content standards is further verified during a review by members of a Content and Assessment Panel, who ensure items not only match the content standards, but also verify overall quality and appropriateness. Reviewers either accept items as a strong match to the targeted standards, edit items to achieve a strong match, or reject items which do not strongly match the standards.

The Appendix to this document includes additional evidence describing procedures ensuring alignment during item, development, including descriptions of the Item Development Process and the Life of an Item.

Content Coverage

Prior to item writing activities, item databases are reviewed to determine the extent that the available items represent the emphasis and content in the standards. If any grade level standards are underrepresented in the item pool, they are identified and targeted specifically for additional item development. This assures that every year; the proportion of items in the item pool is comparable in both emphasis and content to the content standards. The table on the following page describes the emphasis given to each content strand; this emphasis is reflected in both the item pool and administered tests.

All tests and the item pool from which they are constructed follow the weighting of each content strand as reflected in the tables on the following pages. Items within a strand, or SRC, are selected to provide a range of difficulty so that the progressive nature of the test is maintained as students of varied ability levels are presented with items most appropriate to their ability from that pool. Although a student may not see an item addressing every one of the assessable standards in a single test event, the item pool contains multiple items for each content standard at a variety of difficulty levels.

Adaptive Algorithm

In addition, the adaptive algorithm specifically considers alignment criteria when drawing test items. As a result, we accomplish the dual purpose of creating a test form that is appropriately developed for each student and meets the criteria set forth for alignment (e.g., balance of representation, depth of knowledge).

Additional Test Design Criteria

Each item assesses content aligned at one grade within the grade level standards.

Item Availability

Online-adaptive test opportunities provide a range and breadth of items within each Core SRC and Subject SRC. Each grade level test pool has approximately 900 items available for testing.

Key Placement

Key placement cannot be controlled for online-adaptive assessments, so to ensure more random correct keys, item writers are instructed to rotate the correct key for their items during item authoring.

Modules

Modules**,** or items that have a stimulus and have 1-6 questions, are designed to be presented together on the same test. Between one third and one half of the items from each SRC in each test pool are Modules.

Spanish Test Pool

The English test blueprints provide the criteria for all English-Spanish tests. Each Spanish test pool has the same items as the English test pool.

Science Score Reporting Categories

This table diagrams the science unifying concepts and processes to be reported.

Score Reporting Categories		Unifying Concepts and Processes			
		Big Ideas		Science Processes	
		*Structure and Function (SRC 1)	*Interaction and Change (SRC 2)	**Scientific Inquiry (SRC 3)	**Engineering Design (SRC 4)
				**Scientific Inquiry and Engineering Design (SRC 8)	
Science Disciplines or Subjects	*Physical Science (SRC 5)	*Structure and Function in Physical Science*	*Interaction and Change in Physical Science*		
	*Life Science (SRC 6)	*Structure and Function in Life Science*	*Interaction and Change in Life Science*		
	*Earth and Space Science (SRC 7)	*Structure and Function in Earth and Space Science*	*Interaction and Change in Earth and Space Science*		

*Test items aligned to SRC 1 and SRC 2 will also be reported to a subject SRC of Physical Science, Life Science, or Earth and Space Science. But, each test item in SRC 1 or SRC 2 will only be counted **once** toward a student's summary science score.

Weighting of Score Reporting Categories

The 2009 science content standards are organized under four Core Standards. The Core Standard statements describe the unifying concepts and processes in science. Core Standards One, **Structure and Function**, and Two**, Interaction and Change**, describe the big ideas in the three science disciplines or subjects of **Physical, Life, and Earth and Space**. Core Standards Three, **Scientific Inquiry**, and Four, **Engineering Design**, describe the science process skills and understandings that characterize the nature and practice of science and engineering.

The chart below shows the score reporting categories (SRC) for each grade tested and the percentage of questions on a given test administration that would asses that category. Test items aligned to SRC 1 and SRC 2 will also be reported to a subject SRC of Physical Science, Life Science, or Earth and Space Science. But, each test item in SRC 1 or SRC 2 will only be counted once toward a student's summary science score. In 2011-12, test items aligned to SRC 3 and SRC 4 will be reported only once as SRC 8.

For example, at grade 5, 25% of the items on a test will assess Structure and Function, which equals about 11 items on a 45-item test. Those 11 items will also be reported as they align to a Subject SRC, for reporting purposes only.

