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DEPARTMENT OF EDUCATION

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Grade 4 Item Specifications and Essential Foundational Knowledge Targets for State Assessment Overlap of the South Carolina Academic Standards and Performance Indicators for Science 2014 and South Carolina College- and Career-Ready Science Standards 2021

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Contents

Purpose and Use

- Provides guidelines for item writers for the state assessment
- Provides supporting key content vocabulary used in the state assessment
- Provides focused DCI/SEP/CCC targets for the state assessment
- Identifies specific state assessment limits on foundational knowledge
- Defines universal design considerations
- Provides examples of state assessment contexts for items/clusters/tasks (not exhaustible)
- Provides information on overlap with 2014 standards

Note to Teachers:

This document is intended as a guide for item developers working in and with the Office of Assessment and Standards and not as a curriculum or instructional guide. The information found within the *Grade 4 Item Specifications and Essential Foundational Knowledge for Assessment Overlap of the South Carolina Academic Standards and Performance Indicators for Science 2014 and South Carolina College and Career-Ready Science Standards 2021* reflects the content limits and the foundational knowledge targets addressed by the state assessment.

Each item/cluster/task is developed using the three dimensions as set forth by the *South Carolina College- and Career–Ready Science Standards* and will assess science and engineering practices (SEPs) and crosscutting concepts (CCCs) and the Disciplinary Core Ideas (DCIs) found in *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas*."

Items may assess a:

- CCC, DCI, and SEP within one item (3D).
- DCI and CCC **or** a DCI and SEP within one item (2D).

2D items may not assess a CCC and SEP within a single item.

Items may not assess any single dimension.

Tasks/Clusters will be 3D, meaning that within the body of items associated with that cluster or task, all dimensions will be assessed.

The terms "**can**", "**could,**" and "**may**" are terms that infer information that is **not exhaustive**.

Links to the pertinent foundation statements and evidence statements are provided at below the State Assessment Boundary. Return links are provided to return to the PE.

4-PS4-2 Waves and Their Applications for Technologies for Information Transfer
Performance Expectation: Develop a model to describe that light reflecting from objects and entering the eye allows objects to be seen.
Clarification Statement: None
State Assessment Boundary: Assessment does not include knowledge of specific colors reflected and seen, the cellular mechanisms of vision, or how the retina works.

DCI: 4-PS4.B.1; **SEP:** 4-II.b; **CCC:** 4.CE.1; **4-PS4-2** Evidence Statements

PE Specific Phenomenon-Related Terminology for 4-PS4-2 That Could Be Used on the State Assessment

- eye
- illuminate
- light
- light source
- luminous
- reflect/reflection
- visible

4-PS4-2 On the state assessment, items may not:

- ask students about the angle of reflection,
- ask students to describe the effect of color filters,
- reference the visible light spectrum,
- require student knowledge of cellular mechanisms of vision,
- require student knowledge of the cornea, pupil, and retina or of its function,
- require students to identify the reflection of a specific color,
- use the term "absolute brightness" or "apparent brightness,"
- use the terms opaque, transparent, and translucent (unless defined in the scenario/stimulus),
- use the terms "see and seen,*" and/or
- use units of illuminance or intensity.

4-PS4-2 For state assessment purposes:

- *when possible, the terms "see" and "seen" will be replaced by "view/viewed", "visible" and "visibility." *This avoids bias against the visually impaired students.*

4-PS4-2 Essential State Assessment Targets Across the Dimensions
Items/Tasks should require students to demonstrate the knowledge, grade level sophistication of skills/abilities, and application of crosscutting concepts to describe that the reflection of light makes objects visible. State assessment targets are listed below.

- Develop/Modify/Use a model to describe/explain:
  - that an object is visible when the object produces light or reflects light which then enters the eye,
  - the effect on the visibility of an object by placing a mirror in the path of light, or
  - how placing an opaque, transparent, or translucent barrier in the path of light affects the visibility of an object.
- Identify the components (e.g., light source, mirror, object, path of light, eye) of a model that illustrates how light affects the visibility of an object.
- Describe the relationships among the components of a model.
- Predict what will occur if one component of a model describing/explaining/illustrating how light affects visibility is changed.

- Develop and compare models to determine which model best describes/explains/illustrates how the reflection of light affects visibility.
- Make connections between the patterns and cause and effect related to light and the visibility of an object.
- Analyze models to determine the strengths and weaknesses to in describing/illustrating how light affects the visibility of an object. Students may be required to:
    - identify the specific weakness(es) in the model, and/or
    - refine the model to make it better describe/explain/illustrate how light affects the visibility of an object.
- Develop an experiment/investigation to test a model related to the visibility of an object. Students could be required to:
    - evaluate the model for how well it illustrates the phenomenon being investigated.
    - predict the outcome when one component of the model is changed or removed.
- Analyze/Interpret data develop/modify/use model that illustrates the visibility of an object. Students could be required to:
    - use graphs and/or tables; or
    - compare data collected by different groups to identify and/or model the differences or similarities.

