



# Ohio

Ohio's Learning Standards

# Science

ADOPTED FEBRUARY 2018

# Table of Contents

**Introduction to Ohio's Learning Standards for Science .....3**

**Topics by Grade Level .....7**

**Ohio's Learning Standards for Science, Grades K-8 .....9**

Kindergarten .....9

Grade 1 .....17

Grade 2 .....25

Grade 3 .....33

Grade 4 .....44

Grade 5 .....53

Grade 6 .....62

Grade 7 .....77

Grade 8 .....90

**Ohio's Learning Standards for Science, High School .....101**

Physical Science .....101

Biology .....103

Chemistry .....105

Environmental Science .....107

Physical Geology .....109

Physics .....112

Human Anatomy and Physiology .....114

# Introduction to Ohio's Learning Standards for Science

## OVERVIEW

This overview restates the visions and goals of Ohio's Learning Standards and Model Curriculum for Science, lists the guiding principles that framed their development and contains definitions of terms used in the document. Users also will see definitions for the Cognitive Demands that guided the development of the Expectations for Learning.

## STANDARDS

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

- Know, use and interpret scientific explanations of the natural world;
- Generate and evaluate scientific evidence and explanations, distinguishing science from pseudoscience;
- Understand the nature and development of scientific knowledge; and
- Participate productively in scientific practices and discourse.<sup>1</sup>

"Knowledge of science can enable us to think critically and frame productive questions. Without scientific knowledge, we are wholly dependent on others as "experts." With scientific knowledge, we are empowered to become participants rather than merely observers. Science, in this sense, is more than a means for

getting ahead in the world of work. It is a resource for becoming a critical and engaged citizen in a democracy." -Ready, Set, *SCIENCE! (2008)*<sup>2</sup>

The K-8 and high school document offers guidance for educators who teach science to Ohio students. Each Content Statement and Content Elaboration presents what students should know about a given discipline of science. The accompanying Expectations for Learning incorporate science skills and processes, and technological and engineering design. The Visions into Practice section offers optional examples of tasks students can perform to learn about science and demonstrate their understanding of the grade-level materials. The Instructional Supports section includes subsections on Instructional Strategies and Resources, Common Misconceptions, Diverse Learners, and Classroom Portals.

It is the blending of the Content Statements and Content Elaborations with the Expectations for Learning that will form the basis for future assessments.

**Note: The model curriculum is being revised. The Ohio Department of Education will add the model curriculum to this document once it is adopted. The model curriculum includes the Content Elaborations, Expectations for Learning, and Visions into Practice.**

## GOALS

Ohio's student-centered goals (Duschl et. al., 2007; Bell et. al. 2009) for science education include helping students:

1. Experience excitement, interest and motivation to learn about phenomena in the natural and physical world.
2. Come to generate, understand, remember and use concepts, explanations, arguments, models and facts related to science.
3. Manipulate, test, explore, predict, question, observe and make sense of the natural and physical world.
4. Reflect on science as a way of knowing; on processes, concepts and institutions of science; and on their own process of learning about phenomena.
5. Participate in scientific activities and learning practices with others, using scientific language and tools.
6. Think about themselves as science learners and develop an identity as someone who knows about, uses and sometimes contributes to science

These goals are consistent with the expectations of [Ohio law](#).

## GUIDING PRINCIPLES

Ohio's Learning Standards Science reflect knowledge drawn from international and national studies, education stakeholders and academic content experts. The guiding principles include:

- **Definition of Science:** Science is a systematic method of continuing investigation based on observation, scientific hypothesis testing, measurement, experimentation and theory building. It leads to explanations of natural phenomena, processes or objects that are open to further testing and revision based on evidence.<sup>3</sup> Scientific knowledge is logical, predictive and testable and expands and advances as new evidence is discovered.

- **Scientific Inquiry:** There is no science without inquiry. Scientific inquiry is a way of knowing and process of doing science. Scientific inquiry includes the diverse ways scientists study the natural world and propose explanations based on the evidence derived from their work. Scientific inquiry also refers to the activities that help students develop knowledge of scientific ideas and understanding of how scientists study the natural world.<sup>4</sup> Teachers model scientific inquiry throughout their instruction.
- **21<sup>st</sup> Century Skills:** According to Ohio law, 21st century skills include creativity and innovation; critical thinking, problem-solving and communication; information, media and technological literacy; personal management, productivity, accountability, leadership and responsibility; and interdisciplinary, project-based, real-world learning opportunities.<sup>5</sup>

21st century skills are integral to the revised science standards and model curriculum. The model curriculum incorporates and integrates these skills through scientific inquiry, science skills and process, and technological and engineering design.