Targeted Percent of Questions by Core SRC					Targeted Percent of Questions by Subject SRC			
	SRC 1	**SRC 2**	**SRC 3***	**SRC 4***	**SRC 5**	**SRC 6**	**SRC 7**	**SRC 8***
	Structure and Function	Interaction and Change	Scientific Inquiry	Engineering Design	Physical Science	Life Science	Earth and Space Science	Science Processes
Grade 5	25%	50%	13%	12%	25%	25%	25%	25%
Grade 8	30%	45%	13%	12%	25%	25%	25%	25%
High School	30%	45%	13%	12%	24%	27%	24%	25%
* Scores from SRC3 and SRC 4 are combined and reported as SRC 8 for 2017-18								

Science Test Blueprint-Grade 5 Test

Content Coverage and Weighting

Score Reporting Categories		Testable content codes	Number of OAKS Online Items	Target % of Questions Assessed per Test*		Online Test Pool Size
Structure and Function	Physical Science	3.1P.1, 4.1P.1,	11-15	25%		290+
	Life Science	3.1L.1,4.1L.1, 5.1L.1				
	Earth and Space Science	4.1E.1,5.1E.1				
Interaction and Change	Physical Science	3.2P.1,4.2P.1, 5.2P.1	22-26	50%		500+
	Life Science	3.2L.1,4.2L.1, 5.2L.1				
	Earth and Space Science	3.2E.1,4.2E.1,5.2L.1,5.2E.1				
Science Processes (SI and ED)	Scientific Inquiry	3.3S.1, 3.3S.2, 3.3S.3,4.3S.1, 4.3S.2, 4.3S.3,5.3S.1,5.3S.2,5.3S.3	11-15	25%		250+
	Engineering Design	3.4D.1, 3.4D.2, 3.4D.3, 4.4D.1, 4.4D.2,4.4D.3,5.4D.1,5.4D.2,5.4D.3				
Operational Item Total			45			Approx. 1040
Field Test Item Total			6			300
Total items on Test			51	100%		

*During an individual student testing session, the test algorithm selects items from each SRC, targeting the percentages indicated. Furthermore, items are selected to match the target item difficulty level, determined by the student's performance on previous items, and also to match the Cognitive Demand Distribution Goals for the test. The numbers of items available in the item pool for each SRC are sufficient to allow three tests per student each year without the student seeing any item more than once.

Target Cognitive Demand and Item Pool Distribution by Difficulty

The science test pools are designed so that a range of cognitive demand items and a range of difficult items are included for each student's test opportunity. The target item pool difficulty distribution for the Grade 5 test is outlined in the chart. A target range of cognitive demand item delivery is also included. (See Appendix B, Cognitive Demand and Target Item Pool Difficulty Distribution for all grades).

The three Cognitive Demand levels used to qualify Oregon's test items are:

- Recall: Item requires a student to recall a fact, information or procedure.
- Skill/Concept: Item requires a student to use skill or concept, including thinking that requires two or more steps.
- Strategic Thinking: Item requires a student to use reason, develop a plan or use a sequence of steps.

Adaption and RIT Scores

Online adaptive tests provide students with questions at the beginning of the test at or about the mean RIT level and as the student responds, the test item delivery system makes adjustments by selecting appropriate items for each student based upon their correct and incorrect responses. Student scores on each test will vary due to performance and the set of unique test items issued to the student. Generally, students will earn scores between the maximum high and minimum low range. The following are the possible high and low RIT student scores for grade 5 tests, within one or two points, based on a given year's item pool.

High RIT= 285

Low RIT= 159

Difficulty Criteria for Grade 5 level:

Grade 5 Science	Target Item Pool Difficulty Distribution
RIT by Difficulty	
204-223	33%
224-231	33%
232-249	33%
RIT Range	204-249
Mean RIT	228
Cognitive Demand	**Target for Item Delivery**
Recall	25%
Skill/Concept	50%
Strategic Thinking	25%

Achievement Level Descriptors

Achievement Level Descriptors describe what students know and can do based on their performance on statewide knowledge and skills tests in the various content areas. These may be used by educators to target instruction and inform parents and students of the expectations for students to be considered proficient at a particular grade level.

The Achievement Level Descriptors are based on a sampling of a larger set of testable content outlined in the Oregon Content Standards. Results for individual students are only one indicator of student ability as measured at the time of testing. These statements give a general description of what most students know and can do within a particular band of achievement and are presented in the order of the way they are reported rather than by importance or test emphasis. Students who score at or within a particular level of achievement possess the bulk of abilities described at that level and generally have mastered the skills described in the preceding achievement levels.

Achievement Level Descriptors for each subject area were developed by groups of parents, educators and business people who worked with state officials to establish the minimum scores required for Exceeds, Meets, Nearly Meets, and Does Not Yet Meet.

Achievement Level Descriptors (ALDs)

General Policy Definitions (apply to all grades and subjects)

- Does Not Yet Meet: Students do not demonstrate mastery of grade-level knowledge and skills required for proficiency.
- Nearly Meets: Students demonstrate partial mastery of grade-level knowledge and skills required for proficiency.
- Meets: Students demonstrate mastery of grade-level knowledge and skills required for proficiency
- Exceeds: Students demonstrate mastery of grade-level knowledge and skills exceeding the requirement for proficiency.

