ITEM SPECIFICATIONS
5TH GRADE
OAKS SCIENCE TEST

2014 Oregon Science Standards (NGSS)

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Introduction

This document presents *cluster specifications* for use with the Next Generation Science Standards (NGSS). These standards are based on the Framework for K-12 Science Education. The present document is not intended to replace the standards, but rather to present guidelines for the development of items and item clusters used to measure those standards.

The remainder of this section provides a very brief introduction to the standards and the framework, an overview of the design and intent of the item clusters, and a description of the cluster specifications that follow. The bulk of the document is composed of cluster specifications, organized by grade and standard.

Background on the framework and standards

The Framework for K-12 Science Education is organized around three core dimensions of scientific understanding. The standards are derived from these same dimensions:

Disciplinary Core Ideas

The fundamental ideas that are necessary for understanding a given science discipline. The core ideas all have broad importance within or across science or engineering disciplines, provide a key tool for understanding or investigating complex ideas and solving problems, relate to societal or personal concerns, and can be taught over multiple grade levels at progressive levels of depth and complexity.

Science and Engineering Practices

The practices are what students **do** to make sense of phenomena. They are both a set of skills and a set of knowledge to be internalized. The SEPs (Science and Engineering Practices) reflect the major practices that scientists and engineers use to investigate the world and design and build systems.

Cross-Cutting Concepts

These are concepts that hold true across the natural and engineered world. Students can use them to make connections across seemingly disparate disciplines or situations, connect new learning to prior experiences, and more deeply engage with material across the other dimensions. The NGSS requires that students explicitly use their understanding of the CCCs to make sense of phenomena or solve problems.

There is substantial overlap between and among the three dimensions

For example, the cross-cutting concepts are echoed in many of the disciplinary core ideas. The core ideas are often closely intertwined with the practices. This overlap reflects the nature of science itself. For example, we often come to understand and communicate causal relationships by employing models to make sense of observations. Even within a dimension, overlap exists. Quantifying characteristics of phenomena is important in developing an understanding of them, so employing computational and mathematical thinking in the construction and use of models is a very common scientific practice, and one of the cross-cutting concepts suggests that scientists often infer causality by observing patterns. In short, the dimensions are not orthogonal.

The framework envisions effective science education as occurring at the intersection of these interwoven dimensions: students learn science by doing science; applying the practices through the lens of the cross-cutting concepts to investigate phenomena that relate to the content of the disciplinary core ideas.

Item clusters

Each item cluster is designed to engage the examinee in a grade-appropriate, meaningful scientific activity aligned to a specific standard.

Each cluster begins with a phenomenon, an observable fact or design problem that engages student interest and can be explained, modeled, investigated, or designed using the knowledge and skill described by the standard in question.

What it means to be observable varies across practices. For example, a phenomenon for a performance expectation exercising the a*nalyze data* practice may be observable through regularities in a data set, while standards related to the *development and use of models* might be something that can be watched, seen, felt, smelled, or heard.

What it means to be observable also varies across grade levels. For example, elementary-level phenomena are very concrete and directly observable. At the high school level, an observation of the natural world may be more abstract: for example, "observing" changes in the chemical composition of cells through the observation of macroscopic results of those changes on organism physiology, or through the measurement of system- or organ-level indications.

Content limits refine the intent of the performance expectations and *provide limits* on what may be asked of items in the cluster to structure the student activity. The content limits also reflect the disciplinary core ideas learning progressions that are present in the K-12 Framework for Science Education.

The task or goal should be explicitly stated in the stimulus or the first item in the cluster: statements such as "In the questions that follow, you will develop a model that will allow you to identify moons of Jupiter," or "In the questions below, you will complete a model to describe the processes that lead to the steam coming out of the teapot."

Whereas item clusters have been described elsewhere as "scaffolded," they are better described as providing structure to the task. For example, some clusters begin with students summarizing data to discover patterns that may have explanatory value. Depending on the grade level and nature of the standard, items may provide complete table shells or labeled graphs to be drawn, or may require the student to choose what to tabulate or graph. Subsequent items may ask the student to note patterns in the tabulated or graphed data and draw on domain content knowledge to posit explanations for the patterns.

These guidelines for clusters do not appear separately in the specifications. Rather, they apply to all clusters.

Structure of the cluster specifications

The item cluster specifications are designed to guide the work of item writers and the review of item clusters by stakeholders.

Each item cluster has the following elements:

- The text of the performance expectations, including the practice, core idea, and cross-cutting concept.
- Content limits, which refine the intent of the performance expectations and provide limits of what may be asked of examinees. For example, they may identify the specific formulae that students are expected to know or not know.
- Vocabulary, which identifies the relevant technical words that students are expected to know, and related words that they are explicitly not expected to know. Of course, the latter category should not be considered exhaustive, since the boundaries of relevance are ambiguous, and the list is limited by the imagination of the writers.
- Sample phenomena, which provide some examples of the sort of phenomena that would support effective

item clusters related to the standard in question. In general, these should be guideposts, and item writers should seek comparable phenomena, rather than drawing on those within the documents. Novelty is valued when applying scientific practices.

- Task demands comprise the heart of the specifications. These statements identify the types of items and activities that item writers should use, and each item written should be clearly linked to one or more of the demands. The verbs in the demands (e.g., select, identify, illustrate, describe) provide guidance on the types of interactions that item writers might employ to elicit the student response. We avoid explicitly identifying interaction types or item formats to accommodate future innovations and to avoid discouraging imaginative work by the item writers.
- For each cluster we present, the printed documentation includes the cluster, the task demands represented by each item, and its linkage to the practice and cross-cutting concept identified in the performance expectation.

Item cluster specifications follow, organized by grade and standard. This collection of item cluster specifications is not exhaustive of all 2014 Oregon Science Standards that may be assessed in the OAKS Science Test.

Performance Expectation 3-ESS2-1

Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

Dimensions

Analyzing and Interpreting Data

- Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships.

ESS2.D: Weather and Climate

- Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next.

Patterns

- Patterns of change can be used to make predictions.

Clarifications and Content Limits

Clarification Statement:

- Examples of data could include average temperature, precipitation, and wind direction.

Content Limits:

- Assessment of graphical displays is limited to pictographs and bar graphs.
- Assessment does not include climate change
- Students do not need to know: probabilities or how to calculate them, fronts and pressure systems, the movements of weather systems.

Science Vocabulary Students Are Expected to Know

- season
- weather
- temperature
- precipitation
- rain
- snow
- wind
- sunlight
- patterns
- average

Science Vocabulary Students Are Not Expected to Know

- climate change
- probability
- anthropogenic change
- latitude
- longitude

Phenomena

Some example phenomena for 3-ESS2-1:

- Vienna, Austria, records more sunny days in the summer than in the winter. Data: Average sunshine hours by month for the city, given as a table or graph.
- People in Florida can often go outside without jackets during the winter. Data: Months and Temperatures for Florida, given as a table or graph.
- Visitors to the desert in Death Valley, California, were surprised to be rained on. Data: Months and Precipitation Averages for the region given as table or graph.
- Flags in California's San Joaquin Valley are seen blowing to the SE for most of the year, but are seen blowing to the NW in winter months. Data: Monthly average wind direction (and maybe speed) for the region, given as a table or graphic with wind direction arrows.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Organize and/or arrange (e.g., using illustrations and/or labels), or summarize data to highlight trends, patterns, or correlations in weather patterns.* **(SEP/DCI/CCC)**
2. Generate or construct graphs, tables, or assemblages of illustrations and/or labels of data that document patterns, trends, or correlations in weather patterns. This may include sorting out distractors. * **(SEP/DCI/CCC)**
3. Use relationships and patterns identified in the data to predict weather.
4. Identify patterns or evidence in the data that support conclusions about weather.**

*Denotes those task demands which are deemed appropriate for use in stand-alone item development.
**TD4 can be used for stand-alone item development if paired with TD2.

Performance Expectation 3-ESS2-2

Obtain and combine information to describe climates in different regions of the world.

Dimensions

Obtaining, Evaluating, and Communicating Information

- Obtain and combine information from books and other reliable media to explain phenomena.

ESS2.D: Weather and Climate

- Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years.

Patterns

- Patterns of change can be used to make predictions.

Clarifications and Content Limits

Content Limits

Students do not need to know

- Complex interactions that cause weather patterns and climate
- The role of the water cycle in weather.

Science Vocabulary Students Are Expected to Know

- prediction
- precipitation
- glacier
- ocean
- region
- climate
- weather
- typical
- vegetation
- latitude
- longitude
- drought
- temperature
- freeze
- atmosphere

Science Vocabulary Students Are Not Expected to Know

- average
- high/low pressure
- air mass
- altitude
- humidity
- radiation
- water cycle.

Phenomena

Some example phenomena for 3-ESS2-2:

- Anchorage, Alaska has cool summers and very cold winters with a lot of snowfall.
- It often snows in Colorado in July, but it does not often snow in Kansas in July.
- On the western side of the Cascade Mountains of Oregon, it rains frequently, but on the eastern side, it does not.
- The temperature in London, England does not get very hot in summer or very cold in winter. (Will use Auckland as key for prediction; both are oceanic/maritime Cfb climates.)

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Organize and/or arrange data (including labels and symbols) regarding the climates in different regions to highlight/identify trends or patterns, or make comparisons/contrasts between different regions and/or climatically relevant aspects of their geology and/or geography.* **(SEP/DCI/CCC)**
2. Generate or construct tables or assemblages of data (including labels and symbols) that document the similarities and differences between climates of different regions (this includes completing incomplete maps).
3. Analyze and interpret scientific evidence (including textural and numerical information as well labels and symbols) from multiple sources (e.g., texts, maps, and/or graphs) that help identify patterns in weather in regions of different climate. This includes communicating the analysis or interpretation.* **(SEP/DCI)**
4. Analyze and interpret patterns of information on maps (including textural and numerical information as well labels and symbols) to explain, infer, or predict patterns of weather over time in a region. * **(SEP/DCI/CCC)**
5. Based on the information that is obtained and/or combined, identify, assert, describe, or illustrate a claim regarding the relationship between the location of a region and its climate, or the relationship between geological and/or geographical aspects/characteristics of a region and its climate. * **(SEP/DCI/CCC)**
6. Use spatial and/or temporal relationships identified in the obtained and/or combined climate data to predict typical weather conditions in a region.
7. Organize and/or arrange data regarding the climate of a region to highlight/identify trends or relationships between the weather patterns of a region and its geology and/or geography.
8. Analyze and interpret scientific evidence (including textural and numerical information as well labels and symbols) from multiple sources (e.g., texts, maps, and/or graphs) that helps identify patterns in climate based on geography and/or geology. This includes communicating the analysis or interpretation.

