

Ohio's Academic Content Standards - Extended Science

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Introduction

In June 2010, the state of Ohio adopted the Revised Academic Content Standards for Science. The Revised Academic Content Standards are now a part of Ohio's Content Standards. Recognizing the need to make the content standards accessible for all students, the Offices of Curriculum, Assessment and Exceptional Children at the Ohio Department of Education developed the Ohio's Academic Content Standards-Extended (OACS-E).

The OACS-E, found on the following pages are designed to assist teachers in providing access to the general education curriculum for students with significant cognitive disabilities. Students receiving instruction based on the grade band Extensions total approximately 1% of Ohio's student population and are assessed using the Alternate Assessment for Students with Significant Cognitive Disabilities (AASCD). These Extensions are not meant to replace the Revised Academic Content Standards for Science, but to serve as a complement to them. The Extensions will be the first resource teachers should use when designing instruction for students with significant cognitive disabilities. The Extensions have been written and designed to provide a continuum of entry points related to the Science Standards. However, this document has been designed so that the reader can reference the Revised Academic Content Standards for each grade level on the left hand page with Extensions displayed on the right hand page. There may be times when the instructor may want to further supplement the Extensions with the Revised Academic Content Standards listed on the left hand page. This was the intent of the design of this document; to further enhance curricular content for students with significant cognitive disabilities.

At the same time, in planning academic activities for students with significant cognitive disabilities, teachers must consider incorporation of non-academic skills necessary for student success such as communication, self-determination, gross/fine motor, and social skills as well as individual accommodations or supports that be necessary for students to access the curriculum. Life Skills should also serve to be taught as complements to the Extensions. These Extensions will assist teachers in the instruction of content that is directly aligned with the Revised Academic Content Standard for Science.

Grade Band

Standards (academic skills) from the Revised Academic Content Standards were identified within the following grade bands:

K-2

3-5

6-8

9-12

Some standards within specific grade bands were not extended due to the complexity of the skills and are not included in this document. As such, you will see certain components of the Revised Academic Content Standards not addressed within the Extensions. However, it should be noted that the Extensions presented here will provide a strong foundation for learning for all students.

It is critical when designing instruction for students, it is to be completed using the student's assigned grade band. In other words, if the student is officially registered as an eighth grade student, they would be instructed using the grade 6-8 Extensions. This will ensure proper grade level content and progression within the standards.

Complexity Levels

Specific standards were extended among three complexity levels from "most complex" to "least complex". The three levels comprise varying difficulty levels for students based on a standard from the Revised Academic Content Standards. The Extensions have been codified individually for clearer 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 verb of the extension simply changes to a lower taxonomy level. In other cases, there is different content to be included in the instructional process. It is important to move from left to right when reading the Extensions; that is, begin with the most complex level when determining where student instruction should begin before reverting to the lower complexity levels. *Please note: Students should not be categorized according to a particular extension level. Instead, instruction should target Extensions appropriate to individual strengths which may vary across standards. Ideally, one should see instruction occurring at all ranges of complexity when these Extensions are applied within each grade band.*

Utilization

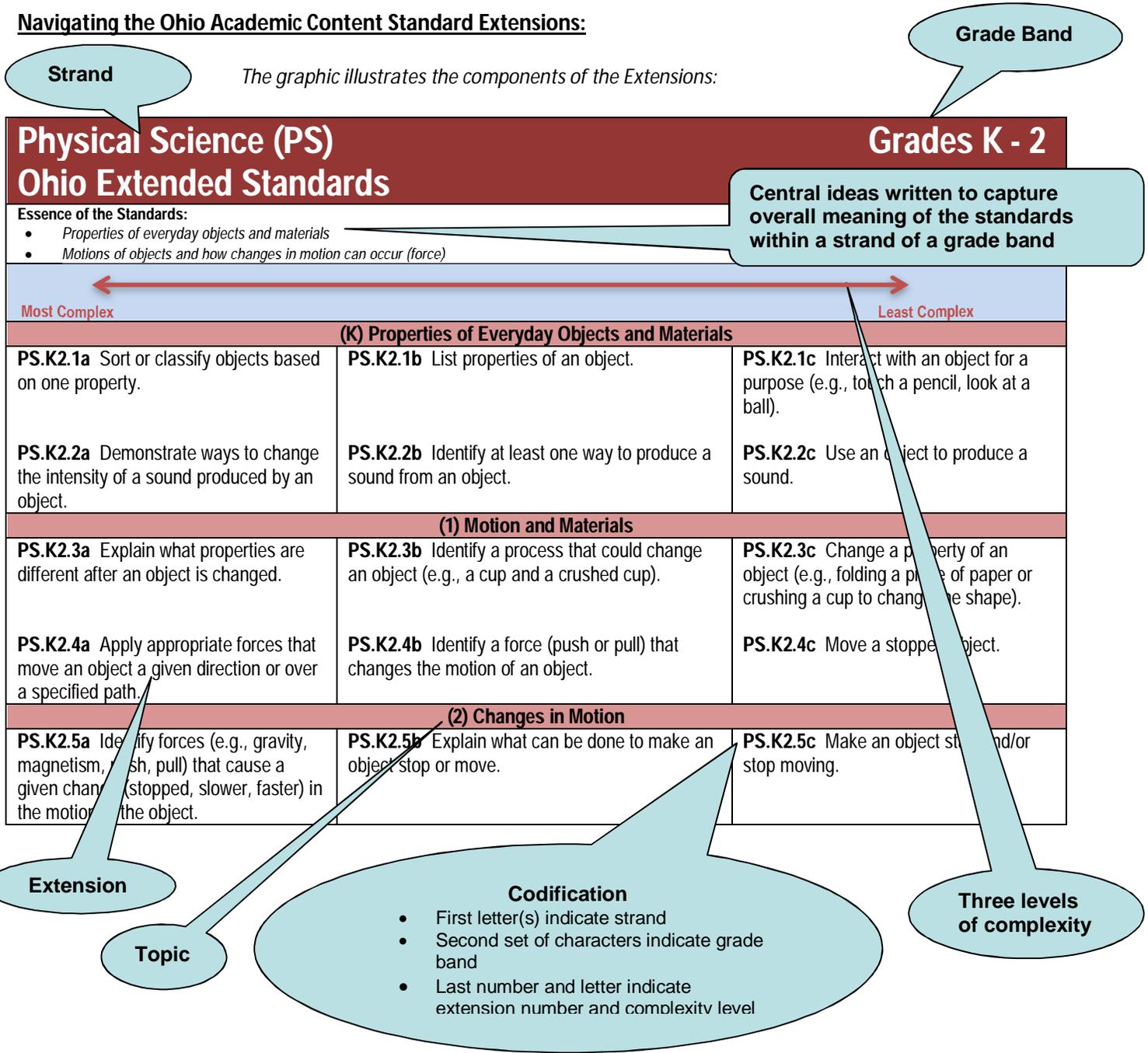
The Ohio Academic Content Standards-Extended do not specify individual accommodations or supports that may be necessary for students across the curriculum. When designing lessons based on the Extensions, teachers should consider the unique learning needs of each student and employ the necessary accommodations. According to the Common Core State Standards *Application to Students with Disabilities* document (CCSSO 2010),

“These supports and accommodations should ensure that students receive access to multiple means of learning and opportunities to demonstrate knowledge, but retain the rigor and high expectations of the Common Core State Standards.”

While the Common Core State Standards are referenced here, our Extensions design team felt it imperative to align our work across all four content areas utilizing the same expectations. The Extensions will be used by school personnel to plan and implement lessons based upon academic standards. The use of these Extensions is intended for the population of students that will be engaged in Ohio’s Alternate Assessment.¹

Navigating the Ohio Academic Content Standard Extensions:

The graphic illustrates the components of the Extensions:



¹ During the roll out process of this document, many educators felt that OACS-E could help with the differentiation of instruction for all students. These Extensions may be utilized for this purpose, but it must be done with caution. The Revised Academic Content Standards are written and will be assessed with general assessments at a much higher level of expectation. Thus, while these Extensions can provide entry points into the Revised Academic Content Standards for students who need differentiation in the classroom-but are not engaged in the Alternate Assessment-it is imperative to remember that these students must transition and be assessed using the Revised Academic Content Standards.

Acknowledgements

Development of Ohio's Academic Content Standards-Extended was a collaborative effort between the Ohio Department of Education's Office of Curriculum and Assessment and the Office for Exceptional Children. The writing committee, comprised of special educators, regular educators, administrators, parents and other stakeholders around the state of Ohio came together to create these Extensions. Additional credit is due to the states of Delaware and North Carolina whose already completed Extensions provided great insight for our work.

The following individuals served on our writing committee who provided extensive time, dedication, thought and expertise to this project. Sincere appreciation goes to:

Shawna Benson	<i>OCALI, Urbana University</i>	Vickie Hesler	<i>State Support Team Region 10</i>
Marilyn Brigati	<i>State Support Team Region 10</i>	Kate Kandel	<i>Parent</i>
Pat Cronin	<i>State Support Team Region 4</i>	Caren McCoy	<i>State Support Team Region 12</i>
Hope Douglas	<i>Coshocton County Board of Developmental Disabilities</i>	Michelle Miller	<i>Groveport Madison Local Schools</i>
Beth Duffy	<i>State Support Team Region 16</i>	Bill Nellis	<i>State Support Team Region 6</i>
Cindy Ford	<i>State Support Team Region 1</i>	Gretchen Schmitz	<i>Auglaize County ESC</i>
Barb Gentile Green	<i>Mt. Gilead Exempted Village Schools</i>	Amy Szymanski	<i>State Support Team Region 1</i>
Randy Grieser	<i>K12 Incorporated</i>	Angie Chappel-Wang	<i>Cuyahoga County ESC, State Support Team Region 3</i>
Joan Griest	<i>Marion County Schools</i>	Ilana Webber	<i>Groveport Madison Local Schools</i>
Bette Hackett	<i>State Support Team Region 16</i>		

Special thanks to Kathy Staugler who led the committee work and revised rough drafts through several iterations of these Extensions.

