

Alignment with Maryland's 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

Skills and Processes – Students will demonstrate the thinking and acting inherent in the practice of science.

Grades 3-5

A. Constructing Knowledge

1. Gather and question data from many different forms of scientific investigations which include reviewing appropriate print resources, observing what things are like or what is happening somewhere, collecting specimens for analysis, and doing experiments.

Support investigative findings with data found in books, articles, and databases, and identify the sources used and expect others to do the same.

g. Judge whether measurements and computations of quantities are reasonable in a familiar context by comparing them to typical values when measured to the nearest:

Millimeter - length

Square centimeter - area

Milliliter - volume

Newton – weight

Gram - mass

Second - time

Degree C - temperature

B. Applying Evidence and Reasoning

1. Seek better reasons for believing something than "Everybody knows that . . ." or "I just know" and discount such reasons when given by others.

a. Develop explanations using knowledge possessed and evidence from observations, reliable print resources, and investigations.

b. Offer reasons for their findings and consider reasons suggested by others.

c. Review different explanations for the same set of observations and make more observations to resolve the differences.

C. Communicating Scientific Information

1. Recognize that clear communication is an essential part of doing science because it enables scientists to inform others about their work, expose their ideas to criticism by other scientists, and stay informed about scientific discoveries around the world.
 - c. Submit work to the critique of others which involves discussing findings, posing questions, and challenging statements to clarify ideas.
 - d. Construct and share reasonable explanations for questions asked.
 - e. Recognize that doing science involves many different kinds of work and engages men and women of all ages and backgrounds.

D. Technology

Design & Systems

- b. Realize that there is no perfect design and that usually some features have to be sacrificed to get others, for example, designs that are best in one respect (safety or ease of use) may be inferior in other ways (cost or appearance).
- c. Identify factors that must be considered in any technological design—cost, safety, environmental impact, and what will happen if the solution fails.

Making Models

1. Examine and modify models and discuss their limitations.
 - a. Explain that a model is a simplified imitation of something and that a model's value lies in suggesting how the thing modeled works.
 - d. Realize that one way to make sense of something is to think how it is like something more familiar.

Grades 6-8

A. Constructing Knowledge

- a. Explain that scientists differ greatly in what phenomena they study and how they go about their work.
- b. Develop the ability to clarify questions and direct them toward objects and phenomena that can be described, explained, or predicted by scientific investigations.
- d. Locate information in reference books, back issues of newspapers, magazines and compact disks, and computer databases.
- f. Give examples of when further studies of the question being investigated may be necessary.
- g. Give reasons for the importance of waiting until an investigation has been repeated many times before accepting the results as correct.
- h. Use mathematics to interpret and communicate data.

B. Applying Evidence and Reasoning

1. Review data from a simple experiment, summarize the data, and construct a logical argument about the cause-and-effect relationships in the experiment.
 - d. Describe the reasoning that lead to the interpretation of data and conclusions drawn.
 - e. Question claims based on vague statements or on statements made by people outside their area of expertise.

C. Communicating Scientific Information

1. Develop explanations that explicitly link data from investigations conducted, selected readings and, when appropriate, contributions from historical discoveries.

c. Give examples of how scientific knowledge is subject to modification as new information challenges prevailing theories and as a new theory leads to looking at old observations in a new way.

d. Criticize the reasoning in arguments in which

- Fact and opinion are intermingled
- Conclusions do not follow logically from the evidence given.
- Existence of control groups and the relationship to experimental groups is not made obvious.
- Samples are too small, biased, or not representative.

e. Explain how different models can be used to represent the same thing. What kind of a model to use and how complex it should be depend on its purpose. Choosing a useful model is one of the instances in which intuition and creativity come into play in science, mathematics, and engineering

f. Participate in group discussions on scientific topics by restating or summarizing accurately what others have said, asking for clarification or elaboration, and expressing alternative positions.

g. Recognize that important contributions to the advancement of science, mathematics, and technology have been made by different kinds of people, in different cultures, at different times

D. Technology

Design & Systems

c. Realize that design usually requires taking constraints into account. (Some constraints, such as gravity or the properties of the materials to be used, are unavoidable. Other constraints, including economic, political, social, ethical, and aesthetic ones also limit choices.)

d. Identify reasons that systems fail—they have faulty or poorly matched parts, are used in ways that exceed what was intended by the design, or were poorly designed to begin with.