*Denotes those task demands which are deemed appropriate for use in stand-alone item development

Performance Expectation 3-LS1-1

Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

Dimensions

Developing and Using Models

- Develop models to describe phenomena.

LS1.B Growth and Development of Organisms

- Reproduction is essential to the continued existence of every kind of organism. Plants and animals have unique and diverse life cycles.

Patterns

- Patterns of change can be used to make predictions.

Clarifications and Content Limits

Clarification Statement:

- Changes organisms go through during their lifetime form a pattern.

Content Limits:

- Assessment of plant life cycles is limited to those of flowering plants.
- Assessment does not include details of human reproduction.
- Students do not need to know: the alteration of generations life cycle, the human reproductive system, mitosis and meiosis.

Science Vocabulary Students Are Expected to Know

- adult
- growth
- life cycle
- parent
- pollen
- offspring
- structure
- feature
- trait
- birth
- death
- young
- caterpillar
- root
- stem
- leaf/leaves
- seed
- flower
- petal
- tadpole
- frog

Science Vocabulary Students Are Not Expected to Know

- organism
- breed
- diverse
- transfer
- development
- germination
- reproductive system
- organ
- cell
- tissue
- egg
- fertilize
- genetic
- unicellular
- multicellular
- specialized cell
- sperm
- cell differentiation
- cell division
- variation
- juvenile
- metamorphosis
- chrysalis
- pupa
- spores
- pistil
- stamen
- ovary
- anther
- filament
- sepal
- receptacle
- ovule
- stigma
- style

Phenomena

Some example phenomena for 3-LS1-1:

- A young moth builds a soft case around it called a cocoon and a young butterfly builds a hard case called a chrysalis.
- A young ladybug looks very different from an adult ladybug.
- Plants and animals both form eggs.
- A pea planted in the ground grows into a new pea plant.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Select the components needed to model the phenomenon. Components might include stages of life cycles such as birth, growth, reproduction, and death.
2. Assemble or complete an illustration or flow chart that is capable of representing the patterns in life cycles of different types of organisms.
3. Manipulate the components of a model to demonstrate the changes, properties, processes and/or events that act to result in a phenomenon.
4. Make predictions about the effects of changes in life cycles on organisms. Predictions can be made by manipulating model components, completing illustrations, or selecting from a list with distractors.
5. Given models or diagrams of life cycles, identify relevant components such as birth, growth, reproduction, and death, and how the life cycles are different in each scenario.
6. Identifying missing components, relationships, or other limitations of the model of a life cycle.
7. Describe, select, or identify the relationships among components of a model that describe the patterns of life cycles among different organisms.

Performance Expectation 3-LS2-1

Construct an argument that some animals form groups that help members survive.

Dimensions

Engaging in Arguments from Evidence

- Construct an argument with evidence, data, and/or a model.

LS2.D: Social Interactions and Group Behavior

- Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size.

Cause and Effect

- Cause and effect relationships are routinely identified and used to explain change.

Clarifications and Content Limits

Clarification Statement:

- Focus is on how being part of a group helps animals obtain food, defend themselves, and cope with changes, and does not cover how group behavior evolved as a result of a survival advantage.

Content Limits:

- Assessment does not include the evolution of group behavior.
  Students do not need to know:
- Social hierarchy in animal groups (pecking order, dominance, submissive, altruism)

Science Vocabulary Students Are Expected to Know

- environment
- survive/survival
- prey
- predator
- characteristic
- habitat
- species
- group behavior
- herd
- inherit
- trait
- diet
- mate
- parent
- color

Science Vocabulary Students Are Not Expected to Know

- organism
- social
- relative
- predation
- gene/genetic
- hereditary
- harmful
- beneficial
- variation
- probability
- adaptation
- decrease
- increase
- behavioral
- variation
- ecosystem
- pecking order
- dominance/submissive behavior
- hierarchy
- migrate
- defend

Phenomena

Some example phenomena for 3-LS2-1

- In Yellowstone National Park, a wolf preys on a much larger bison.
- In the Atlantic Ocean, bottlenose dolphins capture fast-swimming tuna in the open ocean.
- In the Willamette Valley, a colony of beavers builds a dam.
- A colony of ants protects its nests.
- A male honey bee returns to a hive each day.
- As an ant approaches, a termite bangs its head against the wall of its nest.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Identify patterns or evidence in the data that support inferences and/or determine relationships about the effect of group membership on survival of an animal.
2. Understand and generate simple bar graphs or tables that document patterns, trends, or relationships between group membership and survival.
3. Sort observations/evidence into those that appear to support or not support an argument.
4. Based on the provided data, identify or describe a claim regarding the relationship between survival of an animal and being a member of a group.
5. Identify, summarize, select or organize given data or other information to support or refute a claim regarding the relationship between group membership and survival of an animal. ***(SEP/DCI/CCC)**
6. Using evidence, explain the relationship between group membership and survival. ***(SEP/DCI/CCC)**

*Denotes those task demands which are deemed appropriate for use in stand-alone item development

Performance Expectation 3-LS3-2

Use evidence to support the explanation that traits can be influenced by the environment.

Dimensions

Constructing explanations and designing solutions

- Use evidence (e.g., observations, patterns) to support and explanation.

LS3.A Inheritance of Traits

- Other characteristics result from individuals' interactions with the environment, which can range from diet to learning. Many characteristics involve both inheritance and environment.

LS3.B Variation of Traits

- The environment also affects the traits that an organism develops.

Cause and Effect

- Cause-and-effect relationships are routinely identified and used to explain change.

Clarifications and Content Limits

Clarification Statement:

- Examples of the environment affecting a trait could include normally tall plants that are grown with insufficient water and are student; and, a pet dog that is given too much food and little exercise and becomes overweight.

Content Limits:

- Focus on physical traits.
- Do not use human traits.

Science Vocabulary Students Are Expected to Know

- characteristic
- offspring
- feature
- inherit/inheritance
- trait
- individual differences
- diet
- survival
- flood
- drought
- habitat
- reproduce
- winter
- spring
- summer
- fall
- seasons
- plant
- soil
- sun
- wind
- rain
- rock
- color

Science Vocabulary Students Are Not Expected to Know

- organism
- variation
- version
- harmful/beneficial
- increase/decrease
- trend

Phenomena

Some example phenomena for 3-LS3-2:

- The arctic fox is white in winter but turns to brown in the summer.
- Flamingoes are born gray, but some become very pink as they grow.
- Trees growing on the edge of cliffs are often bent.
- A goldfish in a pond grows larger than one in a fish bowl.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Describe or select the relationships, interactions, or processes to be explained. This may entail sorting relevant from irrelevant information or features.
2. Express or complete a causal chain explaining that traits can be influenced by the environment. This may include indicating directions of causality in an incomplete model such as a flow chart or diagram, or completing cause-and-effect chains.
3. Identify evidence supporting the inference of causation that is expressed in a causal chain.
4. Use an explanation to predict changes in the trait of an organism given a change in environmental factors
5. Describe, identify, and/or select information needed to support an explanation of environmental influence on traits.

Performance Expectation 3-LS4-1

Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.

Dimensions

Analyzing and Interpreting Data

- Analyze and interpret data to make sense of phenomena using logical reasoning, mathematics, and/or computation.

LS4.A: Evidence of Common Ancestry and Diversity

- Some kinds of plants and animals that once lived on Earth are no longer found anywhere.
  Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments.

Scale, Proportion, and Quantity

Observable phenomena exist from very short to very long periods.

Clarifications and Content Limits

Clarification Statements:

- Examples of data could include type, size, and distributions of fossil organisms.
- Examples of fossils and environments could include marine fossils found on dry land, tropical plant fossils found in Arctic areas, and fossils of extinct organisms.
- Focus is on the fossils and environment in which the organisms lived, not how the fossils got to where they are today.
- Data can be represented in tables and/or various graphic displays.
- Data collected by different groups can be compared and contrasted to discuss similarities and differences in their findings.

Content Limits:

- Assessment does not include identification of specific fossils or present plants and animals.
- Assessment is limited to major fossil types and relative ages.
- Graphs and charts can include bar graphs, pictographs, pie charts, and tally charts.
- Types of math can include simple addition/subtraction.
- Standard units that can be used to measure and describe physical quantities such as weight, time, temperature, and volume.

Science Vocabulary Students Are Expected to Know

- exist
- existence
- ecosystem
- characteristic
- habitat
- species
- volcanic eruption
- climate
- extinct
- extinction
- predator
- time period
- earthquake
- erosion
- weathering

Science Vocabulary Students Are Not Expected to Know

- chronological order
- fossil record
- radioactive dating
- descent
- ancestry
- evolution
- evolutionary
- genetic
- relative
- rock layer

Phenomena

For this performance expectation, the phenomena are sets of data. Those are the observed facts that the students will look at to discover patterns. Below, we enumerate some of the patterns that might comprise the data sets (phenomena) to be analyzed.

Some example phenomena for 3-LS4-1:

- Fossil trees are found in sedimentary rocks in Antarctica.
- The Redwall Limestone in the Grand Canyon contains many different fossils including corals, clams, octopi, and fish.
- Whale fossils have been found in rocks in the Andes Mountains.
- Fossils of corals and snails are found in Iowa.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Organize or summarize data to highlight trends, patterns, or correlations between plant and animal fossils and the environments in which they lived.
2. Generate graphs or tables that document patterns, trends, or correlations in the fossil record.
3. Identify evidence in the data that supports inferences about plant and animal fossils and the environments in which they lived.

Performance Expectation 3-LS4-3

Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

Dimensions

Engaging in Argument from Evidence

- Construct an argument with evidence.

LS4.C: Adaptation

- For any particular environment, some kinds of organisms survive well, some survive less well, and some cannot survive at all.

Cause and Effect

- Cause-and-effect relationships are routinely identified and used to explain change.

Clarifications and Content Limits

Clarification Statements:

- Examples of evidence could include needs and characteristics of the organisms and habitats involved. The organisms and their habitat make up a system in which the parts depend on each other.