Gratitude is due to the following individuals from the American Institutes for Research for their time and knowledge during this process:

Dee Wagner	John Kwening	Heather Williams	Paula Sable
Leslie Booth	Kevin Mirkoff	Jim McCain	

Four Ohio Department of Education staff members led the project while providing valuable insight and global thinking:

Cathy Csanyi	Andrew Hinkle	Bill Sternberg	Wendy Stoica
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Finally, thanks to all who provided comments, support and guidance along the way including family and community members, university faculty, school administrators, teachers and others. Ohio's Academic Content Standards-Extended would not be possible without the support of all who worked tirelessly to create a guiding tool to support access to the general education curriculum for all students.

Science – Table of Contents

Science – Table of Contents			
Code	Strand	Grade Band	Pages
ESS	Earth and Space Science	K-2	2-3
		3-5	4-5
		6-8	6-7
LS	Life Science	K-2	8-9
		3-5	10-11
		6-8	12-13
PS	Physical Science	K-2	14-15
		3-5	16-17
		6-8	18-19
High School – Grades 9-12			
Code	Strand	Pages	
BIO	Biology	20-23	
CHM	Chemistry	24-25	
EVS	Environmental Science	26-27	
PG	Physical Geology	28-31	
PS-H	Physical Science-High School	32-35	
PHY	Physics	36-37	

Earth and Space Science (ESS) Ohio Revised Science Standards

Grades K – 2

Grade K	Grade 1	Grade 2
Topic: Daily and Seasonal Changes	Topic: Sun, Energy and Weather	Topic: The Atmosphere
<ul style="list-style-type: none"> • Weather changes are long-term and short-term. • The moon, sun and stars can be observed at different times of the day or night. 	<ul style="list-style-type: none"> • The sun is the principal source of energy. • The physical properties of water can change. 	<ul style="list-style-type: none"> • The atmosphere is made up of air. • Water is present in the air. • Long- and short-term weather changes occur due to changes in energy.
Description		
<ul style="list-style-type: none"> • The above standards offer a focus for instruction each year and help ensure that students gain adequate exposure to science content standards. <i>Students advancing through the grades are expected to meet each year's grade-specific standards and retain or further develop skills and understandings mastered in preceding grades.</i> • <i>The complexity options of these standards assure that all students, including those with significant cognitive disabilities, have access to these core standards through appropriate instructional tasks.</i> 		

Earth and Space Science (ESS) Ohio Extended Standards

Grades K – 2

Essence of the Standards:

- Daily and seasonal changes in weather
- Sun as a source of energy
- Changes in physical properties of water
- Atmospheric properties
- Sun, moon and stars



(K) Daily and Seasonal Changes

<p>ESS.K2.1a Describe what (sun, moon, stars) could be found in the sky at a specific time of day.</p>	<p>ESS.K2.1b Indicate which objects are found in the sky during the day and at night.</p>	<p>ESS.K2.1c Identify daytime and nighttime.</p>
<p>ESS.K2.2a Identify the weather pattern and the season when that weather occurs.</p>	<p>ESS.K2.2b Describe types of weather changes.</p>	<p>ESS.K2.2c Identify types of short-term weather (e.g., rain, snow, clear).</p>

(1) Sun, Energy and Weather

<p>ESS.K2.3a Recognize that the sun is a source of energy that can change temperature (e.g., Why is the ground warmer/cooler in the shade/sun? Where does the cup of water heat up faster: Sun/shade, cloud cover/clear sky?).</p>	<p>ESS.K2.3b Recognize that the sun warms an object.</p>	<p>ESS.K2.3c Identify properties of the sun (temperature, brightness, size).</p>
<p>ESS.K2.4a Explain that temperature changes modify the state of water.</p>	<p>ESS.K2.4b Predict what happens when ice is put in a heated environment or when water is put into a cold environment.</p>	<p>ESS.4c Identify that water when frozen becomes ice.</p>

(2) The Atmosphere

<p>ESS.K2.5a Recognize the various properties of air (e.g., temperature, movement or takes up space).</p>	<p>ESS.K2.5b Identify a property of air (e.g., moving air in some way).</p>	<p>ESS.K2.5c Recognize that air takes up space.</p>
<p>ESS.K2.6a Investigate that water condenses (goes from vapor to liquid) and evaporates (goes from liquid to vapor).</p>	<p>ESS.K2.6b Identify forms of water in the air (e.g., cloud, rain, snow, humidifier).</p>	<p>ESS.K2.6c Identify rain or snow as water in the air.</p>

Earth and Space Science (ESS) Ohio Revised Science Standards

Grades 3 - 5

Grade 3	Grade 4	Grade 5
Topic: Earth's Resources	Topic: Earth's Surface	Topic: Cycles and Patterns in the Solar System
<ul style="list-style-type: none"> • Earth's nonliving resources have specific properties. • Earth's resources can be used for energy. • Some of Earth's resources are limited. 	<ul style="list-style-type: none"> • Earth's surface has specific characteristics and landforms that can be identified. • The surface of Earth changes due to weathering. • The surface of Earth changes due to erosion and deposition. 	<ul style="list-style-type: none"> • The solar system includes the sun and all celestial bodies that orbit the sun. Each planet in the solar system has unique characteristics. • The sun is one of many stars that exist in the universe. • Most of the cycles and patterns of motion between the Earth and sun are predictable.
Description		
<ul style="list-style-type: none"> • The above standards offer a focus for instruction each year and help ensure that students gain adequate exposure to science content standards. <i>Students advancing through the grades are expected to meet each year's grade-specific standards and retain or further develop skills and understandings mastered in preceding grades.</i> • <i>The complexity options of these standards assure that all students, including those with significant cognitive disabilities, have access to these core standards through appropriate instructional tasks.</i> 		

Earth and Space Science (ESS) Ohio Extended Standards

Grades 3 - 5

Essence of the Standards:

- Properties of the Earth's resources
- Changes that occur to the surface of Earth and the impact of those changes
- Cycles and patterns in the Solar System



(3) Earth's Resources

ESS.35.1a Sort resources into categories of renewable and nonrenewable.	ESS.35.1b Identify a resource as renewable or nonrenewable.	ESS.35.1c Identify Earth's nonliving resources (e.g., water, air).
ESS.35.2a Investigate how different soils absorb or hold water.	ESS.35.2b Match soil composition and where it can be found.	ESS.35.2c Identify Earth's nonliving resources (soil).
ESS.35.3a Sort and classify rocks with specific characteristics (e.g., texture, color).	ESS.35.3b Sort rocks with similar characteristics (e.g., texture, color).	ESS.35.3c Identify Earth's nonliving resources (rocks).

(4) Earth's Surface

ESS.35.4a Recognize reasons for changes of landforms on the Earth's surface (e.g., weathering, erosion or deposition).	ESS.35.4b Identify that Earth's surface consists of land (e.g., mountains, beaches, valleys, deserts) and water (e.g., salt water, frozen water, fresh water).	ESS.35.4c Identify landforms (e.g., island, mountains).
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(5) Cycles and Patterns in the Solar System

ESS.35.5a Build a model of the solar system, including the sun and planets.	ESS.35.5b Compare or contrast the sun, planets, and moons that are found in the solar system.	ESS.35.5c Identify what can be found in the solar system.
ESS.35.6a Compare the sun to other stars (e.g., the sun is closest. The sun is the only star in the solar system.).	ESS.35.6b Recognize that properties of the sun are the same properties that stars have.	ESS.35.6c Recognize that the sun is a star.
ESS.35.7a Identify patterns (e.g., day/night or seasons) that result from Earth's movement.	ESS.35.7b Recognize that Earth revolves around the sun while it rotates on its axis.	ESS.35.7c Recognize that Earth rotates on its axis.

Earth and Space Science (ESS) Ohio Revised Science Standards

Grades 6 - 8

Grade 6	Grade 7	Grade 8
<p>Topic: Rocks, Minerals and Soil</p>	<p>Topic: Cycles and Patterns of Earth and the Moon</p>	<p>Topic: Physical Earth</p>
<ul style="list-style-type: none"> • Minerals have specific, quantifiable properties. • Igneous, metamorphic and sedimentary rocks have unique characteristics that can be used for identification and/or classification. • Igneous, metamorphic and sedimentary rocks form in different ways. • Soil is unconsolidated material that contains nutrient matter and weathered rock. • Rocks, minerals and soils have common and practical uses. 	<ul style="list-style-type: none"> • The hydrologic cycle illustrates the changing states of water as it moves through the lithosphere, biosphere, hydrosphere and atmosphere. • Thermal-energy transfers in the ocean and the atmosphere contribute to the formation of currents, which influence global climate patterns. • The atmosphere has different properties at different elevations and contains a mixture of gases that cycle through the lithosphere, biosphere, hydrosphere and atmosphere. • The relative patterns of motion and positions of Earth, moon and sun cause solar and lunar eclipses, tides and phases of the moon. 	<ul style="list-style-type: none"> • The composition and properties of Earth's interior are identified by the behavior of seismic waves. • Earth's crust consists of major and minor tectonic plates that move relative to each other. • A combination of constructive and destructive geologic processes formed Earth's surface. • Evidence of the dynamic changes of Earth's surface through time is found in the geologic record.
<p>Description</p>		
<ul style="list-style-type: none"> • The above standards offer a focus for instruction each year and help ensure that students gain adequate exposure to science content standards. <i>Students advancing through the grades are expected to meet each year's grade-specific standards and retain or further develop skills and understandings mastered in preceding grades.</i> • <i>The complexity options of these standards assure that all students, including those with significant cognitive disabilities, have access to these core standards through appropriate instructional tasks.</i> 		

Earth and Space Science (ESS) Ohio Extended Standards

Grades 6 - 8

Essence of the Standards:

- *Rocks, minerals and types of soil*
- *Cycles and patterns of Earth and the moon*
- *Physical attributes of the Earth's surface*



(6) Rocks, Minerals and Soil

<p>ESS.68.1a Sort minerals by properties (e.g., color, density and luster).</p> <p>ESS.68.2a Classify igneous, metamorphic or sedimentary rocks.</p> <p>ESS.68.3a Identify how each rock type is formed (pressure, erosion, cooling, melting, compaction, cementation, heat and/or weathering).</p>	<p>ESS.68.1b Identify an object as a mineral or a rock.</p> <p>ESS.68.2b Identify the properties of igneous (e.g., granite, basalt) or metamorphic (e.g., marble, quartzite) rocks.</p> <p>ESS.68.3b Identify components of a rock cycle.</p>	<p>ESS.68.1c Identify a common rock-forming mineral.</p> <p>ESS.68.2c Identify properties of sedimentary rocks.</p> <p>ESS.68.3c Identify a component of a rock cycle.</p>
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(7) Cycles and Patterns of Earth and the Moon