Science Policy Definitions (apply to all grade questions)

- Does Not Yet Meet: Students demonstrate limited mastery of science, scientific inquiry and engineering design knowledge and skills, through the application of the basic concepts with occasional success.
- Nearly Meets: Students demonstrate partial mastery of science, scientific inquiry, and engineering design knowledge and skills, through the application of basic concepts with regular success.
- Meets: Students demonstrate mastery of science, scientific inquiry and engineering design knowledge and skills, through the interpretations and application of grade-level concepts with consistent success.
- Exceeds: Students demonstrate mastery of science, scientific inquiry and engineering design knowledge and skills, through the interpretation and application of advanced concepts with consistent success.

Structure and Function Domain Specific Achievement Level Descriptors

Physical Science

Does Not Yet Meet:

- Identifies a substance as a solid or liquid, but cannot describe the properties that make it so.
- Identify some type of energy.

Nearly Meets:

- Identify substances as solids, liquids, or gasses. Name some critical properties.
- Identify some types of energy and their effects on matter.

Meets:

- Compare and contrast the properties of states of matter.
- Describe the properties of forms of energy and how objects vary in the extent to which they absorb, reflect, and conduct energy.

Exceeds:

- Place an unknown substance in the correct category of matter by comparing and contrasting properties.
- Compare various forms of energy and describe why objects vary in the extent to which they absorb, reflect, and conduct energy.

Life Science

Does Not Yet Meet:

- Identify that living things have parents that are similar to them in appearance.
- Identify that there are fossils of once living organisms.
- Identify that organisms have different parts.

(Structure and Function Domain Specific ALDs Continued)

Life Science

Nearly Meets:

- Identify some characteristic offspring and parents share
- Identify some characteristics of fossils and living organisms.
- Identify that organisms have different parts that function together.

Meets:

- Compare and contrast the characteristics of offspring and parents.
- Compare and contrast characteristics of fossils and living organisms.
- Explain that organisms are composed of parts that function together to form a living system.

Exceeds:

- Predict what a young organism will look like when it is mature based on the appearance of the parents.
- Explain why fossils may be different than living organisms.
- Apply the concept of systems to something other than a living organism.

Earth and Space Science

Does Not Yet Meet:

- Differentiate between Earth materials and synthetic materials
- Identify Sun, Moon, and Earth, but not that they form a system

Nearly Meets:

- Identify properties of Earth materials that affect their use.
- Describe Earth's place and movement in the Sun-Earth-Moon system.

(Structure and Function Domain Specific ALDs Continued)

Earth and Space Science

Meets:

- Identify properties, uses and availability of Earth materials.
- Describe the Sun-Earth-Moon system, including changes that occur in the observable shape of the moon over the course of a month.

Exceeds:

- Justify the use of an Earth material based on its properties and/or availability.
- Demonstrate an understanding that the interactions between the Sun, Earth, and Moon are a function of their size and relative placement.

Interaction and Change Achievement Level Descriptors

Domain Specific Descriptors

Physical Science

Does Not Yet Meet:

- Understand that a push makes an object change speed and position.
- Recognized that matter has undergone a physical change.
- Identify that friction, gravity, and magnetism are forces.

Nearly Meets:

- Relate amount of force acting on an object to the degree of change in its position, motion, or speed.
- Describe a physical change in matter that has taken place.
- Identify that friction, gravity, or magnetic forces affect objects.

Meets:

- Describe how forces cause changes in an object's position, motion, and speed.
- Describe physical changes in matter and explain how they occur.
- Describe how friction, gravity, and magnetic forces affect objects on or near Earth.

Exceeds:

- Describe and compare the motion of objects in terms of one or more forces acting upon them.
- Predict the physical change that will occur as a result of an action.
- Utilize understanding of friction, gravity, and magnetic forces to predict how the movement of objects will be affected.

(Interaction and Change Domain Specific ALDs Continued)

Life Science

Does Not Yet Meet:

- Identify that there are stages of development of plants and animals.
- Differentiate between an organism and its environment
- Understand that plants and animals have needs that must be met in order for them to survive.

Nearly Meets:

- Identify some stages of development of plants and/or animals.
- Differentiate between interactions between organisms and between organisms and environment.
- Identify that adaptation is a change in structure, function, or behavior in response to environmental factors and that plants and animals are independent.

Meets:

- Compare and contrast the life cycles of plants and animals.
- Describe the interactions and of organisms and the environment where they live.
- Explain the interdependence of plants, animals, and environment and how adaptation influences survival.

Exceeds:

- Apply the concept of cycles in nature. e.g., water cycle, carbon cycle, seasons.
- Describe factors that might change the interaction of an organism and its environment.
- Suggest adaptations that might increase survival in the face of changing environmental conditions.

