

Alignment with Virginia' Science Standards

This document evaluates the state's Education Standards for Science to determine alignment with content found in Cogno board games. Grades 3-8 were analyzed.



Highlighting Key

Indicates a significant amount of material addresses the standard

Indicates a moderate amount of material is present to develop student understanding of the standard

Grade Three

Standard 3.1

The student will plan and conduct investigations in which

- a) predictions and observations are made;
- b) objects with similar characteristics are classified into at least two sets and two subsets;
- c) questions are developed to formulate hypotheses;
- d) volume is measured to the nearest milliliter and liter;
- e) length is measured to the nearest centimeter;
- f) mass is measured to the nearest gram;
- g) inferences are made and conclusions are drawn; and

In order to meet this standard, it is expected that students should be able to

- develop hypotheses from simple questions. These questions should be related to the concepts in the third grade standards. Hypotheses should be stated in terms such as: "If an object is cut into smaller pieces, then the physical properties of the object and its smaller pieces will remain the same."
- make and communicate predictions about the outcomes of investigations.
- make and communicate careful observations.
- classify objects into at least two major sets and subsets based on similar characteristics, such as predator/prey and herbivore, carnivore, and omnivore.
- measure length to the nearest centimeter, mass to the nearest gram, volume to the nearest milliliter, temperature to the nearest degree Celsius, and time to the nearest minute, using the appropriate instrument.

Standard 3.3

The student will investigate and understand that objects are made of materials that can be described by their physical properties. Key concepts include

- a) materials are composed of parts that are too small to be seen without magnification; and
- b) physical properties remain the same as the material is reduced in size.

In order to meet this standard, it is expected that students should be able to

- conclude that materials have their own set of physical properties that are observable.
- explain that physical properties are observable characteristics that enable one to differentiate objects.
- design an investigation to determine if the physical properties of a material will remain the same if the material is reduced in size.

Standard 3.4

The student will investigate and understand that behavioral and physical adaptations allow animals to respond to life needs. Key concepts include

- a) methods of gathering and storing food, finding shelter, defending themselves, and rearing young; and

In order to meet this standard, it is expected that students should be able to

- compare the physical characteristics of animals, and explain how the animals are adapted to a certain environment.
- explain how an animal's behavioral adaptations help it live in its specific habitat.

Standard 3.9

The student will investigate and understand the water cycle and its relationship to life on Earth. Key concepts include

- a) the energy from the sun drives the water cycle;
- b) water is essential for living things; and

In order to meet this standard, it is expected that students should be able to

- identify the sun as the origin of energy that drives the water cycle.
- appraise the importance of water to people and to other living things.

Standard 3.11

The student will investigate and understand different sources of energy. Key concepts include

- a) the sun's ability to produce light and heat energy;
- b) sources of energy (sunlight, water, wind);

In order to meet this standard, it is expected that students should be able to

- explain that the sun is the major source of energy for the Earth.

Grade Four

Standard 4.1

The student will plan and conduct investigations in which

- a) distinctions are made among observations, conclusions, inferences, and predictions;
- b) hypotheses are formulated based on cause-and-effect relationships;
- c) appropriate metric measures are used to collect, record, and report data;

In order to meet this standard, it is expected that students should be able to

- differentiate among simple observations, conclusions, inferences, and predictions, and correctly apply the terminology in oral and written work. This requires students to comprehend the basic terminology and apply it in novel situations related to fourth grade SOL concepts.
- use millimeters, centimeters, meters, kilometers, milliliters, liters, grams, and kilograms in measurement.
- create a plausible hypothesis, stated in terms of cause and effect, from a set of basic observations that can be tested. This requires a student to comprehend what “cause and effect” is and to be able to apply that idea in new situations. The application should occur in terms of fourth grade SOL-related concepts or other concrete situations. Hypotheses should be stated in terms such as: “If the water temperature is increased, then the amount of sugar that can be dissolved in it will increase.”

Standard 4.2

The student will investigate and understand characteristics and interaction of moving objects. Key concepts include

- a) motion is described by an object’s direction and speed;
- b) forces cause changes in motion;
- c) friction is a force that opposes motion; and
- d) moving objects have kinetic energy.

In order to meet this standard, it is expected that students should be able to

- describe the position of an object.
- explain that speed is a measure of motion.
- identify the forces that cause an object’s motion.
- describe the direction of an object’s motion: up, down, forward, backward.
- infer that objects have kinetic energy.

Standard 4.5

The student will investigate and understand how plants and animals in an ecosystem interact with one another and the nonliving environment. Key concepts include

- a) behavioral and structural adaptations;
- b) habitats and niches;

In order to meet this standard, it is expected that students will be able to

- investigate and infer the function of basic adaptations and provide evidence for the conclusion.
- understand that adaptations allow an organism to succeed in a given environment.
- explain how different organisms use their unique adaptations to meet their needs.

