Ohio Science - Extended Learning Standards

Grade 6

Earth and Space Science

1 **Minerals have specific, quantifiable properties. 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.** 6.ESS.1

Complexity a

a Sort minerals by properties (e.g., color, density, luster). 6.ESS.1A

Complexity b

b Identify a common rock-forming mineral. 6.ESS.1B

Complexity c

c Identify an object as a mineral or a rock. 6.ESS.1C

Learning Progression

- Compare rocks and minerals. 6.ESS.1.LP.A
- Match a sample rock or mineral to a given set of properties. 6.ESS.1.LP.B
- Manipulate both rocks and minerals to identify characteristics of each (e.g., rubbing on a piece of paper, breaking into pieces, feeling texture, etc.) 6.ESS.1.LP.C
- Engage with various minerals and rocks. 6.ESS.1.LP.D

2 **Igneous, metamorphic, and sedimentary rocks have unique characteristics that can be used for identification and/or classification. 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).** 6.ESS.2

Complexity a

a Classify igneous, metamorphic, or sedimentary rocks. 6.ESS.2A

Complexity b

b Identify the properties of igneous rocks (e.g., granite, basalt), metamorphic rocks (e.g., marble, quartzite), or sedimentary rocks (layers). 6.ESS.2B

Complexity c

c Sort rocks by textual characteristics. 6.ESS.2C

Learning Progression

- Compare the characteristics of igneous, metamorphic and sedimentary rocks. 6.ESS.2.LP.A
- Match a sample rock to its origin given a set of characteristics (e.g., using pictures, maps, illustrations, etc.) 6.ESS.2.LP.B
- Manipulate rocks to identify textural characteristics of each. 6.ESS.2.LP.C
- Engage with various types of rocks. 6.ESS.2.LP.D

3 **Igneous, metamorphic, and sedimentary rocks form in different ways. 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.** 6.ESS.3

Complexity a

a Identify how each rock type is formed (e.g., pressure, erosion, cooling, melting, compaction, cementation, heat, and/or weathering). 6.ESS.3A

Complexity b

b Compare parts of the rock cycle (e.g., some rocks form from pressure while some form from lava). 6.ESS.3B

Complexity c

c Identify a component of a rock cycle. 6.ESS.3C

Learning Progression

- Given characteristics of a rock or location in the rock cycle, identify the specific rock type. 6.ESS.3.LP.A
- Match where a given rock fits into the rock cycle. 6.ESS.3.LP.B
- Explore a variety of different rocks and identify specific characteristics of the rock. 6.ESS.3.LP.C
- Identify the processes that can change a rock (e.g., heat, pressure, lava cooling, etc.). 6.ESS.3.LP.D
- Actively participate in discussion about an animation or simulation that illustrates the rock cycle (e.g., the creation of coal). 6.ESS.3.LP.E
- Engage with various visual or tactile representations of the rock cycle. 6.ESS.3.LP.F
- Engage with materials that can represent the formation of rocks (e.g., different colors of playdoh). 6.ESS.3.LP.G

4 **Soil is unconsolidated material that contains nutrient matter and weathered rock. 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.** 6.ESS.4

Complexity a

a Identify the different properties of each layer (horizon) of soil. 6.ESS.4A

Complexity b

b Recognize that soils can have different properties (e.g., texture, color, composition, permeability, porosity). 6.ESS.4B

Complexity c

c Identify the components of soil (e.g., small pieces of rock and living and decaying organisms). 6.ESS.4C

Learning Progression

- Investigate plant growth in a variety of soils. 6.ESS.4.LP.A
- Match characteristics of soil to its purpose or use. 6.ESS.4.LP.B
- Identify the different layers in a soil sample/cross section as "horizons". 6.ESS.4.LP.C
- Manipulate different soil samples to identify characteristics of each (e.g., texture, color, composition, permeability, porosity). 6.ESS.4.LP.D
- Engage with different samples of soil. 6.ESS.4.LP.E

5 Rocks, minerals, and soils have common and practical uses. 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. 6.ESS.5

Complexity a

a Classify specific rocks, minerals, or soils into their general use (agriculture, transportation, construction, domestic, energy, and technology). 6.ESS.5A

