Ohio’s Learning Standards – Extended

Science

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Ohio | Department of Education

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Introduction to Ohio's New Learning Standards - Extended: Science

OVERVIEW

In February 2018, the state of Ohio adopted updated Ohio Learning Standards (OLS) for social studies and science. Consequently, Ohio revised the Ohio Learning Standards-Extended (OLS-E) to be aligned with the OLS. The Ohio Department of Education collaborated with teams of educators and experts from around the state to do the work. These committees met multiple times to draft the new extensions. The Department then posted the drafts for public feedback and received hundreds of comments. After the public comment period, the committees considered the comments and implemented suggestions into the final version.

The OLS-E are specific statements of knowledge and skills linked to the expectations in the OLS. The purpose of the extensions is to build a bridge that provides grade level access for students with the most significant cognitive disabilities to the content of the OLS.

The Department developed the OLS-E specifically for students who qualify for and take the Alternate Assessment for Students with Significant Cognitive Disabilities (AASCD). These extensions do not replace the OLS for Science, they are aligned to them. Teachers may use the standards and extensions as a skill or knowledge progression when designing instruction and assessments. Using a standards progression provides flexible access from varied entry points and allows learners with the most significant cognitive disabilities to grow knowledge and skill across a modified curriculum that is linked to the grade-level standards. Educators can then use the link to grade-level targets or outcomes as comparison data in present levels of performance on an IEP. Because instruction and assessment should always consider the full range of extended standards and the links to the grade-level targets and outcomes, the OLS-E development committee designed this document so that the reader can reference the OLS and the extensions on the same page to easily see the progression.

While educators should use the extended standards to provide content that is directly aligned to the OLS for science, they must also meet each child's individual education needs by incorporating other skills as necessary. Teachers should consider incorporating instruction with individual accommodations or supports students need to access the curriculum as well as non-academic skills needed for student success such as communication, self-determination, fine/gross motor, and social/emotional skills. Daily living and life skills are sometimes the same skills presented in the standards as reading, speaking, listening, writing, and economics skills and should be taught and integrated with the extensions. Educational plans should also include any other additional skills necessary for each child's individual education needs and transition planning goals.

Educators can use the OLS-E to differentiate instruction for a wide range of students by using the extensions as entry points to the OLS, but they must do so with caution. Students who do not take Ohio's AASCD will take the general assessments aligned to the general standards. These extensions can provide entry points into the OLS. However, schools must remember that students who do not participate in the AASCD should transition to and will be assessed using the OLS.

Complexity Levels

The committee extended the Ohio Learning Standards to include three levels from "most complex" to "least complex". The complexity levels are comprised of three targets of varying difficulty aligned to each standard from the OLS. The extensions are codified individually for clear designation. The last letter in the extension code indicates the complexity level: "a" denotes the highest level of complexity, "b" denotes the middle complexity level and "c" denotes the lowest complexity level. In some instances, the committee tiered the verb of the extension to increase or decrease the complexity level. In other

cases, the concept or skill within the OLS is tiered across the three complexity levels. It is important to move from left to right when reading the extensions. To determine where instruction should begin, educators should start with the general standard and then progress down through the complexity levels until finding the optimum starting point. It's important to note that no one should categorize students according to an extension level. Instead, instruction should build skills across the extensions to the highest level possible based on individual student strengths which may vary across standards. Ideally, when educators apply these extensions within each grade level one should see instruction occurring at all ranges of complexity. When citing standards for lessons and/or assessment design, educators should include the full complexity range, including the general standard. Citing standards in this way acknowledges a range of entry points and a range of learning progress.

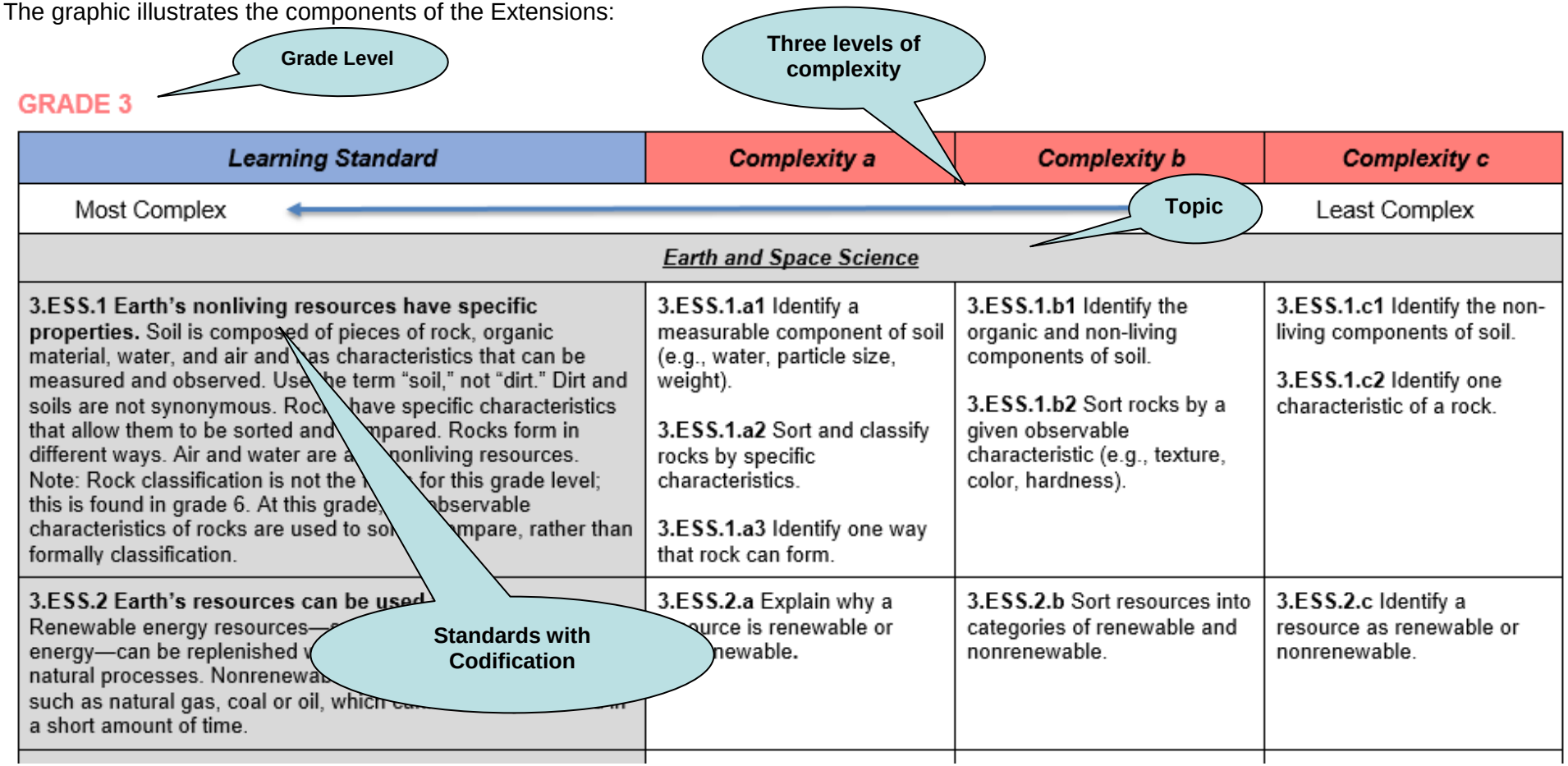
*Complex and advanced learning standards in Ohio's New Learning Standards are not included in the extended standards.

Accessibility

The OLS-E do not specify individual accommodations or supports that may be necessary for students to access the curriculum. Teachers should consider the unique learning needs of each student and employ the Individualized Education Plan (IEP) designated supports and services when designing lessons. It is imperative that teachers provide specially designed instruction, assistive technology, accommodations and other supports needed to ensure full access to learning opportunities so that students can demonstrate their knowledge and skills.

Navigating the Ohio Learning Standard Extensions

The graphic illustrates the components of the Extensions:



Learning Standard	Complexity a	Complexity b	Complexity c
Most Complex			Least Complex
	Earth and Space Science		
3.ESS.1 Earth's nonliving resources have specific properties. 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 soils are not synonymous. 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, observable characteristics of rocks are used to sort and compare, rather than formally classification.	**3.ESS.1.a1** Identify a measurable component of soil (e.g., water, particle size, weight). **3.ESS.1.a2** Sort and classify rocks by specific characteristics. **3.ESS.1.a3** Identify one way that rock can form.	**3.ESS.1.b1** Identify the organic and non-living components of soil. **3.ESS.1.b2** Sort rocks by a given observable characteristic (e.g., texture, color, hardness).	**3.ESS.1.c1** Identify the non-living components of soil. **3.ESS.1.c2** Identify one characteristic of a rock.
3.ESS.2 Earth's resources can be used Renewable energy resources—such as energy—can be replenished within natural processes. Nonrenewable such as natural gas, coal or oil, which can in a short amount of time.	**3.ESS.2.a** Explain why a resource is renewable or nonrenewable.	**3.ESS.2.b** Sort resources into categories of renewable and nonrenewable.	**3.ESS.2.c** Identify a resource as renewable or nonrenewable.