2.0 Earth/Space Science – Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe that occur over time.

A. Materials and Processes That Shape A Planet

Grade 5

2. Cite and describe the processes that cause rapid or slow changes in Earth's surface.

a. Identify and describe events such as tornadoes, hurricanes, volcanic eruptions, earthquakes, and flooding which change surface features rapidly.

b. Recognize that the natural force of gravity causes changes in Earth's surface features as it pulls things toward Earth, as in mud and rock slides, avalanches, etc.

C. Plate Tectonics

Grade 6

1. Recognize and describe the internal and external structure of the Earth.

a. Recognize and describe that the Earth's mantle

- Lies between the core and the crust
- Is very hot
- Has properties of both solids and liquid

b. Recognize and describe that the Earth's core

- Is at the center of the Earth
- Is very hot
- Is dense and metallic

c. Identify and describe the Earth's crust.

- The solid crust consists of separate plates
- The plates constantly move in different directions due to convection currents
- The plates interact with one another as a result of plate motion.

D. Astronomy

Grade 4

1. Identify and describe the variety of objects in the universe through first-hand observations using the unaided eye, binoculars or telescopes or videos and/or pictures from reliable sources. Observe and describe the stars and the planets as seen through a telescope, graphically in pictures or in video clips from reliable sources.
 - a. Identify the sun as the Earth's closest star.
 - c. Recognize that stars are like the sun, some are smaller and some larger.
 - d. Recognize and describe that the stars are not all the same in apparent brightness.
 - e. Recognize that the pattern of stars in the sky stays the same although their locations in the sky appear to change with the seasons.

Grade 5

1. Identify and compare properties, location, and movement of celestial objects in our solar system.
 - a. Recognize that like all planets and stars, the Earth is spherical in shape.
 - b. Identify the properties of the planet Earth that make it possible for the survival of life as we know it.
 - Temperature
 - Location
 - Presence of an atmosphere
 - Presence of water (solid, liquid, and gas)
 - c. Compare the properties of at least one other planet in our solar system to those of Earth to determine if it could support life, as we know it.
 - d. Identify and describe physical properties of comets, asteroids, and meteors.
 - e. Provide evidence that supports the idea that our solar system is sun-centered.
2. Recognize and describe the causes of the repeating patterns of celestial events.
 - a. Describe the rotation of the planet Earth on its axis.
 - b. Recognize and describe that the rotation of planet Earth produces observable effects
 - The day and night cycle.
 - The apparent movement of the sun, moon, planets, and stars
 - c. Describe the revolution of the planet Earth around the sun.
 - d. Recognize and describe that the revolution of the planet Earth produces effects.
 - The observable patterns of stars in the sky stay the same although different stars can be seen in different seasons.
 - Length of year
 - e. Verify with models and cite evidence that the moon's apparent shape and position change.

Grade 6

1. Recognize that objects of our solar system are interrelated.
 - a. Recognize that Earth and its closest star, the sun, are part of a disk-shape galaxy of stars and that our galaxy is one of billions of galaxies.
 - c. Identify and describe the general pattern of movement of all objects in our solar system.
 - d. Recognize that the pull of gravity causes the pattern of motion of celestial objects.

Grade 8

1. Identify and describe the components of the universe.
 - a. Recognize that a galaxy contains billions of stars that cannot be distinguished by the unaided eye because of their great distance from Earth, and that there are billions of galaxies.

- b. Identify that our solar system is a component of the Milky Way Galaxy.
- c. Identify and describe the various types of galaxies
- d. Identify and describe the type, size, and scale, of the Milky Way Galaxy.

2. Identify and explain celestial phenomena using the regular and predictable motion of objects in the solar system.

- a. Identify and describe the relationships among the period of revolution of a planet, the length of its solar year, and its distance from the sun.
- b. Identify and explain the relationship between the rotation of a planet or moon on its axis and the length of the solar day for that celestial object.
- c. Identify and explain the cause of the phases of the moon.
- e. Identify and describe how the shape and location of the orbits of asteroids and comets affect their periods of revolution.

E. Interactions of Hydrosphere and Atmosphere

Grade 3

1. Recognize and describe that water can be found as a liquid or a solid on the Earth's surface and as a gas in the Earth's atmosphere.
 - a. Describe that air is a substance that surrounds us and contains such things as oxygen, water vapor (gas), pollen, dust, etc.
 - b. Observe and explain what happens when liquid water disappears.
 - Turns into water vapor (gas) in the air
 - Can reappear as a liquid or solid when cooled, such as clouds, fog, rain, snow, etc.

