

# Kindergarten

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## Physical Sciences

1. Objects have properties that can be observed and described. As a basis for understanding this concept, students know:
  - a. objects can be described in terms of the materials they are made of (clay, cloth, paper, etc.)
  - b. objects can be described in terms of their physical properties (color, size, shape, weight, texture, flexibility, etc.).
2. The motion of objects can be observed, measured, and controlled. As a basis for understanding this concept, students know:
  - a. the position of an object can be described by locating it relative to another object or the background.
  - b. an object's motion can be described by tracing and measuring its position over time.
  - c. the way to change how something is moving is to give it a push or a pull. The size of the change is related to the strength, or the amount of "force" of the push or pull.
  - d. tools and machines are used to apply pushes and pulls (forces) to make things move.
  - e. objects move in many different ways, such as straight, zigzag, round and round, back and forth, and fast and slow.

## Life Sciences

3. Living things have properties that can be observed and described. As a basis for understanding this concept, students know:
  - a. how to observe and describe similarities and differences in the appearance and behavior of plants and of animals.
  - b. stories sometimes give plants and animals attributes they really do not have.
4. Plants and animals have predictable life cycles. As a basis for understanding this concept, students know:
  - a. organisms reproduce offspring of their own kind. The offspring are very much, but not exactly, like their parents and like one another.
  - b. most living things need water, food, and air.
  - c. plants and animals both need to take in water and air, and animals need to take in food. In addition, plants need light.

## Earth and Space Sciences

5. Earth materials and weather have properties that can be observed and described. As a basis for understanding this concept, students know:
  - a. rocks come in many sizes and shapes, from boulders to grains of sand and mud.
  - b. changes in weather occur from day to day and over seasons, affecting daily activities.

## Investigation and Experimentation

6. In the context of investigations designed to develop understanding of the content of the other strands students will:
  - a. observe common objects using the five senses.
  - b. describe the properties of common objects.
  - c. describe the relative position of objects using one reference (e.g., above or below).
  - d. compare and sort common objects based on one physical attribute (including color, shape, texture, size, and weight).

# Kindergarten

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## **Investigation and Experimentation** (6. continued)

- e. communicate observations orally and in drawings.
- f. use simple tools to observe weather and record changes from day to day and over the seasons.

# Grade 1

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## Physical Sciences

1. Changes in the properties of materials can be observed, measured, and predicted. As a basis for understanding this concept, students know:

- a. water can be a liquid or a solid and can be made to change back and forth from one form to the other.
- b. water left in an open container evaporates (goes into the air), but water in a closed container does not.

2. Magnets can be used to make some objects move without being touched. As a basis for understanding this concept, students know:

- a. magnets have poles that attract and repel.
- b. magnets can be a variety of sizes, shapes, and strengths.
- c. magnets attract only certain metals.

## Life Sciences

3. Living things have needs that must be met in order to survive. As a basis for understanding this concept, students know:

- a. living things are found almost everywhere in the world. Different plants and animals inhabit different kinds of environments.
- b. different plants and animals have external features that help them thrive in different kinds of places.

4. Plants and animals have predictable life cycles. As a basis for understanding this concept, students know:

- a. organisms reproduce offspring of their own kind. The offspring are very much, but not exactly, like their parents and like one another.
- b. different plants and animals have external features that help them thrive in different kinds of places.
- c. animals eat plants or other animals for food and may also use plants (or even other animals) for shelter and nesting.
- d. the sequential stages of life cycles are different for different animals, for example butterflies, frogs, and mice.

## Earth and Space Sciences

5. Weather can be observed, measured and described. As a basis for understanding this concept, students know:

- a. how to use simple tools to observe weather and record changes from day to day and over the seasons.
- b. the position of the sun causes day and night.
- c. the weather changes from day to day, but things such as temperature, rain, and snow tend to be high, low, or medium in the same months every year.