<p>ESS.68.4a Build a hydrologic cycle showing evaporation, condensation, precipitation or transpiration (plants giving off water).</p> <p>ESS.68.5a Show how the positions of Earth, moon and sun cause tides and eclipses.</p> <p>ESS.68.6a Compare and describe patterns found in the ocean currents, atmosphere and climate (e.g., how differences in temperature cause air or water to move).</p> <p>ESS.68.7a Recognize natural events and human activities that can cause changes in the Earth's atmosphere.</p>	<p>ESS.68.4b Identify evaporation, condensation, precipitation or transpiration (plants giving off water).</p> <p>ESS.68.5b Recognize different stages in the lunar cycle (e.g., full moon, new moon).</p> <p>ESS.68.6b Describe the difference between climate and weather.</p> <p>ESS.68.7b Identify a gas that is naturally present in our atmosphere (oxygen, nitrogen, carbon).</p>	<p>ESS.68.4c Identify evaporation or condensation.</p> <p>ESS.68.5c Recognize that the moon orbits around Earth.</p> <p>ESS.68.6c Identify the regional climates.</p> <p>ESS.68.7c Identify the air around us as atmosphere.</p>
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(8) Physical Earth

<p>ESS.68.8a Identify properties of each layer of Earth.</p> <p>ESS.68.9a Categorize geologic processes as constructive (e.g., depositions, volcanoes) or destructive (e.g., flooding, volcanoes).</p> <p>ESS.68.10a Recognize how the geologic record can be used to determine the age of Earth.</p> <p>ESS.68.11a Identify the different types of plate boundaries (e.g., convergent, divergent, transform).</p>	<p>ESS.68.8b Identify Earth's core, mantle and crust.</p> <p>ESS.68.9b Identify destructive and constructive processes that change Earth's surface.</p> <p>ESS.68.10b Explain how fossils indicate Earth's history, environment changes and life on Earth.</p> <p>ESS.68.11b Recognize that the crust is broken into plates that move.</p>	<p>ESS.68.8c Identify the layer of Earth that we live on as the crust.</p> <p>ESS.68.9c Identify a destructive process that changes Earth's surface.</p> <p>ESS.68.10c Identify a fossil.</p> <p>ESS.68.11c Identify the layer of Earth that we live on as the crust.</p>
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Life Science (LS) Ohio Revised Science Standards

Grades K - 2

Grade K	Grade 1	Grade 2
Topic: Physical and Behavioral Traits of Living Things	Topic: Basic Needs of Living Things	Topic: Interactions within Habitats
<ul style="list-style-type: none"> Living things are different from nonliving things. Living things have physical traits and behaviors, which influence their survival. 	<ul style="list-style-type: none"> Living things have basic needs, which are met by obtaining materials from the physical environment. Living things survive only in environments that meet their needs. 	<ul style="list-style-type: none"> Living things cause changes on Earth. Some kinds of individuals that once lived on Earth have completely disappeared, although they were something like others that are alive today.
Description		
<ul style="list-style-type: none"> The above standards offer a focus for instruction each year and help ensure that students gain adequate exposure to science content standards. <i>Students advancing through the grades are expected to meet each year's grade-specific standards and retain or further develop skills and understandings mastered in preceding grades.</i> <i>The complexity options of these standards assure that all students, including those with significant cognitive disabilities, have access to these core standards through appropriate instructional tasks.</i> 		

Life Science (LS) Ohio Extended Standards

Grades K - 2

Essence of the Standards:

- *Living things have specific characteristics.*
- *Living things have basic needs.*
- *Living things meet their needs within their environments.*
- *Living things impact and interact with their environment in a variety of ways.*

(K) Physical and Behavioral Traits of Living Things		
LS.K2.1a Sort living and nonliving things.	LS.K2.1b Identify a living thing and a nonliving thing.	LS.K2.1c Identify a living thing.
LS.K2.2a Describe traits living things have that assist in their survival.	LS.K2.2b Match function with identified body part (e.g., mouth – eating, nose - smelling).	LS.K2.2c Identify part of plants and animals (e.g., leaves, flowers, feet, eyes).
(1) Basic Needs of Living Things		
LS.K2.3a Describe food sources for a variety of animals.	LS.K2.3b Identify the basic needs of plants and animals.	LS.K2.3c Identify a source of food.
LS.K2.4a List environmental resources needed to help living things survive.	LS.K2.4b Match environmental resources needed for a specific living thing.	LS.K2.4c Identify an environmental resource.
(2) Interactions within Habitats		
LS.K2.5a Describe the effect(s) of the environmental change(s) caused by an animal.	LS.K2.5b Identify how an animal has changed an environment.	LS.K2.5c Match an animal to its environment.
LS.K2.6a Compare an animal that once lived and is now extinct with an animal alive today with similar traits.	LS.K2.6b Recognize that fossils are physical traces of living things preserved in rock.	LS.K2.6c Identify a fossil as the remains of an organism.

Life Science (LS) Ohio Revised Science Standards

Grades 3 - 5

Grade 3	Grade 4	Grade 5
Topic: Behavior, Growth and Changes	Topic: Earth's Living History	Topic: Interconnections within Ecosystems
<ul style="list-style-type: none"> • Offspring resemble their parents and each other. • Individuals of the same kind differ in their traits, and sometimes the differences give individuals an advantage in surviving and reproducing. • Plants and animals have life cycles that are part of their adaptations for survival in their natural environments. 	<ul style="list-style-type: none"> • Changes in an organism's environment are sometimes beneficial to its survival and sometimes harmful. • Fossils can be compared to one another and to present-day organisms according to their similarities and differences. 	<ul style="list-style-type: none"> • Organisms perform a variety of roles in an ecosystem. • All of the processes that take place within organisms require energy.
Description		
<ul style="list-style-type: none"> • The above standards offer a focus for instruction each year and help ensure that students gain adequate exposure to science content standards. <i>Students advancing through the grades are expected to meet each year's grade-specific standards and retain or further develop skills and understandings mastered in preceding grades.</i> • <i>The complexity options of these standards assure that all students, including those with significant cognitive disabilities, have access to these core standards through appropriate instructional tasks.</i> 		

Life Science (LS) Ohio Extended Standards

Grades 3 - 5

Essence of the Standard:

- *Parents and offspring have many similarities.*
- *Plants and animals have life cycles that affect their ability to survive and reproduce in their environment.*
- *Plants and animals have traits and behaviors that impact their survival.*
- *Environmental changes may impact the survival of an organism.*
- *Fossils provide a point of comparison between the types of organisms that lived long ago and those existing today.*
- *All organisms require energy and can be categorized by their methods of energy acquisition.*
- *Food webs can be used to identify the relationships among producers, consumers and decomposers in an ecosystem.*



(3) Behavior, Growth and Changes

<p>LS.35.1a Describe how an animal's behavior helps it to survive (e.g., a cat will stalk its prey so it can go undetected in the hunt).</p>	<p>LS.35.1b Given a physical trait, match the trait to its specific function (e.g., birds have wings to fly).</p>	<p>LS.35.1c Match animal babies to their parents.</p>
<p>LS.35.2a List two or more survival behaviors that parents teach their offspring.</p>	<p>LS.35.2b Recognize one survival behavior a parent teaches his or her offspring.</p>	<p>LS.35.2c Identify a survival behavior.</p>
<p>LS.35.3a Recognize how a stage in the life cycle supports the survival of a plant or animal.</p>	<p>LS.35.3b Sequence the stages of an animal or plant life cycle from egg to adult.</p>	<p>LS.35.3c Identify a stage in the life cycle of an animal or plant.</p>

(4) Earth's Living History

<p>LS.35.4a Compare two different animals and their migratory patterns.</p>	<p>LS.35.4b Determine reasons for migration of animals.</p>	<p>LS.35.4c Identify season changes that cause migration.</p>
<p>LS.35.5a Predict the effect of environmental changes (e.g., natural disasters, seasons) on animal populations.</p>	<p>LS.35.5b Identify environmental changes that occur suddenly or gradually.</p>	<p>LS.35.5c Identify environmental changes that affect animal behavior.</p>
<p>LS.35.6a Compare a fossil with a present day organism of similar species noting similar characteristics.</p>	<p>LS.35.6b Match fossils with a representation of the organism.</p>	<p>LS.35.6c Identify an object as a fossil.</p>

(5) Interconnections within Ecosystems

<p>LS.35.7a Identify producers, consumers or decomposers.</p>	<p>LS.35.7b Identify predator/prey relationships in a food chain.</p>	<p>LS.35.7c Match a food source for a given animal.</p>
<p>LS.35.8a Trace energy flow in a food web.</p>	<p>LS.35.8b Recognize that plants use the sun's energy.</p>	<p>LS.35.8c Recognize that animals use energy.</p>

Life Science (LS) Ohio Revised Science Standards

Grades 6 - 8

Grade 6	Grade 7	Grade 8
Topic: Cellular to Multicellular	Topic: Cycles of Matter and Flow of Energy	Topic: Species and Reproduction
<ul style="list-style-type: none"> • Cells are the fundamental unit of life. • All cells come from pre-existing cells. • Cells carry on specific functions that sustain life. • Living systems at all levels of organization demonstrate the complementary nature of structure and function. 	<ul style="list-style-type: none"> • Matter is transferred continuously from one organism to another and between organisms and their physical environments. • In any particular biome, the number, growth and survival of organisms and populations depend on biotic and abiotic factors. 	<ul style="list-style-type: none"> • Reproduction is necessary for the continuation of every species. • Diversity of species occurs through gradual processes over many generations. Fossil records provide evidence that changes have occurred in number and types of species. • The characteristics of an organism are a result of inherited traits received from parent(s).
Description		
<ul style="list-style-type: none"> • The above standards offer a focus for instruction each year and help ensure that students gain adequate exposure to science content standards. <i>Students advancing through the grades are expected to meet each year's grade-specific standards and retain or further develop skills and understandings mastered in preceding grades.</i> • <i>The complexity options of these standards assure that all students, including those with significant cognitive disabilities, have access to these core standards through appropriate instructional tasks.</i> 		

Life Science (LS) Ohio Extended Standards

Grades 6 - 8

Essence of the Standards:

- All living things are composed of cells, and those cells carry on specific functions that sustain life.
- Matter cycles between organisms and between organisms and the environment to promote sustainability.
- The number, growth and survival of organisms and populations depend on the living and nonliving factors in the environment.
- Earth has many different environments that support a variety of organisms.