4-PS4-2 Possible Contexts for Phenomena on State Assessment Items/Clusters/Tasks (not exhaustive)

- Light reflecting off an object: (e.g., a street sign, the Moon)
- Comparison of an object in a lighted room vs an object in a dark closet
- An opaque, transparent and/or translucent barrier placed in the path of light
- A mirror placed in the path of light making a previously invisible object, visible

4-PS4-2 Example of State Assessment Items/Clusters/Tasks (not exhaustive)

- Scenario/Task describing the path of light as it travels from the source to the eye.
    - Select the best model/statement explaining/illustrating the path of the light.
    - Compare models to identify which model describes which behavior.
    - Compare models to identify which models best explains/illustrates the phenomenon being investigated.
    - Predict the effect adding a specific barrier to a model will have on the visibility of the light.

2014 4th Grade Standards and Indicators Related to 4-PS4-2 (4th Grade Support Guide 3.0)

4.P.4A.3 Obtaining communicate information to explain how the visibility of an object is related to light.

- Light is necessary for objects to be visible.
- The Sun, light bulbs, and flames are sources of light.

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4.P.4A.4 Develop and use models to describe how light travels and interacts when it strikes an object using evidence from observations.

- Light is reflected when it strikes an object and bounces back.
- Objects that do not produce their own light are visible when light reflects off the surface. Examples are the Moon or a stop sign.

4.P.4A.5 Plan and conduct scientific investigations to explain how light behaves when it strikes transparent, translucent, and opaque materials. (*For 2021, students are not expected to use and apply the terms "opaque, translucent, and transparent" but do need to experience the behavior of light as it interacts with different media since it will still be assessed conceptually.*)

- Light interacts differently with different materials.
    - Some materials allow light to pass through it.
        - Objects viewed through these materials are clearly visible.
        - Examples are water and clear window glass.
    - Some materials allow some of the light to pass through it.
        - Objects viewed through these material appear blurry.
        - Examples are frosted glass and waxed paper.
    - Some materials block all light.
        - When light hits objects that block all light, a shadow is produced.
        - Examples are a solid wall or a wooden door.

4-PS4-3 Waves and Their Applications for Technologies for Information Transfer
Performance Expectation: Generate and compare multiple solutions that use patterns to transmit information.
Clarification Statement: Examples of solutions include drums sending coded information through sound waves, using a grid of 0s and 1s representing black and white to send information about a picture, QR codes, barcodes, and using Morse code to send text. The coding method does not need to be electronic or digital, and the code should only be two possible values such as on/off, 0/1, black/white.
State Assessment Boundary: None

DCI: 4-PS4.C.1,2/ 4-ETS1.C.1/ 4-ETS2.A.1; **SEP:** 4-VI.c; **CCC:** 4.P.1;
4-PS4-3 Evidence Statements

PE Specific Phenomenon-Related Terminology for 4-PS4-3 That Could be Used on the State Assessment

- barcode
- code
- decode
- digitized information
- encode/encrypt
- Morse code
- decode
- QR code
- transmit

4-PS4-3 On the state assessment, items may not:

- reference or use blinking lights as a form of coded communication.

4-PS4-3 For state assessment purposes:

- methods for sending coded messages will be limited to binary codes (i.e., 0/1, black/white, dot-dash (long/short beeps or vibrations) or on/off,
    - Binary image (ex. use of zeros and ones to create a black and white image)
- criterion is limited to accuracy of the message communicated,
- use of devices that convert digitized information into sound waves (radio, cell phone) or pictures (television), and
- use of light or sound to transmit Morse code will be modeled using the dot-dash.

4-PS4-3 Essential State Assessment Targets Across the Dimensions
Items/Clusters/Tasks should require students to demonstrate the knowledge, grade level sophistication of skills/abilities, and application of crosscutting concepts to generate and compare multiple solutions using patterns to transmit information. State assessment targets are listed below.

- Develop two different solutions to a problem(s). Assessable knowledge, practices and skills related to generating and comparing multiple solutions are listed below and could be included in any item, cluster, or task.
    - Specify criterion* for the solutions. *This is limited to the accuracy of the communicated message for the purposes of the state assessment.
    - Identify the constraints of the solutions (i.e., availability of materials, safety).
    - Compare the solutions to determine which best meets the criterion.

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- Develop a test to determine the how well two different solutions meets the criterion. Assessable practices and skills related to generating and comparing multiple solutions are listed below and could be included in any item, cluster, or task.
    - Identify the appropriate tools/equipment/materials needed to test the solutions.
    - Develop/follow a plan and procedure for testing the solutions.
    - Decide how the data are being collected and reported.
    - Determine how many trials are needed to collect sufficient data to determine how well the solutions meet the criterion.