(Interaction and Change Domain Specific ALDs Continued)

Earth and Space Science

Does Not Yet Meet:

- Identify Earth as a planet. Name the seasons and at least one weather characteristic of each season.
- Recognize that Earth's surface changes.
- Identify that energy from the sun provides light and heat.

Nearly Meets:

- Describe seasons in terms of precipitation and temperature patterns in the area where the student lives.
- Identify a change of Earth's surface features due to a slow or a rapid change.
- Differentiate between weather and climate.

Meets:

- Identify Earth as a planet and describe its seasonal weather patterns of precipitation and temperature
- Compare and contrast the changes in the surface of the Earth that are due to slow and rapid processes.
- Explain how the energy from the sun affects Earth's weather and climate.

Exceeds:

- Explain differences in weather patterns around the Earth as a result of seasonal changes.
- Suggest processes responsible for changes to Earth's surface.
- Explain the influence of the tilt of the Earth and Earth's orbital path on weather and climate.

Scientific Inquiry Achievement Level Descriptors

Does Not Yet Meet:

- Plan a simple investigation based on a testable question.
- Match measuring tools to their uses
- Collect and record data from a scientific investigation.
- Use the data collected from a scientific investigation to explain the results and draw conclusions.
- Explain why when a scientific investigation is repeated, similar results are expected.

Nearly Meets:

- Based on observations, identify testable questions.
- List the steps of a scientific investigation and identify possible tools you would need.
- Identify data relevant to the question being tested.
- Summarize the results from a scientific investigation and use the results to respond to the question being tested.
- Explain that scientific claims about the natural world use evidence that can be confirmed and support a logical argument.

Meets:

- Based on observations and science principles, identify questions that can be tested.
- Design an experiment or investigation, and identify appropriate tools.
- Collect and record multiple observations while conducting investigations or experiments to test a scientific question or hypothesis.
- Identify patterns in data that support a reasonable explanation for the results of an investigation or experiment and communicate findings using graphs, charts, maps, models, and oral and written reports.
- Explain the reasons why similar investigations may have different results.

(Scientific Inquiry ALDs Continued)

Exceeds:

- Link observations and science principles to questions or hypotheses that can be examined through scientific investigation.
- Design and conduct an investigation that uses appropriate tools and procedures.
- Give reasons for the collection of multiple observations while conducting investigations or experiments.
- Use patterns in data to communicate the results of an investigation using graphs, charts, maps, models, and oral and written reports.
- Propose changes in an investigation's procedure that will improve the accuracy of the data.

Engineering Design Achievement Level Descriptors

Does Not Yet Meet:

- Identify a problem that can be addressed through engineering design using science principles.
- Identify problems that have been solved through engineering design and the impact that has had on the way that people live.
- Differentiate between intended and unintended consequences of inventions.

Nearly Meets:

- Recognize that some proposed solutions to a problem will not be feasible because of given criteria and constraints.
- Identify appropriate tools, materials, and resources needed to construct a prototype of a possible engineering solution.
- Identify uses or outcomes of an invention for which they were not designed.

Meets:

- Using science principles, describe a solution to a need or problem given criteria and constraints
- Design a prototype of a proposed engineering solution and identify factors such as cost, safety, appearance, environmental impact, and what will happen if the solution fails.
- Explain that inventions may lead to other inventions and once an invention exists, people may think of novel ways of using it.

Exceeds:

- Justify a proposed solution based on science principles, criteria, and constraints.
- Evaluate proposed engineering design solutions in relation to factors such as cost, safety, appearance, environmental impact, and likelihood of failure.

Local Assessments Required by OAR 581-22-2115 Assessment of Essential Skills

Local Performance Assessment

School districts and public charter schools that offer instruction at grades 3 through 8 or high school must administer annual local performance assessments for students in grades 3 through 8 and at least once in high school for the skill areas of writing, speaking, mathematics problem solving, and scientific inquiry. The purpose of the local performance assessment requirement is to ensure that students in grades 3 through high school are afforded opportunities to learn and to receive feedback regarding their progress toward meeting specific state standards throughout their years in public schools.

A local performance assessment is a standardized measure (e.g., activity, exercise, problem, or work sample scored using an official state scoring guide), embedded in the school district's or public charter school's curriculum that evaluates the application of students' knowledge and skills. Local performance assessments must be designed to closely align with state standards and to promote independent, individual student work.

School districts and public charter schools may either use a work sample scored using an official state scoring guide or a comparable measure adopted by the school district or public charter school to satisfy the local performance assessment requirement. *Section 6.0 Local Performance Assessment Requirement* of the 2016-17 Essential Skills and Local Performance Assessment Manual provides guidance for those school districts and public charter schools choosing to use a work sample to satisfy this requirement.