		
Most Complex	Least Complex	
(6) Cellular to Multicellular		
LS.68.1a Explain how cells are organized to form multicellular organisms (cells make up tissue such as muscle).	LS.68.1b Recognize that cells can reproduce or divide.	LS.68.1c Recognize that living things are made of cells.
LS.68.2a Compare plant and animal cells.	LS.68.2b Identify a plant and animal cell.	LS.68.2c Identify a plant cell.
LS.68.3a Recognize that each type of cell has a distinct structure and function.	LS.68.3b Identify various organelles in a cell.	LS.68.3c Identify an organelle in a cell.
(7) Cycles of Matter and Flow of Energy		
LS.68.4a Identify what is required for photosynthesis to occur (carbon dioxide, water, sunlight).	LS.68.4b Identify the term “photosynthesis” as the process by which plants make their own food.	LS.68.4c Explain that plants use light to make their food.
LS.68.5a Identify the products of photosynthesis (oxygen or sugar).	LS.68.5b Explain that the process that plants use to produce food is what produces oxygen for animals to breathe. Focus is on the interaction of organisms.	LS.68.5c Identify what humans need to breathe (oxygen).
LS.68.6a Describe how cellular respiration is the breakdown of food to release the stored energy.	LS.68.6b Identify what is required for cellular respiration (oxygen or sugar).	LS.68.6c Explain that plants break down food to release energy.
LS.68.7a Provide examples of how a plant/animal population changes in relation to the availability of certain resources.	LS.68.7b Explain how an animal population changes if resources become scarce.	LS.68.7c Identify an endangered species of an animal.
LS.68.8a Explain the interactions of physical (abiotic) and biological (biotic) components in an ecosystem.	LS.68.8b Match a given ecosystem with its characteristics.	LS.68.8c Identify an ecosystem.
(8) Species and Reproduction		
LS.68.9a Identify the number of parents required for sexual and asexual reproduction.	LS.68.9b Match eggs to females and sperm cells to males.	LS.68.9c Recognize that living things reproduce.
LS.68.10a Make a list of traits that are passed through DNA.	LS.68.10b Identify DNA as the source of traits.	LS.68.10c Identify DNA.
LS.68.11a Explain how fossils indicate Earth’s history, environment changes and life on Earth.	LS.68.11b Match animals to traits that help them survive in their environment.	LS.68.11c Identify an animal trait needed for survival.
LS.68.12a Explain how an inherited trait gets passed onto the next generation.	LS.68.12b Identify two inherited traits from a set of parents.	LS.68.12c Identify an inherited trait.

Physical Science (PS) Ohio Revised Science Standards

Grades K - 2

Grade K	Grade 1	Grade 2
Topic: Properties of Everyday Objects and Materials	Topic: Motion and Materials	Topic: Changes in Motion
<ul style="list-style-type: none"> • Objects and materials can be sorted and described by their properties. • Some objects and materials can be made to vibrate to produce sound. 	<ul style="list-style-type: none"> • Properties of objects and materials can change. • Objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth. 	<ul style="list-style-type: none"> • Forces change the motion of an object.
Description		
<ul style="list-style-type: none"> • The above standards offer a focus for instruction each year and help ensure that students gain adequate exposure to science content standards. <i>Students advancing through the grades are expected to meet each year's grade-specific standards and retain or further develop skills and understandings mastered in preceding grades.</i> • <i>The complexity options of these standards assure that all students, including those with significant cognitive disabilities, have access to these core standards through appropriate instructional tasks.</i> 		

Physical Science (PS) Ohio Extended Standards

Grades K - 2

Essence of the Standards:

- *Properties of everyday objects and materials*
- *Motions of objects and how changes in motion can occur (force)*

Most Complex	Least Complex	
(K) Properties of Everyday Objects and Materials		
<p>PS.K2.1a Sort or classify objects based on one property.</p> <p>PS.K2.2a Demonstrate ways to change the intensity of a sound produced by an object.</p>	<p>PS.K2.1b List properties of an object.</p> <p>PS.K2.2b Identify at least one way to produce a sound from an object.</p>	<p>PS.K2.1c Interact with an object for a purpose (e.g., touch a pencil, look at a ball).</p> <p>PS.K2.2c Use an object to produce a sound.</p>
(1) Motion and Materials		
<p>PS.K2.3a Explain what properties are different after an object is changed.</p> <p>PS.K2.4a Apply appropriate forces that move an object a given direction or over a specified path.</p>	<p>PS.K2.3b Identify a process that could change an object (e.g., a cup and a crushed cup).</p> <p>PS.K2.4b Identify a force (push or pull) that changes the motion of an object.</p>	<p>PS.K2.3c Change a property of an object (e.g., folding a piece of paper or crushing a cup to change the shape).</p> <p>PS.K2.4c Move a stopped object.</p>
(2) Changes in Motion		
<p>PS.K2.5a Identify forces (e.g., gravity, magnetism, push, pull) that cause a given change (stopped, slower, faster) in the motion of the object.</p>	<p>PS.K2.5b Explain what can be done to make an object stop or move.</p>	<p>PS.K2.5c Make an object start and/or stop moving.</p>

Physical Science (PS) Ohio Revised Science Standards

Grades 3 - 5

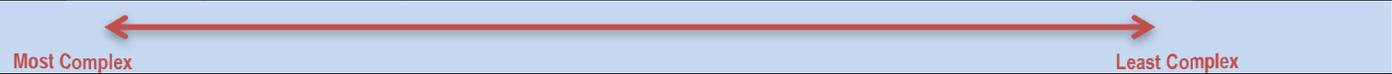
Grade 3	Grade 4	Grade 5
Topic: Matter and Forms of Energy	Topic: Electricity, Heat and Matter	Topic: Light, Sound and Motion
<ul style="list-style-type: none"> • All objects and substances in the natural world are composed of matter. • Matter exists in different states, each of which has different properties. • Heat, electrical energy, light, sound and magnetic energy are forms of energy. 	<ul style="list-style-type: none"> • The total amount of matter is conserved when it undergoes a change. • Energy can be transformed from one form to another or can be transferred from one location to another. 	<ul style="list-style-type: none"> • The amount of change in movement of an object is based on the mass of the object and the amount of force exerted. • Light and sound are forms of energy that behave in predictable ways.
Description		
<ul style="list-style-type: none"> • The above standards offer a focus for instruction each year and help ensure that students gain adequate exposure to science content standards. <i>Students advancing through the grades are expected to meet each year's grade-specific standards and retain or further develop skills and understandings mastered in preceding grades.</i> • <i>The complexity options of these standards assure that all students, including those with significant cognitive disabilities, have access to these core standards through appropriate instructional tasks.</i> 		

Physical Science (PS) Ohio Extended Standards

Grades 3 - 5

Essence of the Standards:

- All objects are made of matter.
- There are different states of matter.
- The amount of matter stays constant.
- There are many forms of energy.
- Energy can be transformed or transferred.
- Sound and light are forms of energy that behave in predictable ways.
- Forces change the movement of an object.



(3) Matter and Forms of Energy

<p>PS.35.1a Classify matter into three states (solid, liquid, gas).</p> <p>PS.35.2a Conduct an experiment with an object showing how energy is utilized (e.g., rock falling, heating water causing it to change into gas).</p>	<p>PS.35.1b Identify properties of solids, liquids and gases.</p> <p>PS.35.2b Identify forms of energy (e.g., heat, light, sound, electrical, magnetic).</p>	<p>PS.35.1c Identify an object as being either a solid or a liquid.</p> <p>PS.35.2c Identify heat and light as a form of energy.</p>
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(4) Electricity, Heat and Matter

<p>PS.35.3a Recognize that the temperature of an object changes as heat is added to or removed from the object.</p> <p>PS.35.4a Explain why the volume of water decreases when placed in an open container and left to sit for an extended period of time.</p> <p>PS.35.5a Complete a simple circuit (e.g., closing a switch or connecting a wire).</p>	<p>PS.35.3b Identify ways objects can be heated.</p> <p>PS.35.4b Recognize that the weight of an object remains the same before and after a property of the object has been changed.</p> <p>PS.35.5b Add an element to expand an existing circuit (e.g., switch, battery, speaker, fan, motor, light bulb).</p>	<p>PS.35.3c Identify an object that produces heat.</p> <p>PS.35.4c Identify the weight of an object before inducing a change (e.g., glass of water before being frozen).</p> <p>PS.35.5c Trace the flow of energy in a circuit in which a battery is used to light a bulb.</p>
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(5) Light, Sound and Motion

<p>PS.35.6a Compare the time it takes two or more objects to travel the same distance at different speeds.</p> <p>PS.35.7a Identify properties that affect pitch (e.g., a large bell makes a deeper sound than a smaller bell).</p> <p>PS.35.8a Identify an instance of refraction (e.g., pencil appearing broken in a glass of water).</p>	<p>PS.35.6b Identify ways the speed of an object can be changed.</p> <p>PS.35.7b Match objects/tools/instruments to examples of sounds of various pitch.</p> <p>PS.35.8b Use a tool or object to create a reflection.</p>	<p>PS.35.6c Identify how the speed of an object can be changed.</p> <p>PS.35.7c Identify the source of a specific sound or light.</p> <p>PS.35.8c Identify the reflection of an object.</p>
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Physical Science (PS) Ohio Revised Science Standards

Grades 6 - 8

Grade 6	Grade 7	Grade 8
Topic: Matter and Motion	Topic: Conservation of Mass and Energy	Topic: Forces and Motion
<ul style="list-style-type: none"> • All matter is made up of small particles called atoms. • Changes of state are explained by a model of matter composed of atoms and/or molecules that are in motion. • There are two categories of energy: kinetic and potential. • An object's motion can be described by its speed and the direction in which it is moving. 	<ul style="list-style-type: none"> • The properties of matter are determined by the arrangement of atoms. • Energy can be transformed or transferred, but is never lost. • Energy can be transferred through a variety of ways. 	<ul style="list-style-type: none"> • Forces between objects act when the objects are in direct contact or when they are not touching. • Forces have magnitude and direction. • There are different types of potential energy.
Description		
<ul style="list-style-type: none"> • The above standards offer a focus for instruction each year and help ensure that students gain adequate exposure to science content standards. <i>Students advancing through the grades are expected to meet each year's grade-specific standards and retain or further develop skills and understandings mastered in preceding grades.</i> • <i>The complexity options of these standards assure that all students, including those with significant cognitive disabilities, have access to these core standards through appropriate instructional tasks.</i> 		

Physical Science (PS) Ohio Extended Standards

Grades 6 - 8

Essence of the Standards:

- All matter is composed of atoms.
- There are two categories of energy: kinetic and potential.
- The motion of an object can be described by its speed and the direction in which it is moving.