Grade 4

2. Recognize and describe that each season has different weather conditions.

Grade 5

1. Recognize and describe that the amount of water on Earth continues to stay the same even though it may change from one form to another.
 - b. Explain that the sun is the main source of energy that causes the changes in the water on Earth.
 - c. Describe the relationship between the amount of energy from the sun and the quantity of water that is changed.

Grade 8

1. Cite evidence to explain the relationship between the hydrosphere and atmosphere.
 - a. Describe the composition of the atmosphere and hydrosphere.
3. Identify and describe the atmospheric and hydrospheric conditions related to weather systems.
 - b. Identify and describe the atmospheric and hydrospheric conditions associated with the formation and development of hurricanes, tornadoes, and thunderstorms.

3.0 Life Science – The students will use scientific skills and processes to explain the dynamic nature of living things, their interactions, and the results from the interactions that occur over time.

A. Diversity of Life

Grade 4

1. Explain how animals and plants can be grouped according to observable features.
 - a. Observe and compile a list of a variety of animals or plants in both familiar and unfamiliar environments.

b. Classify a variety of animals and plants according to their observable features and provide reasons for placing them into different groups.

1. Cite evidence to support the fact that all matter is made up of atoms, which are far too small to see directly through a microscope.

Grade 5

1. Explain the idea that in any particular environment, some kinds of plants and animals survive well, some less well, and some cannot survive at all.

a. Identify and describe features and behaviors of some of the plants and animals living in a familiar environment and explain ways that these organisms are well suited to their environment.

b. Based on information about the features and behaviors of animals and plants from very different environments describe reasons that they might not survive if their environment changed or if they were moved from one environment to another.

D. Evolution

Grade 4

1. Explain that individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing.

b. Explain that the characteristics of an organism affect its ability to survive and reproduce.

Grade 6

1. Explain that in any particular environment, the growth and survival of organisms and species depend on the physical conditions.

c. Explain that in any particular environment individual organisms with certain traits are more likely than others to survive and have offspring.

e. Describe ways in which changes in environmental conditions can affect the survival of individual organisms and entire species.

Grade 8

a. Recognize and describe that gradual (climatic) and sudden (floods and fires) changes in environmental conditions affect the survival of organisms and populations.

c. Recognize and describe that adaptation and speciation involve the selection of natural variations in a population.

d. Recognize and describe that extinction occurs when the adaptive traits of a population do not support its survival.

e. Recognize that evolution accounts for the diversity of species.

3.0 Chemistry – Students will use scientific skills and processes to explain the composition, structure, and interactions of matter in order to support the predictability of structure and energy transformations

A. Structure of Matter

Grade 3

1. Identify ways to classify objects using supporting evidence from investigations of observable properties.

a. Classify objects based on their observable properties.

b. Provide reasons for placing the objects into groups.

c. Compare classifications with those of others.

Grade 7

- a. Recognize and describe that the atoms of each element are alike but different from atoms of other elements.

B. Conservation of Matter

Grade 5

1. Cite evidence to support the statement that, “No matter how many parts of an object are assembled, the mass of the whole object made is always the same as the sum of the parts.”
- c. Describe the relationship between the masses of whole objects to the sum of the mass of their parts using appropriate tools to gather supporting data.

Grade 8

1. Provide evidence to support the fact that the idea of atoms explains conservation of matter.
- c. Give reasons to justify the statement, “If the number of atoms stays the same no matter how the same atoms are rearranged, then their total mass stays the same.”

- 4.0 Physics – Students will use scientific skills and processes to explain the interactions of matter and energy and the energy transformations that occur.

Grade 3

1. Cite evidence from observations to describe the motion of an object using position and speed.
 - a. Describe the position of an object by locating it relative to another object or to its the background.
 - b. Using information from multiple trials, compare the speeds (faster or slower) of objects that travel the same distance in different amounts of time.
 - c. Using information from multiple trials, compare the distances that objects moving at different speeds travel in the same amount of time.
2. Explain that changes in the ways objects move are caused by forces.
 - a. Observe and describe the way an object’s motion changes in a variety of situations (rolling a ball, bouncing a ball, dropping a yo-yo, winding up a toy, etc.) and identify what may have caused the change.
 - b. Describe changes in the motion of objects as they move across different textured surfaces and suggest possible causes for the change.
 - c. Observe and describe that objects fall to the ground unless something holds them up (gravity).

