

# Oakwood City School District Science Standards

Ohio's Learning Standards and Model Curriculum for Science outlines what all students should know and be able to do to become scientifically literate citizens. This includes the knowledge and skills they need for the 21st century workforce and higher education. The standards provide Ohio educators with the content and expectations for learning they can use to develop science curriculum at each grade level.

By the end of high school, students should be proficient in science in order to:

- Know, use and interpret scientific explanations of the natural world;
- Generate and evaluate scientific evidence and explanations, distinguishing science from pseudoscience;
- Understand the nature and development of scientific knowledge; and
- Participate productively in scientific practices and discourse.

"Knowledge of science can enable us to think critically and frame productive questions. Without scientific knowledge, we are wholly dependent on others as "experts." With scientific knowledge, we are empowered to become participants rather than merely observers. Science, in this sense, is more than a means for getting ahead in the world of work. It is a resource for becoming a critical and engaged citizen in a democracy." -Ready, Set, SCIENCE! (2008)

# Kindergarten Science Standards

## Earth and Space Science: Daily and Seasonal Changes

- A. Weather changes are long-term and short-term.
  - a. Weather changes occur throughout the day and from day to day.
  - b. Air is a nonliving substance that surrounds Earth and wind is air that is moving.
  - c. Wind, temperature and precipitation can be used to document short-term weather changes that are observable.
  - d. Yearly weather changes (seasons) are observable patterns in the daily weather changes.
- B. The moon, sun and stars can be observed at different times of the day or night.
  - a. The moon, sun and stars appear in different positions at different times of the day or night.
  - b. The observable shape of the moon changes in size very slowly throughout the month. The sun is visible only during the day.
  - c. The sun's position in the sky appears to change in a single day and from season to season.
  - d. Stars are visible at night, some are visible in the evening or morning and some are brighter than others.

## Life Science: Physical and Behavioral Traits of Living Things

- A. Living things have specific characteristics and traits.
  - a. Living things grow and reproduce. Living things are found worldwide.
- B. Living things have physical traits and behaviors, which influence their survival.
  - a. Living things are made up of a variety of structures. Some traits can be observable structures. Some of these structures and behaviors influence their survival.

## Physical Science: Properties of Everyday Objects and Materials

- A. Objects and materials can be sorted and described by their properties.

- a. Objects can be sorted and described by the properties of the materials from which they are made. Some of the properties can include color, size and texture.
- B. Some objects and materials can be made to vibrate to produce sound.
  - a. Sound is produced by touching, blowing or tapping objects. The sounds that are produced vary depending on the properties of objects. Sound is produced when objects vibrate.

# First Grade Science Standards

## Earth and Space Science: Sun, Energy, and Weather

- A. The sun is the principal source of energy
  - a. Sunlight warms Earth's land, air and water. The amount of exposure to sunlight affects the amount of warming or cooling of air, water and land.
- B. Water on Earth is present in many forms.
  - a. The physical properties of water can change. These changes occur due to changing energy..Water can change from a liquid to a solid and from a solid to a liquid.

## Life Science: Basic Needs of Living Things

- A. Living things have basic needs, which are met by obtaining materials from the physical environment.
  - a. Living things require energy, water, and a particular range of temperatures in their environments. Plants get energy from sunlight. Animals get energy from plants and other animals. Living things acquire resources from the living and nonliving components of the environment.
- B. Living things survive only in environments that meet their needs.
  - a. Resources are necessary to meet the needs of an individual and populations of individuals. Living things interact with their physical environments as they meet those needs. Effects of seasonal changes within the local environment directly impact the availability of resources.

## Physical Science: Motion and Materials

- A. Properties of objects and materials can change.
  - a. Objects and materials change when exposed to various conditions, such as heating or cooling.Changes in temperature are a result of changes in energy. Not all materials change in the same way.

- B. Objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth.
- a. The position of an object can be described by locating it relative to another object or to the object's surroundings. An object is in motion when its position is changing.
  - b. The motion of an object can be affected by pushing or pulling. A push or pull is a force that can make an object move faster, slower or go in a different direction. Changes in motion are a result of changes in energy.

# Second Grade Science Standards

## Earth and Space Science: The Atmosphere

- A. The atmosphere is primarily made up of air.
  - a. Air has properties that can be observed and measured. The transfer of energy in the atmosphere causes air movement, which is felt as wind. Wind speed and direction can be measured.
- B. Water is present in the atmosphere.
  - a. Water is present in the atmosphere as water vapor. When water vapor in the atmosphere cools, it forms clouds, fog, rain, ice, snow, sleet or Hail.
- C. Long- and short-term weather changes occur due to changes in Energy.
  - a. Changes in energy affect all aspects of weather, including temperature, precipitation, and wind.