- The properties of matter are determined by the arrangement of atoms.
- Energy can be transformed or transferred in a variety of ways, but is never lost.
- Forces have magnitude and direction.

Most Complex

Least Complex

(6) Matter and Motion

PS.68.1a Identify when an object has the greatest/least kinetic and/or potential energy.

PS.68.1b Recognize that the potential energy of an object changes based on its height.

PS.68.1c Demonstrate potential energy.

PS.68.2a Recognize that speed involves both distance and time.

PS.68.2b Identify the speed and direction of a moving object.

PS.68.2c Change the direction or speed of a moving object.

PS.68.3a Compare potential energy with kinetic energy.

PS.68.3b Recognize that the kinetic energy of an object changes based on its speed.

PS.68.3c Identify kinetic energy in a model.

PS.68.4a Identify the elements that make up a given compound (water - hydrogen, oxygen).

PS.68.4b Identify one or more common compounds (e.g., water, salt).

PS.68.4c Recognize that a compound is composed of two or more different elements.

(7) Conservation of Mass and Energy

PS.68.5a Identify at least one difference between a mixture and a compound.

PS.68.5b Identify the components of a given mixture.

PS.68.5c Make a mixture by combining materials.

PS.68.6a Sort common elements found on the Periodic Table of Elements into metals, non-metals.

PS.68.6b Identify common elements (e.g., oxygen, hydrogen, iron, helium, calcium, carbon) found on the Periodic Table of Elements.

PS.68.6c Identify two common elements found on the Periodic Table of Elements.

PS.68.7a Identify an energy transfer (e.g., electricity to heat in a circuit).

PS.68.7b Describe what happens to an object as it loses energy (e.g., pendulum swings less, toy car slows down).

PS.68.7c Demonstrate energy transfer by completing a circuit (e.g., switch to activate a mechanical item).

(8) Forces and Motion

PS.68.8a Classify interactions as static, electrical, gravitational or magnetic.

PS.68.8b Determine the type of interaction between objects (e.g., static, electrical, magnetic or gravitational).

PS.68.8c Use a magnet to demonstrate force on an object.

PS.68.9a Create a force diagram.

PS.68.9b Identify the direction of the different forces acting on an object.

PS.68.9c Cause two objects to interact.

PS.68.10a Predict the result of an application of force in a particular direction (e.g., "hard" push forward, throw downward).

PS.68.10b Conduct an experiment to show how force on an object can change direction.

PS.68.10c Use two objects to display force.

Biology (BIO) Ohio Science Standards

Grades 9 - 12

Heredity	Evolution
<ul style="list-style-type: none"> • Cellular genetics • Structure and function of DNA in cells • Genetic mechanisms and inheritance • Mutations • Modern genetics 	<p>Mechanisms</p> <ul style="list-style-type: none"> • Natural selection • Mutation • Genetic drift • Gene flow (immigration, emigration) • Sexual selection • History of life on Earth <p>Diversity of Life</p> <ul style="list-style-type: none"> • Speciation and biological classification based on molecular evidence • Variation of organisms within a species due to population genetics and gene frequency
Diversity and Interdependence of Life	Cells
<ul style="list-style-type: none"> • Classification systems are frameworks created by scientists for describing the vast diversity of organisms indicating the degree of relatedness between organisms. • Ecosystems <ul style="list-style-type: none"> ○ Homeostasis <ul style="list-style-type: none"> ▪ Carrying capacity ▪ Equilibrium and disequilibrium 	<ul style="list-style-type: none"> ▪ Cell structure and function <ul style="list-style-type: none"> ○ Structure, function and interrelatedness of cell organelles ○ Eukaryotic cells and prokaryotic cells ▪ Cellular processes <ul style="list-style-type: none"> ○ Characteristics of life regulated by cellular processes ○ Photosynthesis, chemosynthesis, cellular respiration ○ Cell division and differentiation
Course Description	
<p>Biology is a high school-level course, which satisfies the Ohio Core science graduation requirements of Ohio Revised Code Section 3313.603. This section of Ohio law requires a three-unit course with inquiry-based laboratory experience that engages students in asking valid scientific questions and gathering and analyzing information.</p> <p>This course investigates the composition, diversity, complexity and interconnectedness of life on Earth. Fundamental concepts of heredity and evolution provide a framework through inquiry-based instruction to explore the living world, the physical environment and the interactions within and between them.</p> <p>Students engage in investigations to understand and explain the behavior of living things in a variety of scenarios that incorporate scientific reasoning, analysis, communication skills and real-world applications.</p> <ul style="list-style-type: none"> • <i>The complexity options of these standards assure that all students, including those with significant cognitive disabilities, have access to these core standards through appropriate instructional tasks.</i> 	

Biology (BIO)

Ohio Extended Standards

Grades 9 - 12

← Most Complex

Least Complex →

Essence of the Standards:

Heredity

- Deoxyribonucleic acid (DNA) is the biological information that directs the formation and maintenance of all living things.
- The sorting and recombination of genes in sexual reproduction and meiosis specifically result in a variance of traits in offspring.
- Classical and modern genetic mechanisms including incomplete dominance, sex-linked traits and dihybrid crosses.

Evolution

- The diversity of life is explained by biological evolution. Populations evolve over time.
- Inheritable characteristics influence how likely an organism is to survive and reproduce in a particular environment.

Diversity and Interdependence of Life

- Classification systems are frameworks developed by scientists for describing the diversity of organisms, indicating the degree of relatedness between organisms.
- Morphological comparisons and molecular evidence must be used to describe biodiversity (cladograms).
- Organisms transform energy (flow of energy) and matter (cycles of matter) as they survive.

Cells

- The cell is a system that conducts a variety of functions associated with life including photosynthesis, chemosynthesis, cellular respiration, cell division and differentiation.
- Cells have organelles (cytoskeleton, Golgi complex and endoplasmic reticulum) that help carry out life functions.
- Within the cell are specialized parts for the transport of materials, energy transformation, protein building, waste disposal, information feedback and movement.

Heredity

BIO.912.1a Identify that different species have different DNA.

BIO.912.1b Identify a trait that was inherited from a parent (personal connection).

BIO.912.1c Identify parents and identify a trait about each one.

BIO.912.2a Identify DNA as a code for traits (e.g., eye color, hair color).

BIO.912.2b Match a picture of a DNA structure to the term DNA.

BIO.912.2c Recognize that genes make up DNA.

BIO.912.3a Complete a partially filled dihybrid cross.

BIO.912.3b Recognize that genes combine during sexual reproduction.

BIO.912.3c Identify a sex-linked trait.

Evolution

BIO.912.4a Describe adaptations animals and plants make to survive in their environment.

BIO.912.4b Identify how plants or animals adapt to their environments.

BIO.912.4c Identify an animal that would survive in a given environment (e.g., polar bear in the Arctic)

BIO.912.5a Complete a cladogram (evolutionary tree) showing the common ancestor of specific organisms.

BIO.912.5b Match a common ancestor to a living organism (e.g., an elephant and a mammoth).

BIO.912.5c Identify evolutionary changes between a living organism and its ancestor (e.g., change in size throughout horse evolution).

BIO.912.6a Identify the time it takes for an evolutionary change to take place.

BIO.912.6b Describe changes to an organism that has changed over the course of many generations.

BIO.912.6c Identify an organism that has changed over the course of many generations.

Diversity and Interdependence of Life

BIO.912.7a Sort organisms according to their classification.

BIO.912.7b Match two organisms in the same classification.

BIO.912.7c Sort plants and animals according to their classification.

BIO.912.8a Describe how a plant/animal population changes in relation to the availability of certain resources.

BIO.912.8b Identify how a population would change in relation to a predator/prey population.

BIO.912.8c Match a plant/animal to a resource it uses from its environment.

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Cells

<p>BIO.912.9a Compare and contrast plant and animal cells.</p> <p>BIO.912.10a Complete a diagram that depicts the process of photosynthesis.</p> <p>BIO.912.11a Categorize different types of cells by the specific function they perform (e.g., blood cells, fat cells, muscle cells, sex cells).</p>	<p>BIO.912.9b Identify a plant and animal cell.</p> <p>BIO.912.10b Identify photosynthesis and cellular respiration as occurring in a cell.</p> <p>BIO.912.11b Match the organelle with the process it helps to execute (e.g., chloroplast, photosynthesis).</p>	<p>BIO.912.9c Identify differences in models of plant and animal cells (e.g., color, shape).</p> <p>BIO.912.10c Recognize that processes like photosynthesis and respiration take place at the cellular level.</p> <p>BIO.912.11c Identify organelles within a cell.</p>
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Chemistry (CHM) Ohio Science Standards

Grades 9 - 12

Structure and Properties of Matter	Interactions of Matter
<ul style="list-style-type: none"> • Atomic structure <ul style="list-style-type: none"> ○ Evolution of atomic models/theory ○ Electrons ○ Electron configurations • Periodic table <ul style="list-style-type: none"> ○ Properties ○ Trends • Intramolecular chemical bonding <ul style="list-style-type: none"> ○ Ionic ○ Polar/covalent • Representing compounds <ul style="list-style-type: none"> ○ Formula writing ○ Nomenclature ○ Models and shapes (Lewis structures, ball and stick, molecular geometries) • Quantifying matter • Phases of matter • Intermolecular chemical bonding <ul style="list-style-type: none"> ○ Types and strengths ○ Implications for properties of substances <ul style="list-style-type: none"> ▪ Melting and boiling point ▪ Solubility ▪ Vapor pressure 	<ul style="list-style-type: none"> • Chemical reactions <ul style="list-style-type: none"> ○ Types of reactions ○ Kinetics ○ Energy ○ Equilibrium ○ Acids/bases • Gas laws <ul style="list-style-type: none"> ○ Pressure, volume and temperature ○ Ideal gas law • Stoichiometry <ul style="list-style-type: none"> ○ Molar calculations ○ Solutions ○ Limiting reagents • Nuclear Reactions <ul style="list-style-type: none"> ○ Radioisotopes ○ Nuclear energy

Course Description

Chemistry is a high school-level course, which satisfies the Ohio Core science graduation requirements of Ohio Revised Code Section 3313.603. This section of Ohio law requires a three-unit course with inquiry-based laboratory experience that engages students in asking valid scientific questions and gathering and analyzing information.