Extended Standards for Science, Grades 3 – 8

GRADE 3

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
	Earth and Space Science		
3.ESS.1 Earth's nonliving resources have specific properties. 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 soils are not synonymous. 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 are used to sort or compare, rather than formally classification.	**3.ESS.1.a1** Identify a measurable component of soil (e.g., water, particle size, weight). **3.ESS.1.a2** Sort and classify rocks by specific characteristics. **3.ESS.1.a3** Identify one way that rock can form.	**3.ESS.1.b1** Identify the organic and non-living components of soil. **3.ESS.1.b2** Sort rocks by a given observable characteristic (e.g., texture, color, hardness).	**3.ESS.1.c1** Identify the non-living components of soil. **3.ESS.1.c2** Identify one characteristic of a rock.
3.ESS.2 Earth's resources can be used for energy. Renewable energy resources—such as wind, water or solar energy—can be replenished within a short amount of time by natural processes. Nonrenewable energy is a finite resource, such as natural gas, coal or oil, which cannot be replenished in a short amount of time.	**3.ESS.2.a** Explain why a resource is renewable or nonrenewable**.**	**3.ESS.2.b** Sort resources into categories of renewable and nonrenewable.	**3.ESS.2.c** Identify a resource as renewable or nonrenewable.
3.ESS.3 Some of Earth's resources are limited. 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.	**3.ESS.3.a** Explain a way to conserve a given resource.	**3.ESS.3.b** Match a limited resource to a means to conserve it (e.g., fresh water can be conserved by taking short showers).	**3.ESS.3.c** Identify a way to conserve a given resource.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Life Science			
3.LS.1 Offspring resemble their parents and each other. Individual organisms inherit many traits from their parents indicating a reliable way to transfer information from one generation to the next. Some behavioral traits are learned through interactions with the environment and are not inherited.	**3.LS.1.a1** Explain why you can expect the offspring to have similar physical traits to the parent. **3.LS.1.a2** Explain why a given trait is learned behavior or an inherited. **3.LS.1.a3** Explain how a change in an environment can affect a behavior of an organism in that environment.	**3.LS.1.b1** Identify similar inherited physical traits that can be observed in a parent and offspring. **3.LS.1.b2** Sort a set of given traits as either learned behaviors or inherited physical traits. **3.LS.1.b3** Match an environmental change to a potential behavioral change of an organism.	**3.LS.1.c1** Identify one observable way an offspring resembles a parent. **3.LS.c2** Identify a trait as either a learned behavior or an inherited physical trait. **3.LS.1.c3** Given an environmental change, identify a behavioral change that would help an organism in that environment.
3.LS.2 Individuals of the same kind of organism differ in their inherited traits. These differences give some individuals an advantage in surviving and/or reproducing. Plants and animals have physical features that are associated with the environments where they live. 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.LS.2.a1** Describe how a variation in a physical or behavioral trait would give an individual an advantage. **3.LS.2.a2** Explain why one physical or behavioral trait within a species would be an advantage in a given environment.	**3.LS.2.b1** Identify variations in physical and behavioral traits within the same species. **3.LS.2.b2** When given an environment and given variations of the same organism, select the one variation that will be an advantage to the organism.	**3.LS.2.c1** Identify that there is variation within the same species. **3.LS.2.c2** Identify traits in an individual organism that would help it be successful in its environment.
3.LS.3 Plants and animals have life cycles that are part of their adaptations for survival in their natural environments. 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.	**3.LS.3.a** Describe how a specific environment supports a specific organism's life cycle (e.g., flowering plants do not flower outside in the winter).	**3.LS.3.b** Match an organism's life cycle to an environment.	**3.LS.3.c** Identify the main stages of an organism's life cycle: birth, growth, adulthood, reproduction, and death.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
	Physical Science		
3.PS.1 All objects and substances in the natural world are composed of matter. Matter takes up space and has mass. Differentiating between mass and weight is not necessary at this grade level.	**3.PS.1.a** Using non-traditional measurements, measure the volume of different objects, and using metric or non-traditional measurements, measure the mass of different objects.	**3.PS.1.b** Using non-traditional measurement, units (e.g., paper clips, cubes), identify the volume or mass of an object.	**3.PS.1.c** Identify one or more characteristics of matter (takes up space and has mass).
3.PS.2 Matter exists in different states, each of which has different properties. The most recognizable states of matter are solids, liquids, and gases. Shape and compressibility are properties that can distinguish between the states of matter. One way to change matter from one state to another is by heating or cooling.	**3.PS.2.a1** Match a given property to its state of matter. **3.PS.2.a2** Given a substance, predict how it will change if heated or cooled.	**3.PS.2.b1** Identify the possible states of matter for a given property (e.g., gas or liquids can take the shape of a container). **3.PS.2.b2** Identify how the state of matter will change if a substance is heated or cooled.	**3.PS.2.c1** Identify an object as being either a solid, a liquid, or a gas. **3.PS.2.c2** Identify if something is being heated or cooled.
3.PS.3 Heat, electrical energy, light, sound, and magnetic energy are forms of energy. 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.	**3.PS.3.a1** Explain the difference between two or more types of energy. **3.PS.3.a2** Design a simple experiment that would show a form of energy making a change.	**3.PS.3.b1** Identify multiple forms of energy. **3.PS.3.b2** Match a type of energy to an example of change (e.g., light bulb on, light bulb off - electrical energy).	**3.PS.3.c1** Identify a form of energy. **3.PS.3.c2** Identify a change in energy (e.g., a light turned on after being plugged in).

GRADE 4

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
	Earth and Space Science		
4.ESS.1 Earth's surface has specific characteristics and landforms that can be identified. About 70 percent of Earth's surface is covered with water, and most of that is the ocean. Only a small portion of Earth's water is freshwater, which is found in rivers, lakes, groundwater, and glaciers. Earth's surface can change due to erosion and deposition of soil, rock, or sediment. Catastrophic events such as flooding, volcanic activity, and earthquakes can also create landforms.	**4.ESS.1.a1** Explain how a surface process has changed an area of the Earth's surface. **4.ESS.1.a2** Using a visual or actual field observation, describe specific landform features.	**4.ESS.1.b1** Match a surface process to the landform that it creates (e.g., volcanic activity can create an island). **4.ESS.1.b2** Match the names of landforms to a picture or description.	**4.ESS.1.c1** Identify a characteristic of the Earth's surface. **4.ESS.1.c2** Identify Earth's landforms.
4.ESS.2 The surface of Earth changes due to weathering. 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.	**4.ESS.2.a** Describe ways that weathering (e.g., freezing/thawing, plant growth, flooding, wind, acid rain, etc.) affects landforms.	**4.ESS.2.b** Match a change in a landform caused by weathering to the type of weathering that occurred (e.g., a crack getting larger from water freezing).	**4.ESS.2.c** Identify an effect of weathering.
4.ESS.3 The surface of Earth changes due to erosion and deposition. 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.	**4.ESS.3.a** Predict the effect on a landform when a natural force is introduced (e.g., erosion and deposition).	**4.ESS.3.b** Identify a change in a landform that was caused by erosion or deposition (e.g., formation of valleys, sand dunes, etc.).	**4.ESS.3.c** Identify natural forces that can move rock and soil (e.g., erosion and deposition).

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ⟷			Least Complex
Life Science			
4.LS.1 Changes in an organism's environment are sometimes beneficial to its survival and sometimes harmful. 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. 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.	**4.LS.a1** Given an ecosystem, describe changes that could be harmful or beneficial to an organism in that ecosystem. **4.LS.a2** Describe environmental changes that are sudden or gradual.	**4.LS.1.b1** Within a given ecosystem, identify which organisms would benefit or which organisms would be harmed after a change occurs. **4.LS.1.b2** Match environmental changes as sudden or gradual.	**4.LS.1.c1** Identify that a given change in an ecosystem can be beneficial or harmful to a specific organism in that ecosystem. **4.LS.1.c2** Identify environmental changes as sudden or gradual.
4.LS.2 Fossils can be compared to one another and to present-day organisms according to their similarities and differences. The concept of biodiversity is expanded to include different classification schemes based upon shared internal and external characteristics of organisms. Most species that have lived on Earth are extinct. Fossils provide a point of comparison between the types of organisms that lived long ago and those existing today.	**4.LS.2.a1** Explain the pre-historic environment that a fossil organism may have lived in and compare that to the present day environment where the fossil was found. **4.LS.2.a2** Given a set of fossils and present day organisms, explain why some fossil organisms do not have a present day representative.	**4.LS.2.b1** Given a fossil organism, identify the pre-historic environment it would have lived in, and compare that to the present day environment where the fossil was found. **4.LS.2.b2** Given a set of fossils and present day organisms, sort them by similar characteristics.	**4.LS.2.c1** Match a fossil to an ecosystem that it would have lived in**.** **4.LS.2.c2** Match a fossil with a representation of the organism.
Physical Science			
4.PS.1 When objects break into smaller pieces, dissolve, or change state, the total amount of matter is conserved. 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.	**4.PS.1.a** Make a prediction about what will happen to the mass of an object after a change of state occurs.	**4.PS.1.b** When given multiple objects, make changes to their physical state and measure the mass before and after the changes are made to determine conservation of mass.	**4.PS.1.c** Recognize that the mass of a given object remains the same before and after a physical change is made to that object.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ⟷			Least Complex
4.PS.2 Energy can be transferred from one location to another or can be transformed from one form to another. Energy transfers from hot objects to cold objects as heat, resulting in a temperature change. Electric circuits require a complete loop of conducting materials through which an electrical energy can be transferred. Electrical energy in circuits can be transformed to other forms of energy, including light, heat, sound, and motion. Electricity and magnetism are closely related.	**4.PS.2.a1** Sort objects by whether or not they transfer energy. **4.PS.2.a2** Describe how one form of energy is transformed to another form.	**4.PS.2.b1** Identify examples of how different types of energy may be transferred or how different types of energy may not be transferred. **4.PS.2.b2** Demonstrate how energy can be transformed.	**4.PS.2.c1** Identify an example of energy transfer (e.g., the handle of a pot on the stove may become hot to the touch, showing transfer of thermal energy from the pot to your hand). **4.PS.2.c2** Identify an example of how a type of energy can transform to another type of energy (e.g., electricity transforms to light energy when a lamp is turned on).