Complexity b

b Identify a common use for rocks, minerals, or soils. 6.ESS.5B

Complexity c

c Identify that rocks, minerals, and soils are nonrenewable resources that are used by people in many ways. 6.ESS.5C

Learning Progression

- Identify what happens when a nonrenewable resource is used (e.g., coal is burned up to create heat). 6.ESS.5.LP.A
- Match a rock or mineral to its industrial use (e.g., road salt, jewellery, building material, etc.). 6.ESS.5.LP.B
- Identify the practical use of rocks, minerals, or soils found in everyday items. 6.ESS.5.LP.C
- Engage with common products that are made with rocks, minerals, or soils. 6.ESS.5.LP.D

Life Science

1 Cells are the fundamental unit of life. 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. 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. 6.LS.1

Complexity a

a Explain how cells are organized to form multicellular organisms (cells make up tissue such as muscle). 6.LS.1A

Complexity b

b Recognize that organisms can be made of only one cell or can be made of many cells. 6.LS.1B

Complexity c

c Recognize that living things are made of cells. 6.LS.1C

Learning Progression

- Match cell organelles to the specific function they perform in a cell. 6.LS.1.LP.A
- Recognize that cells work together to perform different functions for the organism (e.g., groups of special cells work together to create an organ called the heart that pumps blood throughout an organism's body). 6.LS.1.LP.B
- Identify the needs of all living things (energy, removal of waste, reproduction, etc.). 6.LS.1.LP.C
- Identify that a cell has smaller parts that perform their own functions for living things. 6.LS.1.LP.D
- Compare differences between plants and animals at the macro- and microscopic level. 6.LS.1.LP.E
- Identify a single-celled versus a multicellular organism. 6.LS.1.LP.F
- Identify relative size of a single cell to a known organism or object (e.g., have students engage with various models to describe the relative size of a cell). 6.LS.1.LP.G
- Engage with models or visuals of single-celled and multicellular organisms (both plant and animal). 6.LS.1.LP.H
- Engage with or manipulate a model of a cell (both plant and animal). 6.LS.1.LP.I

2 **All cells come from pre-existing cells. 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.** 6.LS.2

Complexity a

a Describe that every cell contains information about traits that can be passed to the next generation through reproduction or cell division. 6.LS.2A

Complexity b

b Identify that cells multiply for growth, repair, and reproduction. 6.LS.2B

Complexity c

c Identify that cells can multiply to produce more cells. 6.LS.2C

Learning Progression

- Recognize that cells have a master set of directions for structure and function within a living system. For multicellular organisms, only a portion of the genetic information is used. 6.LS.2.LP.A
- Identify a situation where a cell is multiplying in order to grow or repair (e.g., provide images of cut on human skin and a scab forming, cut hair and regrowth). 6.LS.2.LP.B
- Recognize that cell division results in growth of an organism or the production of cells to replace cells. 6.LS.2.LP.C
- Identify the source of a specific type of cell (e.g., muscle cell was produced from another muscle cell). 6.LS.2.LP.D
- Actively participate in discussion of how organisms grow or how bodies make repairs (e.g., what happens when you get a cut?) 6.LS.2.LP.E
- Engage in visual models or animations of a cell dividing and developing into an embryo. 6.LS.2.LP.F
- Engage in visual models or animations of a cell dividing and creating an exact copy.Match cell organelles to the specific function they perform in a cell. 6.LS.2.LP.G
- Recognize that cells work together to perform different functions for the organism (e.g., groups of special cells work together to create an organ called the heart that pumps blood throughout an organism's body). 6.LS.2.LP.H
- Identify the needs of all living things (energy, removal of waste, reproduction, etc.). 6.LS.2.LP.I
- Identify that a cell has smaller parts that perform their own functions for living things. 6.LS.2.LP.J
- Compare differences between plants and animals at the macro and microscopic level. 6.LS.2.LP.K
- Identify a single-celled versus a multicellular organism. 6.LS.2.LP.L

- Identify relative size of a single cell to a known organism or object (e.g., have students engage with various models to describe the relative size of a cell). 6.LS.2.LP.M
- Engage with models or visuals of single-celled and multicellular organisms (both plant and animal). 6.LS.2.LP.N
- Engage with or manipulate a model of a cell (both plant and animal). 6.LS.2.LP.O