This course introduces students to key concepts and theories that provide a foundation for further study in other sciences as well as advanced science disciplines. Chemistry comprises a systematic study of the *predictive* physical interactions of matter and subsequent events that occur in the natural world. The study of matter through the exploration of classification, its structure and its interactions is how this course is organized.

Investigations are used to understand and explain the behavior of matter in a variety of inquiry and design scenarios that incorporate scientific reasoning, analysis, communication skills and real-world applications. An understanding of leading theories and how they have informed current knowledge prepares students with higher order cognitive capabilities of evaluation, prediction and application.

- *The complexity options of these standards assure that all students, including those with the significant cognitive disabilities, have access to these core standards through appropriate instructional tasks.*

← Most Complex

→ Least Complex

Essence of the Standards:

Structure of Matter

- The Periodic Table of Elements organizes the elements according to similarities in their electron configurations.
- Many of the properties of compounds can be predicted by the types of bonding between atoms.
- Compounds can be represented by chemical formulas and ball-and-stick models.

Interactions of Matter

- The amount of energy involved in breaking and forming of bonds during chemical reactions can be used in part to determine the likelihood of a reaction occurring spontaneously.
- The kinetic-molecular theory can be used to explain the macroscopic properties of gases (pressure, temperature and volume) through the motion and interactions of its particles.
- Coefficients in balanced equations can be used to determine the relative amounts of substances (reactants and/or products) involved in chemical reactions.

Structure and Properties of Matter

CHM.912.1a Identify parts of an atom (protons, neutrons, electrons).

CHM.912.1b Identify a diagram or model of an atom.

CHM.912.1c Identify that all matter is made of atoms.

CHM.912.2a Represent a chemical compound with a ball and stick model or chemical formula.

CHM.912.2b Identify that a ball and stick model or chemical formula represents a chemical compound.

CHM.912.2c Identify that two elements combine to form a compound.

CHM.912.3a Use a Periodic Table to answer questions (e.g., electron configurations, groupings).

CHM.912.3b Recognize that elements are organized on the Periodic Table.

CHM.912.3c Identify the Periodic Table of Elements.

Interactions of Matter

CHM.912.4a Identify the reactants and the products in a chemical reaction (e.g., Ingredients/bread)

CHM.912.4b Perform a chemical reaction (baking soda and vinegar).

CHM.912.4c Identify common chemical reactions (e.g., cooking, burning).

CHM.912.5a Use litmus paper to test and determine the pH of a substance.

CHM.912.5b Given a pH scale with common ingredients (orange juice, water, baking soda), determine if they are acid, neutral or basic.

CHM.912.5c Interact with acids and bases (e.g., food, water, soil).

CHM.912.6a Identify measurements of gases (volume, temperature and pressure).

CHM.912.6b Identify objects that will contain gases.

CHM.912.6c Identify gases.

Environmental Science (EVS)

Ohio Science Standards

Grades 9 - 12

Earth Systems: Interconnected Spheres of Earth	Earth's Resources
<ul style="list-style-type: none"> • Biosphere <ul style="list-style-type: none"> ○ Evolution and adaptation in populations ○ Biodiversity ○ Ecosystems (equilibrium, species interactions, stability) ○ Population dynamics • Atmosphere <ul style="list-style-type: none"> ○ Atmospheric properties and currents • Lithosphere <ul style="list-style-type: none"> ○ Geologic events and processes • Hydrosphere <ul style="list-style-type: none"> ○ Oceanic currents and patterns (as they relate to climate) ○ Surface and ground water flow patterns and movement ○ Cryosphere • Movement of matter and energy through the hydrosphere, lithosphere, atmosphere and biosphere <ul style="list-style-type: none"> ○ Energy transformations on global, regional and local scales ○ Biogeochemical cycles ○ Ecosystems ○ Climate and weather 	<ul style="list-style-type: none"> • Energy resources <ul style="list-style-type: none"> ○ Renewable and nonrenewable energy sources and efficiency ○ Alternate energy sources and efficiency ○ Resource availability ○ Mining and resource extraction • Air and air pollution <ul style="list-style-type: none"> ○ Primary and secondary contaminants ○ Greenhouse gases ○ Clean Air Act • Water and water pollution <ul style="list-style-type: none"> ○ Potable water and water quality ○ Hypoxia, eutrophication ○ Clean Water Act ○ Point source and non-point source contamination • Soil and land <ul style="list-style-type: none"> ○ Desertification ○ Mass wasting and erosion ○ Sediment contamination ○ Land use and land management (including food production, agriculture and zoning) ○ Solid and hazardous waste • Wildlife and wilderness • Wildlife and wilderness management • Endangered species
<p>Global Environmental Problems and Issues</p> <ul style="list-style-type: none"> ○ Human population ○ Potable water quality, use and availability ○ Climate change ○ Sustainability ○ Species depletion and extinction ○ Air quality ○ Food production and availability ○ Deforestation and loss of biodiversity ○ Waste management (solid and hazardous) 	
<p>Course Description</p>	
<p>Environmental science is a high school-level course, which satisfies the Ohio Core science graduation requirements of Ohio Revised Code Section 3313.603. This section of Ohio law requires a three-unit course with inquiry-based laboratory experience that engages students in asking valid scientific questions and gathering and analyzing information.</p> <p>Environmental science incorporates biology, chemistry, physics and physical geology and introduces students to key concepts, principles and theories within environmental science.</p> <p>Investigations are used to understand and explain the behavior of nature in a variety of inquiry and design scenarios that incorporate scientific reasoning, analysis, communication skills and real-world applications. It should be noted that there are classroom examples in the model curriculum that can be developed to meet multiple sections of the syllabus, so one well-planned, long-term project can be used to teach multiple topics.</p> <ul style="list-style-type: none"> • <i>The complexity options of these standards assure that all students, including those with significant cognitive disabilities, have access to these core standards through appropriate instructional tasks.</i> 	

Environmental Science (EVS)

Ohio Extended Standards

Grades 9 - 12



Most Complex

Least Complex

Essence of the Standards:

Earth Systems

- Connections and interactions (human-made and natural) between Earth's spheres (hydrosphere, atmosphere and lithosphere).
- Movement of matter and energy through the hydrosphere, atmosphere, biosphere and lithosphere.

Earth's Resources

- Availability of Earth's resources, extraction of the resources, contamination problems, remediation techniques and the storage/disposal of the resources or by-products.
- Conservation, protection and sustainability of Earth's resources.

Global Environmental Problems and Issues

- Availability of Earth's resources, extraction of the resources, contamination problems, remediation techniques and the storage/disposal of the resources or by-products on a global or international scale.
- Conservation, protection and sustainability of Earth's resources on a global or international scale.

Earth Systems: Interconnected Spheres of Earth

EVS.912.1a Identify how a contaminant can move between the hydrosphere, atmosphere and lithosphere (hydrologic cycle).

EVS.912.1b Recognize that pollution can affect more than one sphere (hydrosphere, lithosphere, atmosphere).

EVS.912.1c Identify a contaminant.

Earth's Resources

EVS.912.2a Explain why a species is considered endangered.

EVS.912.2b Identify species as endangered or non-endangered.

EVS.912.2c Identify multiple types of endangered species.

EVS.912.3a Identify a consequence of soil, water or air pollution.

EVS.912.3b Identify a greenhouse gas.

EVS.912.3c Identify soil, water and/or air pollution.

EVS.912.4a Describe the benefit(s) of alternative energy.

EVS.912.4b Describe forms of alternative energy.

EVS.912.4c Identify an alternative source of energy.

Global Environmental Problems and Issues

EVS.912.5a Explain how resources can be preserved to reduce the impact on Earth (e.g., planting new trees after chopping down others).

EVS.912.5b Recognize that some environmental problems are global (e.g., water or air pollution, extinction, deforestation).

EVS.912.5c Recognize what makes a resource renewable or non-renewable.

EVS.912.6a Describe a change or preservation in the environment caused by people around the world (deforestation and replanting of trees).

EVS.912.6b Identify ways humans have changed the global environment (e.g., water quality, air quality, waste management).

EVS.912.6c Recognize that humans can change their environment.