GRADE 5

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Earth and Space Science			
5.ESS.1 The solar system includes the sun and all celestial bodies that orbit the sun. Each planet in the solar system has unique characteristics. The distance from the sun, size, composition, and movement of each planet are unique. Planets revolve around the sun in elliptical orbits. Some of the planets have moons and/or debris that orbit them. Comets, asteroids, dwarf planets, and meteoroids also orbit the sun.	**5.ESS.1.a1** Compare different celestial bodies including composition and size. **5.ESS.1.a2** Explain what would happen to orbits if there was no gravitational force. **5.ESS.1.a3** Compare the composition and sizes of the major planets.	**5.ESS.1.b1** Match a set of descriptions to the corresponding set of celestial bodies. **5.ESS.1.b2** Identify examples of celestial objects that are being affected by a gravitational force resulting in an orbit. **5.ESS.1.b3** Match the composition of the major planets as related to their position in the solar system (e.g., rocky planets are close to the sun, gas giants are further from sun).	**5.ESS.1.c1** Identify celestial bodies in our solar system. **5.ESS.1.c2** Identify a representation of an orbital path within our solar system. **5.ESS.1.c3** Identify Earth's place in our solar system.
5.ESS.2: The sun is one of many stars that exist in the universe. 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.	**5.ESS.2.a1** Compare the Sun to stars beyond our solar system. **5.ESS.2.a2** Explain how a constellation can be used for navigation. **5.ESS.2.a3** Compare the characteristics of different stars (e.g., size, brightness, age).	**5.ESS.2.b1** Explain the relationship of our Sun to our solar system and to our universe. **5.ESS.2.b2** Explain that the pattern of stars within a constellation stays constant. **5.ESS.2.b3** Describe the characteristics of the Sun that make it a star.	**5.ESS.2.c1** Identify that the Sun is a star and that the Sun is the only star in our solar system. **5.ESS.2.c2** Identify a visual representation of a constellation. **5.ESS.2.c3** Identify the characteristics of the Sun that make it a star.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
5.ESS.3 Most of the cycles and patterns of motion between the Earth and sun are predictable. 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.	**5.ESS.3.a** Explain the difference between Earth's revolution and Earth's rotation.	**5.ESS.3.b** Sort patterns into those that result from Earth's revolution and those that result from Earth's rotation.	**5.ESS.3.c** Identify patterns that result from Earth's revolution and rotation.
Life Science			
5.LS.1 Organisms perform a variety of roles in an ecosystem. Populations of organisms can be categorized by how they acquire energy. Food webs can be used to identify the relationships among producers, consumers, and decomposers in an ecosystem.	**5.LS.1.a1** Explain the role of a producer, consumer, or decomposer in a food web**.** **5.LS.1.a2** Trace the flow of energy through a food web.	**5.LS.1.b1** Given a set of organisms, match them to their roles in a food web. **5.LS.b2** Sequence components of a food web.	**5.LS.1c1** Identify a producer, consumer, and decomposer. **5.LS.1.c2** Sequence components of a simple food chain**.**
5.LS.2 All of the processes that take place within organisms require energy. For most ecosystems, the major source of energy is sunlight. Energy entering ecosystems as sunlight is transformed by producers 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.	**5.LS.2.a** Use a food web to explain how an organism can get a constant flow of energy.	**5.LS.2.b** Identify that producers transform sun energy into energy it uses to grow and that consumers get their energy to grow by a transfer of energy from another organism.	**5.LS.2.c** Identify ways that organisms can obtain energy.
Physical Science			
5.PS.1 The amount of change in movement of an object is based on the mass* of the object and the amount of force exerted. 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). Any change in speed 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.	**5.PS.1.a** Given a change in mass or force, explain the effect that change will have on the speed of an object.	**5.PS.1.b** Identify a change that can be made to an object to change its speed (e.g., add more mass, use more force).	**5.PS.1.c** Demonstrate how the speed of an object can be changed by adding mass or exerting a force.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
5.PS.2 Light and sound are forms of energy that behave in predictable ways. Light travels and maintains its direction until it interacts with an object or moves from one medium to another and then it can be reflected, refracted, or absorbed. Sound is produced by vibrating objects and requires a medium through which to travel. The rate of vibration is related to the pitch of the sound. Note: At this grade level, the discussion of light and sound should be based on observable behavior. Waves are introduced at the middle school level.	**5.PS.2.a1** Given an object, explain how it would change the path of light (e.g., a mirror will reflect light, a dark cloth will absorb light, etc.). **5.PS.2.a2** Given an object, explain how you could make a change that would change its pitch.	**5.PS.2.b1** Identify objects that will change the path of light. **5.PS.2.b2** Identify properties that affect pitch (e.g., a large bell makes a deeper sound than a smaller bell).	**5.PS.2.c1** Demonstrate the observable characteristics of how light travels. **5.PS.2.c2** Match objects/tools/instruments to examples of sounds of various pitch.

GRADE 6

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Earth and Space Science			
6.ESS.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.1a** Sort minerals by properties (e.g., color, density, luster).	**6.ESS.1b** Identify a common rock-forming mineral.	**6.ESS.1c** Identify an object as a mineral or a rock.
6.ESS.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.2a** Classify igneous, metamorphic, or sedimentary rocks.	**6.ESS.2b** Identify the properties of igneous rocks (e.g., granite, basalt), metamorphic rocks (e.g., marble, quartzite), or sedimentary rocks (layers).	**6.ESS.2c** Sort rocks by textual characteristics.
6.ESS.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.3a** Identify how each rock type is formed (e.g., pressure, erosion, cooling, melting, compaction, cementation, heat, and/or weathering).	**6.ESS.3b** Compare parts of the rock cycle (e.g., some rocks form from pressure while some form from lava).	**6.ESS.3c** Identify a component of a rock cycle.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
6.ESS.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.4a** Identify the different properties of each layer (horizon) of soil.	**6.ESS.4b** Recognize that soils can have different properties (e.g., texture, color, composition, permeability, porosity).	**6.ESS.4c** Identify the components of soil (e.g., small pieces of rock and living and decaying organisms).
6.ESS.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.5a** Classify specific rocks, minerals, or soils into their general use (agriculture, transportation, construction, domestic, energy, and technology).	**6.ESS.5b** Identify a common use for rocks, minerals, or soils.	**6.ESS.5c** Identify that rocks, minerals, and soils are nonrenewable resources that are used by people in many ways.
Life Science			
6.LS.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.1a** Explain how cells are organized to form multicellular organisms (cells make up tissue such as muscle).	**6.LS.1b** Recognize that organisms can be made of only one cell or can be made of many cells.	**6.LS.1c** Recognize that living things are made of cells.
6.LS.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.2a** Describe that every cell contains information about traits that can be passed to the next generation through reproduction or cell division.	**6.LS.2b** Identify that cells multiply for growth, repair, and reproduction.	**6.LS.2c** Identify that cells can multiply to produce more cells.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
6.LS.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.3a** Explain that each cell part has a distinct structure and function that is critical to life.	**6.LS.3b** Match an organelle to its function.	**6.LS.3c** Identify an organelle in a cell.
6.LS.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.4a** Compare and contrast different types of cells and tissues.	**6.LS.4b** Identify that cells make up tissues, which make up organs.	**6.LS.4c** Identify a plant cell and an animal cell.
Physical Science			
6.PS.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.1a** Compare objects based on the properties of matter (e.g., mass, volume, density).	**6.PS.1b** Identify a property of matter that can be measured (e.g., mass, volume, density).	**6.PS.1c** Identify that matter is made of atoms, which are too small to be seen.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
6.PS.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.2a** 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.2b** Identify that heating an object causes the particles of the object to speed up.	**6.PS.2c** Recognize that heating an object can make it change from a solid to a liquid to a gas.
6.PS.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.3a** Identify when an object has the greatest/least kinetic and/or potential energy.	**6.PS.3b** 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.3c** Identify examples of potential or kinetic energy in a model or visual representation.
6.PS.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.4a** Explain how speed involves both distance and time.	**6.PS.4b** Identify the speed and direction of a moving object.	**6.PS.4c** Identify factors that affect the speed of an object.