Content Limits:

- While students are not expected to know the definitions to vocabulary terms such as extinction, climate, and mimic, they are expected to know the general concepts behind these terms.

Science Vocabulary Students Are Expected to Know

- survival
- habitat
- health
- species
- population
- region
- resource
- animal features
- behavior
- growth
- petal
- thorn
- structure
- characteristics
- mate
- trait

Science Vocabulary Students Are Not Expected to Know

- organism
- threaten
- impact
- terrestrial
- climate change
- response
- body plan
- external
- function
- internal
- invertebrate
- adaptation
- beneficial change
- detrimental change
- species diversity
- gene
- variation
- artificial selection
- natural selection

Phenomena

Some example phenomena for 3-LS4-3:

- Desert plants are able to survive where there is little to no rain.
- Black bears survive the harsh winter months of their forest habitats by going into a deep sleep.
- The arctic fox is better able to survive in colder climates than the red fox.
- Emperor penguins have special traits which help them survive in Antarctica.
- Compared to alligators, crocodiles can inhabit saltier water environments.
- African elephants can survive in hotter climates than Asian elephants.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Organize or summarize data to highlight trends, patterns, and/or determine relationships between the traits of an organism and survival in its environment.
2. Understand and generate simple bar graphs or tables that document patterns, trends, or relationships between traits of an organism and its survival in a particular environment.
3. Identify patterns or evidence in the data that supports inferences about characteristics on an organism and those of its environment.
4. Based on the provided data, identify or describe a claim regarding the relationship between the characteristics of an organism and survival in a particular environment. ***(SEP/DCI/CCC)**
5. Evaluate the evidence to sort relevant from irrelevant information regarding survival of an organism in a particular environment.

*Denotes those task demands which are deemed appropriate for use in stand-alone item development.

Performance Expectation 3-LS4-4

Make a claim about the merit of a solution caused when the environment changes and the types of plants and animals that live there may change.

Dimensions

Engaging in Argument from Evidence

- Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem.

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die.

LS4.D: Biodiversity and Humans

- Populations live in a variety of habitats, and change in those habitats affects the organisms living there.

Systems and System Models

- A system can be described in terms of its components and their interactions.

Clarifications and Content Limits

Clarification Statements:

- Examples of environmental changes could include changes in land characteristics, water distribution, temperature, food, and other organisms.

Content Limits:

- Assessment is limited to a single environmental change.
- Assessment does not include the greenhouse effect or climate change.
- Students do not need to know: greenhouse effect, ultraviolet (UV) radiation, nuclear disasters.

Science Vocabulary Students Are Expected to Know

- population
- organism
- community
- habitat
- solution
- resource
- survive
- reproduce
- food
- shelter
- temperature
- matter
- predator
- prey
- flood
- frost
- tide
- warm
- cold fire

Science Vocabulary Students Are Not Expected to Know

- ecosystem
- biotic
- abiotic
- food web
- producer
- consumer
- decomposer
- photosynthesis
- pollinate
- adapt
- energy flow
- biosphere
- sustain
- predation
- mutualism
- carrying capacity
- volcano
- earthquake
- drought
- arid
- blight

Phenomena

Some example phenomena for 3-LS4-4:

- A riverbank covered in milkweed eroded after strong rainstorms, causing part of the riverbank to fall into the river. The remaining land was bare with no plants. Prior to the storms, Monarch butterflies were present by the river, but they were not seen once the milkweed was gone.
- To help ornamental bushes grow, no other plants should grow in the immediate vicinity.
- Before stocking a lake with fish, the lake pollution needs to be reduced.
- A late frost threatens the orange groves in Georgia.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Articulate, describe, illustrate, or select the relationships, interactions, and/or processes involved when the types of plants and/or animals change as a result of environmental changes. This may entail sorting relevant from irrelevant information or features.
2. Identify a problem that results when the types of plants and/or animals change as a result of environmental changes.
3. Express or complete a causal chain explaining a solution to problem that results when the types of plants and/or animals change as a result of environmental changes. The causal chain should include the ecosystem before the environmental change, the environmental change, the problem to plants and animals resulting from the environmental change, the solution to the problem, and the effect(s) of the solution on the ecosystem. This may include indicating directions of causality in an incomplete model such as a flow chart or diagram, or completing cause-and-effect chains. ***(SEP/DCI/CCC)**
4. Identify and/or evaluate evidence related to a solution to a problem caused when the types of plants and/or animals change as a result of environmental changes. The evidence may support or refute the solution, or students may identify missing evidence.
5. Evaluate a solution to a problem that results when the types of plants and/or animals change as a result of environmental changes, including how the solution may affect plants, animals, and/or other aspects of the ecosystem. ***(SEP/DCI/CCC)**
6. Identify information or data needed to support or refute a claim regarding a problem resulting from an environmental change affecting the native plants and animals

*Denotes those task demands which are deemed appropriate for use in stand-alone item development.

Performance Expectation 3-PS2-1

Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.

Dimensions

Planning and Carrying Out Investigations

- Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and then number of trials considered.

PS2.A: Forces and Motion

- Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. (Boundary: Qualitative and conceptual, but on quantitative addition of forces are used at this level).

PS2.B: Types of Interactions

- Objects in contact exert forces on each other.

Cause and Effect

- Cause and effect relationships are routinely identified.

Clarifications and Content Limits

Clarification Statements:

- Examples could include an unbalanced force on one side of a ball can make it start moving, and balanced forces pushing on a box from both sides will not produce any motion at all.

Content Limits:

- Assessment is limited to gravity being addressed as a force that pulls objects down.
- Assessment is limited to one variable at a time: number, size, or direction of forces.
- Assessment does include normal force, but not name or magnitude
- Assessment does not include quantitative force size, only qualitative and relative.

Science Vocabulary Students Are Expected to Know

- force
- balanced
- unbalanced
- strength
- direction
- motion
- speed
- gravity
- net
- sum
- weight (physical)

Science Vocabulary Students Are Not Expected to Know

- velocity
- acceleration
- mass
- friction
- vector
- quantitative
- relative
- scale
- weight (mass • gravity)
- Newtons
- normal force

Phenomena

Some example phenomena for 3-PS2-1:

- Kids of the same size and strength play a game of tug of war. When the same number of kids are on each side, a ribbon ties to the rope does not move. When more kids are on one side, the rope moves in that direction.
- A ball rests on the ground, unmoving. When it is gently kicked, it moves slowly in the direction it was kicked. When it is kicked harder, it moves more quickly in the direction it was kicked.
- A box is sitting in the center of a table. Strings attached to the left and right sides of the box hang over the sides of the table. Identical weights can be attached to the end of these strings.
- A flat track with posts and rubber bands on either ends of the track. The student can pull a car back different distances to gather data.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Assemble, complete, or identify, from a collection including distractors, the essential components of an investigation that studies balanced and unbalanced forces on an object at rest and/or in motion.
2. Identify the variables in the investigation that are held constant and which are changing, and define important factors in the design including number of trials, methods, and techniques.
3. Identify the observations that should be collected in an investigation of an object's motion to determine the forces on the object and the causes of those forces.
4. Observe, collect, and record data from observations of the forces acting on an object at rest and/or in motion after forces of different strengths and/or directions are applied, including both balanced and unbalanced forces. ***(SEP/DCI/CCC)**
5. Identify from a list, including distractors, the effects of forces on an object's motion and the cause of those forces.
6. Make predictions about the effects of changes in the motion of an object given specific forces. Predictions can be made by manipulating components of the investigation, completing illustrations, or selecting from lists with distractors.

*Denotes those task demands which are deemed appropriate for use in stand-alone item development.

Performance Expectation 3-PS2-2

Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.

Dimensions

Planning and Carrying Out Investigations

- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or to test a design solution.

PS2.A: Forces and Motion

- The patterns of an object's motion in various situations can be observed and measured; when the past motion exhibits a regular pattern, future motion can be predicted from it.

Patterns

- Patterns of change can be used to make predictions.

Clarifications and Content Limits

Clarification Statements:

- Examples of motion with a predictable pattern could include a child swinging in a swing, a ball rolling back and forth in a bowl, and two children on a seesaw.

Content Limits:

- Technical terms, such as magnitude, velocity, momentum, and vector quantity, are not introduced at this level, but the concept that some quantities need both size and direction to be described is developed.
- Students do not need to know: Newton's laws of motion, Law of Conservation of Energy.

Science Vocabulary Students Are Expected to Know

- speed
- distance
- height
- time
- mass
- force
- gravity
- electrical field
- static electricity
- distribution of charged particles
- electrical charge
- negatively charged
- positively charged
- neutral/neutrally charged
- magnetic field
- polarity (magnetic)
- North pole
- South pole
- Attraction
- Repulsion
- electromagnet

Science Vocabulary Students Are Not Expected to Know

- frequency
- amplitude
- displacement
- equilibrium position
- oscillate
- momentum
- velocity
- vector
- elastic collision
- inelastic collision
- friction
- acceleration of gravity
- work
- power
- mechanical advantage
- Coulomb's law
- Faraday cage
- induction
- conduction
- electron
- proton
- atom
- controlled variable
- dependent variable
- independent variable
- kinetic energy
- potential energy
- average

Phenomena

Some example phenomena for 3-PS2-2:

- A boy and a girl play on a swing set. In 10 tries, the girl cannot get the boy to swing higher than the height she released him.
- A ball can be thrown farther when a person launches the ball from a plastic ball thrower rather than from his/her bare hand.
- A marble is rolled down a slide. It takes five seconds for the marble to reach the bottom of the slide. The same marble is rolled down another slide. This time, it takes the marble two seconds to reach the bottom of the slide.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Identify the output data that should be collected in an investigation of an object's motion.
2. Make and/or record observations about an object's motion as it repeats a pattern over time.
3. Generate or construct graphs, tables, assemblages of illustrations and/or labels of data that highlight patterns, trends, or correlations in the pattern of an object's motion. This may include sorting out distractors. *** (SEP/DCI/CCC)**
4. Summarize data to highlight trends, patterns, or correlations in the motion of an object.
5. Use relationships identified in the data to predict/infer the future motion of an object. ***(DCI/CCC)**
6. Identify patterns or evidence in the data that supports predictions/inferences about an object's future motion**. * (DCI/CCC)**

*Denotes those task demands which are deemed appropriate for use in stand-alone item development.