Assessment of Proficiency in the Essential Skills

As part of the new graduation requirements, high school students must demonstrate proficiency in a set of Essential Skills, which are defined as process skills that cross academic disciplines and are embedded in the content standards. Students may demonstrate proficiency in these Essential Skills using any of the assessment options approved by the State Board of Education.

Students may demonstrate proficiency using Oregon's Statewide Assessments, Smarter Balanced, or other standardized assessment listed in section 3.2 of the 2016-17 Essential Skills and Local Performance Assessment Manual. Another approved

option of the Essential Skills of Writing, Speaking, and Mathematics is the completion of work samples scored locally using an official state scoring guide. Section3.4: Local Assessment Option of the 2016-17 Essential Skills and Local Performance Assessment Manual provides guidance for those school districts and public charter schools choosing to use a work sample to satisfy this requirement.

Three of the essential skills are established as requirements for graduation including: Reading, Writing, and Mathematics. Science Inquiry is not a requirement for graduation as of the 2017-18 school year.

Appendices

Included in this section are:

Appendix A: Target Cognitive Demand and Item Pool Distribution Goals for all Grades

Appendix B: Item Development Process

Appendix A: Target Cognitive Demand and Item Pool Distribution by Difficulty

Oregon recognizes the importance of Cognitive Demand as part of test specification. To that end, we are implementing a strategy to overtly incorporate a test design process that includes the three dimensions of content, difficulty and Depth of Knowledge.

- The first step in the process was convening content panels to ask for their determination as to the appropriate allocation of Cognitive Demand, given the newly adopted content standards.
- The second step was to analyze the gap between the Cognitive Demand and Level of Complexity of all items in the current pools against the content panel's recommendations.
- The third step involved engaging item writers to write items to fill in the critical gaps. These items were reviewed and field tested through our standard processes.

The three Level of Complexity levels to be addressed are:

- Recall: Item requires a student to recall a fact, information or procedure.
- Skill/Concept: Item requires a student to use a skill or concept, including thinking that requires two or more steps.
- Strategic Thinking: Item requires a student to use reason, develop a plan or use a sequence of steps.

Target Cognitive Demand and Item Pool Distribution by Difficulty

Grade 5	Target Item Pool Difficulty Distribution	Grade 8	Target Item Pool Difficulty Distribution	High School	Target Item Pool Difficulty Distribution
Difficulty		**Difficulty**		**Difficulty**	
204-223	33%	213-231	33%	213-233	33%
224-231	33%	232-240	33%	234-241	33%
232-249	33%	241-257	33%	242-258	33%
Cognitive Demand		**Cognitive Demand**		**Cognitive Demand**	
Recall	25%	Recall	20%	Recall	20%
Skill/Concept	50%	Skill/Concept	50%	Skill/Concept	50%
Strategic Thinking	25%	Strategic Thinking	30%	Strategic Thinking	30%
RIT Range	204-249	**RIT Range**	213-257	**RIT Range**	213-258
Mean RIT	228	**Mean RIT**	235	**Mean RIT**	237

Appendix B: Item Development Process

Oregon's item development process is consistent with industry practice and takes approximately two years, including writing, reviewing, and field-testing new items. Just as the development of Oregon's content and performance standards is an open, consensus-driven process, the development of test items and prompts to measure those constructs is grounded in a similar philosophy.

Item Writing

For the Knowledge and Skills (multiple-choice) tests and the Writing Performance Assessment, most item writing takes place during either on site, remote and/or online item writing workshops, in which Oregon teachers across the five main content areas write and review items. The process remains the same regardless of workshop format.

Item writers are typically Oregon teachers who have received training in item construction, are familiar with test specifications, and have demonstrated skill in writing items that pass content and sensitivity panel review. Item writers receive professional development compensation for their time and travel expenses. Among other security precautions, ODE requires item writers to sign confidentiality forms assuring that they will work with the items in a secure manner.

All items are written to measure specific subdomains of the content standards at a variety of specified levels of cognitive complexity. Cognitive complexity is represented by the following classification, developed from Bloom's (1956) educational taxonomy:[1]

- **Recall:** Recall, label, or locate information; define or describe facts or processes.
- **Skill/Concept (Basic Application):** Use information or conceptual knowledge, often requiring two or more steps; summarize, classify, or explain information or processes; make predictions or generalizations; solve problems.
- **Strategic thinking:** Analyze, critique, compare or contrast; create new information; or organize presented information.
- **Extended thinking:** Make connections and extensions (exclusively assessed in the Writing Performance Assessment and local performance assessments).