## Life Science: Interactions within Habitats

- A. Living things cause changes on Earth.
  - a. Living things function and interact with their physical environments. Living things cause changes in the environments where they live; the changes can be very noticeable or slightly noticeable, fast or slow.

Note: At this grade level, discussion is limited to changes that can be easily observed.

- 1. All organisms alive today result from their ancestors, some of which may be extinct. Not all kinds of organisms that lived in the past are represented by living organisms today.
  - a. Some kinds of organisms become extinct when their basic needs are no longer met or the environment changes.

## Physical Science

Topic: Changes in Motion

This topic focuses on observing the relationship between forces and motion.

1. Forces change the motion of an object.
  - a. Motion can increase, change direction or stop depending on the force applied.
  - b. The change in motion of an object is related to the size of the force.
  - c. Some forces act without touching, such as using a magnet to move an object or objects falling to the ground.

# Third Grade Science Standards

## Earth and Space Science

### Topic: Earth's Resources

This topic focuses on Earth's resources. While resources can be living and nonliving, within this strand, the emphasis is on Earth's nonliving resources, such as water, air, rocks, soil and the energy resources they represent.

1. Earth's nonliving resources have specific properties.
  - a. Soil is composed of pieces of rock, organic material, water and air and has characteristics that can be measured and observed. Use the term "soil", not "dirt". Dirt and soil are not synonymous.
  - b. Rocks have specific characteristics that allow them to be sorted and compared. Rocks form in different ways. Air and water are also nonliving resources.

Note: Rock classification is not the focus for this grade level; this is found in grade 6. At this grade, the observable characteristics of rocks can be used to sort or compare, rather than formal classification.

2. Earth's resources can be used for energy.
  - a. Renewable energy resources, such as wind, water or solar energy, can be replenished within a short amount of time by natural processes.
  - b. Nonrenewable energy is a finite resource, such as natural gas, coal or oil, which cannot be replenished in a short amount of time.
3. Some of Earth's resources are limited.
  - a. Some of Earth's resources become limited due to overuse and/or contamination. Reducing resource use, decreasing waste and/or pollution, recycling and reusing can help conserve these resources.

## Life Science

### Topic: Behavior, Growth and Changes

This topic explores life cycles of organisms and the relationship between the natural environment and an organism's (physical and behavioral) traits, which affect its ability to survive and reproduce.

1. Offspring resemble their parents and each other.

- a. Individual organisms inherit many traits from their parents indicating a reliable way to transfer information from one generation to the next.
  - b. Some behavioral traits are learned through interactions with the environment and are not inherited.
2. Individuals of the same kind of organism differ in their inherited traits.
    - a. These differences give individuals an advantage in surviving and/or reproducing. Plants and animals have physical features that are associated with the environments where they live.
    - b. Plants and animals have certain physical or behavioral characteristics that influence their chances of surviving in particular environments.

Note: The focus is on the individual, not the population. Adaption is not the focus at this grade level.

3. Plants and animals have life cycles that are part of their adaptations for survival in their natural environments.
  - a. Worldwide, organisms are growing, reproducing, dying and decaying. The details of the life cycle are different for different organisms, which affects their ability to survive and reproduce in their natural environments.

Note: The names of the stages within the life cycles are not the focus.

## Physical Science

Topic: Matter and Forms of Energy

This topic focuses on the relationship between matter and energy. Matter has specific properties and is found in all substances on Earth. Heat is a familiar form of energy that can change the states of matter.

1. All objects and substances in the natural world are composed of matter.
  - a. Matter takes up space and has mass.
  - b. Differentiating between mass and weight is not necessary at this grade level.
2. Matter exists in different states, each of which has different properties.
  - a. The most recognizable states of matter are solids, liquids and gases.
  - b. Shape and compressibility are properties that can distinguish between the states of matter.
  - c. One way to change matter from one state to another by heating or cooling.
3. Heat, electrical energy, light, sound and magnetic energy are forms of energy.
  - a. There are many different forms of energy. Energy is the ability to cause motion or create change. The different forms of energy that are outlined at this grade level should be limited to familiar forms that a student is able to observe.

# Fourth Grade Science Standards

## Earth and Space Science

### Topic: Earth's Surface

This topic focuses on the variety of processes that shape and reshape Earth's surface.

1. Earth's surface has specific characteristics and landforms that can be identified.
  - a. About 70 percent of the Earth's surface is covered with water and most of that is the ocean. Only a small portion of the Earth's water is freshwater, which is found in rivers, lakes, groundwater and glaciers.
    - b. Earth's surface can change due to erosion and deposition of soil, rock or sediment.
    - c. Catastrophic events such as flooding, volcanoes and earthquakes can create landforms.
  2. The surface of Earth changes due to weathering.
    - a. Rocks change shape, size and/or form due to water or glacial movement, freeze and thaw, wind, plant growth, acid rain, pollution and catastrophic events such as earthquakes, flooding, and volcanic activity.