GRADE 7

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Earth and Space Science			
7.ESS.1 The hydrologic cycle illustrates the changing states of water as it moves through the lithosphere, biosphere, hydrosphere, and atmosphere. Thermal energy is transferred as water changes state throughout the cycle. The cycling of water in the atmosphere is an important part of weather patterns on Earth. The rate at which water flows through soil and rock is dependent upon the porosity and permeability of the soil or rock.	**7.ESS.1a** Build a hydrologic cycle showing evaporation, condensation, precipitation, and surface run-off.	**7.ESS.1b** Identify evaporation, condensation, and precipitation.	**7.ESS.1c** Identify types of precipitation.
7.ESS.2 Thermal-energy transfers in the ocean and the atmosphere contribute to the formation of currents, which influence global climate patterns. The sun is the major source of energy for wind, air, and ocean currents and the hydrologic cycle. As thermal energy transfers occur in the atmosphere and ocean, currents form. Large bodies of water can influence weather and climate. The jet stream is an example of an atmospheric current and the Gulf Stream is an example of an oceanic current. Ocean currents are influenced by factors other than thermal energy, such as water density, mineral content (such as salinity), ocean floor topography, and Earth's rotation. All of these factors delineate global climate patterns on Earth.	**7.ESS.2a** Describe how thermal energy affects ocean and atmospheric currents.	**7.ESS.2b** Identify that air and water move due to currents.	**7.ESS.2c** Identify how temperature causes air and water to move.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ⟵			⟶ Least Complex
7.ESS.3 The atmosphere has different properties at different elevations and contains a mixture of gases that cycle through the lithosphere, biosphere, hydrosphere, and atmosphere. The atmosphere is held to Earth by the force of gravity. There are defined layers of the atmosphere that have specific properties, such as temperature, chemical composition, and physical characteristics. Gases in the atmosphere include nitrogen, oxygen, water vapor, carbon dioxide, and other trace gases. Biogeochemical cycles illustrate the movement of specific elements or molecules (such as carbon or nitrogen) through the lithosphere, biosphere, hydrosphere, and atmosphere. Note: The emphasis is on why the atmosphere has defined layers, not on naming the layers.	**7.ESS.3a** Recognize that natural events and human activities can cause changes in the Earth's atmosphere (e.g., by adding pollution to the atmosphere or depleting valuable gases).	**7.ESS.3b** Identify a gas that is naturally present in our atmosphere (e.g., oxygen, nitrogen).	**7.ESS.3c** Identify the atmosphere as the air around us.
7.ESS.4 The relative patterns of motion and positions of Earth, moon, and sun cause solar and lunar eclipses, tides, and phases of the moon. The moon's orbit and its change of position relative to Earth and sun result in different parts of the moon being visible from Earth (phases of the moon). A solar eclipse is when Earth moves into the shadow of the moon (during a new moon). A lunar eclipse is when the moon moves into the shadow of Earth (during a full moon). Gravitational force between Earth and the moon causes daily oceanic tides. When the gravitational forces from the sun and moon align (at new and full moons), spring tides occur. When the gravitational forces of the sun and moon are perpendicular (at first and last quarter moons), neap tides occur.	**7.ESS.4a** Show how the positions of the Earth, the moon, and the sun cause tides and phases of the moon.	**7.ESS.4b** Recognize different stages in the lunar cycle (e.g., full moon, new moon).	**7.ESS.4c** Recognize that the moon orbits around the Earth.
7.ESS.5 The relative positions of Earth and the sun cause patterns we call seasons. Earth's axis is tilted at an angle of 23.5°. This tilt, along with Earth's revolution around the sun, affects the amount of direct sunlight that the Earth receives in a single day and throughout the year. The average daily temperature is related to the amount of direct sunlight received.	**7.ESS.5a** Compare the amount of direct sunlight on Earth as it tilts toward or away from the sun, and show how that relates to summer and winter season.	**7.ESS.5b** Model the tilt of the Earth towards or away from the sun.	**7.ESS.5c** Recognize that the Earth is tilted.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Life Science			
7.LS.1 Energy flows and matter is transferred continuously from one organism to another and between organisms and their physical environments. Plants use the energy in light to make sugars out of carbon dioxide and water (photosynthesis). These materials can be used or stored for later use. Organisms that eat plants break down plant structures to release the energy and produce the materials needed to survive. The organism may then be consumed by other organisms for materials and energy. Energy can transform from one form to another in living things. Animals get energy from oxidizing food, releasing some of its energy as heat. The total amount of matter and energy remains constant, even though its form and location change. Note: Chemical reactions in terms of subatomic structures of atoms are not appropriate at this grade level. Chemical reactions are presented as the rearrangement of atoms in molecules.	**7.LS.1a** Demonstrate the flow of energy from plants to consumers (e.g., energy pyramid).	**7.LS.1b** Trace the path of oxygen between plants and animals (e.g., plants create oxygen during photosynthesis and animals breathe in oxygen to produce carbon dioxide).	**7.LS.1c** Identify that plants use light energy to make their own food (photosynthesis) and humans and animals consume other organisms to get energy.
7.LS.2 In any particular biome, the number, growth, and survival of organisms and populations depend on biotic and abiotic factors. The variety of physical (abiotic) conditions that exists on Earth gives rise to diverse environments (biomes) and allows for the existence of a wide variety of organisms (biodiversity). Biomes are regional ecosystems characterized by distinct types of organisms that have developed under specific soil and climatic conditions. Ecosystems are dynamic in nature; the number and types of species fluctuate over time. Disruptions, deliberate or inadvertent, to the physical (abiotic) or biological (biotic) components of an ecosystem impact the composition of an ecosystem.	**7.LS.2a** Provide examples of how a plant/animal population changes in relation to the availability of certain resources and characteristics of a given biome.	**7.LS.2b** Match a given ecosystem/biome with its characteristics.	**7.LS.2c** Identify an ecosystem or a biome.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Physical Science			
7.PS.1 Elements can be organized by properties. Elements can be classified as metals, non-metals, and metalloids, and can be organized by similar properties such as color, solubility, hardness, density, conductivity, melting point and boiling point, viscosity, and malleability. Note 1: This is the conceptual introduction of the Periodic Table of Elements and should be limited to classifications based on observable properties; it should not include the names of the families.	**7.PS.1a** Sort common elements found on the periodic table by properties (e.g., metals, nonmetals, gases).	**7.PS.1b** Identify an element on the Periodic Table of Elements based on its properties (e.g., metal, non-metal, and gases).	**7.PS.1c** Identify common elements (e.g., oxygen, hydrogen, iron, helium, calcium, carbon) found on the Periodic Table of Elements.
7.PS.2 Matter can be separated or changed, but in a closed system, the number and types of atoms remains constant. When substances interact and form new substances, the properties of the new substances may be very different from those of the original substances, but the amount of mass does not change. Physically combining two or more substances forms a mixture, which can be separated through physical processes. Note: Under these standards, classifying specific changes as chemical or physical is not appropriate.	**7.PS.2a** Explain that the mass and number of atoms remains the same after being combined in a mixture or a compound.	**7.PS.2b** Identify at least one difference between a mixture and a compound (e.g., mixtures can be separated by physical processes).	**7.PS.2c** Identify the components of a given mixture.
7.PS.3 Energy can be transformed or transferred but is never lost. When energy is transferred from one system to another, the quantity of energy before transfer equals the quantity of energy after transfer. When energy is transformed from one form to another, the total amount of energy remains the same.	**7.PS.3a** Describe what happens to an object as it transfers energy elsewhere (e.g., toy car slows down going uphill as energy changes from kinetic to potential).	**7.PS.3b** Demonstrate energy transfer by completing a circuit (e.g., switch to activate a mechanical item).	**7.PS.3c** Identify an energy transfer (e.g., electricity to light after a lamp is plugged in).
7.PS.4 Energy can be transferred through a variety of ways. Mechanical energy can be transferred when objects push or pull on each other over a distance. Mechanical and electromagnetic waves transfer energy when they interact with matter. Thermal energy can be transferred through radiation, convection and conduction. An electrical circuit transfers energy from a source to a device. Note 1: Energy transfers should be experiential and observable at this grade level.	**7.PS.4a** Describe how some energy is transferred in waves (e.g., water, heat, light).	**7.PS.4b** Identify ways energy can be transferred (e.g., push and pull, heat from hot to cold objects, light from the sun, electricity through wires, etc.).	**7.PS.4c** Transfer energy in an object by a force (e.g., push or pull).

GRADE 8

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Earth and Space Science			
8.ESS.1 The composition and properties of Earth's interior are identified by the behavior of seismic waves. The refraction and reflection of seismic waves as they move through one type of material to another is used to differentiate the layers of Earth's interior. Earth has a core, a mantle, and a crust. Impacts during planetary formation generated heat. These impacts converted gravitational potential energy to heat. Earth's core is also able to generate its own thermal energy because of decaying atoms. This continuously releases thermal energy. Thermal energy generated from Earth's core drives convection currents in the asthenosphere. Note 1: Radioactive decay is not the focus; this will be discussed in physical science and chemistry. Note 2: At this grade level, analyzing seismograms (e.g., amplitude and lag time) and reading a travel time curve are not the focus. At this grade, the properties of seismic waves should be addressed.	**8.ESS.1a** Match properties to the correct layer of Earth.	**8.ESS.1b** Identify Earth's core, mantle, outer core, and inner core.	**8.ESS.1c** Recognize that the inside of the Earth is made up of distinct layers.
8.ESS.2 Earth's lithosphere consists of major and minor tectonic plates that move relative to each other. Historical data and observations such as fossil distribution, paleomagnetism, continental drift, and sea-floor spreading contributed to the theory of plate tectonics. The rigid tectonic plates move with the molten rock and magma beneath them in the upper mantle. Convection currents in the asthenosphere cause the movement of the lithospheric plates. The energy that forms convection currents comes from deep within the Earth. There are three main types of plate boundaries: divergent, convergent, and transform. Each type of boundary results in specific motion and causes events (such as earthquakes or volcanic activity) or features (such as mountains or trenches) that are indicative of the type of boundary.	**8.ESS.2a** Identify the different types of plate boundaries (e.g., convergent, divergent, transform).	**8.ESS.2b** Recognize that the crust is broken into plates that move.	**8.ESS.2c** Identify the layer of Earth that we live on as the crust.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
8.ESS.3 A combination of constructive and destructive geologic processes formed Earth's surface. Earth's surface is formed from a variety of different geologic processes, including but not limited to plate tectonics.	**8.ESS.3a** Categorize geologic processes as constructive (e.g., depositions, volcanoes spreading new layers) or destructive (e.g., flooding, volcanoes forming craters).	**8.ESS.3b** Identify destructive and constructive processes that change Earth's surface.	**8.ESS.3c** Identify a destructive process that changes Earth's surface.
8.ESS.4 Evidence of the dynamic changes of Earth's surface through time is found in the geologic record. Earth is approximately 4.6 billion years old. Earth history is based on observations of the geologic record and the understanding that processes observed at present day are similar to those that occurred in the past (uniformitarianism). There are different methods to determine relative and absolute age of some rock layers in the geologic record. Within a sequence of undisturbed sedimentary rocks, the oldest rocks are at the bottom (superposition). The geologic record can help identify past environmental and climate conditions.	**8.ESS.4a** Explain how fossils indicate Earth's history and environment changes.	**8.ESS.4b** Explain that fossils are millions of years old.	**8.ESS.4c** Identify that humans can study Earth's past by looking at layers of rocks and fossils.
Life Science			
8.LS.1 Diversity of species, a result of variation of traits, occurs through the process of evolution and extinction over many generations. Fossils provide important evidence of how life and environmental conditions have changed. Changes in environmental conditions can affect how beneficial a trait will be for the survival and reproductive success of an organism or an entire species. Throughout Earth's history, extinction of a species has occurred when the environment changes and the individual organisms of that species do not have the traits necessary to survive and reproduce in the changed environment. Most species (approximately 99 percent) that have lived on Earth are now extinct. Note: Population genetics and the ability to use statistical mathematics to predict changes in a gene pool are reserved for high school biology.	**8.LS.1a** Explain how fossils indicate how traits have changed over Earth's history.	**8.LS.1b** Identify how a trait could be helpful or harmful to the animal's survival after a change in an environmental condition.	**8.LS.1c** Explore animal traits and how they are useful for survival.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
8.LS.2 Every organism alive today comes from a long line of ancestors who reproduced successfully every generation. Reproduction is the transfer of genetic information from one generation to the next. It can occur with mixing of genes from two individuals (sexual reproduction). It can occur with the transfer of genes from one individual to the next generation (asexual reproduction). The ability to reproduce defines living things.	**8.LS.2a** Explain a survival benefit of sexual reproduction and a survival benefit of asexual reproduction.	**8.LS.2b** Describe that asexual reproduction results in the exact same traits as the parent and that sexual reproduction results in a mixing of traits from both parents.	**8.LS.2c** Identify the number of parents required for sexual and asexual reproduction.
8.LS.3 The characteristics of an organism are a result of inherited traits received from parent(s). Expression of all traits is determined by genes and environmental factors to varying degrees. Many genes influence more than one trait, and many traits are influenced by more than one gene. During reproduction, genetic information (DNA) is transmitted between parent and offspring. In asexual reproduction, the lone parent contributes DNA to the offspring. In sexual reproduction, both parents contribute DNA to the offspring. Note 1: The focus should be the link between DNA and traits without being explicit about the mechanisms involved. Note 2: The ways in which bacteria reproduce is beyond the scope of this content statement. Note 3: The molecular structure of DNA is not appropriate at this grade level.	**8.LS.3a** Communicate how characteristics are a result of the DNA inherited from parents.	**8.LS.3b** Identify DNA as the source of traits.	**8.LS.3c** Identify an inherited trait.
Physical Science			
8.PS.1 Objects can experience a force due to an external field such as magnetic, electrostatic, or gravitational fields. Magnetic, electrical, and gravitational forces can act at a distance.	**8.PS.1a** Given an interaction, determine what type of force is acting on the object.	**8.PS.1b** Determine the type of interaction between objects (e.g., magnetic, electrostatic, or gravitational fields).	**8.PS.1c** Recognize that an object has experienced a force from an external field (e.g., magnetic, electrostatic, or gravitational fields).