Performance Expectation 3-PS2-4

Define a simple design problem that can be solved by applying scientific ideas about magnets.

Dimensions

Asking Questions and Defining Problems

- Define a simple problem that can be solved through the development of a new or improved object or tool.

PS2.B: Types of Interactions

- Electric and Magnetic forces between a pair of objects do not require the objects to be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart, and, for forces between two magnets, on their orientation relative to each other.

Interdependence of Science, Engineering, and Technology

- Scientific discoveries about the natural world can often lead to new and improved technologies, which are developed through the engineering design process.

Clarifications and Content Limits

Clarification Statements:

- Examples of problems could include constructing a latch to keep a door shut and creating a device to keep two moving objects from touching each other.

Content Limits:

- Students only need to know the basics about magnets. They do not need to know about the magnetic field and how it is shaped for different objects, etc.
- Students do not need to know how a magnet can magnetize other objects; they just need to know that it does. For example, a paper clip is not magnetic but will be attracted to a magnet. (The student does not need to know anything about magnetic domains.)
- Students do not need to know how electricity and magnetism are coupled (that moving electrons create a magnetic field and that a changing magnetic field creates a current)
- Students do not need to know anything about magnets except that they can repel/attract each other based on their orientation relative to each other.

Science Vocabulary Students Are Expected to Know

- magnetic
- attraction
- repulsion
- non-contact force
- north Pole
- south Pole
- bar magnet

Science Vocabulary Students Are Not Expected to Know

- Ampere's law
  force fields
- field gradients
- conductor
- orientation
- magnetic field
- exert
- interaction
- electromagnetism

Phenomena

Some example phenomena for 3-PS2-4:

- The shower leaks because the curtain is not secured to the bottom of the bathtub.
- Things continually fall out of a handbag because the latch is not secure.
- While working on a project, pencil shavings were dropped on the carpet and the vacuum may not have cleaned them all up.
- The refrigerator door won't stay closed, making it difficult to keep food cool.
- Two carts used in experiments keep damaging each other when they collide.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Identify or assemble from a collection, including distractors, the relevant aspects of the problem that given design solutions, if implemented, will resolve/improve.
2. Articulate, describe, illustrate, or select the relationships, interactions, and/or processes to be explained OR to be used to solve the problem. This may entail sorting relevant from irrelevant information or features.
3. Express or complete a causal chain explaining how the repulsion or attraction of magnets will solve the problem that has been identified. This may include indicating directions of causality in an incomplete model such as a flow chart or diagram, or completing cause-and-effect chains.
4. Using given data, propose/illustrate/assemble a potential device (prototype) or solution.
5. Describe, identify, and/or select information needed to support an explanation about the proposed solution.

Performance Expectation 4-ESS1-1

Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

Dimensions

Constructing Explanations and Designing Solutions

- Identify the evidence that supports particular points in an explanation.

ESS1.C: The History of Planet Earth

- Local, regional, and global patterns of rock formations reveal changes over time due to Earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed.

Patterns

- Patterns can be used as evidence to support an explanation.

Clarifications and Content Limits

Clarification Statement:

Examples of evidence from patterns could include rock layers with marine shell fossils above rock layers with plant fossils and no shells, indicating a change from land to water over time, and a canyon with different rock layers in the walls and a river in the bottom, indicating that over time a river cut through the rock.

Content Limits:

- Assessment does not include specific knowledge of the mechanism of rock formation or memorization of specific rock formations and layers.
- Assessment is limited to relative time
- Excludes earthquakes—the clarification statement focuses on geomorphology and landscape change through time. The focus is not on tectonics, despite its mention in the DCI.

Science Vocabulary Students are Expected to Know

- weathering
- erode
- rock formations
- rock layers
- earthquake
- glacier
- climate
- fossil
- landscape
- shell
- river
- mountain
- canyon
- deposit
- marine

Science Vocabulary Students Are Not Expected to Know

- rock strata
- ocean basins
- glaciation
- watersheds
- geological
- mountain chains
- igneous rock
- metamorphic rock
- sedimentary rock
- terrestrial
- aquatic

Phenomena

Sample phenomena for 4-ESS1-1:

- The rock walls on both sides of the Grand Canyon contain layers with marine fossils, interspersed with layers containing terrestrial fossils.
- Church Rock, New Mexico, is a very dry place far from the sea. However, exposures of rocks in the area contain many fossils of marine organisms.
- Axel Heiberg Island in the Canadian Arctic is too cold for trees to grow. However, sedimentary rocks on the island preserve hundreds of fossil stumps from large evergreen trees.

  Sihetun, China, is dry and mountainous. Sedimentary rocks exposed in the area preserve thousands of fish fossils. These sedimentary rocks are sandwiched between lava flow rocks. There are no active volcanoes in this part of China.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Describe, identify, and/or select evidence from patterns of rock formations and/or patterns of fossils in rock layers to support the explanations of changes in the landscape over time.
2. Express or complete a causal chain explaining changes in patterns of fossils in rock layers.
3. Identify patterns of rock formations and/or patterns of fossils in rock layers.

Performance Expectation 4-ESS2-1

Make observations and/or measurements to provide evidence of the effect of weathering or the rate of erosion by water, ice, wind, or vegetation.

Dimensions

Planning and Carrying Out Investigations

- Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.

ESS2.A: Earth Materials and Systems

- Rainfall helps to share the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.

Cause and Effect

- Cause and effect relationships are routinely identified, tested, and used to explain change.

Clarifications and Content Limits

Clarification Statement:

- Examples of variables to test could include: angle of slope in the downhill movement of water, amount of vegetation, speed of wind, relative rate of deposition, cycles of freezing and thawing of water, cycles of heating and cooling, and volume of water flow.

Content Limits:

- Students aren't expected to know the flow of energy that causes the phenomena.
- Assessment is limited to one form of erosion.
- Assessment does not include chemical erosion.
- Students do not need to know: sedimentation, Earth's interior, crystallization, minerals, the rock cycle, dynamic forces, feedback interactions, constructive forces, or deformation.

Science Vocabulary Students are Expected to Know

- grass
- land
- tree
- ice
- rock
- win
- water
- rain
- living thing
- erosion
- freeze
- movement
- cycle
- weathering
- ocean
- sediment
- vegetation
- particle
- earthquake
- volcanoes
- thaw

Science Vocabulary Students Are Not Expected to Know

- composition
- slope
- continental boundaries
- trench
- minerals
- plate tectonics
- topography

Phenomena

Sample phenomena for 4-ESS2-1:

- Rocks in the bottom of a river are usually smooth, but the rocks sitting on the ground nearby often have sharp edges and corners.
- Near it start in Colorado, the bed of the North Platte River is covered with boulders. Some five hundred miles away in Nebraska, the bed of the rivers is mostly sand.
- New gullies appear in a gravel driveway after a heavy rain.
- Over the course of a summer there is a series of major storms. At the end of the season, the channel of a small stream running through grassy park is significantly wider than it was before the storms.
- An asphalt road runs past a very large tree. Next to the tree the pavement is lifted and cracked.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Identify the factors that affect weathering or the rate of erosion by water, ice, wind, or vegetation.
2. Identify from a list the materials/tools needed for an investigation of how wind affects the factors that affect weathering or the rate of erosion by water, ice, wind, or vegetation.
3. Identify, among distractors, the outcome data that should be collected in the investigation.
4. Make and/or record observations about how input factors affect relevant outcomes while using fair tests in which variables are controlled. ***(SEP/DCI/CCC)**
5. Make or communicate the conclusions from investigation. Conclusions will be causal relationships.**

*denotes those task demands which are deemed appropriate for use in stand-alone item development

**Task Demand 5 can be used ONLY if used in concert with Task Demand 4.

Performance Expectation 4-ESS2-2

Analyze and interpret data from maps to describe patterns of Earth's features.

Dimensions

Analyzing and Interpreting Data

- Analyze and interpret data to make sense of phenomena using logical reasoning.

ESS2.B: Plate Tectonics and Large-Scale System Interactions

- The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes appear in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth.

Patterns

- Patterns can be used as evidence to support an explanation.

Clarifications and Content Limits

Clarification Statement:

- Maps can include topographic maps of Earth's land and ocean floor, as well as maps of the locations of mountains, continental boundaries, volcanoes, and earthquakes.

Content Limits:

- Students do not need to know: the tectonic processes that form Earth's features.

Science Vocabulary Students are Expected to Know

- earthquake
- Earth's surface/crust
- volcanic eruption
- region
- barrier
- global
- local
- physical characteristic
- ocean
- force
- landscape
- mountain chain/range
- continental boundary
- sea floor
- collide
- properties
- ocean trench
- pressure
- topographic map

Science Vocabulary Students Are Not Expected to Know

- rock strata
- ocean basins
- glaciation
- watersheds
- geological
- mountain chains
- igneous rock
- metamorphic rock
- sedimentary rock
- terrestrial
- aquatic

Phenomena

For this performance expectation, the phenomena are the patterns of features on maps that the student examines. These patterns can sometimes be described with simple statements as shown below, but the actual phenomenon in each case is the pattern on the map. If descriptive statements are used, writers must be careful not to give the pattern of the point of the cluster away to the student.

Sample phenomena for 4-ESS2-2:

- There are active volcanoes in Alaska. There are no active volcanoes near Buffalo, New York. (If this statement were to be used to describe the map, then the students task would have to be something more than simply pointing out that there are volcanoes in Alaska and none near Buffalo, such as figuring out that Alaska is closer to a tectonic plate boundary than is New York.)
- Earthquakes occur often in western South America. Earthquakes almost never occur on the eastern side of the continent. (If this statement were to be used to describe the map, then the student's task would have to be something more than simply pointing out that there are earthquakes on the eastern side more often than the western, such as figuring out that a plate boundary lies along the eastern coast of South America.)
- Many volcanoes are found in a ring around the Pacific Ocean. There are fewer found on the edges of the Atlantic Ocean. (if this statement were to be used to describe the map, then the students task would have to be something more than simply point out that there are many volcanoes around the Pacific and few around the Atlantic, such as figuring out that tectonic plant boundaries surround the Pacific Ocean.)
- There are no mountain ranges in Kansas. There are many mountains in Washington State. (If this statement were to be used to describe the map, then the students task would have to be something more than simply pointing out that there are mountains in Washington and none in Kansas, such as figuring out that Washington is closer to a tectonic plate boundary than Kansas.)