Note: Differentiating between chemical and physical weathering is not the focus at this grade level.

3. The surface of Earth changes due to erosion and deposition.
  - a. Liquid water, wind and ice physically remove and carry rock, soil and sediment (erosion) and deposit the material in a new location (deposition). Gravitational force affects movements of water, rock and soil.

## Life Science

### Topic: Earth's Living History

This topic focuses on using fossil evidence and living organisms to observe that suitable habitats depend upon a combination of biotic and abiotic factors.

1. Changes in an organism's environment are sometimes beneficial to its survival and sometimes harmful.
  - a. Ecosystems can change gradually or dramatically. When the environment changes, some plants and animals survive and reproduce and others die or move to new locations.
  - b. Ecosystems are based on interrelationships among and between biotic and abiotic factors. These include the diversity of other organisms present, the availability of food and other resources, and the physical attributes of the environment.
2. Fossils can be compared to one another and to present-day organisms according to their similarities and differences.
  - a. The concept of biodiversity is expanded to include different classification schemes based upon shared internal and external characteristics of organisms.
  - b. Most species that have lived on Earth are extinct.
  - c. Fossils provide a point of comparison between the types of organisms that lived long ago and those existing today.

## Physical Science

Topic: Electricity, Heat and Matter

This topic focuses on the conservation of matter and the processes of energy transfer and transformation, especially as they apply to heat and electrical energy.

1. When objects break into smaller pieces, dissolve, or change state, the total amount of matter is conserved.
  - a. When an object is broken into smaller pieces, when a solid is dissolved in a liquid or when matter changes state (solid, liquid, gas), the total amount of matter remains constant.

Note: Differentiation between mass and weight is not necessary at this grade level.

2. Energy can be transferred from one location to another or can be transformed from one form to another.
  - a. Energy transfers from hot objects to cold objects as heat, resulting in a temperature change.
3. Electric circuits require a complete loop of conducting materials through which electrical energy can be transferred.
  - a. Electrical energy in circuits can be transformed into other forms of energy, including light, heat, sound and motion. Electricity and magnetism are closely related.

# Fifth Grade Science Standards

## Earth and Space Science (ESS)

### Topic: Cycles and Patterns in the Solar System

This topic focuses on the characteristics, cycles and patterns in the solar system and within the universe.

1. The solar system includes the sun and all celestial bodies that orbit the sun. Each planet in the solar system has unique characteristics.
  - a. The distance from the sun, size, composition and movement of each planet are unique. Planets revolve around the sun in elliptical orbits.
  - b. Some of the planets have moons and/or debris that orbit them. Comets, asteroids and meteoroids orbit the sun.
2. The sun is one of many stars that exist in the universe.
  - a. The sun appears to be the largest star in the sky because it is the closest star to Earth. Some stars are larger than the sun and some stars are smaller than the sun.
3. Most of the cycles and patterns of motion between the Earth and sun are predictable.
  - a. Earth's revolution around the sun takes approximately 365 days. Earth completes one rotation on its axis in a 24-hour period, producing day and night. This rotation makes the sun, stars and moon appear to change position in the sky.

Note: Moon phases should not be the focus.

## Life Science

### Topic: Interconnections within Ecosystems

This topic focuses on foundational knowledge of the structures and functions of ecosystems.

1. Organisms perform a variety of roles in an ecosystem.
  - a. Populations of organisms can be categorized by how they acquire energy.
  - b. Food webs can be used to identify the relationships among producers, consumers and decomposers in an ecosystem.
2. All of the processes that take place within organisms require energy.

- a. For ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transferred and transformed by producers into energy that organisms use through the process of photosynthesis. That energy is used or stored by the producer and can be passed from organism to organism as illustrated in food webs.

## Physical Science

Topic: Light, Sound and Motion

This topic focuses on the forces that affect motion. This includes the relationship between the change in speed of an object, the amount of force applied and the mass of the object. Light and sound are explored as forms of energy that move in predictable ways, depending on the matter through which they move.

1. The amount of change in movement of an object is based on the mass of the object and the amount of force exerted.
  - a. Movement can be measured by speed. The speed of an object is calculated by determining the distance ( $d$ ) traveled in a period of time ( $t$ ).
  - b. Any change in speed or direction of an object requires a force and is affected by the mass of the object and the amount of force applied.

Note: Differentiating between mass and weight is not necessary at this grade level.

# Sixth Grade Science Standards

## Earth and Space Science

### Topic: Rocks, Minerals and Soil:

This topic focuses on the study of rocks, minerals and soil, which make up the lithosphere. Classifying and identifying different types of rocks, minerals and soil can decode the past environment in which they formed.

1. Minerals have specific, quantifiable properties.
  - a. Minerals are naturally occurring, inorganic solids that have a defined chemical composition. Minerals have properties that can be observed and measured. Minerals form in specific environments.