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
8.PS.2 Forces can act to change the motion of objects. The motion of an object is always measured with respect to a reference point. Forces can be added. The net force on an object is the sum of all the forces acting on the object. If there is a nonzero net force acting on an object, its speed and/or direction will change. Kinetic friction and drag are forces that act in a direction opposite the relative motion of objects.	**8.PS.2a** Complete a force diagram.	**8.PS.2b** Predict the result of an application of force in a particular direction.	**8.PS.2c** Show how a force on an object can change its direction.

Extended Standards for Science, High School

PHYSICAL SCIENCE

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Study of Matter			
PS.M.1 Classification of matter o Heterogeneous vs. homogeneous o Properties of matter o States of matter and its changes	**PS.M.1a1** Recognize the difference between a solution and mixture. **PS.M.1a2** Classify objects by their physical properties (e.g., weight, melting and boiling points). **PS.M.1a3** Describe how thermal energy moves (e.g., thermal energy as ice melts).	**PS.M.1b1** Identify a method to separate a mixture. **PS.M.1b2** Describe physical properties of matter (e.g., size, weight, shape, magnetic, melting and boiling points). **PS.M.1b3** Identify heat as thermal energy.	**PS.M.1c1** Create a mixture. **PS.M.1c2** Identify a physical property of matter. **PS.M.1c3** Identify heat as the cause of a phase change**.**
PS.M.2 Atoms o Models of the atom (components) o Ions (cations and anions) o Isotopes	**PS.M.2a** Identify parts of an atom (protons, neutrons, electrons).	**PS.M.2b** Identify a diagram or model of an atom.	**PS.M.2c** Identify that all matter is made of atoms.
PS.M.3 Periodic trends of the elements o Periodic law o Representative groups	**PS.M.3a** Use a Periodic Table to answer questions (e.g., number of outer electrons, groupings).	**PS.M.3b** Recognize that elements are organized on the Periodic Table by their properties, number of protons, and number of outer electrons.	**PS.M.3c** Identify an element(s) on the periodic table.
PS.M.4 Bonding and compounds o Bonding (ionic and covalent) o Nomenclature	**PS.M.4a** Recognize that atoms can bond ionically or covalently.	**PS.M.4b** Recognize that atoms can bond (interact).	**PS.M.4c** Identify a chemical compound.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Energy and Waves			
PS.EW.1 Conservation of energy o Quantifying kinetic energy o Quantifying gravitational potential energy	**PS.EW.1a** Describe the requirement(s) to change an object's energy from kinetic to potential (or potential to kinetic).	**PS.EW.1b** When a given a situation, identify if the change in energy was to kinetic or potential energy.	**PS.EW.1c** Identify a situation that demonstrates a change to the kinetic or the potential energy of an object.
PS.EW.2 Transfer and transformation of energy (including work)	**PS.EW.2a** Describe how heat energy can be transferred (e.g., radiation, conduction, convection).	**PS.EW.2b** Identify the transformation of energy in a given scenario (e.g., light bulb).	**PS.EW.2c** Identify that energy can be transferred (e.g., electricity is transferred to light energy in a light bulb).
PS.EW.4 Thermal energy	**PS.EW.4a1** Describe how thermal energy moves from a warmer object to a cooler object. **PS.EW.4a2** Describe how different colors of objects absorb thermal energy differently.	**PS.EW.4b1** Identify heat as thermal energy **PS.EW.4b2** Explore how thermal energy can be absorbed by objects.	**PS.EW.4c1** Identify heat as the cause of a phase change. **PS.EW.4c2** Follow the path of thermal energy transfer in a diagram.
Forces and Motion			
PS.FM.1 Motion o Introduction to one-dimensional vectors o Displacement, velocity (constant, average and instantaneous) and acceleration. o Interpreting position vs. time and velocity vs. time graphs	**PS.FM.1a** Describe the motion of an object given its placement on a graph (position vs. time graph).	**PS.FM.1b** Identify the force (balanced or an unbalanced force) of a moving object.	**PS.FM.1c** Apply an unbalanced force to an object to change its motion (e.g., accelerate it, stop it, start it).

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
PS.FM.2 Forces o Force diagrams o Types of forces (gravity, friction, normal, tension) o Field model for forces at a distance	**PS.FM.2a1** Create a force diagram by indicating the location and direction of the normal force. **PS.FM.2a2** Organize the surface types from "causes the most friction" (most difficult to push) to "causes the least amount of friction" (easiest to push).	**PS.FM.2b1** Label forces and/or directions of forces on a force diagram. **PS.FM.2b2** Investigate friction and normal force as it relates to moving an object (sliding furniture over different types of flooring).	**PS.FM.2c1** Identify a force on an object in a force diagram. **PS.FM.2c2** Recognize that diverse surface types cause friction differently.
PS.FM.3 Dynamics (how forces affect motion) o Objects at rest o Objects moving with constant velocity o Accelerating objects	**PS.FM.3a** Describe a motion of an object given its position vs. time graph.	**PS.FM.3b** Apply an unbalanced force to an object to change its motion (e.g., accelerate it, stop it, start it).	**PS.FM.3c** Identify an unbalanced force.
The Universe			
PS.U.1 History of the universe	**PS.U.1a** Create a model that shows how the universe is expanding (e.g., blowing up a balloon).	**PS.U.1b** Identify a model that illustrates the Big Bang theory.	**PS.U.1c** Recognize that the universe is expanding.
PS.U.2 Galaxies	**PS.U.2a** Classify a galaxy based on its shape (e.g., spiral, barred-spiral, elliptical, irregular).	**PS.U.2b** Match two galaxies of the same type (e.g., spiral, elliptical).	**PS.U.2c** Recognize that many stars make up a galaxy.
PS.U.3 Stars o Formation; stages of evolution o Fusion in stars	**PS.U.3a** Match a star of a specific relative mass (e.g., low, medium, high) with its life cycle.	**PS.U.3b** Identify "mass" as the property that determines the life cycle of a star.	**PS.U.3c** Recognize that stars form from clouds of gas.

BIOLOGY

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
	Heredity		
B.H.1 Cellular Genetics	**B.H.1a**.Describe that different genes code for proteins that determine different traits.	**B.H.1b** Communicate that genes code for specific traits (e.g., eye color, hair color).	**B.H.1c** Recognize that genes are made up of DNA.
B.H.2 Structure and Function of DNA in Cells	**B.H.2a** Recognize that changing the segments of DNA molecules can alter genes.	**B.H.2b** Recognize that genes are made up of DNA, so changing the segments of DNA can alter genes.	**B.H.2c** When given a representation of individuals from the same parents, identify variations in physical traits.
B.H.3 Genetic Mechanisms and Inheritance	**B.H.3a** Predict the possible phenotypes of an offspring when given the genotype of the parents (e.g., using a Punnett square).	**B.H.3b** Recognize that genes combine during sexual reproduction which causes the traits of offspring to not be exact replicas of either parent.	**B.H.3c** Identify X and Y as female and male chromosomes.
B.H.4 Mutations	**B.H.4a** Describe how some mutations can be helpful and some can be harmful to organisms.	**B.H.4b** Recognize that genes can be altered and that those changed genes may then be passed to offspring.	**B.H.4c** Identify traits that can vary among a population (e.g., eye color, beak shape, etc.).
B.H.5 Modern Genetics	**B.H.5a** Describe specific ways in which scientists have used DNA to help people or the environment (e.g., sweeter fruit, etc.).	**B.H.5b** Identify one reason DNA would be purposely altered by humans.	**B.H.5c** Identify a model of DNA.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Evolution			
B.E.1 Mechanisms o Natural selection o Mutation o Genetic drift o Gene flow (immigration, emigration) o Sexual selection	**B.E.1a** Describe how the presence or absence of traits may help some individuals in a plant or animal population survive and reproduce in their environment (e.g., natural selection).	**B.E.1b** When given a population of animals or plants, identify how variation in traits impacts their ability to survive and reproduce (e.g., populations of endangered species).	**B.E.1c** When given a plant or animal, identify traits that help it to survive in its environment.
B.E.2 Speciation o Biological classification expanded to molecular evidence o Variation of organisms within a species due to population genetics and gene frequency	**B.E.2a** Identify evolutionary changes to a given species that have allowed the species to continue to survive and reproduce.	**B.E.2b** Diagram and describe the evolutionary change in a species.	**B.E.2c** Given a visual representation, identify a species that has changed over the course of many generations (e.g., cladogram diagram).
Diversity and Interdependence of Life			
B.DI.1 Biodiversity o Genetic diversity o Species diversity	**B.DI.1a** Explain how low genetic diversity impacts population size, energy flow or the cycle of matter in a given environment (e.g., Isle Royale Wolf population).	**B.DI.1b** When given two examples of an animal or plant in a given environment, describe which one would have the higher chance to survive or reproduce based on traits (e.g., fur coat thickness, coloration).	**B.DI.1c** When given an environment, recognize a plant or an animal that could survive in that environment.
B.DI.2 Ecosystems o Equilibrium and disequilibrium o Carrying capacity	**B.DI.2a** Identify how both populations will change in a predator/prey relationship, when given a model of an ecosystem that is not in balance (e.g., carrying capacity).	**B.DI.2b** Identify how a human or natural change to an ecosystem results in a change to a predator or prey population.	**B.DI.2c** When given a set of before and after pictures of an ecosystem, (e.g., meadow changed to farm, forest changed to apartment buildings) observe the human caused changes.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
B.DI.3 Loss of Diversity o Climate change o Anthropocene effects o Extinction o Invasive species	**B.DI.3a** Describe how drought, flood, volcanic eruption, habitat loss, or introduction of a new species may affect the diversity in an ecosystem.	**B.DI.3b** Match the cause (e.g., drought, flood, habitat loss, new species) to its effect on organisms in an ecosystem.	**B.DI.3c** Identify factors that can harm organisms in an environment (e.g., drought, floods, volcanic eruption, habitat loss, new species etc.).
Cells			
B.C.1 Cell Structure o Structure, function and interrelatedness of cell organelles o Eukaryotic cells and prokaryotic cells	**B.C.1a** Compare and contrast a prokaryotic cell and a eukaryotic cell.	**B.C.1.b** Match the organelle with the process it helps to execute (e.g., chloroplast, photosynthesis).	**B.C.1.c** Identify the function of the cell membrane.
B.C.2 Cellular Processes o Characteristics of life regulated by cellular processes o Photosynthesis, chemosynthesis, cellular respiration, biosynthesis of macromolecules	**B.C.2a** Describe how the cell needs specific conditions (e.g., temperature, pH) in order to perform its essential functions (e.g., respiration, photosynthesis).	**B.C.2b** Complete a diagram that depicts the process of photosynthesis.	**B.C.2c** Identify photosynthesis and cellular respiration as occurring in a cell.