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Organize, arrange, or summarize map data and/or symbols to highlight/describe patterns of geological features on Earth's surface.**
2. Generate/construct graphs, tables, or assemblages of illustrations and/or labels, of map data that document patterns of geological features on Earth's surface. This may include sorting out distractors. ***(SEP/DCI/CCC)**
3. Use relationships identified in the presented map data to predict the location of geological features on Earth's surface, such as mountain ranges, volcanoes, earthquake foci, and deep ocean trenches. ***(SEP/DCI/CCC)**
4. Identify evidence or patterns in map data that support inferences about the patterns of geological features on Earth's surface. ***(SEP/DCI/CCC)**

*denotes those task demands which are deemed appropriate for use in stand-alone item development
**Task demand 1 may be used in combination with 2, 3, or 4 for stand-alone development.

Performance Expectation 4-LS1-1

Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Dimensions

Engaging in Argument from Evidence

- Construct an argument with evidence, data, and/or a model.

LS1.A: Structure and Function

- Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction.

Systems and System Models

- A system can be described in terms of its components and their interactions.

Clarifications and Content Limits

Clarification Statement:

- Examples of structures could include thorns, stems, roots, colored petals, heart, stomach, lung, brain, and skin.

Content Limits:

- Assessment is limited to macroscopic structures within plant and animal systems.
- The student does not need to know about cellular structures like the nucleus, mitochondria, the Golgi apparatus, or the endoplasmic reticulum.

Science Vocabulary Students Are Expected to Know

- animal features
- brain
- body
- flow
- flower
- growth
- heart
- lung
- muscle
- movement
- grasp
- habit
- intruder
- moisture
- organization
- petal
- plant
- predator
- prey
- roots
- skin
- stem
- stomach
- survival
- temperature

Science Vocabulary Students Are Not Expected to Know

- cell
- detect
- response
- body plan
- circulatory system
- digestive system
- elastic
- excretory system
- external
- intellectual
- internal
- invertebrate
- muscular system
- nervous system
- organ
- reproductive system
- vertebrate
- multicellular
- stimulus
- tissue
- enzyme
- xylem
- phloem
- parenchyma
- cambium cells

Phenomena

Some example phenomena for 4-LS1-1:

- In a field of grass, a butterfly lands on one of the only red poppy flowers in sight.
- A manta ray has a flat circular body. Its fins spread out like wings from its body.
- A pelican can hold up to 3 gallons of water in its pouch.
- A student sees a hollow, brown copy of a cicada insect attached to the bark of a tree.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Identify evidence or patterns in the data that support inferences and/or determine relationships between a particular structure of an organism and a function that supports survival, growth, behavior, and reproduction.
2. Understand and generate simple bar graphs or tables to document patterns, trends, or relationships between a particular structure of an organism and a function that supports survival, growth, behavior, and reproduction.
3. Sort observations/evidence into those that appear to support or not support an argument.
4. Based on the provided data, identify or describe a claim regarding the relationship between a structure of an organism and a function that supports survival, growth, behavior, and reproduction
5. Summarize or organize given data or other information to support or refute a claim regarding an organism's structure and its function.
6. Sort, tabulate, classify, separate, and/or categorize relevant from irrelevant information regarding an organism's structure and its function.

Performance Expectation 4-LS1-2

Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

Dimensions

Developing and Using Models

- Use a model to test interactions concerning the functioning of a natural system.

LS1.D: Information Processing

- Different sense receptors are specialized for particular kinds of information, which may be then processed by the animal's brain. Animals are able to use their perceptions and memories to guide their actions.

Systems and System Models

- A system can be described in terms of its components and their interactions.

Clarifications and Content Limits

Clarification Statement:

- Emphasis is on systems of information transfer.

Content Limits:

- Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.

Science Vocabulary Students Are Expected to Know

- lens
- vision
- hearing
- senses
- muscle
- organ
- ear
- middle ear
- outer ear
- inner ear
- eardrum
- response
- habitat
- eye
- lens
- time
- seconds
- memory

Science Vocabulary Students Are Not Expected to Know

- Sensory
- brain
- cells
- retina
- pupil
- saliva
- salivary gland
- vibration
- cornea
- iris
- brainstem
- consumer
- nerve
- optic nerve
- nerve cell
- nerve tissue
- nerve impulse
- connecting nerve
- nerve fiber,
- organ system
- reflex
- reflex action
- reaction time
- cue

Phenomena

Some example phenomena for 4-LS1-2:

- A bear cub in the woods cries out. Its mother immediately runs toward it.
- A deer walks in the woods. It turns suddenly and moves off in a different direction. A few minutes later, a skunk appears from the bushes.
- A cat sits on a stone wall. A mouse appears at the base of a nearby tree. The cat springs after the mouse.
- A hawk flies overhead. Suddenly, it dives toward the tall grass. A moment later, it returns to the sky, a snake in its claws.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Select or identify from a collection of potential model components the components needed to model the phenomenon. Components might represent organ systems or parts of a system needed for collection and/or processing of sensory information.
2. Assemble or complete, from a collection of potential model components, an illustration or flow chart that is capable of representing the flow and/or processing of sensory information in an animal. This does not include labeling an existing diagram.
3. Manipulate the components of a model to demonstrate the changes, properties, processes, and/or events that act to result in the phenomenon. ***(SEP/DCI/CCC)**
4. Given models or diagrams of the flow and/or processing of sensory information in an animal, identify responses to sensory inputs and how they change in each scenario OR identify the properties of organs and/or organ systems that allow animals to respond to sensory information. ***(SEP/DCI/CCC)**
5. Identify missing components, relationships, or other limitations of a model that shows the flow and/or processing of sensory information in an animal.
6. Describe, select, or identify the relationships among components of a model that describe how sensory information is processed or explain how an animal responds to sensory inputs.

Performance Expectation 4-PS3-3

Ask questions and predict outcomes about the changes in energy that occur when objects collide.

Dimensions

Asking Questions and Defining Problems

- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause-and-effect relationships.

PS3.A: Definitions of Energy

- Energy can be moved from place to place by moving objects or through sound, light, or electric currents.

PS3.B: Conservation of Energy and Energy Transfer

- Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced.

PS3.C: Relationship Between Energy and Forces

- When objects collide, the contact forces transfer energy so as to change the object's motions.

Energy and Matter

- Energy can be transferred in various ways and between objects.

Clarifications and Content Limits

Clarification Statements:

- Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.

Content Limits:

- Assessment does not include quantitative measurements of energy.
- Students do not need to know: names of energy types, how to calculate energy or forces.

Science Vocabulary Students Are Expected to Know

- sound
- light
- heat
- electrical currents
- motion
- magnets
- magnetic

Science Vocabulary Students Are Not Expected to Know

- kinetic energy
- potential energy
- friction
- force fields
- vector
- magnitude
- elastic
- inelastic

Phenomena

Some example phenomena for 4-PS3-3:

- A large wave crashes into the cliffs of Étretat and some rocks are knocked loose. A small wave then crashes into the cliffs.
- A person hits a nail with a hammer and the nail is driven into a board. The person swings the hammer again, but misses the nail.
- A person walks down a hallway. The sound of their shoes on the floor can be heard many feet away. There person then runs down the hallway.
- A bowler rolls a ball down a lane. It slams into the pins and knocks several of them down. After the pins are reset, the bowler rolls the ball down the lane again. The ball misses and knocks down no pins.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Select or identify from a collection, including distractors, questions that will help clarify the properties that are correlated with the changes in energy that occur in the phenomenon. In addition to distractors that are plausible responses, distractors may include non-testable ("nonscientific") questions.
2. Identify, describe, or select from a collection, including distractors, characteristics to be manipulated or held constant while gathering information to answer a well-articulated question.
3. Select or describe conclusions relevant to the question posed and supported by the data, especially conclusions about causes and effects.
4. Predict outcomes when properties or proximity of the objects are changed, given the inferred cause-and-effect relationships.
5. Describe, identify, gather, and/or select information needed to identify patterns that can be used to predict outcomes about the changes in energy.

Performance Expectation 4-PS3-4

Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

Dimensions

Constructing Explanations and Designing Solutions

- Apply scientific ideas to solve design problems.

PS3.B: Conservation of Energy and Energy Transfer

- Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.

PS3.D: Energy in Chemical Processes and Everyday Life

- The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use.

ETS1.A: Defining Engineering Problems

- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.

Energy and Matter

- Energy can be transferred in various ways and between objects.

Clarifications and Content Limits

Clarification Statement:

- Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.

Content Limits:

- Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.

Science Vocabulary Students Are Expected to Know

- electric current
- electrical energy
- magnetic
- motion
- speed
- conservation
- measurement of motion
- gravitational
- battery
- conversion
- properties
- chemical

Science Vocabulary Students Are Not Expected to Know

- mass
- net force
- velocity
- relative position
- constant speed
- direction of motion
- direction of a force
- deceleration
- independent
- economic
- control
- impact
- inertia
- Newton's laws (1st, 2nd, 3rd)
- stationary
- frame of reference
- potential energy
- mechanical energy
- kinetic energy
- conserve
- motion energy
- relative
- chemical energy

Phenomena

Engineering practices are built around meaningful design problems rather than phenomena; so for this standard, a design problem and associated competing solutions will replace phenomena.
Some example design problems for P-PS3-4:

- A front door does not have an alarm. Any alarm that is added needs to be heard in the back hallway.
- A person hiking on a hot day needs to take a fan to stay cool. The fan must be small so that it does not add to the weight of the hiker's pack but must also last the entire hike.
- The water in a house is heated with electricity purchased from a power company. A decision is made to instead heat the water using electricity generated with solar panels on the roof. The water heater must heat enough water to meet the needs of the home but the cost of installation and/or maintenance cannot exceed the family's budget.
- A motor is added to a toy car for a race. The motor must be able to move the car across a room at a high speed.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Express or complete a causal chain explaining how energy can be transferred via electric current to produce light, sound, heat, and/or motion. This may include indicating directions of causality in an incomplete model such as a flow chart or diagram, or completing cause-and-effect chains.
2. Identify evidence supporting the inference of causation that is expressed in a causal chain.
3. Use an explanation to predict how the motion, sound, heat, or light of an object changes, given a change in electrical energy—or, how the expression of energy will change, given a change in the conversion of stored energy.
4. Identify or assemble from a collection, including distractors, the relevant aspects of the problem that given design solutions, if implemented, will resolve/improve. The design solution must convert energy from one form to another within the content limits.
5. Using given information, select or identify constraints that the device that converts energy from one form to another must meet OR criteria against which it should be judged.
6. Using given information, design, propose, illustrate, assemble, test, or refine a potential device (prototype) that converts energy from one form to another.