Standard 4.7

The student will investigate and understand the relationships among the Earth, moon, and sun. Key concepts include

- a) the relative size, position, age, and makeup of the Earth, moon, and sun; and
- b) historical contributions in understanding the Earth-moon-sun system.

In order to meet this standard, it is expected that students will be able to

- describe the major characteristics of the sun, including its approximate size, color, age, and overall composition.
- create and describe a model of the Earth-moon-sun system with approximate scale distances and sizes.
- compare and contrast an Earth-centered to the sun-centered model of the solar system.
- compare and contrast the surface conditions of the Earth, moon, and sun.
- describe a contribution of the NASA Apollo missions to our understanding of the moon.

Grade Five

Standard 5.1

The student will plan and conduct investigations in which

- a) estimations of length, mass, and volume are made;
- b) predictions are made using patterns, and simple graphical data are extrapolated;
- c) an understanding of the nature of science is developed and reinforced.

In order to meet this standard, it is expected that students should be able to

- make plausible estimations of length, mass, and volume.
- measure temperature, length, mass, and volume, using metric measures. This includes millimeters, centimeters, meters, kilometers, grams, kilograms, milliliters, liters, and degrees Celsius.
- make predictions based on trends in data. This requires the recognition of patterns and trends and determination of what those trends may represent.
- define/make observations and inferences.

Standard 5.2

The student will investigate and understand how sound is transmitted and is used as a means of communication. Key concepts include

- a) frequency, waves, wavelength, vibration;
- b) the ability of different media (solids, liquids, and gases) to transmit sound; and

In order to meet this standard, it is expected that students should be able to

- use the basic terminology of sound to describe what sound is, how it is formed, how it affects matter, and how it travels.
- explain why sound waves travel only where there is matter to transmit them.
- compare and contrast sound traveling through a solid with sound traveling through the air. Explain how different media (solid, liquid, and gas) will affect the transmission of sound.

Standard 5.3

The student will investigate and understand basic characteristics of visible light and how it behaves. Key concepts include

- a) the visible spectrum and light waves;
- b) refraction of light through water and prisms;
- c) reflection of light from reflective surfaces (mirrors);
- d) historical contributions in understanding light.

In order to meet this standard, it is expected that students should be able to

- explain the relationships between wavelength and the color of light. Name the colors of the visible spectrum.
- compare and contrast reflection and refraction, using water, prisms, and mirrors.
- analyze the effects of a prism on white light and describe why this occurs. Explain why a rainbow occurs.

Grade Six

Standard 6.1

The student will plan and conduct investigations in which

- a) precise and approximate measurements are recorded;
- b) scale models are used to estimate distance, volume, and quantity;
- c) data are organized and communicated through graphical representation (graphs, charts, and diagrams);
- d) models are designed to explain a sequence; and
- e) an understanding of the nature of science is developed and reinforced.

In order to meet this standard, it is expected that students should be able to

- make precise and consistent measurements and estimations.
- create approximate scale models to demonstrate an understanding of distance, volume, and quantity.

- compare and contrast predictions and inferences. Analyze and judge the evidence, observations, scientific principles, and data used in making predictions and inferences.
- organize and communicate data, using graphs (bar, line, and circle), charts, and diagrams.
- design a model that explains a sequence, for example, the sequence of events involved in the process of photosynthesis.
- propose hypotheses or predictions from observed patterns.

Standard 6.2

The student will investigate and understand basic sources of energy, their origins, transformations, and uses. Key concepts include

- a) potential and kinetic energy;
- b) the role of the sun in the formation of most energy sources on Earth;

In order to meet this standard, it is expected that students should be able to

- compare and contrast potential and kinetic energy through common examples found in the natural environment.

Standard 6.8

The student will investigate and understand the organization of the solar system and the relationships among the various bodies that comprise it. Key concepts include

- a) the sun, moon, Earth, other planets and their moons, meteors, asteroids, and comets;
- b) relative size of and distance between planets;
- c) the role of gravity;
- d) the unique properties of Earth as a planet;
- e) the history and technology of space exploration.

In order to meet this standard, it is expected that students should be able to

- describe the nine planets and their relative positions from the sun.
- explain the role of gravity in the solar system.
- describe the unique characteristics of planet Earth.
- create and interpret a timeline highlighting the advancements in solar system exploration over the past half century. This should include information on the first modern rockets, artificial satellites, orbital missions, missions to the moon, Mars robotic explorers, and exploration of the outer planets.

Earth Science

Standard ES.1 c, d, e

The student will plan and conduct investigations in which

- c) scales, diagrams, maps, charts, graphs, tables, and profiles are constructed and interpreted;
- d) variables are manipulated with repeated trials; and

e) a scientific viewpoint is constructed and defended (the nature of science).