6. The Earth is made of different kinds of materials, which have distinct properties and provide resources for human activities. As the basis for understanding this concept, students know:

- a. how to compare the physical properties of different kinds of rocks and that rock is composed of different combinations of minerals.
- b. smaller rocks come from the breakage and weathering of larger rocks.

# Grade 1

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## **Earth and Space Sciences** (6. continued)

- c. soil is made partly from weathered rock and partly from plant remains, and that soils differ in their color, texture, capacity to retain water, and ability to support the growth of many kinds of plants.
- d. natural processes, including freezing/thawing and growth of roots, cause rocks to break down into smaller pieces.

## **Investigation and Experimentation**

7. In the context of investigations designed to develop understanding of the content of the other strands students will:

- a. label parts of a diagram or drawing of an observed object.
- b. record observations and data with pictures, numbers, and/or written statements.
- c. record observations on a bar graph.
- d. make predictions.
- e. describe the relative position of objects using two references (e.g., above and next to, below and left of).
- f. describe the properties of common objects.
- g. compare and sort common objects based on one physical attribute (including color, shape, texture, size, and weight).

# Grade 2

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## Physical Sciences

1. Changes in the properties of materials can be observed, measured, and predicted. As a basis for understanding this concept, students know:

- a. water can be a liquid or a solid and can be made to change back and forth from one form to the other. If water is turned into ice and then the ice is allowed to melt, the amount of water is the same as it was before freezing.
- b. water samples left in an open container evaporate and often leave a salt, but water in a closed container does not.

2. Objects that make sound vibrate, and the pitch of the sound can be varied. As a basis for understanding this concept, students know:

- a. how sound waves move.
- b. ears can perceive sound.
- c. sound can travel through different kinds of matter.
- d. sounds are produced by vibrations.

## Life Sciences

3. Adaptations in physical structure or behavior may improve an organism's chance for survival.

As a basis for understanding this concept, students know:

- a. plants and animals have structures that serve different functions in growth, survival, and reproduction.
- b. Students know examples of diverse life forms in different environments, such as oceans, deserts, tundra, forests, grasslands, and wetlands.
- c. when the environment changes, some plants and animals survive and reproduce, and others die or move to new locations.
- e. some kinds of organisms that once lived on Earth have completely disappeared, although they were something like others that are alive today.
- f. the germination, growth, and development of plants can be affected by light, gravity, touch, or environmental stress.
- g. many characteristics of an organism are inherited from the parents of the organism, but others result from an interaction with the environment.
- h. there is variation among individuals of one kind within a population.

## Earth and Space Sciences

4. Weather can be observed, measured and described. As a basis for understanding this concept, students know:

- a. some events in nature have a repeating pattern. The weather changes from day to day, but things such as temperature and rain (or snow) tend to be high, low, or medium in the same months every year.
- b. the sun warms the land, air, and water.

5. Water on Earth moves between the oceans and land through the processes of evaporation and condensation. As a basis for understanding this concept, students know:

- a. almost all of Earth's water is present as salt water in the oceans which cover most of the Earth's surface.
- b. when liquid water evaporates, it turns into water vapor (invisible) in the air and can reappear as a liquid when cooled, or as a solid if cooled below the freezing point of water.

## Grade 2

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### **Earth and Space Sciences** (5. continued)

- c. water moves in the air from one place to another in the form of clouds or fog, which are tiny droplets of water or ice, and falls to the Earth as rain, hail, sleet, or snow.
- d. fossils provide evidence about plants and animals that lived long ago and that scientists learn about the past history of earth by studying fossils.
- e. resources from the ocean
- f. the amount of fresh water, located in rivers, lakes, underground sources, and glaciers, is limited, and its availability can be extended through recycling and decreased use.

### **Investigation and Experimentation**

6. In the context of investigations designed to develop understanding of the content of the other strands students will:

- a. make predictions based on patterns of observation rather than random guessing.
- b. measure length, weight, temperature, and liquid volume with appropriate tools and express measurements in standard and/or non-standard units.
- c. compare and sort common objects based on two or more physical attributes (including color, shape, texture, size, and weight).
- d. compare measurements.
- e. construct bar graphs to record data using appropriately labeled axes.
- f. write or draw descriptions of a sequence of steps, events and observations.
- g. follow verbal instructions for a scientific investigation.