Performance Expectation 4-PS4-1

Develop a model of waves to describe patterns in terms of amplitude and wavelength, and that waves can cause objects to move.

Dimensions

Developing and Using Models

- Develop a model using an analogy, example, or abstract representation to describe a scientific principle.

PS4.A: Wave Properties

- Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets a beach.
- Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks).

Patterns

- Similarities and differences in patterns can be used to sort, classify, and analyze simple rates of change for natural phenomena.

Clarifications and Content Limits

Clarification Statements:

- Examples of models could include diagrams, analogies, and physical models using wire to illustrate wavelength and amplitude of waves.
- Acceptable clusters may include: amplitude and wavelength, motion of an object, or both.

Content Limits:

- Limited to physically visible mechanical waves.
- Assessment does not include interference effects, electromagnetic waves, non-periodic waves, or quantitative models of amplitude and wavelength.
- Examples of objects being moved by waves are limited to up and down motion. Horizontal motion is above grade level due to the other factors involved.
- Don't directly reference energy. Energy is addressed in 4-PS3.

Students do not need to know

- Types of waves: sound, light, non-periodic, compression
- Particle movement
- Quantitative models
- Behaviors of waves:
    - Absorption
    - Reflection
    - Refraction
    - Transmission
    - Interactions with different materials (angle of incidence, amount of reflection or absorption, light being refracted into colors)
    - Reflection is limited to the concept
    - How waves are reflected and the details of reflection (as well as other behaviors) are covered in MS-PS4-2.
- Wave calculations
- Motion of objects in the ocean due to ocean currents

Science Vocabulary Students Are Expected to Know

- wave
- amplitude
- wavelength
- crest
- trough
- peak
- rate
- property
- medium
- period
- periodic

Science Vocabulary Students Are Not Expected to Know

- electromagnetic
- non-periodic
- compression
- particle
- transmission
- seismic wave
- radio wave
- microwave
- infrared
- ultraviolet
- gamma rays
- X-rays
- angle of incidence
- concave
- convex
- diffraction
- constructive Interference
- destructive Interference
- resonance
- refraction
- absorption
- reflection
- pitch
- sound wave
- light wave

Phenomena

Some example phenomena for 4-PS4-1:

- A boat floating in the ocean is tied to a pier. The boat rises and falls with the waves.
- Two students hold ends of a rope. One student lifts her end, and then drops it toward the ground. The rope forms a wave that travels from that student to the other student.
- The sand waves on a windy beach get bigger and more pronounced over time. They are regular and evenly spaced.
- A surfer riding a wave stays up if she moves along the wave but falls as soon as she stops moving.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Select or identify the components of a model that are needed to describe wave behavior, patterns of wave creation, and/or the motion of objects carried on/by waves. Components might include the source, amplitude, frequency, and/or wavelength.
2. Manipulate the components of a model to demonstrate properties, processes, and/or events that result in the patterns of wave behavior that are identified in the phenomenon. These patterns of wave behavior can include creation and replication of waves.
3. Describe, select, or identify the relationships among components of a model that describe wave behavior, patterns of wave creation, and/or the motion of objects carried on or by a wave.
4. Given a model of waves, illustrate the way in which the wave changes to yield a given result (more movement, less movement) and/or identify the result based on changes to the wave.
5. Make predictions about the effects of changes in model components (e.g., energy of wave source, distance from wave source), the amplitude or wavelength of a wave, or motion of objects affected by the wave. Item writer: Do not directly reference the energy of the wave source. Instead, show the speed and size of the object causing the wave, etc.

Performance Expectation 4-PS4-2

Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.

Dimensions

Developing and Using Models

- Develop a model to describe phenomena.

PS4.B: Electromagnetic Radiation

- An object can be seen when light reflected from its surface enters the eyes.

Cause and Effect

- Cause-and-effect relationships are routinely identified.

Clarifications and Content Limits

Content Limits:

- Assessment does not include:
    - Knowledge of specific colors reflected and seen;
    - The cellular mechanisms of vision;
    - How the retina works

Science Vocabulary Students Are Expected to Know

- energy
- light ray
- path of light
- reflection
- reflective
- surface
- properties of light

Science Vocabulary Students Are Not Expected to Know

- particle
- transmission
- angle of incidence
- angle of reflection
- concave
- convex
- diffraction
- constructive interference
- destructive interference
- refraction
- absorption
- wave
- field
- illuminate
- diffuse reflection
- specular reflection
- spectrum
- prism

Phenomena

Some example phenomena for P-PS4-2:

- A person can see a cat in the mirror. The cat is otherwise hidden from view.
- A performance is being watched by a person. Another person stands up and blocks the view.
- A flashlight is pointed at a door in a dark room. The door is the only object seen in the room.
- The moon is seen at night.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Identify the components needed to model the phenomenon. Components might include the light, the light source, the object, the path the light follows, and the eye.
2. Complete an illustration or flow chart that is capable of representing how light reflecting from objects and entering the eye allows objects to be seen. This does not include labeling an existing diagram.
3. Manipulate the components of a model to demonstrate the changes, properties, processes, and/or events that act to result in the phenomenon.
4. Make predictions about the effects of changes in the model, particularly using mirrors, changing positions of light sources, objects, and the eye. Predictions can be made by manipulating model components, completing illustrations, or selecting from lists with distractors.
5. Identify missing components, relationships, or other limitations of the model.
6. Describe, select, or identify the relationships among components of a model that describe how light reflecting from objects and entering the eye allows objects to be seen.

Performance Expectation 5-ESS1-1

Support an argument that the apparent brightness of the sun and stars is due to their relative distances from Earth.

Dimensions

Engaging in Argument from Evidence

- Support an argument with evidence, data, or a model.

ESS1.A: The Universe and Its Stars

- The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.

Scale, Proportion, and Quantity

- Natural objects exist from the very small to the immensely big.

Clarifications and Content Limits

Content Limits:

- Assessment is limited to relative distances, not sizes, of stars.
- Assessment does not include other factors that affect apparent brightness (such as stellar masses, age, stage, etc.).
- Students do not need to know specific stars and their names.
- Students do not need to know anything about luminosity and how that is affected by the size/age of a star.
- Students do not need to know what flux is or how to calculate it.
- Assessment does not include absolute brightness.

Science Vocabulary Students Are Expected to Know

- space
- planet
- sun's size
- solar system
- moon
- burn
- star brightness
- constellation
- galaxy
- visible
- astronomical

Science Vocabulary Students Are Not Expected to Know

- lunar phase
- eclipse
- celestial
- mass
- comet
- light year
- astronomical unit
- emit
- interstellar
- fission
- fusion
- radiation
- spectrum
- star size
- star composition
- star formation
- star types
- luminosity
- flux

Phenomena

Some example phenomena for 5-ESS1-1:

- Most stars cannot be seen during the daytime but can be seen at night.
- The sun is never seen at the same time as other stars in the sky.
- Alpha Centauri A is larger than the sun but does not look as bright in the sky.
- Street lights that are farther away from you look dimmer.
- A car's lights become brighter as it drives toward you at night.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Organize, arrange (e.g., using illustrations and/or labels), or summarize data to highlight trends, patterns, or correlations in how the data changes over time. ***(SEP/DCI/CCC)**
2. Generate/construct graphs, tables, or assemblages of illustrations and/or labels of data that document patterns, trends, or correlations in how the brightness of stars is based on their relative distance from Earth. This may include sorting out distractors. ***(DCI/CCC)**
3. Describe, identify, and/or select information needed to support an explanation. ***(SEP/DCI)**
4. Use relationships identified in the data to predict the distance of a star depending on its brightness, or vice versa. ***(DCI/CCC)**
5. Identify patterns or evidence in the data that supports inferences about how the brightness of stars depends on their relative distance from Earth.

*denotes those task demands which are deemed appropriate for use in stand-alone item development

Performance Expectation 5-ESS1-2

Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.

Dimensions

Analyzing and Interpreting Data

- Represent data in graphical displays (bar graphs, pictographs, and/or pie charts) to reveal patterns that indicate relationships.

ESS1.B: Earth and the Solar System

- The orbits of Earth around the sun and of the moon around Earth, together with the rotation of Earth about an axis between its North and South poles, cause observable patterns. These include day and night; daily changes in the length and direction of shadows; and different positions of the sun, moon, and stars at different times of the day, month, and year.

Patterns

- Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena.

Clarifications and Content Limits

Content Limits:

- Examples of patterns could include the position and motion of Earth with respect to the sun and selected stars that are visible only in particular months.
- While the names of celestial objects, stars, or constellations can be included, students are not expected to identify them.
- Objects to be used to assess this PE are limited to the sun, Earth's moon, Earth, and stars/constellations visible in Earth's night sky.
- "Positions of the moon" refers to its location in Earth's sky and not its appearance (phase).
- Assessment does not include cause of seasons, lunar phases, or the position of the sun in the sky throughout the year.

Science Vocabulary Students Are Expected to Know

- circular motion
- universe
- Earth's rotation
- galaxy
- North Pole
- South Pole
- axis
- solar system
- Milky Way
- constellation
- moon phases
- lunar astronomical
- orbit
- tilt
- annual
- rotation
- revolution

Science Vocabulary Students Are Not Expected to Know

- eclipse
- celestial
- comet
- light year
- astronomical unit
- stellar

Phenomena

Some example phenomena for 5-ESS1-2:

- The shadow cast by a sundial changes position and size throughout the day.
- A constellation that is viewed right above someone's house at 8:00 p.m. one night can no longer be seen at 8:00 p.m. in a few months.
- The sun is seen in the sky only during the day
- It gets dark out after the sun goes below the horizon

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Organize, arrange (e.g., using illustrations and/or labels), or summarize data to highlight trends, patterns, or correlations in how the data changes over time. ***(SEP/DCI/CCC)**
2. Generate/construct graphs, tables, or groups of illustrations and/or labels of data that document patterns, trends, or correlations in how the data change over time. This may include sorting out distractors. **(SEP/DCI/CCC)**
3. Use relationships identified in the data to predict whether or not the pattern will continue OR how the data will look at some time in the future. ***(SEP/DCI/CCC)**
4. Identify patterns or evidence in the data that supports inferences about the phenomena.