4-PS4-3 Possible Contexts for Phenomena on State Assessment Items/Clusters/Tasks (not exhaustive)

- Bar codes and QR codes
- Cell phone signal sent from one phone to another
- Compare two different solutions for communicating information

4-PS4-3 Example of State Assessment Tasks (not exhaustive)

- Scenario/Task describes a need to send a message over distance with given criteria and constraints.
    - Select from a list or group of possible designs/solutions the best design/solution to solve the problem.
    - Identify the advantages/disadvantages of the design based on the information.
    - Analyze the solution provided and select possible modifications from a list to provide a solution to the problem.

2014 Grade 4 Standards and Indicators Related to 4-PS4-3 (4th Grade Support Guide 3.0)

4.P.4B.3 Define problems related to the communication of information over a distance and design devices or solutions that use sound to solve the problem.

- Students engage in the design process to design and test different solutions to solving the problem of communicating sound over different distances, including the following steps:
    - Asking questions about the nature of the problem is related to communicating information through sounds over different distances.
    - Designing devices or devising solutions to these problems.
    - Testing devices or solutions to collect data related to the quality of sound over different distances.
    - Analyzing and interpreting data to determine if solutions are successful based on the volume of clarity of the sound over different distances.
    - Using data to refine and retest their designs.
    - Communicating their solutions

4-LS1-1 From Molecules to Organisms: Structure and Processes
Performance Expectation: Construct an argument that plants and animals have internal and external structures that function together in a system to support survival, growth, behavior, and reproduction.
Clarification Statement: Examples of structures could include thorns, roots, heart, lungs, or skin.
State Assessment Boundary: Assessment does not include microscopic structures within plant and animal systems.

DCI: 4-LS1-A.1; **SEP:** 4-VII.a; **CCC:** 4.SSM.1; **4-LS1-1** Evidence Statements

PE Specific Phenomenon-Related Terminology for 4-LS1-1 That Could Be Used on the State Assessment

- behavior
- camouflage
- external structure
- grow
- internal structure
- organism
- reproduction
- survive/ survival
- system

4-LS1-1 On the state assessment, items may not:

- ask students to demonstrate knowledge of body systems (e.g., circulatory, respiratory, etc.),
- reference, or require students to demonstrate knowledge of, microscopic structures in animals and plants,
- require students to classify organisms into flowering and nonflowering groups and/or invertebrate and vertebrate groups,
- use examples of external and internal structures beyond those found in the table titled *External and Internal Structures of Animals and Plants Used for State Assessment*, or
- use the word "organ." When necessary, use "internal structure." (The compositional hierarchy of organs is not taught until 6-LS1-3.)

4-LS1-1 For state assessment purposes:

- applicable animal and plant structures are limited to those listed in the table titled *External and Internal Structures of Animals and Plants Used for State Assessment*,
- "organs" will be referred to as "internal structures," and
- the term "spines" should be used instead of "quills" when referencing these external animal structures

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External and Internal Structures of Animals and Plants Used for State Assessment

Structure	External/Internal Structure	Function
bark	external	the tough covering on the outside of a woody plant; provides protection from the environment
beak	external	the hard extension of a bird's or turtle's jaw; functions to allow animal to eat hard seeds and other types of food and to help the animal protect itself
brain	internal	controls all the functions of the body
claw	external	sharp curved extension of an animals toe; used to grasp branches, grab prey, and for protection
feathers	external	the covering a bird's body; functions to camouflage and regulate body temperature
fin	external	flat appendage found on fish; used for movement
flippers	external	flat, modified legs in sea birds and mammals; used for movement
flower	external	part of the plant that develops seeds; color and scent helps attract animals that help it reproduce
fruit	external	grow from pollenated flowers; contain and protect seeds; attract animals that eat them and disperse seeds
fur/hair	external	outer covering on most mammals that functions to camouflage and regulate body temperature
heart	internal	functions to pump oxygen and nutrients to the cells of the body
leaves	external	contain the internal structures that use sunlight, water from the roots, and carbon dioxide to make food which is carried throughout the plant by internal structures
legs	external	appendages that provide movement; function to help animal hunt for food and avoid predators
lungs	internal	helps bring oxygen into the body
roots	external	functions to provide water and nutrients from the soil to the plant and provided support by anchoring it in the ground
seed	external or internal	structure produced in flowers from which a new plant grows
shells	external	hard, outside covering on some animals; functions to provide camouflage and protects the internal structures of the body
skin	external	outer covering on some animals that protects the internal structures of the body and helps regulate temperature; can have colors and structures that camouflage
spines	external	• on animals: hard, sharp modified hairs that project to provide protection from predators (Note: "quills" are special types of spines but for assessment "spines" with be used) • on plants: hard, sharp modified leaves that provide protection from being eaten
stems	external	provide support for plants
stomach	internal	helps breakdown food eaten animals
thorns	external	hard, sharp projections on the outside of plants that provide protection from predators

4-LS1-1 Essential State Assessment Targets Across the Dimensions

Items/Tasks should require students to demonstrate the knowledge, grade level sophistication of skills/abilities, and application of crosscutting concepts related to how the internal and external structures of plants and animals function together to support survival, growth, behavior, and reproduction. State assessment targets are listed below.