Grade 5

1. Describe the motion of objects using distance traveled, time, direction, and speed.
 - b. Use measurements to describe the distance traveled as the change in position.
 - c. Based on data describe speed as the distance traveled per unit of time.
2. Explain that the changes in the motion of objects are determined by the mass of an object and the amount (size) of the force applied to it.
 - a. Observe and give examples that show changes in speed or direction of motion are caused by an interaction of forces acting on an object:
 - Friction
 - Gravity.
 - b. Observe and explain the changes in selected motion patterns using the relationship between force and mass.
4. Cite evidence that energy in various forms exists in mechanical systems.
 - a. Identify ways of storing energy (potential) in an object.
 - Raising an object above the ground
 - Putting it on the end of a compressed or extended spring or rubber band

- b. Identify that an object has energy (kinetic) related to its motion.
 - The greater the mass, the greater the energy
 - The greater the speed, the greater the energy
- c. Observe and cite examples showing that stored energy may be converted to energy of motion and vice versa.

Grade 8

1. Develop an explanation of motion using the relationships among time, distance, velocity, and acceleration.
 - a. Observe, describe, and compare the motions of objects using position, speed, velocity, and the direction.
 - c. Compare accelerated and constant motions using time, distance, and velocity.
2. Identify and relate formal ideas (Newton's Laws) about the interaction of force and motion to real world experiences.
 - a. Investigate and explain the interaction of force and motion that causes objects that are at rest to move.
 - b. Demonstrate and explain, through a variety of examples, that moving objects will stay in motion at the same speed and in the same direction unless acted on by an unbalanced force.
 - c. Investigate and collect data from multiple trials, about the motion that explain the motion that results when the same force acts on objects of different mass; and when different amounts of force act on objects of the same mass.
 - d. Based on data collected and organized, explain qualitatively the relationship between net force applied to an object and its mass for a given acceleration.
3. Recognize and explain that every object exerts gravitational force on every other object.
 - a. Explain the difference between mass and weight.
 - Mass is a measure of inertia
 - Weight is a measure of the force of gravity.
 - b. Describe the relationship between the gravitational force and the masses of the attracting objects.
 - c. Describe the relationship between the gravitational force and the distance between the attracting objects.
 - d. Recognize and cite examples showing that mass remains the same in all locations while weight may vary with a change in location (weight on Earth compared to weight on moon).
 - e. Recognize that gravity is the force that holds planets, moons, and satellites in their orbits.
4. Recognize and explain that energy can neither be created nor destroyed; rather it changes form or is transferred through the action of forces.
 - a. Observe and describe the relationship between the distance an object is moved by a force and the change in its potential energy or kinetic energy, such as in a slingshot, in mechanical toys, the position of an object and its potential energy..

C. Electricity and Magnetism

Grade 4

3. Cite evidence supporting that forces can act on objects without touching them.
 - a. Investigate and describe the effect that two magnets have on each other.
 - Like poles repel
 - Opposite poles attract
 - b. Based on observations, describe the effect of a magnet on a variety of objects including those that are metallic or non-metallic; those made with iron or made with other metals; and on other magnets.
 - g. Cite examples showing that magnetic, electrical, and gravitational forces can act at a distance.

E. Wave Interactions

Grade 3

2. Identify and describe the relationship between a sound and the vibrations that produce it.
 - a. Based on observations of objects that produce sound, relate vibration to the back and forth motion of parts of the object.

Grade 5

3. Provide evidence to show that light travels in a straight line until it is reflected or refracted.
 - a. Observe and describe the images formed by a plane mirror.
4. Recognize and describe how light interacts with different materials.
 - c. Observe and describe that prisms separate white light into its component colors.
 - d. Pose questions about why objects appear to be different colors.

Grade 6

1. Identify and describe the relationships among the various properties of waves.
 - a. Cite examples to show that waves transfer energy from one place to another.
 - Light
 - Sound
 - c. Measure and describe the relationship between the frequency and the wavelength of a wave.
3. Investigate and cite the rules that govern behaviors of light.
 - a. Based on data generalize the law of reflection.
 - b. Cite evidence from observations and research to support the fact that something can be “seen” when light waves emitted or reflected by it enter the eye.
 - d. Cite evidence that the amount of light energy absorbed or reflected depends on the color of the object illuminated.

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