Performance Expectation 5-ESS2-1

Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Dimensions

Developing and Using Models

- Develop a model using an example to describe a scientific principle.

ESS2.A: Earth Materials and Systems

- Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.

System and System Models

- A system can be described in terms of its components and their interactions.

Clarifications and Content Limits

Clarification Statements:

- Examples could include the influence of the ocean on ecosystems, landform shape, and climate; the influence of the atmosphere on landforms and ecosystems through weather and climate; and the influence of mountain ranges on winds and clouds in the atmosphere.
- The geosphere, hydrosphere, atmosphere, and biosphere are each a system.

Content Limits:

- Assessment is limited to the interactions of two systems at a time.

Science Vocabulary Students Are Expected to Know

- core
- mantle
- crust
- geosphere
- biosphere
- hydrosphere
- atmosphere
- solid
- liquid
- gas
- vapor
- tundra
- boreal forest
- deciduous forest
- grassland
- desert
- savannah
- tropical rainforest
- freshwater
- marine
- high pressure
- low pressure
- currents
- circulation

Science Vocabulary Students Are Not Expected to Know

- troposphere
- stratosphere
- mesosphere
- thermosphere
- ionosphere
- chaparral

Phenomena

Some example phenomena for 5-ESS2-1:

- The land area found on the beaches around Nantucket Sound in 2016 were about three times the land area in the same location in 1984.
- In 2016, Tucson, Arizona received more rain between June and September than Yuma, Arizona received during the entire year.
- The amount of carbon dioxide in the atmosphere measured at Mauna Loa Observatory in April is 397 parts per million. The amount measured at the same location the previous September was 2% less.
- In 1980, the salt content in the freshwater Biscayne Aquifer in Florida was 50 milligrams per liter. In 1997, the salt content of the same water was 1,000 milligrams per liter.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Select or identify from a collection of potential model components, including distractors, the components needed to model the phenomenon. Components might include labels, text, steps in a process.
2. Assemble or complete, from a collection of potential model components, an illustration or flow chart that is capable of representing how the geosphere, biosphere, hydrosphere, and/or atmosphere interact. This does not include labeling an existing diagram.
3. Manipulate the components of a model to demonstrate the changes, properties, processes, and/or events that act to result in the phenomenon
4. Make predictions about the effects of changes in the geosphere, biosphere, hydrosphere, or atmosphere on each other. Predictions can be made by manipulating model components, completing illustrations, or selecting from lists with distractors.
5. Given models or diagrams of ways in which the geosphere, biosphere, hydrosphere, and/or atmosphere interact, identify relationships between the spheres and how a change in one causes a change in another.
6. Identify missing components, relationships, or other limitations of the model.

Performance Expectation 5-LS1-1

Support an argument that plants get the materials they need for growth chiefly from air and water.

Dimensions

Engaging in Argument from Evidence

- Support an argument with evidence, data, or model.

LS1.C: Organization for Matter and Energy Flow in Organisms

- Plants acquire their material for growth chiefly from air and water.

Energy and Matter

- Matter is transported into, out of, and within systems.

Clarifications and Content Limits

Clarification Statement:

- Emphasis is on the idea that matter that plant matter comes mostly from air and water, not from the soil.

Content Limits:

- Assessment does not include photosynthesis or the photosynthesis reaction equation. Students should know that plants carry out photosynthesis for energy, but they do not need to know the specifics of the process or equation.

Science Vocabulary Students Are Expected to Know

- organism
- algae
- atmosphere
- consumer
- cycle
- matter
- photosynthesis
- photosynthetic plants
- product
- transport
- chemical
- convert
- transfer
- energy flow
- flow chart
- conservation
- nutrients

Science Vocabulary Students Are Not Expected to Know

- plant structure
- producer
- chemical process
- carbon
- carbon dioxide
- aerobic
- anaerobic
- molecule
- sugars

Phenomena

Some example phenomena for 5-LS1-1:

- A Neoregelia plant sits on the branch of a much larger kapok tree in the Cloud Forest of South America.
- A plant grows in a classroom and the students weigh the soil every day. The weight of the soil does not change over time but the plant continues to grow.
- Spanish moss hangs from the branches of a live oak tree in the swamps of Louisiana.
- Strawberries sold in a supermarket were grown inside of a greenhouse without soil.

Tasks Demands Supported by This Performance Expectation and associated Evidence Statements

1. Sort observations into those that appear to support competing (given) arguments, or into those that support, contradict, or are not relevant to a given argument. Observations are from animations, simulations, or other given material.
2. Sort, tabulate, classify, separate, and/or categorize relevant from irrelevant evidence (observations) or data.
3. Select from a given collection additional relevant observations that would help distinguish between competing arguments or the veracity of a single argument.
4. Select, identify, or describe apparent counterexamples to a supported argument.
5. Identify from a given collection—or explain in writing—flaws in observation that lead to an apparent counterexample, or explain the counterexample in terms of grade-level appropriate properties of plant growth.
6. Sort statements into categories such as facts, reasonable judgments based on available facts, and speculation.
7. Articulate the evidence supporting and/or contradicting an argument that plants chiefly need air and water for growth.

Performance Expectation 5-LS2-1

Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Dimensions

Developing and Using Models

- Develop a model to describe phenomena.

LS2.A: Interdependent Relationships in Ecosystems

- The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plant parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem.

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

- Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases and water from the environment and release waste matter (gas, liquid, or solid) back into the environment.

Systems and System Models

- A system can be described in terms of its components and their interactions.

Clarifications and Content Limits

Clarification Statement:

- Emphasis is on the idea that matter that is not food (air, water, decomposed materials in soil) is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and Earth.

Content Limits:

- Assessment does not include molecular explanations.

Science Vocabulary Students Are Expected to Know

- Organism
- matter
- plant
- animal
- bacteria
- fungus
- algae
- gas
- nutrients
- producer
- consumer
- decomposer
- cycle
- matter
- photosynthesis
- conserve
- products
- break down
- relationship
- waste
- recycle
- environment
- system
- species
- balance
- material
- model
- soil

Science Vocabulary Students Are Not Expected to Know

- chemical process
- reaction
- molecule
- carbon
- carbon dioxide
- oxygen
- sugar
- aerobic
- anaerobic

Phenomena

Some example phenomena for 5-LS2-1:

- Insects in a terrarium only survive when bacteria and plants are present.
- A new fish tank must rest for 2–3 weeks with water before introducing fish or the fish die.
- Under a microscope, a sample of soil contains many bacteria, but a sample of desert sand does not.
- Farmers put fish in stock tanks to keep them clean.

Tasks Demands Supported by This Performance Expectation and associated Evidence Statements

1. Select or identify from a collection of potential model components, including distractors, the parts of a model needed to describe the movement of matter among plants, animals, decomposers, and the environment. ***(SEP/DCI/CCC)**
2. Manipulate the components of a model to demonstrate properties, processes, and/or events that result in the movement of matter among plants, animals, decomposers, and the environment, including the relationships of organisms and/or the cycle(s) of matter and/or energy.
3. Articulate, describe, illustrate, select, or identify the relationships among components of a model that describe the movement of matter among plants, animals, decomposers, and the environment.
4. Make predictions about the effects of changes in model components, including the substitution, elimination, or addition of matter and/or an organism and the result.

*denotes those task demands which are deemed appropriate for use in stand-alone item development

Performance Expectation 5-PS1-1

Develop a model to describe that matter is made of particles too small to be seen.

Dimensions

Developing and Using Models

- Use models to describe phenomena.

PS1.A: Structure and Properties of Matter

- Matter of any type can be subdivided into particles that are too small to see, but even then the matter still exists and can be detected by other means. A model showing the gases are made from matter particles that are too small to see and are moving freely around in space can explain many observations, including the inflation and shape of a balloon and the effects of air on larger particles or objects.

Scale, Proportion, and Quantity

- Natural objects exist from the very small to the immensely large.

Clarifications and Content Limits

Clarification Statement:

- Examples of evidence supporting a model could include adding air to expand a basketball, compressing air in a syringe, dissolving sugar in water, and evaporating salt water.

Content Limits:

- Assessment does not include the atomic-scale mechanism of evaporation and condensation or the defining of the unseen particles.
- Students are expected to know that matter can neither be destroyed nor created.

Science Vocabulary Students Are Expected to Know

- matter
- substance
- particle
- solid
- liquid
- gas
- vapor
- steam
- air
- phase change
- evaporate
- boil
- condense
- freeze
- melt
- dissolve
- mixture
- chemical reaction
- energy

Science Vocabulary Students Are Not Expected to Know

- atom
- compound
- molecule
- chemical bond
- solution
- homogenous
- heterogeneous
- colloid
- solute
- solvent
- precipitant
- precipitate
- reactant
- product
- air pressure
- Law of conservation of matter

Phenomena

Some example phenomena for 5-PS1-1:

- A hissing sound can be heard as a bicycle wheel deflates.
- A sour odor can be smelled from milk that has been kept too long (or expired).
- When you pump air out of a closed bottle that is partially filled with marshmallows, the marshmallows expand in size. However, when you open the bottle, the marshmallows shrink back to their original size.
- When you place a lit match into a glass bottle and a boiled egg is set on the bottle opening, the egg eventually gets sucked into the bottle.

Task Demands Supported by This Performance Expectation and associated Evidence Statements

1. Select or identify from a collection of potential model components, including distractors, the components needed to model the phenomenon. Components might include solid, liquid, or gas particles; particles of different substances; and representations of particle movement.
2. Assemble or complete — from a collection of potential model components — an illustration, flow chart, or causal chain that is capable of representing the particle nature of matter. This does not include labeling an existing diagram.
3. Manipulate the components of a model to demonstrate the changes, properties, processes, and/or events that act to result in the phenomenon.
4. Make predictions about the effects of changes in the movements of, distances between, or phases of the particles of matter under investigation. Predictions can be made by manipulating model components, completing illustrations, or selecting from lists with distractors.
5. Provided with models or diagrams of the particles of matter under investigation, identify the properties of the particles under investigation and how they change in each scenario. The properties of the particles may include the relative motions of, distances between, and phases of the particles.
6. Describe, select, or identify the relationships among components of a model that explains the observed effects of the particle nature of matter.