CHEMISTRY

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Structure and Properties of Matter			
C.PM.1 Atomic structure o Evolution of atomic models/theory o Electrons o Electron configurations	**C.PM.1a** Identify the location of a valence electron and/or how valance electrons affect an atom's interactions.	**C.PM.1b** Identify part(s) of an atom (i.e., protons, neutrons, electrons).	**C.PM.1c** Identify a diagram or model of an atom.
C.PM.2 Periodic table o Properties o Trends	**C.PM.2a** Use the periodic table to answer questions about types of elements and the properties of elements (e.g., number of outer electrons, groupings).	**C.PM.2b** Recognize that elements are organized on the periodic table by their properties, number of protons, and number of outer electrons.	**C.PM.2c** Identify an element(s) on the periodic table.
C.PM.3 Chemical bonding o Ionic o Polar/covalent	**C.PM.3a** Identify the type of chemical bonding that has occurred in a given compound.	**C.PM.3b** Compare the characteristics of an ionic bond and a covalent bond.	**C.PM.3c** Identify bonding as an interaction between atoms.
C.PM.4 Representing compounds o Formula writing o Nomenclature o Models and shapes (Lewis structures, ball-and-stick, molecular geometries)	**C.PM.4a** Represent a chemical compound with a ball-and-stick model or chemical formula.	**C.PM.4b** Build a model of a chemical compound in a variety of ways (e.g., ball-and-stick model).	**C.PM.4c** Identify a compound as two or more elements coming together (combining).
C.PM.5 Quantifying matter	Complex and advanced learning standards in Ohio's New Learning Standards are not included in the extended standards.		

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
C.PM.6 Intermolecular chemical bonding forces of attraction o Types and strengths o Implications for properties of substances ▪ Melting and boiling point ▪ Solubility ▪ Vapor pressure	**C.PM.6a** Explore the properties of water and how they change when water is part of a solution (e.g., salt water solutions).	**C.PM.6b** Perform a task with a fixed amount of water and given amounts of a solute (e.g., powdered drink mix) to observe solutions and supersaturated solutions.	**C.PM.6c** Identify a solution when given a field of choices.
Interactions of Matter			
C.IM.1 Chemical reactions o Types of reactions o Kinetics o Energy o Equilibrium o Acids/bases	**C.IM.1a** Use litmus paper to test and determine the pH of a substance.	**C.IM.1b** Given a pH scale with common ingredients (e.g., orange juice, water, baking soda), determine if they are acid, neutral, or basic.	**C.IM.1b** Identify acid, neutral, and/or base on a pH scale.
C.IM.2 Gas laws o Pressure, volume, and temperature o Ideal gas law	**C.IM.2a** Identify types of measurements used for measuring gases (volume, temperature, and pressure).	**C.IM.2b** Define gas as having no definite shape or volume.	**C.IM.2c** Identify a gas.
C.IM.3 Stoichiometry o Molar calculations o Solutions o Limiting reagents	Complex and advanced learning standards in Ohio's New Learning Standards are not included in the extended standards.		

ENVIRONMENTAL SCIENCE

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Earth Systems: Interconnected Spheres of Earth			
ENV.ES.1 Biosphere o Evolution and adaptation in populations o Biodiversity o Ecosystems (equilibrium, species interactions, stability) o Population dynamics	**ENV.ES.1a** Predict the effects on the biosphere based on changes in a given population.	**ENV.ES.1b** Identify cause and effect of population change(s) within the biosphere.	**ENV.ES.1c** Recognize that the biosphere is occupied by living organisms.
ENV.ES.2 Atmosphere o Atmospheric properties and currents	**ENV.ES.2a** Analyze how greenhouse gases affect atmospheric properties**.**	**ENV.ES.2b** Identify atmospheric properties (e.g., temperature, humidity, density and pressure).	**ENV.ES.2c** Recognize air currents on a map.
ENV.ES.3 Lithosphere o Geologic events and processes	**ENV.ES.3a** Describe how a geologic event can impact the other spheres (e.g., volcano eruption into the air, mudslide into water, etc.).	**ENV.ES.3b** List events that can occur within the lithosphere.	**ENV.ES.3c** Recognize that the lithosphere is the outer most layer (crust) of the surface of the Earth.
ENV.ES.4 Hydrosphere o Oceanic currents and patterns (as they relate to climate) o Surface and ground water flow patterns and movement o Cryosphere **AND** **ENV.ES.5** Movement of matter and energy through the hydrosphere, lithosphere, atmosphere, and biosphere o Energy transformations on global, regional, and local scales o Biogeochemical cycles o Ecosystems o Weather o Climate	**ENV.ES.4a** Describe how ocean currents and patterns relate to climate.	**ENV.ES.4b** Follow surface and ground water flow patterns and movement.	**ENV.ES.4c** Recognize that the hydrosphere is the water portion of Earth.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Earth's Resources			
ENV.ER.1 Energy resources o Renewable and nonrenewable energy sources and efficiency o Alternate energy sources and efficiency o Resource availability o Mining and resource extraction	**ENV.ER.1a** Describe the source and benefit of renewable and nonrenewable energy as it relates to resources.	**ENV.ER.1b** Compare renewable and nonrenewable sources of energy (e.g., effectiveness, cost to produce).	**ENV.ER.1c** Sort sources of energy as renewable and nonrenewable.
ENV.ER.2 Air and air pollution o Primary and secondary contaminants o Greenhouse gases o Clean Air Act	**ENV.ER.2a** Identify a consequence and solution to air pollution (e.g., Clean Air Act).	**ENV.ER.2b** Identify a greenhouse gas and how humans have impacted the level of greenhouse gases.	**ENV.ER.2c** Identify types of air pollution.
ENV.ER.3 Water and water pollution o Potable water and water quality o Hypoxia, eutrophication o Clean Water Act o Point source and non-point source contamination	**ENV.ER.3a** Identify a consequence and solution to water pollution (e.g., Clean Water Act).	**ENV.ER.3b** Identify ways that humans have changed the global water supply (e.g., water quality).	**ENV.ER.3c** Identify types of water pollution.
ENV.ER.4 Soil and land o Desertification o Mass movement and erosion o Sediment contamination o Land use and land management (including food production, agriculture, and zoning) o Solid and hazardous waste	**ENV.ER.4a** Identify a consequence and solution of soil pollution (e.g., land use, zoning).	**ENV.ER.4b** Identify ways that humans have contributed to changes in the land (e.g., deforestation, strip mining, waste, etc.).	**ENV.ER.4c** Identify types of soil pollution.
ENV.ER.5 Wildlife and wilderness o Wildlife and wilderness management ▪ Endangered species o Invasive species o Introduced species	**ENV.ER.5a** Explain how a species can become endangered (e.g., deforestation, invasive species).	**ENV.ER.5b** Categorize species as "endangered" or "non-endangered."	**ENV.ER.5c** Identify the meaning of "endangered." species.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Global Environment Problems and Issues			
ENV.GP.1 Human population	**ENV.GP.1a** Describe how the size of the human population can have harmful effects on the environment.	**ENV.GP.1b** Identify how the human population has changed over time.	**ENV.GP.1c** Recognize that humans can change their environment globally.
ENV.GP.2 Potable water quality, use, and availability	**ENV.GP.1a** Describe a way to preserve potable water on Earth.	**ENV.GP.1b** Identify a way humans have changed the global water quality.	**ENV.GP.1c** Identify a fresh water source.
ENV.GP.3 Climate change	**ENV.GP.3a** Describe a way to preserve our global climates.	**ENV.GP.3b** Identify a possible factor of climate change.	**ENV.GP.3c** Recognize the characteristics of a climate change (e.g., melting glaciers).
ENV.GP.4 Sustainability	**ENV.GP.4a** Explain how resources can be sustained to reduce the impact on Earth (e.g., planting new trees after chopping down others).	**ENV.GP.4b** Identify a resource that should be sustained to positively affect Earth.	**ENV.GP.4c** Sort resources into renewable or non-renewable categories.
ENV.GP.5 Species depletion and extinction	**ENV.GP.4a** Describe why species extinction is harmful to Earth.	**ENV.GP.4b** Identify the cause of a species extinction.	**ENV.GP.4c** Identify a species that has become extinct.
ENV.GP.6 Air quality	**ENV.GP.6a** Describe the effect of air quality on humans.	**ENV.GP.6b** Describe the effect of a pollutant on air quality.	**ENV.GP.6c** Identify a type of air pollution.
ENV.GP.7 Food production and availability	**ENV.GP.7a** Describe how a factor could limit the availability of food.	**ENV.GP.7b** Describe a factor that can affect food production (e.g., early frost, drought, etc.).	**ENV.GP.7c** Identify oane food production method (e.g., farming, manufacturing).

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
ENV.GP.8 Deforestation and loss of biodiversity	**ENV.GP.8a** Identify an effect of deforestation on an ecosystem.	**ENV.GP.8b** Describe the importance of a forest ecosystem.	**ENV.GP.8c** Recognize that having many different organisms in an ecosystem generally leads to a healthier ecosystem.
ENV.GP.9 Waste management (solid and hazardous)	**ENV.GP.9a** Describe a way to reduce solid and hazardous waste.	**ENV.GP.9b** Describe an effect of waste on the environment.	**ENV.GP.9c** Sort types of waste into solid or hazardous waste.