- Use evidence from data, informational text, or a model to support an argument that the external and internal structures of animals and plants function together in a system to support behavior, growth, reproduction, and survival. Assessable knowledge, practices and skills related to engaging in argument from evidence are listed below and could be included in any item, cluster, or task.
    - Select the argument (from a list) that is best supported by a model illustrating how external and internal structures function as a system and vice versa.
    - Identify the evidence obtained from various sources that supports an argument related to how external and internal structures function as a system.
- Evaluate the strengths or weaknesses of an argument based on the reliability/validity of evidence used to support the argument. Any item, cluster, or task may require students to:
    - sort the information into "does support" or "does not support" the argument, or
    - determine if the evidence provided refutes or supports the argument/claim.
- Connect/synthesize relevant and appropriate evidence from data, models, and text, to demonstrate the ability to reason by providing the evidence that an argument should be accepted. Any item, cluster, or task may require students to:
    - relate how a specific external and/or internal structure serves a specific function within a system to support behavior, growth, reproduction, and/or survival, or
    - explain the connection among multiple external and internal structures and their functions to a system that supports the behavior, growth, reproduction, and/or survival of an animal.

4-LS1-1 Possible Contexts for Phenomena on State Assessment Items/Clusters/Tasks (not exhaustive)

- A model of the external structures of an organism
- An animal's camouflage

4-LS1-1 Examples of State Assessment Tasks (not exhaustive)

- Scenario/Task presents an argument/claim regarding how the function of external and/or internal structures supports the behavior, growth, reproduction, and/or survival of an animal or plant.
    - Students use a model of the animal or plant to identify how the function of the relevant structures supports the argument/claim.
    - Students use information from a passage and a model to identify how the function of relevant structures supports the claim.

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2014 Grade 4 Standards and Indicators Related to 4-LS1-1 (4th Grade Support Guide 3.0)

Standard 4.L.5 The student will demonstrate an understanding of how the structural characteristics and traits of plants and animals allow them to survive, grow, and reproduce.

4.L.5B.2 Construct explanations for how structural adaptations (such as the types of roots, stems, or leaves; color of flowers; or seed dispersal) allow plants to survive and reproduce.

- Roots
  - take in water and nutrients from the environment
  - store food and water
  - help hold plant in the ground
  - adapted to habitats
    - roots in desert plants (e.g., cacti) grow shallow and wide to collect water
    - roots on water plants (e.g., water lily) have long roots that float underwater to collect nutrients
    - roots on some plants anchor the plant into the ground and store nutrients and water the plant needs (e.g., carrots, potatoes)
- Stems
  - provide support and protection for the plant
    - vines have special stems that grow around other objects to provide support
    - sunflowers have flexible stems so they can move as the Sun moves across the sky during the day
    - trees develop woody stems (branches and trunks) that help support their large size
    - some plants have modified stems that are called thorns that help to protect the plant from being eaten
  - have structures that carry water and nutrients the plant needs
    - cacti have thick stems that store water
- Leaves
  - where food is produced by using nutrients and water from the roots, and sunlight
  - size, texture, thickness, and shape are adapted to the habitats in which the plant lives
    - water lilies are wide and float on the surface of the water to capture sunlight
    - evergreen plants have thin, waxy needles that protect them from freezing and losing water
    - cacti have modified leaves called spines that help protect them from being eaten
- Flowers
  - special sizes, shapes, smells, and/or colors that attract organisms required for pollination

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- Fruit
  - contain and protect seeds
  - eaten by animals which helps disperse seeds
    - some fruits are moist and fleshy (e.g., grapes, peaches, tomatoes)
    - some fruits are covered by hard shells (e.g., bean/pea pods, coconuts)
- Seeds
  - new plants grow from seeds
  - plants produce many seeds to insure survival
  - some seeds have special structures that aid in dispersal:
    - hooks that grab onto animal fur or clothes (e.g., sand spurs, cockleburs)
    - hard, spongy coverings that allow them to float (e.g., coconuts)
    - structures that allow them to be carried away by the wind (e.g., dandelions, maple tree seeds, pine tree seeds)
    - some seeds are only dispersed when certain conditions are present (e.g., forest fire)

4.L.5B.3 Construct explanations for how structural adaptations (such as methods for defense, locomotion, obtaining resources, or camouflage) allow animals to survive in the environment.