During the item writing workshop, writers draft items, document rationale of distracters, and conduct peer reviews of each other's items. Examples of items are provided, and facilitators provide process guidance and additional review. Writers and reviewers evaluate the strength and clarity of the match between the drafted item and the standard it measures. All issues are worked out or solved multiple times

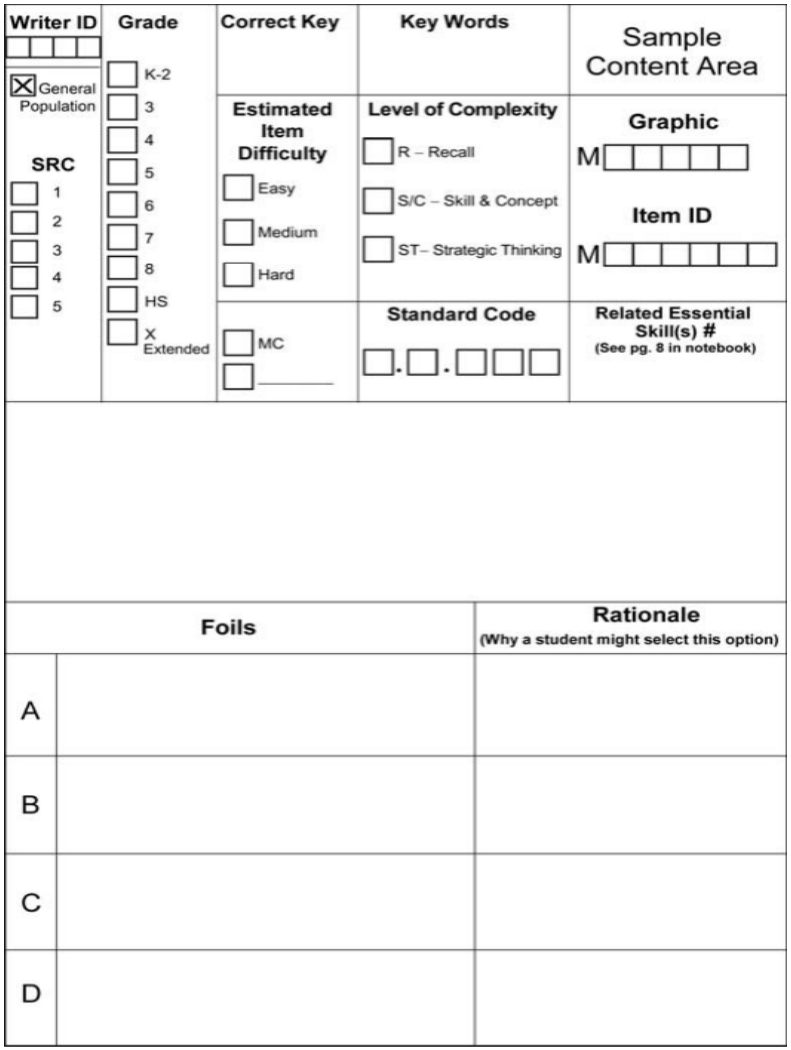
[1] Bloom, B. S. (ed.), Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathwohl, D. R. (1956). *Taxonomy of educational objectives: Handbook I: Cognitive domain*. New York: David McKay.

by multiple reviewers who verify that distractors are plausible, that answers are correct, and that each items has only a single correct answer.

Following item writing workshops, items are entered into the Item Tracking System (ITS). Oregon's original graphics are initially entered into the ODE's Comprehensive Item Management System (CIMS) and then transferred to ITS. Within ITS and CIMS, each item is given a unique item identification number to facilitate the monitoring and tracking of changes to and usage of the item throughout the review process and each item's history. ITS provides authorized users with access to each item's alignment and attributes, field-test results and use, response rationales, and previous versions.

Although item writing workshops may still occur annually, ODE has recently moved toward distributed item writing in which consistently strong item writers author additional items throughout the year. Items still go through the review process previously described. Item writers are trained on the use of secure item entry using ITS, and graphic drafts are scanned by the item writers and securely transmitted to ODE.

Fig. 1 Sample Oregon Writing Form


Writer ID
Grade
Correct Key
Key Words
Sample Content Area
☒ General Population
SRC
1
2
3
4
5
K-2
3
4
5
6
7
8
HS
X Extended
Estimated Item Difficulty
Easy
Medium
Hard
MC
Level of Complexity
R – Recall
S/C – Skill & Concept
ST– Strategic Thinking
Standard Code
Graphic
M
Item ID
M
Related Essential Skill(s) #
(See pg. 8 in notebook)
Foils
Rationale
(Why a student might select this option)
A
B
C
D

Committee/Panel Review

ODE convenes a series of advisory groups to advise ODE both on assessment-related policy and on item development. ODE seeks to ensure that membership on these advisory groups reflects the demographics of Oregon's student population. Each advisory group has approximately 15–35 members who serve three-year terms with one-third of the members rotating out each year and being replaced by new representatives. The following table describes the structure of these groups. Panel members commit up to 6 school days of service with an additional 3 or 4 days during the summer. However, panels will be convened remotely rather than in person as secure technology improvements allow distributed work. Although committee members on district contracts are not compensated for their service, they do receive travel reimbursement for committee travel of more than 70 miles, and substitute teachers are provided for service during the school year. When classroom teacher members work for ODE during non-contract time, they are compensated at an hourly wage as temporary employees.