# Grade 3

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## Physical Sciences

1. The motion of objects can be observed, measured, and controlled. As a basis for understanding this concept, students know:

- a. the position of an object can be described by locating it relative to another object or the background.
- b. an object's motion can be described by tracing and measuring its position over time.
- c. the way to change how something is moving is to give it a push or a pull. The size of the change is related to the strength, or the amount of "force" of the push or pull.
- d. tools and machines are used to apply pushes and pulls (forces) to make things move.
- e. objects move in many different ways, such as straight, zigzag, round and round, back and forth, and fast and slow.
- f. when two solid objects meet, they push or pull on each other.
- g. a spring or elastic band can pull on an object to which it is attached.
- h. objects near the Earth fall to the ground unless something holds them up.

## Life Sciences

2. Living things depend on one another and their environment for survival. As a basis for understanding this concept, students know:

- a. ecosystems can be characterized in terms of their living and nonliving components.
- b. for any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.
- c. many plants depend on animals for pollination and seed dispersal, while animals depend on plants for food and shelter.
- d. most microorganisms do not cause disease and many are beneficial.
- e. organisms, including humans, can change the physical condition of the environment, and these changes may be beneficial, neutral, or detrimental.
- f. living things cause changes in the environment where they live; some of these changes are detrimental to the organism or other organisms, whereas others are beneficial.

3. All organisms need energy and matter to live and grow. As a basis for understanding this concept, students know:

- a. plants are the primary source of matter and energy entering most food chains.
- b. matter may change forms as it moves through the environment.
- c. producers and consumers (herbivores, carnivores, omnivores, and decomposers) are related in food chains and food webs, and may compete with each other for resources in an ecosystem.
- d. decomposers, including many fungi, insects, and microorganisms recycle matter from dead plants and animals.
- e. Students know examples of diverse life forms in different environments, such as oceans, deserts, tundra, forests, grassland, and wetlands
- f. when the environment changes, some plants and animals survive and reproduce, and others die or move to new locations.

## Earth and Space Sciences

4. The Earth is made of different kinds of materials, which have distinct properties and provide resources for human activities. As the basis for understanding this concept, students know:

- a. soil is made partly from weathered rock and partly from plant remains, and that soils differ in their color, texture, capacity to retain water, and ability to support the growth

## Grade 3

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### **Earth and Space Sciences** (4. continued)

- of many kinds of plants.
  - b. fossils provide evidence about the plants and animals that lived long ago and that scientists learn about the past history of Earth by studying fossils.
  - c. how to compare the physical properties of different kinds of rocks and that rock is composed of different combinations of minerals.
  - d. smaller rocks come from the breakage and weathering of larger rocks.
  - e. rock, water, plants and soil provide many resources including food, fuel, and building materials that humans use.
5. Waves, wind, water and ice shape and reshape the Earth's land surface. As a basis for understanding this concept, students know:
- a. some changes in the Earth are due to slow processes, such as erosion (weathering, transport, and deposition), and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.
  - b. natural processes, including freezing/thawing and growth of roots, cause rocks to break down into smaller pieces.
  - c. moving water erodes landforms, reshaping the land by taking it away in places and depositing it as pebbles, sand, silt, and mud in other places.
  - d. the origin of water used by their local communities.
  - e. the amount of fresh water, located in rivers, lakes, underground sources, and glaciers, is limited, and its availability can be extended through recycling and decreased use.

### **Investigation and Experimentation**

6. In the context of investigations designed to develop understanding of the content of the other strands students will:
- a. repeat observations to improve accuracy
  - b. differentiate observation from opinion.
  - c. construct and interpret a simple scale map.
  - d. measure length, weight, temperature, and liquid volume to the nearest centimeter, gram, degree Celsius, and milliliter.
  - e. predict the outcome of a simple investigation, and compare the result to the prediction.