- Defense
  - some animals have physical adaptations to protect themselves from being hurt, killed, and/or eaten
    - spines (e.g., hedgehogs, porcupines), claws (e.g., cats), fangs (e.g., snakes) , special glands that spray bad-smelling scents as a warning (e.g., skunks)
- Locomotion
  - animals need to move to escape predators, find food, shelter, and space
    - some animals have fins that allow them to move through water (e.g., fish) or flippers (e.g., penguins, sharks, whales)
    - some animals have wings that allow them to fly (e.g., bats, birds)
    - some animals legs (e.g., cats, dogs, horses, people)
    - some animals have special tails that allow them to hang from trees (monkeys)
    - some animals have special claws that allow them to climb (e.g., cats, squirrels)
- Obtaining resources
  - Some animals have special structures that allow them to obtain food.
    - Birds have specially shaped beaks according to the type of food they eat.
    - Insects have long, tongue-like structures that allow them to reach into flowers for nectar.
    - Some animals with specially shaped teeth according to the type of food they eat

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- Camouflage
    - camouflage is a color, pattern, or texture that allows an animal to blend in to is environment to protect it from being eaten or to help it obtain food
        - birds have colored and patterned feathers that help them blend in with their environment
        - animals have colored and patterned hair or fur that
        - some reptiles have special coloring and textured scales/skin that allow them to blend into their environment
        - fish have colored scales and skin that help them blend into their environment
        - some octopuses have special skin that changes color and texture to allow them to blend in with their environment

4-LS1-2 From Molecules to Organisms: Structure and Processes
Performance Expectation: 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.
Clarification Statement: Emphasis is on systems of information transfer.
State Assessment Boundary: Assessment does not include the mechanisms by which the brain stores and recalls information or the mechanisms of how sensory receptors function.

DCI: 4-LS1.D.1,2; **SEP:** 4-II.c; **CCC:** 4.SSM.1; **4-LS2-2** Evidence Statements

PE Specific Phenomenon-Related Terminology for 4-LS1-2 That Could Be Used on the State Assessment

- brain
- ear
- environment
- eye
- feel
- hear
- heat
- instinct/ instinctive
- light
- memory
- nose
- odor
- sense
- sense receptor
- sensory input
- sight/ vision
- skin
- sound
- stimulus/ stimuli
- system
- taste
- temperature
- tongue
- touch
- visible

4-LS1-2 On the state assessment, items may not:

- ask students to identify or describe the function or mechanisms of the specific sensory receptors found in the ear, eye, nose, skin, and tongue,
- require students to identify the parts of the brain responsible for processing environmental stimuli, storing memories or controlling the different parts of the body, or
- use unfamiliar animals (unless described in stimulus) or situations.

4-LS1-2 For state assessment purposes:

- evidence will include data from graphs and tables, informational text, models, and/or observations, and/or
- information on senses, sensory receptors, and behaviors/responses to sensory input that can be used in items, clusters, and tasks on the state assessment is found in the table titled *Animal Senses* (from page 77 of the *Support Guide 3.0 for Fourth Grade*).

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Animal Senses (4th Grade Support Guide 3.0) p. 77

Senses	Signals Detected	Examples of Sensory Receptors in Humans and Other Animals	Examples of Behaviors of Humans and Other Animals
sight	detects colors, shapes, sizes, space/distance, light, movement	humans have eyes; other animals' eyes may differ in type, number, and location on the body	locate food or shelter, recognize objects or other organisms, recognize dangers or threats (environmental or predatory)
hearing	receives vibrations, detects sound	humans have ears; other animals' hearing organs may differ in type, number, and location on the body	locate food; sense danger to escape enemies, communication
taste	detects flavors; humans detect salty, sweet, bitter, and sour tastes	humans have taste buds on their tongues; other animals' taste organs different type and in location on the body	judge which foods are safe to eat
smell	detects odors	humans have a nose; other animals' smelling organs different type and location on the body	avoid danger or detect threats (e.g., predators), find foods (plants or prey), recognize other organisms
touch	detects shapes, size, temperature, texture, pain, vibrations, pressure	humans have skin; other animals' touching organs different type and location on the body	identify foods; react to dangerous situations, care for each other; communication, detect environmental conditions (e.g., temperature, vibrations, wind)

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4-LS1-2 Essential State Assessment Targets Across the Dimensions:
Items/Tasks should require students to demonstrate the knowledge, grade level sophistication of skills/abilities, and application of crosscutting concepts that relate to how animals respond to sensory inputs. State assessment targets are listed below.

- Develop/Modify/Use a model to describe the relationships among the components as they relate to sensory inputs, sense receptors and an animal's response. Assessable knowledge, practices and skills related to developing and using models are listed below and could be included in any item, cluster, or task.
  - Identify missing components in a model needed to illustrate an animal's response sensory input.
  - Explain the relationships among the components of a model that describe how different sensory receptors respond to sensory inputs.
  - Select the components (from a list) needed to complete a model of how an animal responds to sensory input.
  - Compare models to determine which model best represents a sensory process.
- Evaluate the strength or weakness of a model based on provided evidence for how an animal responds to sensory input.
- Use a model to explain the sensory process that is occurring.
- Use a model to predict how an animal will respond to a sensory input.