Structure of ODE Assessment-Related Advisory Groups

Committee/Panel	Number of Members	Meeting Frequency	Who Nominates Members?
Assessment Policy Advisory Committee	15–20	2-3 times a year	School districts, COSA, OSBA, OEA, ESDs, and OPTA
Sensitivity Panel	15–20	4–6 times a year	School districts, OEA, ESDs (application process)
English/Language Arts Content and Assessment Panel	35	4-6 times a year	School districts, OEA, ESDs, and self-nominate (application process)
Mathematics Content and Assessment Panel	35	4 - 6 times a year	School districts, OEA, ESDs, and self-nominate (application process)
Science Content and Assessment Panel	35	4- 6 times a year	School districts, OEA, ESDs, and self-nominate (application process)
Social Sciences Content and Assessment Panel	25	1 - 2 times a year	School districts, OEA, ESDs, and self-nominate (application process)
English Language Proficiency Content and Assessment Panel	35	1 – 2 times a year	School districts, OEA, ESDs, and self-nominate (application process)

Oregon's Accommodations and Modifications Review Panel is not described here.

The Assessment Policy Advisory Committee consists of representatives from Oregon school districts, schools, and ESDs who are knowledgeable about assessment-related issues. The purpose of the Committee is to advise ODE on both procedural and policy implications of Oregon's assessment system, as well as the feasibility of proposed improvements to Oregon's assessment system. Committee members provide input regarding the various elements of the state assessment system such as educational technology, electronic reporting, operational assessment issues, and test administration.

In addition to seeking advice on assessment-related policy, ODE requires that all items generated for use on Oregon statewide assessments must pass a series of rigorous reviews before they can be used in field and operational tests. All items go through both a content and a sensitivity review as part of the item development process; only those items that measure the grade-level expectations and meet both overall quality and sensitivity criteria are carried forward to the field-test stage.

ODE Content and Assessment Panels exist for each of the content areas for which statewide tests are given: English/Language Arts (this panel reviews Writing and Reading/Literature assessment items), Mathematics, Science, Social Sciences, and English Language Proficiency.

Most members of these panels are classroom teachers, with some representation from higher education, district curriculum and assessment personnel, and related businesses. Criteria for panel selection include the following:

Criteria For Panel Selection

- Knowledge of Oregon's content standards and expertise in the subject area and its eligible content
- Teaching experience at the grade level or benchmark to which the individual will be assigned
- Geographical location to ensure that all regions of Oregon are represented
- Gender and ethnic diversity to ensure that the panel represents the diversity of Oregon's student population

Current item writers are not allowed to serve on item review committees. However, in some cases, content and assessment panel experts may be utilized as item writing facilitators.

Items are accepted, rejected, or modified by the Content and Assessment Panel to make sure they represent the constructs embodied in grade-specific content standards and test specifications. In addition to judgements of content relevance, the panels appraise the technical quality of items, looking for items that are free from such flaws as (a)inappropriate readability level, (b)ambiguity, (c)incorrectly keyed answers and distracters, (d)unclear instructions, and (e)factual inaccuracy. The panels for each content area use the following review process.

Content Area Review Process

1. Three content panel members review each item independently and complete an Item Review Form (IRF) (figure 1) using a pre-assigned reviewer ID.

2. Then, the three content panel members review the item collectively, and item reviewers make a recommendation for each item on the IRF to either (a) accept the item as written, (b) accept the item with revisions, or (c) reject the item (sometimes an alternate question is offered that entails a simple revision).

3. When all three reviewers agree that an item should be accepted or rejected, no further discussion is needed. If one or more of the reviewers feel that an item should be revised, then they attempt to reach a consensus and produce a "master copy" of their recommendation. The same is true if one or two of the reviewers reject an item that another reviewer finds acceptable with or without revisions.

4. In most cases, recommendations are followed and revisions are made, or items are eliminated. The ODE assessment specialist can override the recommendation, but this occurs rarely and only for compelling reasons.

Specific Checks

The content panels perform specific checks on items to confirm that:

- the SRC and subcategory match.
- the key is correct.
- alternate valid interpretations making the distracters correct do not exist.
- the item is grade-level appropriate in content and reading levels.
- the item is of overall high quality (wording and grammar, graphic quality, curricular importance, etc).
- the identified level of difficulty (i.e., easy, medium, hard) is correct.
- Reading/Literature passages are appropriate in content and reading levels. Science and Social Sciences stimuli align to appropriate content and reading skills.