Essential Understandings

- Information and data collected can be organized and expressed in the form of charts, graphs, and diagrams.
- Changing relevant variables will generally change the outcome.
- A hypothesis can be supported, modified, or rejected based on collected data. A *hypothesis* is a tentative explanation that accounts for a set of facts and can be tested by further investigation.
- Experiments are designed to test hypotheses.
- *Scientific laws* are generalizations of observational data that describe patterns and relationships. Laws may change as new data become available.
- *Scientific theories* are systematic sets of concepts that offer explanations for observed patterns in nature. Theories provide frameworks for relating data and guiding future research. Theories may change as new data become available.

Standard ES.2 a, b, c, d, e

The student will demonstrate scientific reasoning and logic by

- a) analyzing how science explains and predicts the interactions and dynamics of complex Earth systems;
- b) recognizing that evidence is required to evaluate hypotheses and explanations;
- c) comparing different scientific explanations for a set of observations about the Earth;
- d) explaining that observation and logic are essential for reaching a conclusion; and
- e) evaluating evidence for scientific theories.

Essential Understandings

- Earth is a dynamic system, and all atmospheric, geological, and oceanographic processes interrelate and influence one another.
- Conclusions are only as good as the quality of the collected data.
- Any valid hypothesis can be tested.
- Any valid scientific theory has passed tests designed to invalidate it.
- A hypothesis can be supported, modified, or rejected based on collected data.
- Experiments are designed to test hypotheses.
- There can be more than one explanation for any phenomena.

Skills

- Make predictions, using scientific data and data analysis.
- Use data to support or reject a hypothesis.
- Explain how the scientific method is used to validate scientific theories.

Standard ES.4 a, b

The student will investigate and understand the characteristics of the Earth and the solar system. Key concepts include

- a) position of the earth in the solar system; and
- b) sun-Earth-moon relationships (seasons, tides, and eclipses).

Essential Understandings

- Earth is one of nine planets in the solar system.

Essential Knowledge and Skills

- Earth is the third planet from the sun and is located between the sun and the asteroid belt. It has one natural satellite, the moon.
- The moon revolves around Earth creating the moon phases and eclipses.
- The tides are the daily, periodic rise and fall of water level caused by the gravitational pull of the sun and moon.
- Water occurs on Earth as a solid (ice), a liquid, or a gas (water vapor) due to Earth's position in the solar system.

Standard ES.4 c, d

The student will investigate and understand the characteristics of the Earth and the solar system. Key concepts include

- c) characteristics of the sun, planets and their moons, comets, meteors, and asteroids; and
- d) the history and contribution of the space program.

Essential Understandings

- The solar system consists of many types of celestial bodies.
- Much of our knowledge about the solar system is a result of space exploration efforts. These efforts continue to improve our understanding of the solar system

Essential Knowledge and Skills

- The sun consists largely of hydrogen gas. Its energy comes from nuclear fusion of hydrogen to helium.
- Moons are natural satellites of planets that vary widely in composition.
- Comets orbit the sun and consist mostly of frozen gases.
- Asteroids are rocky or metallic iron objects ranging in size from millimeters to kilometers. They are the source of most meteorites.
- Apollo 11 was the first manned landing on the moon.
- The Hubble Space Telescope has greatly improved our understanding of the universe.

Standard ES.14 a, b, c, d, e

The student will investigate and understand scientific concepts related to the origin and evolution of the universe. Key concepts include

- a) nebulae;
- b) the origin of stars and star systems;
- c) stellar evolution;
- d) galaxies; and
- e) cosmology including the big bang theory.

Essential Understandings

- The universe is vast and very old.
- The big bang theory is our best current model for the origin of the universe.
- The solar nebular theory is our best current idea for the origin of the solar system.
- Stars have a finite lifetime and evolve over time.
- The mass of a star controls its evolution, length of its lifetime, and ultimate fate.

Essential Knowledge and Skills

- The big bang theory states that the universe began in a very hot, dense state that expanded and eventually condensed into galaxies.
- The solar nebular theory explains that the planets formed through the condensing of the solar nebula.
- Stars form by condensation of interstellar gas.
- *Galaxies* are collections of billions of stars. The basic types of galaxies are spiral, elliptical, and irregular.
- The solar system is located in the Milky Way galaxy.
- A *light-year* is the distance light travels in one year and is the most commonly used measurement for distance in astronomy.
- Much of our information about our galaxy and the universe comes from ground-based observations.

Physics

Essential Understandings

- Newton's three laws of motion are the basis for understanding the mechanical universe.
- When one object exerts a force on a second object, the second exerts a force on the first that is equal in magnitude but opposite in direction.
- The motion of objects traveling near or approaching the speed of light does not follow Newtonian mechanics but must be treated within the theory of relativity.
- Objects cannot travel faster than the speed of light.

- Alpha, beta, and gamma are different emissions associated with radioactive decay

Please note that use of these standards does not imply this state's endorsement of Cogno.