Performance Expectation 5-PS1-2

Measure and graph quantities to provide evidence that regardless of the type of change that occurs when heating, cooling, or mixing substance, the total weight of matter is conserved.

Dimensions

Using Mathematics and Computational Thinking

- Measure and graph quantities such as weight to address scientific and engineering questions and problems.

PS1.A: Structure and Properties of Matter

- The amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.

PS1.B: Structure and Properties of Matter

- No matter what reaction or change in properties occurs, the total weight of the substance does not change.

Scale, Proportion, and Quantity

- Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

Clarifications and Content Limits

Clarification Statement:

- Examples of reactions or changes could include mixing, dissolving, and phase changes that form new substances.

Content Limits:

- Assessment does not include distinguishing mass and weight.
- Students do not need to know: structure of atoms, specific chemical equations.

Science Vocabulary Students Are Expected to Know

- weight
- substance
- matter
- conservation
- temperature
- mixing
- phase change
- dissolving
- properties
- reaction
- particles
- gas
- solid
- liquid

Science Vocabulary Students Are Not Expected to Know

- mass
- atoms
- molecules
- rates

Phenomena

Some example phenomena for 5-PS1-2:

- A cup of water is taken out of the freezer and left on a counter. After some time, the frozen water melts.
- A cup of hot tea can dissolve more sugar than a cup of cold tea, but they both weigh the same after the mixing is complete.
- When mixed together, silver nitrate and sodium chloride forms a white solid that weighs the same as the individual silver nitrate and sodium chloride weighed.
- • When water, baking soda, and calcium chloride are mixed inside a freezer bag, the bag gets hot and expands. The expanded freezer bag weighs the same as the ingredients did when they were separate.

Task Demands Supported by This Performance Expectation and associated Evidence Statements

1. Make simple calculations using given data to calculate or estimate the total weight of a substance after heating, cooling, or mixing.
2. Measure or graph data that can be used to calculate or estimate the total weight of a substance after heating, cooling, or mixing.
3. Describe and/or summarize data (e.g., using illustrations and/or labels) to identify/highlight trends, patterns, or correlations concerning the weight of the substances being investigated at the beginning and end of an investigation.
4. Compile and/or select, from given information, the particular data needed for a specific inference about the total weight of substances. This can include sorting out the relevant data from the overall body of given information.
5. Select, describe, or illustrate a prediction made by applying the findings from measurements or an investigation.
6. Use relationships identified in the data to explain that regardless of the type of change, the total weight of matter is conserved.

Performance Expectation 5-PS1-3

Make observations and measurements to identify materials based on their properties.

Dimensions

Planning and Carrying Out Investigations

- Make observations and measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon.

PS1.A: Structure and Properties of Matter

- • Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.).

Scale, Proportion, and Quantity

- Standard units are used to measure and describe physical quantities such as weight, time, temperature, and volume.

Clarifications and Content Limits

Clarification Statement:

- Examples of materials to be identified could include baking soda and other powders, metals, minerals, and liquids.
- Examples of properties could include color, hardness, reflectivity, electrical conductivity, thermal conductivity, response to magnetic forces, and solubility.

Content Limits:

- Assessment does not include density or distinguishing mass and weight.
- Students do not need to know: chemical reaction equations, balancing reaction equations, atomic-level processes.

Science Vocabulary Students Are Expected to Know

- electric
- electrically charged
- magnetic
- magnetic attraction
- conductor
- change of state
- substance
- absorbency
- evaporate
- metal
- vapor
- conduction
- relative
- conservation of matter
- phase change
- dissolve
- react
- product
- atom

Science Vocabulary Students Are Not Expected to Know

- insulator
- element
- reaction
- boiling point
- melting point
- molecule
- forms of matter
- reactant
- chemical compound
- chemical reaction

Phenomena

Some example phenomena for 5-PS1-3:

- Sugar and flour are white powdery substances. Sugar is soluble in water and flour is not.
- Three mineral crystals sit on a table. The three crystals are all the same color, resembling clear glass. However, they are all different minerals. One of them is quartz, one of them is halite, and the third is calcite.
- Two nails are on a table. When a magnet is placed over the nails, one of them moves from the table and sticks to the magnet.
- Two pieces of wood are hit with a hammer. One piece of wood has a depression/dent where the hammer hit it. The other does not have a dent/depression.

Task Demands Supported by This Performance Expectation and associated Evidence Statements

1. Identify from a list, including distractors, the materials or tools needed to observe or measure properties of matter to identify unknown materials.
2. Identify from a list, including distractors, the output data needed to identify or differentiate materials. **
3. Make and/or record observations or measurements from the investigation of the properties of materials. ***(SEP/DCI/CCC)**
4. Interpret and/or communicate the data from the investigation of the properties of materials.
5. Make or communicate conclusions from the investigation of the properties of materials.

*denotes those task demands which are deemed appropriate for use in stand-alone item development

**TD2 may be used for stand-alone item if used with TD3

Performance Expectation 5-PS1-4

Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

Dimensions

Planning and Carrying Out Investigations

- Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials are considered.

PS1.B: Chemical Reactions

- When two or more different substances are mixed, a new substance with different properties may be formed.

Cause and Effect

- Cause-and-effect relationships are routinely identified and used to explain change.

Clarifications and Content Limits

Clarification Statement:

- Students are not expected to be able to balance chemical equations, but should be able to complete simple mathematical (addition and subtraction) calculations in regard to starting materials and ending materials.

Content Limits:

- Students are expected to know that matter is neither destroyed nor created.
- Students do not need to know: Chemical names, chemical symbols, general balanced equation {product + product $\Rightarrow$ (yields) reactants}, and isotopes, specific chemical reaction types (e.g. oxidation, reduction, decomposition, and combustion).

Science Vocabulary Students Are Expected to Know

- matter
- substance
- particle
- chemical property
- physical property
- mass
- volume
- density
- melting point
- boiling point
- freezing point
- dissolve
- flammable
- odor
- gas
- solid
- liquid
- mixture
- chemical reaction
- gram(s)
- physical change
- chemical change

Science Vocabulary Students Are Not Expected to Know

- reactant
- product
- atom
- molecule
- compound
- chemical bond
- Law of conservation of mass
- Law of conservation of energy
- intramolecular attractions
- intermolecular attractions
- solubility
- solvent
- solute
- precipitant
- rate of chemical reaction
- acid
- base
- salt (as an ionic crystal)
- fusion
- fission
- homogeneous mixture
- heterogeneous mixture
- plasma
- pH

Phenomena

Some example phenomena for 5-PS1-4:

- A peach shrivels and becomes covered with mold.
- Over time, one metal changes color when exposed to rainwater. However, another metal exposed to rainwater does not.
- A bottle partially filled with vinegar sits on a counter. An empty balloon is partially filled with baking soda. When the open end of the balloon is stretched over the bottle top, a hissing/fizzing sound can be heard and the balloon expands.
- When sugar crystals are added to vinegar in a bowl, the crystals disappear. When crystals of baking soda are added to vinegar in a bowl, the mixture begins to bubble and foam.
- Table sugar exposed to an open flame transforms into a gooey, dark substance. Wood exposed to an open flame transforms into ash.
- Three trials are performed. In the first trial, blowing/exhaling air into water produces no visible result. In the second trial, a piece of paper that measures the amount of hydrogen is dipped into the water before adding air and after adding air. The color of the paper before air is added is different than the color of the paper after air is added. In the third trial, the resulting water from the second trial is heated and cooled. When a new paper is dipped into the water, the color of the paper is the same as the original color, before the air was blown into the water.
- When heated, a solid substance seems to melt and then to evaporate. However, the solid does not reform when cooled.
- A mixture of corn starch and water will blend with stirring. The resulting mixture is slimy and acts more like a fluid. However, sudden pressure hardens the mixture and it acts more like a solid.

Task Demands Supported by This Performance Expectation and associated Evidence Statements

1. Identify from a list, including distractors, the properties that should be tested or the materials/tools needed in an investigation of the physical and chemical properties of the starting and ending substances involved in mixing.
2. . Identify the outcome data that should be collected in an investigation of the physical and chemical properties of the starting and ending substances under investigation.
3. Make and/or record observations/data about the physical and chemical properties of the substances that are mixed and the substances resulting from the mixture.
4. Interpret and/or communicate the data from an investigation. This may include identifying/describing trends, patterns, or correlations among observations and data concerning the physical and chemical properties of the beginning and ending substances being investigated.
5. Explain or describe the causal processes that lead to the observed data.

Performance Expectation 5-PS3-1

Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

Dimensions

Developing and Using Models

- Use models to describe phenomena.

PS3.D: Energy in Chemical Processes and Everyday Life

- The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter.

LS1.C: Organization for Matter and Energy Flow in Organisms

- Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary)

Energy and Matter

- Energy can be transferred in various ways and between objects.

Clarifications and Content Limits

Clarification Statement:

- Examples of models could include diagrams and flow charts.

Content Limits:

- Assessment does not include photosynthesis.
- Students do not need to know: photosynthesis equation

Science Vocabulary Students Are Expected to Know

- energy
- matter
- transfer
- light

Science Vocabulary Students Are Not Expected to Know

- photosynthesis
- metabolism
- atoms
- chemicals
- reaction
- radiation

Phenomena

Some example phenomena for 5-PS3-1:

- Cows eat grass that grew in the sun.
- Termites eat the wood in trees.
- Caterpillars eat leaves and grow big.
- Koalas mainly eat eucalyptus leaves.

Task Demands Supported by This Performance Expectation and Associated Evidence Statements

1. Select or identify, from a collection of potential model components, including distractors, the parts of a model need to describe the flow of energy among plants, animals, and the sun.
2. Assemble or complete a model representing the flow of energy among plants, animals, and the sun.
3. Manipulate the components of a model to demonstrate properties, processes, and/or events that result in the flow of energy among plants, animals, and the sun, including the relationships of organisms and/or the cycles of energy and/or matter.
4. Articulate, describe, illustrate, select, or identify the relationships among components of a model that describe the movement of matter among plants, animals, and the sun.
5. Make predictions about the effects of changes in model components including the substitution, elimination, or addition of energy and/or an organism and the result.