# Grade 4

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## Physical Sciences

1. Electricity and magnetism are related effects that have many useful applications in everyday life.

As a basis for understanding this concept, students know:

- a. how to design and build simple series and parallel circuits using components such as wires, batteries, and bulbs.
- b. how to build a simple compass and use it to detect magnetic effects, including Earth's magnetic field.
- c. that all electric currents produce magnetic effects and how to build a simple electromagnet.
- d. the role of electromagnets in the construction of electric motors, electric generators, and simple devices such as doorbells and earphones.
- e. static electricity results from a repulsive or attractive force at a distance between any two electrically charged objects.
- f. magnets have two poles; when two magnets interact, like poles repel and unlike poles attract.

2. Heating, cooling, and combining materials can cause changes in their properties. As a basis for understanding this concept, students know:

- a. evaporation, condensation, freezing, and melting are changes that depend on the temperature of the substance.
- b. substances soluble in water generally dissolve more rapidly and in greater quantity in hot water than in cold water.
- c. when a new material is made by combining two or more materials, it has properties that are different from the original materials.

3. Elements and their combinations account for all the varied types of matter in the world. As a basis for understanding this concept, students know:

- a. matter is made of objects too small to see called atoms.
- b. atoms combine to form molecules or crystals.
- c. some molecules are made up of only one kind of atom, such as oxygen (O<sub>2</sub>) and nitrogen (N<sub>2</sub>).
- d. elements are substances with only one type of atom.
- e. compounds contain only one type of molecule, but more than one type of atom, such as water (H<sub>2</sub>O), table salt (NaCl), and carbon dioxide (CO<sub>2</sub>).
- f. metals are groups of elements that have common properties such as electrical and thermal conductivity. Some metals, such as aluminum (Al), iron (Fe), nickel (Ni), copper (Cu), silver (Ag), gold (Au), are pure elements while others, such as steel and brass, are not.
- g. many different materials can be made from a small number of elements.

## Life Sciences

4. Adaptations in physical structure or behavior may improve an organism's chance for survival.

As a basis for understanding this concept, students know:

- a. plants and animals have structures that serve different functions in growth, survival, and reproduction.
- b. how sugar, water, and minerals are transported in a vascular plant.
- c. carbon dioxide (CO<sub>2</sub>) and energy from sunlight are used by plants to build molecules of sugar (releasing oxygen into the air) for growth and maintenance.

# Grade 4

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## **Life Sciences** (4. continued)

- d. for any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.
- e. many plants depend on animals for pollination and seed dispersal, while animals depend on plants for food and shelter.
- f. organisms, including humans, can change the physical condition of the environment, and these changes may be beneficial, neutral, or detrimental.

## **Earth and Space Sciences**

5. Water on Earth moves between the oceans and land through the processes of evaporation and condensation. As a basis for understanding this concept, students know:

- a. almost all of the Earth's water is present as salt water in the oceans which cover most of the Earth's surface.
- b. when liquid water evaporates, it turns into water vapor (invisible in the air and can reappear as a liquid when cooled, or as a solid if cooled below the freezing point of water.
- c. water moves in the air from one place to another in the form of clouds or fog, which are tiny droplets of water or ice, and falls to the Earth as rain, hail, sleet, or snow.
- d. the amount of fresh water, located in rivers, lakes, underground sources, and glaciers, is limited, and its availability can be extended through recycling and decreased use.
- e. the origin of water used by their local communities.

## **Investigation and Experimentation**

6. In the context of investigations designed to develop understanding of the content of the other strands students will:

- a. differentiate observation from inference (interpretation).
- b. measure and estimate weight, length, or volume of objects.
- c. formulate predictions and justify predictions based on cause and effect relationships.
- d. conduct multiple trials to test a prediction and draw conclusions about the relationships between results and predictions.
- e. construct graphs from measurements.
- f. interpret graphs.
- g. follow a set of written instructions for a scientific investigation.