Note: The emphasis is on learning how to identify the mineral by conducting tests (not through memorization).

2. Igneous, metamorphic and sedimentary rocks have unique characteristics that can be used for identification and/or Classification.
  - a. Most rocks are composed of one or more minerals, but there are a few types of sedimentary rocks that contain organic material, such as coal. The composition of the rock, types of mineral present, and/or mineral shape and size can be used to identify the rock and to interpret its history of formation, breakdown (weathering) and transport (erosion).
3. Igneous, metamorphic and sedimentary rocks form in different ways.
  - a. Magma or lava cools and crystallizes to form igneous rocks. Heat and pressure applied to existing rock forms metamorphic rocks. Sedimentary rock forms as existing rock weathers chemically and/or physically and the weathered material is compressed and then lithifies. Each rock type can provide information about the environment in which it was formed.
4. Soil is unconsolidated material that contains nutrient matter and weathered rock.
  - a. Soil formation occurs at different rates and is based on environmental conditions, types of existing bedrock and rates of weathering. Soil forms in layers known as horizons. Soil horizons can be distinguished from one another based on properties that can be measured. The terms dirt and soil are not synonymous, use the term "soil".

Note: The emphasis should be on properties of soil rather than memorization.

5. Rocks, minerals and soils have common and practical uses.
  - a. Nearly all manufactured material requires some kind of geologic resource. Most geologic resources are considered nonrenewable. Rocks, minerals and soil are examples of geologic resources that are nonrenewable.

## Life Science

Topic: Cellular to Multicellular:

This topic focuses on the study of the basics of Modern Cell Theory. All organisms are composed of cells, which are the fundamental unit of life. Cells carry on the many processes that sustain life. All cells come from pre-existing cells.

1. Cells are the fundamental unit of life.
  - a. All living things are composed of cells. Different body tissues and organs are made of different kinds of cells. The ways cells function are similar in all living organisms.
  - b. Note: Emphasis should be placed on the function and coordination of cell organelles as well as their roles in overall cell function. Specific information about the organelles that need to be addressed at this grade level will be found in the model curriculum.
2. All cells come from pre-existing cells.
  - a. Cells repeatedly divide resulting in more cells and growth and repair in multicellular organisms.

Note: This is not a detailed discussion of the phases of mitosis or meiosis. The focus should be on reproduction as a means of transmitting genetic information from one generation to the next, cellular growth and repair.

3. Cells carry on specific functions that sustain life.
  - a. Many basic functions of organisms occur in cells. Cells take in nutrients and energy to perform work, like making various molecules required by that cell or an organism.
  - b. Every cell is covered by a membrane that controls what can enter and leave the cell.
  - c. Within the cell are specialized parts for the transport of materials, energy capture and release, protein building, waste disposal, information feedback and movement.

Note: Emphasis should be placed on the function and coordination of cell components, as well as on their roles in overall cell function.

4. Living systems at all levels of organization demonstrate the complementary nature of structure and function.
  - a. The level of organization within organisms includes cells, tissues, organs, organ systems and whole organisms.

- b. Whether the organism is single-celled or multicellular, all of its parts function as a whole to perform the tasks necessary for the survival of the organism.
- c. Organisms have diverse body plans, symmetry and internal structures that contribute to their being able to survive in their environments.

## Physical Science

### Topic: Matter and Motion

This topic focuses on the study of foundational concepts of the particulate nature of matter, linear motion, and kinetic and potential energy.

1. Matter is made up of small particles called atoms.
  - a. Matter has mass, volume and density and is made up of particles called atoms.
  - b. Elements are a class of substances composed of a single kind of atom.
  - c. Molecules are the combination of two or more atoms that are joined together chemically.
2. Changes of state are explained by a model of matter composed of particles that are in motion.
  - a. Temperature is a measure of the average motion of the particles in a substance.
  - b. Heat is a process of energy transfer rather than a type of energy. Energy transfer can result in a change in temperature or a phase change.
  - c. When substances undergo changes of state, atoms change their motion and position.

Note: It is not the intent of this standard to encourage vocabulary identification (matching definitions with heat, temperature, and thermal energy). Instead, these are provided as conceptual tools for understanding the role of energy in physical, biotic, atmospheric, oceanic, and geologic systems covered in grade 6 and subsequent grades and courses.

3. There are two categories of energy: kinetic and potential.
  - a. Objects and substances in motion have kinetic energy.
  - b. Objects and substances can have energy as a result of their position (potential energy).

Note: Chemical and elastic potential energy should not be included at this grade; this is found in PS grade 7.

4. An object's motion can be described by its speed and the direction in which it is moving.
  - a. An object's position and speed can be measured and graphed as a function of time.

Note: Velocity and acceleration rates should not be included at this grade level; these terms are introduced in high school.