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3 **Cells carry on specific functions that sustain life. 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. Every cell is covered by a membrane that controls what can enter and leave the cell. 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.** 6.LS.3

Complexity a

a Explain that each cell part has a distinct structure and function that is critical to life. 6.LS.3A

Complexity b

b Match an organelle to its function. 6.LS.3B

Complexity c

c Identify an organelle in a cell. 6.LS.3C

Learning Progression

- Identify at least one difference between a plant and animal cell (e.g., cell wall versus cell membrane, presence or absence of chloroplasts). 6.LS.3.LP.A
- Recognize that cells have smaller parts called “organelles”. 6.LS.3.LP.B
- Engage with and manipulate a cell model to illustrate cell parts (both plant and animal). 6.LS.3.LP.C

4 Living systems at all levels of organization demonstrate the complementary nature of structure and function. The level of organization within organisms includes cells, tissues, organs, organ systems, and whole organisms. Whether the organism is single-celled or multicellular, all parts function as a whole to perform the tasks necessary for the survival of the organism. 6.LS.4

Complexity a

a Compare and contrast different types of cells and tissues. 6.LS.4A

Complexity b

b Identify that cells make up tissues, which make up organs. 6.LS.4B

Complexity c

c Identify a plant cell and an animal cell. 6.LS.4C

Learning Progression

- Recognize that all organs/organ systems work together to provide function for an organism. 6.LS.4.LP.A
- Recognize that organs that work together to perform a specific job make up an organ system 6.LS.4.LP.B
- Recognize that similar tissues put together make up an organ. 6.LS.4.LP.C
- Recognize that a group of similar cells make up a larger structure called “tissue”. 6.LS.4.LP.D
- Recognize at least one difference between a plant and animal cell (e.g., cell wall versus cell membrane, presence or absence of chloroplasts). 6.LS.4.LP.E
- Engage with pictures and models of various types of cells (plant and animal). 6.LS.4.LP.F

Physical Science

1 Matter is made up of small particles called atoms. Matter has mass, volume and density and is made up of particles called atoms. Elements are a class of substances composed of a single kind of atom. Molecules are the combination of two or more atoms that are joined together chemically. 6.PS.1

Complexity a

a Compare objects based on the properties of matter (e.g., mass, volume, density). 6.PS.1A

Complexity b

b Identify a property of matter that can be measured (e.g., mass, volume, density). 6.PS.1B

Complexity c

c Identify that matter is made of atoms, which are too small to be seen. 6.PS.1C

Learning progression

- Explore different materials of the same size and note similarities and difference. (Use a steellead beaarring and a foam ball of the same size and note the mass, volume and density.) 6.PS.1.LP.A
- Make a model representing atoms joined together to create a substance (e.g., use Legos to create an object or "substance", then change the size, number, or color of Legos to create a new "substance"). 6.PS.1.LP.B
- Recognize unique characteristics of substances (e.g., size, color, malleability, mass, volume). 6.PS.1.LP.C
- Recognize atoms as the "building blocks" of all substances (i.e. they make up everything). 6.PS.1.LP.D
- Recognize that objects can be broken down into smaller and smaller pieces that eventually we cannot see (e.g., physically reduce the size of various objects (break them down into smaller and smaller pieces until they can no longer be reduced)). 6.PS.1.LP.E
- Recognize the size of an atom compared to an everyday object (i.e. understand that atoms can't be seen with the naked just their eyes). 6.PS.1.LP.F
- Engage with a visual representation of atoms of elements such as the Periodic Table of Elements. 6.PS.1.LP.G
- Engage with models of atoms and molecules. 6.PS.1.LP.H
- Engage with objects that represent "building blocks" (e.gi.e., smaller pieces that can be put together to create a larger object, such as Legos). 6.PS.1.LP.I
- Engage with items of the same size and shape, but varying masses, or items of same mass, but varying sizes/ shapes. 6.PS.1.LP.J

2 **Changes of state are explained by a model of matter composed of particles that are in motion. Temperature is a measure of the average motion of the particles in a substance. 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. 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.** 6.PS.2

Complexity a

a Compare the motion of the particles that make up solids, liquids, gases (e.g., solid particles are close together; gas particles are far apart). 6.PS.2A