4-LS1-2 Possible Contexts for Phenomena on State Assessment Items/Clusters/Tasks (not exhaustive)

- A dog and a lizard respond to hot weather
- A squirrel sees a hawk and climbs a tree, then barks a warning
- An insect lands on the open leaf of a Venus flytrap and the leaf closes.

4-LS1-2 Example of State Assessment Tasks (not exhaustive)

- Scenario/task presents model of an organism's response to an environmental stimulus.
  - Students are required to complete the model by selecting the sensory receptor(s) receiving the stimulus or stimuli.
  - Students correctly identify the component responsible for the response and to explain the process of the response.

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2014 Grade 4 Standards and Indicators Related to 4-LS1-2 (4th Grade Support Guide 3.0)

4.L.5A.1 Develop and use models to compare how humans and other animals use their senses and sensory organs to detect and respond to signals from the environment.

- Animals, including humans, have sensory organs that allow them to detect and respond to signals from the environment. After these signals are detected, the organism respond with certain behaviors. (A behavior is a response to a stimulus.)
- Senses tell animals what they need to know about their environment.
- Sensory organs are part of the body that receives the signals from the environment.
- They help keep the animals out of danger and enable them to find food and shelter period
- Many animals have the same type of sense organs as humans.
- Animals have the senses they need for their environment and way of life.
- Some animals have specialized senses.
    - Dogs have a very strong sense of smell.
    - Bats and dolphins use echolocation.
    - Mice, opossums, and owls can see in very low lighting.

Grade 4 Condensed Disciplinary Core Idea Foundation Statements

The information below contains the specific Disciplinary Core Idea foundation statements for Grade 4 as found in the *South Carolina College- and Career- Ready Science Standards 2021*.

4-PS3: Energy

4-PS3.A—Definitions of Energy

1. The faster an object is moving, the more energy it possesses.
2. Energy can be moved [transferred] from place to place by moving objects or through sound, light, or electrical currents.

4-PS3.B—Conservation of Energy and Energy Transfer

1. 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.
2. Light also transfers energy from place to place.
3. 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.

4-PS3.C—Relationship Between Energy and Forces

1. When objects collide, the contact forces transfer energy changing the motions of the objects.

4-PS3.D—Chemical Processes and Everyday Life

1. The expression "produced energy" typically refers to the conversion of stored energy into a desired form for practical use.

4-PS4: Waves

4-PS4.A—Wave Properties

1. 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; it does not move in the direction of the wave except when the water meets the beach.
2. Waves at the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave *crests*/peaks).

4-PS4.B—Electromagnetic Radiation

1. An object can be seen when light reflected from its surface enters the eyes. (4-PS4-2)

4-PS4.C—Information Technologies and Instrumentation

1. Digitized information is transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—converted from digitized form to voice—and vice versa. (4-PS4-3)
2. When in digitized form, information can be recorded, stored for future recovery, and transmitted over long distances without significant degradation of the wave. (4-PS4-3)

4-LS1: From Molecules to Organisms

4-LS1.A—Structures and Function

1. Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)

4-LS1.D—Information Processing

1. Different sense receptors are specialized for kinds of information, which may then be processed by the animal's brain. (4-LS1-2)
2. Animals can use their perceptions and memories to guide their actions. (4-LS1-2)

4-ESS1: Earth's Place in the Universe

4-ESS1.C—The History of Planet Earth

1. Local, regional climate and global patterns of rock formations revealed changes overtime due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed.

4-ESS2.A: Earth's Systems

4-ESS2.A—Earth Materials and Systems

1. Rainfall helps to shape 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.

4-ESS2.B—Plate Tectonics and Large-Scale System Interactions

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

4-ESS2.E—Biogeology

1. Living things affect the physical characteristics of their regions.

4-ESS3: Earth and Human Activity

4-ESS3.A—Natural Resources

1. All materials, energy, and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable overtime and others are not.
2. Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways.

4-ESS3.B—Natural Hazards

1. A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts.

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4-ETS1 Engineering Design

4-ETS1.A—Defining and Delimiting Engineering Problems

1. 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).
2. Different proposals for solutions can be compared based on how well each one meets the specified criteria or how well each takes the constraints into account.

4-ETS1.B—Developing Possible Solutions

1. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
2. Testing a solution involves investigating how well it performs under a range of likely conditions.