Minerals	Igneous, Metamorphic and Sedimentary Rocks
<ul style="list-style-type: none"> • Atoms and elements • Chemical bonding (ionic, covalent, metallic) • Crystallinity (crystal structure) • Criteria of a mineral (crystalline solid, occurs in nature, inorganic, defined chemical composition) • Properties of minerals (hardness, luster, cleavage, streak, crystal shape, fluorescence, flammability, density/specific gravity, malleability) 	<ul style="list-style-type: none"> • Igneous <ul style="list-style-type: none"> ○ Mafic and felsic rocks and minerals ○ Intrusive (igneous structures: dikes, sills, batholiths, pegmatites) ○ Earth's interior (inner core, outer core, lower mantle, upper mantle, Mohorovicic discontinuity, crust) ○ Magnetic reversals and Earth's magnetic field ○ Thermal energy within the Earth ○ Extrusive (volcanic activity, volcanoes: cinder cones, composite, shield) ○ Bowen's Reaction Series (continuous and discontinuous branches) • Metamorphic <ul style="list-style-type: none"> ○ Pressure, stress, temperature and compressional forces ○ Foliated (regional), non-foliated (contact) ○ Parent rock and degrees of metamorphism ○ Metamorphic zones (where metamorphic rocks are found) • Sedimentary <ul style="list-style-type: none"> ○ The ocean ○ Tides (daily, neap and spring) ○ Currents (deep and shallow, rip and longshore) ○ Thermal energy and water density ○ Waves ○ Ocean features (ridges, trenches, island systems, abyssal zone, shelves, slopes, reefs, island arcs) ○ Passive and active continental margins ○ Division of sedimentary rocks and minerals (chemical, clastic/physical, organic) ○ Depositional environments ○ Streams (channels, streambeds, floodplains, cross-bedding, alluvial fans, deltas) ○ Transgressing and regressing sea levels
Earth's History	Plate Tectonics
<ul style="list-style-type: none"> • The geologic rock record <ul style="list-style-type: none"> ○ Relative and absolute age ○ Principles to determine relative age <ul style="list-style-type: none"> ▪ Original horizontality ▪ Superposition ▪ Cross-cutting relationships • Absolute age <ul style="list-style-type: none"> ○ Radiometric dating (isotopes, radioactive decay) ○ Correct uses of radiometric dating • Combining relative and absolute age data • The geologic time scale <ul style="list-style-type: none"> ○ Comprehending geologic time ○ Climate changes evident through the rock record ○ Fossil record 	<ul style="list-style-type: none"> • Internal Earth <ul style="list-style-type: none"> ○ Seismic waves <ul style="list-style-type: none"> ▪ S and P waves ▪ Velocities, reflection, refraction of waves ○ Structure of Earth (Note: Specific layers were part of grade.) <ul style="list-style-type: none"> ▪ Asthenosphere ▪ Lithosphere ▪ Mohorovicic boundary (Moho) ▪ Composition of each of the layers of Earth ▪ Gravity, magnetism and isostasy ▪ Thermal energy (geothermal gradient and heat flow) • Historical review (Note: This would include a review of continental drift and sea-floor spreading found in Grade 8.) <ul style="list-style-type: none"> ○ Paleomagnetism and magnetic anomalies ○ Paleoclimatology • Plate motion (Note: This was introduced in Grade 8.) <ul style="list-style-type: none"> ○ Causes and evidence of plate motion ○ Measuring plate motion ○ Characteristics of oceanic and continental plates ○ Relationship of plate movement and geologic events and features ○ Mantle plumes

Earth's Resources	Glacial Geology
<ul style="list-style-type: none"> • Energy resources <ul style="list-style-type: none"> ○ Renewable and nonrenewable energy sources and efficiency ○ Alternate energy sources and efficiency ○ Resource availability ○ Mining and resource extraction • Air <ul style="list-style-type: none"> ○ Primary and secondary contaminants ○ Greenhouse gases • Water <ul style="list-style-type: none"> ○ Potable water and water quality ○ Hypoxia, eutrophication • Soil and sediment <ul style="list-style-type: none"> ○ Desertification ○ Mass wasting and erosion ○ Sediment contamination 	<ul style="list-style-type: none"> • Glaciers and glaciation <ul style="list-style-type: none"> ○ Evidence of past glaciers (including features formed through erosion or deposition) ○ Glacial deposition and erosion (including features formed through erosion or deposition) ○ Data from ice cores ○ Historical changes (glacial ages, amounts, locations, particulate matter, correlation to fossil evidence) ○ Evidence of climate changes throughout Earth's history ○ Glacial distribution and causes of glaciation ○ Types of glaciers – continental (ice sheets, ice caps), alpine/valley (piedmont, valley, cirque, ice caps) ○ Glacial structure, formation and movement

Course Description

Physical geology is a high school-level course, which satisfies the Ohio Core science graduation requirements of Ohio Revised Code Section 3313.603. This section of Ohio law requires a three-unit course with inquiry-based laboratory experience that engages students in asking valid scientific questions and gathering and analyzing information.

Physical geology incorporates chemistry, physics and environmental science and introduces students to key concepts, principles and theories within geology.

Investigations are used to understand and explain the behavior of nature in a variety of inquiry and design scenarios that incorporate scientific reasoning, analysis, communication skills and real-world applications.

- *The complexity options of these standards assure that all students, including those with significant cognitive disabilities, have access to these core standards through appropriate instructional tasks.*

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Physical Geology (PG) Ohio Extended Standards

Grades 9 - 12

← Most Complex

Least Complex →

Essence of the Standards:

Minerals

- Identify the physical properties of different minerals.
- Use properties of a mineral to interpret the conditions that existed during the formation of the mineral.

Igneous, Metamorphic and Sedimentary Rock

- Each type of rock contains different minerals due to the different environment in which the different rock types form.
- Each rock type forms in different environments.

Earth's History

- Analyze the rock and fossil record.
- Understand fossil formation and the methods scientists use to determine the ages of events through the rock record.

Plate Tectonics

- Predict earthquake and volcano activity based on tectonic activity levels.
- Identify the magnitude of an earthquake.

Earth's Resources

- Analyze the effectiveness and efficiency of renewable and nonrenewable energy resources (at state, national and global levels).

Glacial Geology

- Analyze the rock record and ice cores to investigate changes that have occurred over the history of Earth.

Minerals

PG.912.1a Sort minerals by cleavage, streak, hardness and fracture.

PG.912.1b Identify hardness and fracture as two characteristics to identify a mineral.

PG.912.1c Match minerals by properties (e.g., cleavage, streak, magnetism).

PG.912.2a Match minerals to environments in which they were formed.

PG.912.2b Identify environments in which minerals can form.

PG.912.2c Recognize that minerals are formed by environments.

Igneous, Metamorphic and Sedimentary Rocks

PG.912.3a Match rock types to environments in which they were formed.

PG.912.3b Identify which types of environments rock types are formed.

PG.912.3c Recognize that rock types are formed by environments.

PG.912.4a Match minerals with rock types in which they are commonly found.

PG.912.4b Identify a common mineral in a common rock.

PG.912.4c Recognize that minerals can be found in rocks.

Earth's History

PG.912.5a Identify fossil evidence that supports a theory of the conditions of a past environment (e.g., location was a lake; fossils of fish and aquatic plants are found at that time in the rock record).

PG.912.5b Identify an area in a given section of the rock record where there is evidence of a significant change (e.g., climate, major event like a flood).

PG.912.5c Participate in an investigation displaying how rocks can indicate historical climate events.

Plate Tectonics

PG.912.6a Determine which continents used to be connected based on tectonic evidence.

PG.912.6b Recognize that the shape of the continents is evidence of plate motion (e.g., they fit together like puzzle pieces).

PG.912.6c Identify the crust as the location of the continental plates.

PG.912.7a Analyze which earthquake was larger based on a seismographic report or readout.

PG.912.7b Describe how a Richter scale is used as a tool to measure the seismic waves of an earthquake.

PG.912.7c Recognize that a Richter scale is a tool used to measure intensity of earthquakes.

Earth's Resources

PG.912.8a Identify factors to consider before mining for mineral resources (e.g., cost, pollution, effects on wildlife).

PG.912.8b Identify the effect that mining for a mineral resource has on an area.

PG.912.8c Recognize that minerals are a resource.

Glacial Geology

PG.912.9a Identify land features that were formed through either erosion or deposition from glaciers.

PG.912.9b Identify land features in Ohio that were formed by glaciers.

PG.912.9c Identify that glaciers consist mainly of ice.

Physical Science (PS-H) Ohio Science Standards

Grades 9 - 12

Study of Matter	Energy and Waves
<ul style="list-style-type: none"> • Classification of matter <ul style="list-style-type: none"> ○ Heterogeneous vs. homogeneous ○ Properties of matter ○ States of matter and its changes • Atoms <ul style="list-style-type: none"> ○ Models of the atom (components) ○ Ions (cations and anions) ○ Isotopes • Periodic trends of the elements <ul style="list-style-type: none"> ○ Periodic law ○ Representative groups • Bonding and compounds <ul style="list-style-type: none"> ○ Bonding (ionic and covalent) ○ Nomenclature • Reactions of matter • Chemical reaction • Nuclear reactions 	<ul style="list-style-type: none"> • Conservation of energy <ul style="list-style-type: none"> ○ Quantifying kinetic energy ○ Quantifying gravitational potential energy ○ Energy is relative • Transfer and transformation of energy (including work) • Waves <ul style="list-style-type: none"> ○ Refraction, reflection, diffraction, absorption, superposition ○ Radiant energy and the electromagnetic spectrum ○ Doppler shift • Thermal energy • Electricity <ul style="list-style-type: none"> ○ Movement of electrons ○ Current ○ Electric potential (voltage) ○ Resistors and transfer of energy
Forces and Motion	The Universe
<ul style="list-style-type: none"> • Motion <ul style="list-style-type: none"> ○ Introduction to one-dimensional vectors ○ Displacement, velocity (constant, average and instantaneous) and acceleration ○ Interpreting position vs. time and velocity vs. time graphs • Forces <ul style="list-style-type: none"> ○ Force diagrams ○ Types of forces (gravity, friction, normal, tension) ○ Field model for forces at a distance • Dynamics (how forces affect motion) <ul style="list-style-type: none"> ○ Objects at rest ○ Objects moving with constant velocity ○ Accelerating objects 	<ul style="list-style-type: none"> • History of the universe • Galaxy formation • Stars <ul style="list-style-type: none"> ○ Formation, stages ○ Fusion in stars

Course Description

Physical science is a high school-level course, which satisfies the Ohio Core science graduation requirements of Ohio Revised Code Section 3313.603. This section of Ohio law requires a three-unit course with inquiry-based laboratory experience that engages students in asking valid scientific questions and gathering and analyzing information.

Physical science introduces students to key concepts and theories that provide a foundation for further study in other sciences and advanced science disciplines. Physical science comprises the systematic study of the physical world as it relates to fundamental concepts about matter, energy and motion. A unified understanding of phenomena in physical, living, Earth and space systems is the culmination of all previously learned concepts related to chemistry, physics, and Earth and space science, along with historical perspective and mathematical reasoning.