- the level of cognitive complexity (i.e., recall, skill/concept or strategic thinking) is appropriate to the item and correctly identified.

Following review by the content panel, and according to panel feedback, ODE assessment specialists edit and revise items in ITS in preparation for review by the Sensitivity Panel.

Sensitivity Panel

All items that pass review by the content specialist are next presented to the sensitivity panel. The sensitivity panel reviews convenes day-long meetings, four to six times a year. The panel reviews items from all grade levels and content areas for bias, controversial content, and overly emotional issues.

In general, the sensitivity panel ensures that items:

- present racial, ethnic, and cultural groups in a positive light.
- do not contain controversial, offensive, or potentially upsetting content.
- avoid content familiar only to specific groups of students because of race or ethnicity, class, or geographic location.
- aid in the elimination of stereotypes.
- avoid words or phrases that have multiple meanings.

Following the sensitivity panels and according to panel feedback, ODE assessment specialists edit and revise items in the ITS system.

Expert Review

Next, ODE assessment specialists submit the new items for review by experts that have experience in the roles of item writer and content and assessment panel member. Expert reviewers add an additional quality control check for the online assessments. Experts have received extensive professional development in ITS to review items in a web-preview format providing the exact rendering provided in the online assessments. Experts review each item and confirm that:

- the key is correct.
- alternate valid interpretations making the distracters correct do not exist.
- the item is grade-level appropriate in content and reading levels.
- the item is of overall high quality (wording and grammar, graphic quality, curricular importance, etc).

Following the expert review in most cases, recommendations are followed and revisions are made, or items are eliminated. The ODE assessment specialist can override the recommendation, but this occurs rarely and only for compelling reasons.

Field Testing

Once the items have been reviewed by the content and assessment panel, the sensitivity panel, and an expert reviewer, all Mathematics, Reading/Literature, Science, and Social Sciences test items are field tested. Field test items

identified by the ODE assessment specialists are embedded in the operational tests by content area. As students take the operational tests, they also respond to field test items embedded in the test.

ODE then receives data files of the student responses, which ODE analyzes to determine whether the field test items are behaving as expected. The ODE assessment specialists eliminate those items which the data analysis indicate performed weakly. ODE assessment staff calibrate the difficulty level for those items that performed successfully in preparation for using the item operationally.

Translation of Items Into Spanish

Concurrent with the field testing of items in English, all Mathematics, Science, and Social Sciences test items are translated into Spanish. All required grade-level and benchmark- level statewide tests for Mathematics and Science are offered in English-Spanish tests. English-Spanish tests are also available for Social Sciences. Stacked English-Spanish items are used on electronic tests. Side-by-side English-Spanish and English- Russian Paper/Pencil assessments are available in Mathematics and Science.

Following translation by ODE's translation vendor, the translated items are reviewed by ODE's Spanish- and Russian-speaking experts to ensure that each item accurately conveys the intent of the English text. While the procedure described below specifically addresses Spanish translation, ODE follows a similar procedure for translation of Paper/Pencil items into Russian.

The following linguistic guidelines are used by ODE's translation vendor and Spanish-speaking experts:

- Students are expected to have subject knowledge and use proper terminology/vocabulary for that subject. In other words, what is expected from English-speaking students is also expected from Spanish-speaking students.
- ODE uses formal Spanish (usted, not tú) for test items and includes proper verb conjugation.
- ODE strives to use Global Spanish language that will be interpreted and understood by all Spanish speakers from anywhere in the world. Global Spanish language includes words used worldwide by most Spanish speakers.

After the ODE Spanish reviewers complete a review of the newly translated items, extensive research is conducted by a small group of reviewers on any word that has not met group consensus. Every attempt is made to choose the most correct translation based upon grade level and cultural relevance. A variety of resources are used for selecting the proper translated words including: dictionaries from Mexico, South America and Spain.

Additional Expert Review of Items

On an annual basis, ODE assessment specialists review items from the field test pool for inclusion within the operational test. This level of review acts as an additional quality control for the online assessments. In addition, whenever ODE

transitions to a different test delivery system, ODE submits all of its Reading/Literature, Mathematics, Science, and Social Sciences items for an additional level of expert review to ensure that all items appear consistently from year to year when presented to students.

Item Use and Release

Approximately every three years, ODE releases one sample test for each content area and grade-level and benchmark-level comprised of items used on previous test forms. These items are no longer secure and are taken out of the pool of eligible test items.

Released items are provided in the form of practice tests. Click here to access practice tests for Reading/Literature, Mathematics, Social Sciences, and Science are available on ODE's OAKS Portal. Click here to access Sample Writing Prompts ODE's Local Performance Assessment webpage.