4-ETS1.C—Optimizing the Design Solution

1. Different solutions need to be tested in order to determine which of the best solves the problem, given the criteria and the constraints. (4-PS4-3)

4-ETS2 Links Among Engineering, Technology, and the Applications of Science

4-ETS2.A—Interdependence of Science, Engineering, and Technology

1. Knowledge of relevant scientific concepts and research findings is important in engineering. (4-PS4-3)
3. Tools and instruments (e.g., scales, thermometers, graduated cylinders) are used in scientific exploration to gather data and help answer questions.

4-ETS2.B—Influence of Engineering, Technology, & Science on Society & the Natural World

1. Over time, human needs and wants change as do the demands for new and improved technologies.
2. Engineers improve existing technologies or develop new ones to increase their benefits, reduce known risks, and meet societal demands.

Grade 4 Condensed Science and Engineering Practice Foundation Statements

The information below contains the specific Crosscutting Concept foundation statements for Grade 4 as found in the *South Carolina College- and Career- Ready Science Standards 2021*.

4-I. Asking Questions and Defining Problems

Asking questions and defining problems in grades 3–5 bills on grades K–2 experiences and progresses to specifying qualitative relationships.

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

4-II. Developing and Using Models

Modeling in 3–5 bills on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions.

- **a.** Develop a model using an analogy, example, or abstract representation to describe a scientific principle.
- **b.** Develop and/or use models to describe phenomena. (4-PS4-2)
- **c.** Use a model to test interactions concerning the functioning of a natural system. (4-LS1-2)

4-III. Planning and Carrying Out Investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

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

4-IV. Analyzing and Interpreting Data

Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.

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

4-V. Using Mathematics and Computational Thinking
(not included on any PE at this grade level)

4-VI. Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions and 3–5 bills on K–2 experiences and progress is to the use of evidence and constructing explanations that specify variables that describe and predict phenomenon in designing multiple solutions to design problems.

- **a.** Use evidence (e. g., measurements, observations, patterns) to construct an explanation or design a solution to a problem.
- **b.** Apply scientific ideas to solve design problems.
- **c.** Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design solution. (4-PS4-3)
- **d.** Identify the evidence that supports particular points in an explanation.

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4-VII. Engaging in Argument from Evidence
Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and design world(s).

2. **a.** Construct and/ or support an argument with evidence, data, and/ or a model. (4-LS1-1)

4-VIII. Obtaining, Evaluating, and Communicating Information
Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progress is to evaluate the merit and accuracy of ideas and methods.

a. Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.

Grade 4 Condensed Crosscutting Concept Foundation Statements

The information below contains the specific Crosscutting Concept foundation statements for Grade 4 as found in the *South Carolina College- and Career- Ready Science Standards 2021*.

4.P. Patterns

1. Similarities and differences in patterns can be used to sort, classify, communicate, and analyze simple rates of change for natural phenomena and classify designed products. (4-PS4-3)

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

4.CE. Cause and Effect: Mechanism and Prediction

1. Cause-and-effect relationships are routinely identified, tested, and used to explain change. (4-PS4-2)

4.SPQ. Scale, Proportion, and Quantity (not included on any PEs at this grade level)

4.SSM. Systems and System Models

1. A system can be described in terms of its components in their interactions. (4-LS1-1, (4-LS1-2)

2. A system is a group of related parts that make up a whole and can carry out functions its individual parts cannot.

4.EM. Energy and Matter: Flows, Cycles, and Conservation

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

4.SF. Structure and Function (not included on any PEs at this grade level)

4.SC. Stability and Change (not included on any PEs at this grade level)

Evidence Statements for Grade 4 Overlap
Adapted from
https://www.nextgenscience.org/sites/default/files/evidence_statement/black_white/4th_Grade%20Evidence%20Statements%20June%202015%20asterisks.pdf

Statements in—or containing—italics were modified for clarity.

4-PS4-2
Observable features of the student performance by the end of the grade:

1) Components of the model

a. Students develop a model to make sense of a phenomenon involving the relationship between light reflection and visibility of objects. In the model, students identify the relevant components, including:
- **(i)** Light (including the light source)
- **(ii)** Objects
- **(iii)** The path that light follows
- **(iv)** The eye

2) Relationships

a. Students identify and describe casual relationships between the components, including:
- **(i)** Light enters the eye, allowing objects to be seen.
- **(ii)** Light reflects off objects, and then can travel and enter the eye.
- **(iii)** Objects can be seen only if light follows a path between a light source, the object, and the eye.