# Grade 5

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## Physical Sciences

1. Energy can move from one place to another and be transformed from one form to another.

As a basis for understanding this concept, students know:

- a. when food for fuel is consumed, most of the energy released becomes heat energy.
- b. heat flows in solids by conduction and also by convection (which involves no flow of matter) and in fluids by conduction and also by convection (which does involve the flow of matter).
- c. heat energy is also transferred between objects by radiation; radiation can travel through empty space.
- d. heat moves in a predictable flow from warmer objects to cooler objects until all objects are at the same temperature.
- e. different substances have different thermal conductivities.

2. Sources of energy and materials differ in amounts, distribution, usefulness, and the time required for their formation. As a basis for understanding this concept, students know:

- a. different energy sources and classify them as renewable or nonrenewable based on the time it takes to regenerate them.
- b. the utility of energy sources is determined by factors that are involved in converting these sources to useful forms and the consequences of the conversion process.
- c. different natural resources, including air, soil, rocks, minerals, petroleum, fresh water, and forests, and classify them as renewable or nonrenewable based on the time it takes to regenerate them.
- d. natural origin of the materials used to make common objects.

## Life Sciences

3. Respiration, nutrition, and waste disposal systems in animals transport substances essential for life and growth. As a basis for understanding this concept, students know:

- a. many multicellular organisms have specialized structures to support the transport of materials.
- b. how the blood circulates through the heart chambers, lungs, and body, and how these parts work together to enable exchange of carbon dioxide (CO<sub>2</sub>) and oxygen (O<sub>2</sub>) in the lungs and tissues.
- c. the sequential steps during the passage of food through the digestive system, and how the teeth and mouth, esophagus, stomach, small intestine, large intestine, and colon are important in the function of the digestive system.
- d. the role of the kidney in filtering cellular wastes out of blood, which become urine stored in the bladder.

## Earth and Space Sciences

4. Objects in the sky move in regular and predictable patterns. As a basis for understanding this concept, students know:

- a. the patterns of stars stay the same, although they appear to move across the sky nightly, and different stars can be seen at different seasons.
- b. telescopes magnify the appearance of some distant objects in the sky, including the moon and the planets. The number of stars that can be seen through telescopes is dramatically greater than can be seen by the unaided eye.

# Grade 5

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## **Earth and Space Sciences** (4. continued)

- c. the position of the sun in the sky changes during the course of the day and from season to season.
- d. apparent phases of the moon that occur over a four week lunar cycle.

5. The Earth is a member of a solar system in which the sun is the major source of energy for phenomena on the Earth's surface. As a basis for understanding this concept, students know:

- a. the Earth is one of several planets that orbit the sun, and the moon orbits the Earth.
- b. energy from the sun powers winds, ocean currents, and the water cycle.
- c. seasons result from variations in the amount of sun's energy hitting the surface, due to the tilt of the Earth's rotation on its axis.
- d. how the tilt of the Earth's rotation on its axis is related to changes in the length of the day over the course of a year.
- e. how changes in the angle of incidence of the sun's rays result in differences in the temperature and the seasons.

## **Investigation and Experimentation**

6. In the context of investigations designed to develop understanding of the content of the other strands students will:

- a. classify objects (e.g., rocks, plant, leaves) based on appropriate criteria.
- b. plan and conduct a simple investigation based on a student-developed question.
- c. identify the dependent and controlled variables in an investigation.
- d. identify a single independent variable in a scientific investigation and explain what will be learned by collecting data on this variable.
- e. select appropriate tools (e.g. thermometers, meter sticks, balances, and graduated cylinders) and make quantitative observations.
- f. record data using appropriate graphical representation (including charts, graphs, spreadsheets and labeled diagrams).
- g. represent and interpret data presented in a pie chart, or bar, line or scatter graph and discuss inferences based on those data.
- h. draw conclusions based on scientific evidence and indicate whether further information is needed to support a specific conclusion.
- i. write a report of an investigation that includes tests conducted, data collected or evidence examined, and conclusions drawn.