PHYSICAL GEOLOGY

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ⟷ Least Complex			
Minerals			
PG.M.1 Atoms and elements	**PG.M.1a** Identify parts of an atom (e.g., protons, neutrons, electrons).	**PG.M.1b** Identify a diagram or model of an atom.	**PG.M.1c** Identify that all matter is made of atoms.
PG.M.2 Chemical bonding (ionic, covalent, metallic)	**PG.M.2a** Represent a chemical compound with a ball-and-stick model or chemical formula.	**PG.M.2b** Recognize that a model (ball-and-stick or molecular geometries) or chemical formula represents a chemical compound.	**PG.M.2c** Identify that two elements combine to form a compound.
PG.M.3 Crystallinity (crystal structure)	Complex and advanced learning standards in Ohio's New Learning Standards are not included in the extended standards.		
PG.M.4 Criteria of a mineral (crystalline solid, occurs in nature, inorganic, defined chemical composition)	**PG.M.4a** Match minerals with rock types in which they are commonly found.	**PG.M.4b** Identify a common mineral in a common rock.	**PG.M.4c** Recognize that minerals can be found in rocks.
PG.M.5 Properties of minerals (hardness, luster, cleavage, streak, crystal shape, fluorescence, flammability, density/specific gravity, malleability)	**PG.M.5a** Sort minerals by cleavage, streak, hardness and fracture.	**PG.M.5b** Identify hardness and fracture as two characteristics to identify a mineral.	**PG.M.5c** Match minerals by properties (e.g., cleavage, streak, magnetism).

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Igneous, Metamorphic and Sedimentary Rocks			
PG.IMS.1 Igneous o Mafic and felsic rocks and minerals o Intrusive (igneous structures: dikes, sills, batholiths, pegmatites) o Earth's interior (inner core, outer core, lower mantle, upper mantle, Mohorovičić [Moho] discontinuity, crust) o Magnetic reversals and Earth's magnetic field o Thermal energy within Earth o Extrusive (volcanic activity, volcanoes: cinder cones, composite, shield) o Bowen's Reaction Series (continuous and discontinuous branches)	**PG.IMS.1a** Compare how different environments change the type of igneous rock that is formed.	**PG.IMS.1b** Describe the properties of igneous rocks.	**PG.IMS.1c** Identify environments in which igneous rocks are formed.
PG.IMS.2 Metamorphic o Pressure, stress, temperature, and compressional forces o Foliated (regional), non-foliated (contact) o Parent rock and degrees of metamorphism o Metamorphic zones (where metamorphic rocks are found)	**PG.IMS.2a** Compare how different environments change the type of metamorphic rock that is formed.	**PG.IMS.2b** Describe the properties of metamorphic rocks.	**PG.IMS.2c** Identify environments in which metamorphic rocks are formed.
PG.IMS.3 Sedimentary o Division of sedimentary rocks and minerals (chemical, clastic/physical, organic) o Depositional environments	**PG.IMS.3a** Compare how different environments change the type of sedimentary rock that is formed.	**PG.IMS.3b** Describe the properties of sedimentary rocks.	**PG.IMS.3c** Identify environments in which sedimentary rocks are formed.

Learning Standard	Complexity a	Complexity b	Complexity c
Most Complex ←			→ Least Complex
PG.IMS.4 Ocean o Tides (daily, neap, and spring) o Currents (deep and shallow, rip and longshore) o Thermal energy and water density o Waves o Ocean features (ridges, trenches, island systems, abyssal zone, shelves, slopes, reefs, island arcs) o Passive and active continental margins o Transgressing and regressing sea levels o Streams (channels, streambeds, floodplains, cross-bedding, alluvial fans, deltas)	**PG.IMS.4a** Use data to see how the sea level changes with the tides in a given location.	**PG.IMS.4b** Describe how the tides are controlled by the moon.	**PG.IMS.4c** Identify a reason for a change in sea level. (e.g., tides, currents, waves, etc.).
Earth's History			
PG.EH.1 The geologic rock record o Relative and absolute age o Principles to determine relative age ▪ Original horizontality ▪ Superposition ▪ Cross-cutting relationships o Absolute age ▪ Radiometric dating (isotopes, radioactive decay) ▪ Correct uses of radiometric dating o Combining relative and absolute age data o The geologic time scale ▪ Comprehending geologic time ▪ Climate changes evident through the rock record ▪ Fossil record	**PG.EH.1a** Describe how technology assists in determining the age of rocks (e.g., radiometric dating).	**PG.EH.1b** Identify that in a cross-section of rock, the layer on top is the youngest layer and the layer on the bottom is the oldest (assuming no geological process has shifted the layers).	**PG.EH.1c** Identify changes across layers (cross-section) of rocks.
Plate Tectonics			
PG.PT.1 Internal Earth o Seismic waves ▪ S and P waves ▪ Velocities, reflection, refraction of waves	**PG.PT.1a** Analyze which earthquake was larger based on a seismographic report or readout.	**PG.PT.1b** Describe how a Richter scale is used as a tool to measure the seismic waves of an earthquake.	**PG.PT.1c** Recognize that a Richter scale is a tool used to measure intensity of earthquakes.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ⟷ Least Complex			
PG.PT.2 Structure of Earth (Note: specific layers were part of grade 8) o Asthenosphere o Lithosphere o Mohorovičić (Moho) boundary o Composition of each of the layers of Earth o Gravity, magnetism and isostasy o Thermal energy (geothermal gradient and heat flow)	Complex and advanced learning standards in Ohio's New Learning Standards are not included in the extended standards.		
PG.PT.3 Historical review (Note: this would include a review of continental drift and sea-floor spreading found in grade 8) o Paleomagnetism and magnetic anomalies o Paleoclimatology	Complex and advanced learning standards in Ohio's New Learning Standards are not included in the extended standards.		
PG.PT.4 Plate motion (Note: introduced in grade 8) o Causes and evidence of plate motion o Measuring plate motion o Characteristics of oceanic and continental plates o Relationship of plate movement and geologic events and features o Mantle plumes	**PG.PT.4a** Describe how the continents used to be connected in one super continent of Pangaea and have moved due to tectonic forces.	**PG.PT.4b** Recognize that the shape of the continents is evidence of plate motion (e.g., they fit together like puzzle pieces).	**PG.PT.4c** Identify the crust as the location of the continental plates.
Earth's Resources			
PG.ER.1 Energy resources o Renewable and nonrenewable energy sources and efficiency o Alternate energy sources and efficiency o Resource availability o Mining and resource extraction	**PG.PT.4a** Identify factors to consider before mining for mineral resources (e.g., cost, pollution, effects on wildlife).	**PG.PT.4b** Identify the effect that mining for a mineral resource has on an area.	**PG.PT.4c** Recognize that minerals are a resource.
PG.ER.2 Air o Primary and secondary contaminants o Greenhouse gases	**PG.ER.2a** Describe how greenhouse gas effects the atmosphere.	**PG.ER.2b** Identify a cause and effect of specific air pollution problem (e.g., smoke from a factory causes haze in the air).	**PG.ER.2c** Identify an air contaminant.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ⟷ Least Complex			
PG.ER.3 Water o Potable water and water quality o Hypoxia, eutrophication	**PG.ER.3a** Describe why it is important to have clean drinking water.	**PG.ER.3b** Identify a water contaminant.	**PG.ER.3c** Identify a drinking water source.
PG.ER.4 Soil and sediment o Desertification o Mass wasting and erosion o Sediment contamination	**PG.ER.4a** Describe how erosion can change an environment.	**PG.ER.4b** Identify a reason for erosion.	**PG.ER.4c** Define erosion as the movement of Earth's materials.
Glacial Geology			
PG.GG.1 Glaciers and glaciation o Evidence of past glaciers (including features formed through erosion or deposition) o Glacial deposition and erosion (including features formed through erosion or deposition) o Data from ice cores ▪ Historical changes (glacial ages, amounts, locations, particulate matter, correlation to fossil evidence) ▪ Evidence of climate changes throughout Earth's history o Glacial distribution and causes of glaciation o Types of glaciers: continental (ice sheets, ice caps), alpine/valley (piedmont, valley, cirque, ice caps) o Glacial structure, formation, and movement	**PG.GG.1a** Describe land features that were formed through either erosion or deposition from glaciers.	**PG.GG.1b** Identify land features in Ohio that were formed by glaciers.	**PG.GG.1c** Identify that glaciers consist mainly of ice.

PHYSICS

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Motion			
P.M.1 Motion Graphs o Position vs. time o Velocity vs. time o Acceleration vs. time	**P.M.1a** Complete a motion graph by indicating the sections where the object is speeding up, moving at constant speed, and slowing down.	**P.M.1b** Label areas of different motion on a motion graph.	**P.M.1c** Identify the motion of an object in a motion graph.
P.M.2 Problem Solving o Using graphs (average velocity, instantaneous velocity, acceleration, displacement, change in velocity) o Uniform acceleration including free fall (initial velocity, final velocity, time, displacement, acceleration, average velocity)	**P.M.2a** Use graphs to show that the free fall acceleration rate of varying objects, with negligible air resistance, is the same.	**P.M.2b** Make a prediction of the fall rate of two objects that have significantly different mass and surface area.	**P.M.2c** Drop two objects that have significantly different mass and surface area (e.g., a bowling ball and a feather) and make observations.
P.M.3 Projectile Motion o Independence of horizontal and vertical motion o Problem-solving involving horizontally launched projectiles	**P.M.3a** Determine whether a ball needs to be thrown higher (vertical) or farther (horizontal) for it to land in a designated area (e.g., in a hoop or on an "x" on the ground).	**P.M.3b** Identify the horizontal and vertical motions of a projectile.	**P.M.3c** Recognize that projectiles have movement in both horizontal and vertical directions.
Forces, Momentum and Motion			
P.F.1 Newton's Laws Applied to Complex Problems	**P.F.1a** Recognize that momentum is conserved in a collision.	**P.F.1b** Demonstrate Newton's Third Law: for every action, there is an equal and opposite reaction.	**P.F.1c** Identify the direction of an object's motion after it collides with another moving object.
P.F.2 Gravitational Force and Fields	**P.F.2a** Explain the relationship between mass and gravitational pull.	**P.F.2b** Recognize that gravity is the force that keeps planets and satellites in circular orbits	**P.F.2c** Identify gravity as a force.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
P.F.3 Elastic Forces	**P.F.3a** Design a device that would propel an object using elastic materials (e.g., rubber band cars).	**P.F.3b** Make a prediction of the elasticity of two significantly different elastic materials.	**P.F.3c** Manipulate a variety of elastic bands and other elastic materials and make observations (e.g., rubber bands, hair bands).
P.F.4 Friction Forces (Static and Kinetic)	**P.F.4a** Organize the surface types from "causes the most friction" (most difficult to push) to "causes the least amount of friction" (easiest to push).	**P.F.4b** Investigate friction as it relates to moving an object (e.g., sliding furniture over different types of flooring).	**P.F.4c** Recognize that diverse surface types cause friction differently.
P.F.5 Air Resistance and Drag	**P.F.5a** Through investigation, determine the rate of fall of an object in air and a variety of liquids.	**P.F.5b** When given an object, make a prediction of its motion and rate of fall when dropped in the air and a variety of liquids.	**P.F.5c** Drop the same object in air and into a variety of liquids with different viscosity and make observations (e.g., oil, honey, and water).
P.F.6 Forces in Two Dimensions o Adding vector forces AND **P.F.7 Momentum, Impulse, and Conservation of Momentum** o Motion down inclines o Centripetal forces and circular motion	**P.F.6-7a** Identify the force that, if removed from an object moving in a circular motion, would cause the object to move in a straight line.	**P.F.6-7b** Indicate the direction of the centripetal force of an object moving in a circular motion (e.g., ball being swung on a string).	**P.F.6-7c** Recognize that gravity is the force that creates motion down an incline.
Energy			
P.E.1 Gravitational Potential Energy	**P.E.1a** Explain that when two attracting objects are at a distance from each other there is gravitational potential energy present.	**P.E.1b** Describe that the gravitational force between two objects depends on the distance between them and their masses.	**P.E.1c** Identify ways people use energy