3) Connections

a) Students use the model to describe that for non-luminous objects to be visible, light must reflect off the object and into the eye.

b) Students use the model to describe the effects of the following on the visibility of an object:
- **i)** Removing, blocking, or changing the light source (e.g., a dimmer light);
  - **(1)** Turning the light source on and off
  - **(2)** Changing the path of the light
    - **(a)** Placing mirrors to direct the path of light to make previously invisible object visible.
    - **(b)** Change the position of an object by moving it away or toward the light source.
    - **(c)** Placing *barriers in the direct path between the light source and the object being viewed by using a barrier that:*
      - **(i)** *blocks light (opaque) and causing the object to not be visible.*
      - **(ii)** *makes objects blurry (translucent).*
      - (**iii)** *allows an object to be clearly viewed (transparent).*

4-PS4-3

Observable features of the student performance by the end of the grade:

1) Using scientific knowledge to generate design solutions

a. Students generate at least two design solutions for a given problem that use patterns to transmit a given piece of information (e.g., picture, message). Students describe how the design solution is based on:

(i) Knowledge of digitized information transfer (e.g., information can be converted from a sound wave into a digital signal such as patterns of 0s and 1s and vice versa; visual or verbal messages can be encoded in patterns of flashes of light to be decoded by someone else across the room).

(ii) Ways that high-tech devices convert and transmit information (e.g., cell phones convert sound waves into digital signals, so they can be transmitted long distances, and then converted back into sound waves; a picture or message encoded using light signals to transmit the information over a long distance).

2) Describing criteria and constraints, including quantification when appropriate

a. Students describe the given criteria for the design solutions, including the accuracy of the final transmitted information and that digitized information and that digitized information (patterns) transfer is used.

b. Students describe the given constraints of the design solutions, including:

(i) The distance over which information is transmitted.

(ii) Safety considerations.

(iii) Materials available.

3) Evaluating potential solutions

a. Students compare the proposed solutions based on how well each meets the criteria and constraints.

b. Students identify similarities and differences in the types of patterns used in the solutions to determine whether some ways of transmitting information are more effective than others at addressing the problem.

4-LS1-1

Observable features of student performance by the end of the grade:

1) Supported claims

a. Students make a claim to be supported about a phenomenon. In the claim, students include the idea that plants and animals have internal and external structures that function together as part of a system to support survival, growth, behavior, and reproduction.

2) Identifying scientific evidence

a. Students describe that given evidence, including:

(i) The internal and external structures of selected plants and animals.

(ii) The primary functions of those structures.

3) Evaluating and critiquing evidence

a. Students determine the strengths and weaknesses of the evidence, including whether the evidence is relevant and sufficient to support a claim about the role of internal and external structures of plants and animals in supporting survival, growth, behavior, and/or reproduction.

4) Reasoning and synthesis

a. Students use reasoning to connect the relevant and appropriate evidence and construct an argument that includes the idea that plants and animals have structures that, together, support survival, growth, behavior, and/or reproduction. Students describe a chain of reasoning that includes:

(i) Internal and external structures serve specific functions within plants and animals (e.g., the heart pumps blood to the body, thorns discourage predators).

(ii) The functions of internal and external structures can support survival, growth, behavior, and/or reproduction in plants and animals (e.g., the heart pumps blood throughout the body, *allowing* the entire body to access oxygen and nutrients; thorns prevent predation, *allowing* the plant to grow and reproduce).

(iii) Different structures work together as part of a system to support survival, growth, behavior, and/or reproduction (e.g., the heart works with the lungs to carry oxygenated blood throughout the system; thorns protect the plant, allowing reproduction via *the flower*).

4-LS1-2

Observable features of the student performance by the end of the grade:

1) Components of the model

a. From a given model, students identify and describe the relevant components for testing interactions concerning the functioning of a given natural system, including:

(i) Different types of information about the surroundings (e.g., sound, light, odor, temperature)

(ii) Sense receptors able to detect different types of information from the environment.

(iii) Brain

(iv) Animals' actions

2) Relationships

a. Students describe the relationships between components in the model, including:

(i) Different types of sense receptors detect specific types of information within the environment.

(ii) Sense receptors send information about the surroundings to the brain.

(iii) Information that is transmitted to the brain by sense receptors can be processed immediately as perception of the environment and/or stored as memories.

(iv) Immediate perceptions or memories processed by the brain influence an animal's action or responses to features in the environment.

3) Connections

a. Students use the model to describe that:

(i) Information in the environment interacts with animal behavioral output via interactions mediated by the brain.

(ii) Different types of sensory information are relayed to the brain via different sensory receptors, allowing experiences to be perceived, stored as memories, and influence behavior (e.g., an animal sees a brown, rotten fruit and smells a bad odor—this sensory information allows the animal to use information about other fruits that appear to be rotting to make decisions about what to eat; an animal sees a red fruit and a green fruit—after eating them both, the animal learns that the red fruit is sweet and the green fruit is bitter and then uses this sensory information, perceived, and stored as memories, to guide this fruit selection next time).

(iii) Sensory input, the brain, and behavioral output are all parts of a system and its influence on animal behavior within a natural system, including interactions between:

(i) Information in the environment.

b. Students use the model to test interactions involving sensory perception and its influence on animal behavior within a natural system, including interactions between:

(i) Information in the environment.

(ii) Different types of sense receptors.

(iii) Perception and memory of sensory information.

(iv) Animal behavior.

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