- *The complexity options of these standards assure that all students, including those with significant cognitive disabilities, have access to these core standards through appropriate instructional tasks.*

← Most Complex

→ Least Complex

Essence of the Standards:

Study of Matter

- Matter can be classified into categories according to its composition, chemical and/or physical properties.
- Energy is involved in changing the temperature and phase of a substance.

Energy and Waves

- Waves transmit energy from one place to another and can experience reflection and absorption.
- Changes in the frequency of a wave can be observed if the wave source and the observer are moving relative to one another.
- Radiant energy travels in waves, and can be absorbed, usually increasing the thermal energy of the object.
- Thermal energy can be absorbed by an object, transmitted from an object or transferred within an object.

Forces and Motion

- Motion can be described in terms of distance, position, displacement, speed, velocity, acceleration and time.
- Force has both magnitude and direction. There are many types of forces: friction, normal force, gravitational, magnetic and electrical.
- An object's motion will not change (will remain at rest or at a constant speed) unless an unbalanced net force acts on it.

The Universe

- The Big Bang model explains the origin and evolution of our universe.
- There are billions of galaxies in the universe and they are classified by shape.
- Star formation is the same for all stars. The life cycle of a star is determined by the star's mass.

Study of Matter

PS-H.912.1a Recognize the difference between a solution and mixture.

PS-H.912.1b Identify a method to separate a mixture.

PS-H.912.1c Create a mixture.

PS-H.912.2a Classify objects by their physical properties (e.g., weight, melting and boiling points).

PS-H.912.2b Identify physical properties of matter (e.g., size, weight, shape, magnetic, melting and boiling point).

PS-H.912.2c Explore a physical property of matter.

PS-H.912.3a Describe how thermal energy moves (e.g., thermal energy as ice melts).

PS-H.912.3b Identify heat as thermal energy.

PS-H.912.3c Identify the cause of a phase change.

Energy and Waves

PS-H.912.4a Identify kinetic and potential energy.

PS-H.912.4b Change the kinetic and potential energy of an object.

PS-H.912.4c Change the kinetic or potential energy of an object.

PS-H.912.5a Describe light and sound as traveling in waves.

PS-H.912.5b Identify light and sound as traveling in waves.

PS-H.912.5c Recognize that sound travels in waves.

PS-H.912.6a Describe how different colors of objects absorb thermal energy differently.

PS-H.912.6b Explore how thermal energy can be absorbed by objects.

PS-H.912.6c Follow the path of thermal energy transfer in a diagram.

PS-H.912.7a Construct a circuit with two or more components (e.g., light bulb, motor, battery).

PS-H.912.7b Complete a circuit using two or more components (e.g., light bulb, motor, battery).

PS-H.912.7c Trace the flow of energy in a circuit.

Forces and Motion

PS-H.912.8a Complete a force diagram by indicating the location and direction of the normal force.

PS-H.912.8b Label forces and/or directions of forces on a force diagram.

PS-H.912.8c Identify a force on an object in a force diagram.

PS-H.912.9a Describe a motion of an object given its position vs. time graph (is it moving, speeding up or stopped?).

PS-H.912.9b Apply an unbalanced force to an object to change its motion (e.g., accelerate it, stop it, start it).

PS-H.912.9c Identify an unbalanced force.

PS-H.912.10a In a specific situation, organize the surface types from "causes the most friction" (most difficult to push) to "causes the least amount of friction" (easiest to push).

PS-H.912.10b Investigate friction and normal force as it relates to moving an object (sliding furniture over different types of flooring).

PS-H.912.10c Recognize that diverse surface types cause friction differently.

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The Universe

PS-H.912.11a Create a model that shows how the universe is expanding (e.g., blowing up a balloon).

PS-H.912.12a Classify a galaxy based on its shape (e.g., spiral, barred-spiral, elliptical, irregular).

PS-H.912.13a Match a star of a specific relative mass (e.g., low, medium, high) with its life cycle.

PS-H.912.11b Identify a model that illustrates the Big Bang theory.

PS-H.912.12b Match two galaxies of the same type (e.g., spiral, elliptical).

PS-H.912.13b Identify "mass" as the property that determines the life cycle of a star.

PS-H.912.11c Recognize that the universe is expanding.

PS-H.912.12c Recognize that many stars make up a galaxy.

PS-H.912.19c Recognize that stars form from clouds of gas.

Physics (PHY) Ohio Science Standards

Grades 9 - 12

Motion	Forces, momentum and motion
<ul style="list-style-type: none"> • Graph interpretations <ul style="list-style-type: none"> ○ Position vs. time ○ Velocity vs. time ○ Acceleration vs. time • Problem -solving <ul style="list-style-type: none"> ○ Using graphs (average velocity, instantaneous velocity, acceleration, displacement, change in velocity) ○ Uniform acceleration including free fall (initial velocity, final velocity, time, displacement, acceleration, average velocity) • Projectiles <ul style="list-style-type: none"> ○ Independence of horizontal and vertical motion ○ Problem-solving involving horizontally launched projectiles 	<ul style="list-style-type: none"> • Newton's laws applied to complex problems • Gravitational force and fields • Elastic forces • Friction force (static and kinetic) • Air resistance and drag • Forces in two dimensions <ul style="list-style-type: none"> ○ Adding vector forces ○ Motion down inclines ○ Centripetal forces and circular motion • Momentum, impulse and conservation of momentum
Energy	Waves
<ul style="list-style-type: none"> • Gravitational potential energy • Energy in springs • Nuclear energy • Work and power • Conservation of energy 	<ul style="list-style-type: none"> • Wave properties <ul style="list-style-type: none"> ○ Conservation of energy ○ Reflection ○ Refraction ○ Interference ○ Diffraction • Light phenomena <ul style="list-style-type: none"> ○ Ray diagrams (propagation of light) ○ Law of reflection (equal angles) ○ Snell's law ○ Diffraction patterns ○ Wave – particle duality of light ○ Visible spectrum and color
Electricity and magnetism	
<ul style="list-style-type: none"> • Charging objects (friction, contact and induction) • Coulomb's law • Electric fields and electric potential energy • DC circuits <ul style="list-style-type: none"> ○ Ohm's law ○ Series circuits ○ Parallel circuits ○ Mixed circuits ○ Applying conservation of charge and energy (junction and loop rules) • Magnetic fields and energy • Electromagnetic interactions 	

Course Description

Physics is a high school-level course, which satisfies the Ohio Core science graduation requirements of Ohio Revised Code Section 3313.603. This section of Ohio law requires a three-unit course with inquiry-based laboratory experience that engages students in asking valid scientific questions and gathering and analyzing information.

Physics elaborates on the study of the key concepts of motion, forces and energy as they relate to increasingly complex systems and applications that will provide a foundation for further study in science and scientific literacy.

Students engage in investigations to understand and explain motion, forces and energy in a variety of inquiry and design scenarios that incorporate scientific reasoning, analysis, communication skills and real-world applications.

- *The complexity options of these standards assure that all students, including those with significant cognitive disabilities, have access to these core standards through appropriate instructional tasks.*

Physics (PHY) Ohio Extended Standards

Grades 9 - 12

← Most Complex

Least Complex →

Essence of the Standards:

- *Graphs and problem-solving techniques can be used to represent motion, especially projectile motion and other situations involving uniform acceleration.*
- *Gravitational, elastic, electric and friction forces can be analyzed in situations involving two-dimensional, multiple forces acting on an object.*
- *Apply problem-solving techniques and interpret graphs in relation to motion and its properties.*
- *Identify the effect of gravity.*
- *Identify the various types of energy and usage by consumers.*
- *Identify wave properties.*
- *Identify properties of light.*
- *Identify and interact with direct current circuits.*
- *Investigate magnetic fields and magnetic energy.*

Motion

PHY.912.1a Determine whether a ball needs to be thrown higher (vertical) or farther (horizontal) for it to land in a designated area (e.g., a hoop or on an "x" on the ground).

PHY.912.1b Identify the horizontal and vertical motions of a projectile.

PHY.912.1c Recognize that projectiles have movement in both horizontal and vertical directions.

PHY.912.2a Complete a motion graph by indicating the sections of positive and negative acceleration.

PHY.912.2b Label areas of different motion on a motion graph (e.g., sections of positive and negative acceleration).

PHY.912.2c Identify the motion of an object in a motion graph.

Forces, momentum and motion

PHY.912.3a Demonstrate Newton's Third Law – for every action, there is an equal and opposite reaction.

PHY.912.3b Recognize that momentum is conserved in a collision.

PHY.912.3c Identify the direction of an object's motion after it collides with another moving object.

PHY.912.4a Identify the force that, if removed from an object moving in a circular motion, would cause the object to move in a straight line.

PHY.912.4b Indicate the direction of the centripetal force of an object moving in a circular motion (e.g., ball being swung on a string).

PHY.912.4c Recognize that gravity is the force that keeps planets and satellites in circular orbits.

Energy

PHY.912.5a Chart different energy sources.

PHY.912.5b Describe ways people use energy.

PHY.912.5c Identify types of energy (e.g., nuclear, gravitational, elastic).

Waves

PHY.912.6a Indicate which medium light travels through fastest (e.g., air, water, prism).

PHY.912.6b 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).

PHY.912.6c Use a mirror and/or prism to reflect light.

PHY.912.7a Create a ray diagram showing the path of a light/sound wave.

PHY.912.7b Complete a simple ray diagram to show at what angle a wave is reflected off of a surface.

PHY.912.7c Reflect a wave off a surface.

PHY.912.8a Describe what happens to a sound when wave frequency changes.

PHY.912.8b Change the frequency of a sound wave by changing a property of the string or tube that the wave is resonating through.

PHY.912.8c Make a sound with a string or tube.

Electricity and Magnetism

PHY.912.9a Test for a magnetic field around an electromagnet.

PHY.912.9b Identify a materials needed to create an electromagnet.

PHY.912.9c Manipulate two objects displaying magnetism.

PHY.912.10a Construct a direct current circuit.

PHY.912.10b Complete a direct current circuit.

PHY.912.10c Trace the flow of electricity in a direct circuit.