Complexity b

b Identify that heating an object causes the particles of the object to speed up. 6.PS.2B

Complexity c

c Recognize that heating an object can make it change from a solid to a liquid to a gas. 6.PS.2C

Learning Progression

- Model movement of particles in a state of matter as heat or energy is added or taken away. 6.PS.2.LP.A
- Identify what is present to cause a change of state (i.e. increased energy or heat). 6.PS.2.LP.B
- Relate particle movement to the characteristics of the various states of matter, e.g., liquids and gases flow and take the shape of their container because atoms move over and around each other. Solids have a definite shape due to the limited movement of the atoms. 6.PS.2.LP.C
- Model movement of particles in each state of matter. 6.PS.2.LP.D
- Recognize that particles in matter move according to their “state” (solid-particles vibrate, liquid-particles move around each other, gas-particles move in all directions). 6.PS.2.LP.E
- Recognize that matter is made of particles (atoms) that move. 6.PS.2.LP.F
- Recognize a “change of state” as matter changing from liquid to solid, liquid to gas, solid to liquid, etc.) 6.PS.2.LP.G
- Identify the states of matter that exist as ice melts (e.g., solid, liquid, gas). 6.PS.2.LP.H
- Engage with an animation of particle movement as a substance changes phase as a result of adding or removing heat. 6.PS.2.LP.I
- Actively participate in discussion about a change in state demonstration (e.g., ice changing state from solid to liquid to gas on a hot plate). 6.PS.2.LP.J

- Engage with various solids, liquids, and gases that can change their state within a relatively short amount of time. 6.PS.2.LP.K

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3 **There are two categories of energy: kinetic and potential. Objects and substances in motion have kinetic energy. 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.** 6.PS.3

Complexity a

a Identify when an object has the greatest/ least kinetic and/or potential energy. 6.PS.3A

Complexity b

b Recognize that the potential energy of an object changes based on its height and recognize that the kinetic energy of an object changes based on its speed. 6.PS.3B

Complexity c

c Identify examples of potential or kinetic energy in a model or visual representation. 6.PS.3C

Learning Progression

- (Example for 6.PS.3c) Observe a Rube Goldberg machine (Mouse Trap game) in action and identify the types energy employed. Identify places where potential and kinetic energy are the greatest or least. (think Mouse Trap game). 6.PS.3.LP.A
- Model the effect of an increase or decrease of potential energy on an object's kinetic energy (e.g., drop a ball from different heights and compare the heights of the resulting bounces--"If I drop a ball from really high, the bounce will be bigger."; skiing on the bunny hill versus advanced hill). 6.PS.3.LP.B
- Match picture examples to either having kinetic or potential energy. 6.PS.3.LP.C
- Recognize that objects in motion are said to have "kinetic" energy and those at rest have "potential" energy. 6.PS.3.LP.D
- Identify if an object is in motion or at rest. 6.PS.3.LP.E
- Engage with various objects that are at rest or in motion. 6.PS.3.LP.F

4 An object's motion can be described by its speed and the direction in which it is moving. An object's position can be measured and graphed as a function of time. 6.PS.4

Complexity a

a Explain how speed involves both distance and time. 6.PS.4A

Complexity b

b Identify the speed and direction of a moving object. 6.PS.4B

Complexity c

c Identify factors that affect the speed of an object. 6.PS.4C

Learning Progression

- Match different ramp characteristics to graphs that represent an object's motion. 6.PS.4.LP.A
- Identify how a model must be manipulated to change the speed and direction of an object according to specific requirements (e.g., increase the speed, change the direction of motion and distance to the left). 6.PS.4.LP.B
- Recognize that on a speed graph (showing distance vs. time)a line with represented with a steep slope is an object moving faster than a line represented by a low slope. 6.PS.4.LP.C
- Manipulate the heights and slopes of a ramp to change how fast and how far an object like a ball travels. 6.PS.4.LP.D
- Engage with graphs representing objects moving at high and low speeds. 6.PS.4.LP.E
- Engage with timers when observing movement of objects. 6.PS.4.LP.F
- Engage with models that demonstrate objects moving at different speeds. 6.PS.4.LP.G