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
P.E.2 Energy in Springs	**P.E.2a1** Given a spring stretched various amounts, identify when it has the most potential energy. AND **P.E.2a2** Identify a real-world scenario where the use of a spring might improve the efficiency or performance of a tool.	**P.E.2b1** Compare the distance that two different springs can stretch or can be compressed. AND **P.E.2b2** Investigate how the use of a spring can improve the efficiency of a tool (e.g., a shock absorber in a car or a ball point pen).	**P.E.2c1** Manipulate a variety of springs and make observations (e.g., from inside of a ball point pen, from toys). AND **P.E.2c2** Identify where springs are used in everyday life.
P.E.3 Work and Power	**P.E.3a** Chart the relationship between work and power.	**P.E.3b** Describe the relationship between work and power (pedaling a bicycle, lifting different weights). More work in a shorter period of time equals more power.	**P.E.3c** Identify work being done.
P.E.4 Conservation of Energy	**P.E.4a**.Given situation, describe where the energy has gone (e.g., a car rolling down hill has energy changing from potential to kinetic).	**P.E.4b** Explain that energy changes forms but the total amount is the same before and after a transfer.	**P.E.4c** Identify that energy cannot be created or destroyed.
P.E.5 Nuclear Energy	**P.E.5a** Identify types of nuclear energy (e.g., fission and fusion).	**P.E.5b** Describe ways people use nuclear energy.	**P.E.5c** Identify nuclear energy as a type of energy.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
	Waves		
P.W.1 Wave Properties o Conservation of energy o Reflection o Refraction o Interference o Diffraction	**P.W.1a** Compare the speeds at which light waves travel in different mediums.	**P.W.1b** Identify what results from light traveling into a different medium (e.g., dispersion into colors – prism, apparent location of a pencil is different from actual location - water).	**P.W.1c** Identify the reflection of light in a mirror.
P.W.2 Light Phenomena o Ray diagrams (propagation of light) o Law of reflection (equal angles) o Snell's law o Diffraction patterns o Wave – particle duality of light o Visible spectrum and color	**P.W.2a** Create a ray diagram showing the path of a light wave.	**P.W.2b** Complete a simple ray diagram to show at what angle a wave is reflected off a surface.	**P.W.2c** Identify a ray diagram.
	Electricity and Magnetism		
P.EM.1 Charging Objects (Friction, Contact, and Induction)	**P.EM.1a** Recognize that charges can transfer from one object to another in different ways.	**P.EM.1b** Understand that objects can have charges which can be either negative or postitive.	**P.EM.1c** Relate the symbols (+, -) to their corresponding charge.
P.EM.2 Coulomb's Law	Complex and advanced learning standards in Ohio's New Learning Standards are not included in the extended standards.		
P.EM.3 Electric Fields and Electric Potential Energy	**P.EM.3a** Recognize the effect of an electric field around a positively or negatively charged object (e.g., like charges repel, and opposite charges attract).	**P.EM.3b** Label a model or picture indicating an electric field.	**P.EM.3c** Identify a field as an area around an object.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ← → Least Complex			
P.EM.4 DC Circuits o Ohm's law o Series circuits o Parallel circuits o Mixed circuits o Applying conservation of charge and energy (junction and loop rules)	**P.EM.4a** Construct a direct current circuit.	**P.EM.4b** Identify the required parts of a circuit.	**P.EM.4c** Complete a direct current circuit (e.g., closing a switch to initiate flow).
P.EM.5 Magnetic Fields	**P.EM.5a** Apply a real-life example demonstrating the strength of magnetic fields (e.g., explore how many paper clips a weak magnet can hold up versus a strong magnet).	**P.EM.5b** Demonstrate that different magnets have different sized magnetic fields.	**P.EM.5c** Manipulate two objects displaying magnetism.
P.EM.6 Electromagnetic Interactions	Complex and advanced learning standards in Ohio's New Learning Standards are not included in the extended standards.		

ANATOMY AND PHYSIOLOGY

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
Levels of Organization			
AP.LO.1 Hierarchy of Organization	**AP.LO.1a** Describe the function of organ system**s** (e.g., muscular, skeletal, digestive, nervous, respiratory, reproductive, digestive).	**AP.LO.1b** Recognize the hierarchy of cellular organization (i.e., cells make tissues, tissues make organs, etc.).	**AP.LO.1c** Identify a cell.
AP.LO.2 Types of Tissues	**AP.LO.2a** Describe the function of a particular type of tissue (e.g., muscle tissue).	**AP.LO.2b** Recognize that there are different types of tissues with different functions.	**AP.LO.2c** Identify that tissues are made of cells.
AP.LO.3 Homeostasis	**AP.LO.3a** Describe how the body works to maintain homeostasis (e.g., sweating when the body is hot).	**AP.LO.3b** Recognize that the body's systems interact to maintain balance.	**AP.LO.3c** Identify that the body has many systems that work together.
AP.LO.4 Anatomical Terminology	**AP.LO.4a** Label organs on a model or image of a body.	**AP.LO.4b** Match organ names to a model or image.	**AP.LO.4c** Locate a body part on a model or image of a body.
Support and Motion			
AP.SM.1 Integumentary System	**AP.SM.1a** Identify the accessories of the skin system (e.g., nails, hair follicles, sweat glands).	**AP.SM.1b** Identify the function**s** of skin (e.g., protection, temperature regulation).	**AP.SM.1c** Identify skin as a form of protection.
AP.SM.2 Skeletal System	**AP.SM.2a** Describe the functions of the skeletal system (support, protection, movement).	**AP.SM.2b** Complete a model of a skeleton using the major bones of the body.	**AP.SM.2c** Match major bones with a diagram of a body (e.g., skull=head).

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
AP.SM.3 Muscular System	**AP.SM.3a** Describe how muscles are needed for movement.	**AP.SM.3b** Recognize that some muscle movements are voluntary (e.g., walking) and some are involuntary (e.g., beating heart).	**AP.SM.3c** Identify a muscle.
Integration and Coordination			
AP.IC.1 Nervous System	**AP.IC.1a** Explain how the nervous system controls all of the functions of the body and that it is made up of the brain, spinal cord, and nerves of the body.	**AP.IC.1b** Identify a function of the nervous system (e.g., muscle control, memory, sensory perception, emotions, speech, balance, and basic life functions like breathing).	**AP.IC.1c** Identify that the nervous system consists of the brain, spinal cord, and nerves**.**
AP.IC.2 Special Senses (Sense of Sight, Senses of Hearing and Balance, Senses of Taste and Smell)	**AP.IC.2a** Explain the connection between the senses and involuntary reactions.	**AP.IC.2b** Match each of the five senses to descriptions or images of activities that involve the senses.	**AP.IC.2c** Identify each of the 5 senses using diagrams or pictures (e.g., sight = eyes).
AP.IC.3 Endocrine System	**AP.IC.3a** Recognize that imbalances in the body can lead to diseases (e.g., high blood pressure, diabetes).	**AP.IC.3b** Identify functions of hormones (maintains blood glucose levels, stable blood pressure, body temperature, reproduction).	**AP.IC.3c** Identify that the body produces substances to help bodies grow and develop.
Transport			
AP.T.1 Blood	**AP.T.1a** Describe the specific functions of red blood cells and white blood cells.	**AP.T.1b** Describe the function of blood in the human body (e.g., transportation, protection, and regulation).	**AP.T.1c** Identify the two types of blood cells (e.g., red and white blood cells).
AP.T.2 Cardiovascular System	**AP.T.2a** Describe the structure and function of the	**AP.T.2b** Identify the heart as a muscle that pumps blood	**AP.T.2c** Locate the heart on a diagram/picture.

Learning Standard	*Complexity a*	*Complexity b*	*Complexity c*
Most Complex ←			→ Least Complex
	heart.	throughout the body.	
AP.T.3 Lymphatic and Immune Systems	**AP.T.3a** Describe the role of the immune system in fighting disease.	**AP.T.3b** Identify white blood cells as part of the immune system.	**AP.T.3c** Identify a white blood cell.
Absorption and Excretion			
AP.AE.1 Digestive System	**AP.AE.1a** Explain how the digestive system functions to allow humans to receive nutrients needed to survive.	**AP.AE.1b** Identify structure**s** used in digestion (e.g., mouth, teeth, tongue, esophagus, stomach, small intestine, large intestine, and rectum).	**AP.AE.1c** Identify a digestive organ in a model or diagram of the body.
AP.AE.2 Respiratory System	**AP.AE.2a** Describe how the respiratory system can be damaged by disease or pollutants.	**AP.AE.2b** Identify that breathing is the act of taking in oxygen and expelling carbon dioxide.	**AP.AE.2c** Identify the lungs in a model or diagram of the body.
AP.AE.3 Urinary System	**AP.AE.3a** Describe the main function of the urinary system (e.g., to excrete liquid waste).	**AP.AE.3b** Identify structures of the urinary system (kidneys, bladder, and urethra).	**AP.AE.3c** Identify the kidneys in a model or diagram of the body.
Reproduction			
AP.R.1 Reproductive System	**AP.R.1a** Describe the function of the reproductive system (e.g., producing offspring).	**AP.R.1b** Identify structures of the reproductive system in a model or visual representation.	**AP.R.1c** Identify male and female differences.

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