- **Technological Design:** Technological design is a problem- or project-based way of applying creativity, science, engineering and mathematics to meet a human want or need. Modern science is an integrated endeavor. Technological design integrates learning by using science, technology, engineering and mathematics and fosters 21st century skills.
- **Technology and Engineering:** Technology modifies the natural world through innovative processes, systems, structures and devices to extend human abilities. Engineering is design under constraint that develops and applies technology to satisfy human wants and needs. Technology and engineering, coupled with the knowledge and methods derived from science and mathematics, profoundly influence the quality of life.

- **Depth of Content:** It is vital that the *Content Statements* and *Content Elaborations* within the standards document communicate the most essential concepts and the complexity of the discipline in a manner that is manageable and accessible for teachers. The focus is on what students must know to master the specific grade-level content. The *Expectations for Learning*, cognitive demands, provide the means by which students can demonstrate this grade-level mastery.
- **Internationally Benchmarked:** Ohio's Learning Standards and Model Curriculum for Science incorporate findings from research on the science standards of:
  - Countries whose students demonstrate high-performance on both the Trends in International Mathematics and Science Studies (TIMSS) and Program in Student Assessment (PISA) tests; and
  - States with students who perform well on the National Assessment of Education Progress (NAEP).

As a result, the revised standards and model curriculum are rigorous, relevant, coherent and organized, emphasizing horizontal and vertical articulation of content within and across disciplines.

- **Assessment:** Ohio's State Tests will align with the Content Statements, Content Elaborations and Expectations for Learning.
- **Standards and Curriculum:** The standards and model curriculum provide a framework for developing local curricula. They do not constitute the local curriculum. Development of curriculum will continue to be a local responsibility.

1. Taking Science to School Learning and Teaching Science in Grades K-8. National Research Council of the National Academies
2. Michaels S., Shouse, A.W., & Schweingruber H. A. (2008). *Ready, Set, SCIENCE!* Washington DC: The National Academies Press.
3. National Research Council (1996), National Science Education Standards (Washington, DC: National Academy Press) and including excerpts with minor revision, of The Ohio Academy of Science (2000) definition of science: <http://www.ohiosci.org/s/whatis-science.pdf>
4. Research Council (1996), National Science Education Standards (Washington, DC: National Academy Press), p 192.
5. [http://www.21stcenturyskills.org/index.php?option=com\\_](http://www.21stcenturyskills.org/index.php?option=com_)

## STANDARDS FORMAT AND DEVELOPMENT

The standards are web-based resources that provide the content to be taught in science classrooms. The standards define what all students should know and be able to do, not how teachers should teach. While the standards focus on what is most essential, they do not describe all that teachers can or should teach. Teachers and curriculum developers maintain a great deal of discretion in this area. The model curriculum will offer information and support for planning, developing, implementing and evaluating instruction directly aligned to standards.

Work to revise Ohio's Learning Standards Science took place from November 2016 through September 2017, with input from stakeholders around the state. The Ohio Department of Education started the process by seeking public comment on the existing standards in fall 2016. An advisory committee of representatives from various Ohio agencies and organizations related to science and science education reviewed this public feedback. The advisory committee forwarded suggestions for revisions to working groups consisting of K-12 and higher education professionals. There were three main working groups based on the individual science disciplines: life sciences, Earth and space sciences, and physical sciences.

When comment on the initial public survey pointed to the need for a new human anatomy and physiology course, the Department formed a related subcommittee of the life science working group. These four groups constructed the proposed 2017 standards with Ohio students in mind. The Department presented the proposed standards revisions for public feedback through a summer 2017 survey. The Department made more revisions based on that feedback. The State Board of Education reviewed the revised science standards during its October 2017 meeting and adopted them in February 2018.

The goal of revising the standards was to improve K-12 science education by providing clarity, focus and a logical, vertical progression in each discipline. All Ohio students deserve rigorous, scientifically accurate instruction that makes them college or career ready and

scientifically literate. These standards serve as a road map for Ohio science teachers to use as they customize instruction to fit individual student needs.

## TRANSITION PERIOD

Ohio allows districts until the 2019-2020 school year to fully implement the revised Ohio's Learning Standards Science to give them time to align instruction and resources to the standards. State tests aligned to the standards will be available in spring 2020.

## Topics by Grade Level

### SCIENCE INQUIRY AND APPLICATIONS

During the years of **K to grade 4**, all students must develop the ability to: Observe and ask questions about the natural environment; Plan and conduct simple investigations; Employ simple equipment and tools to gather data and extend the senses; Use appropriate mathematics with data to construct reasonable explanations; Communicate about observations, investigations and explanations; and Review and ask questions about the observations and explanations of others.

THEMES	GRADE	THE PHYSICAL SETTING		THE LIVING ENVIRONMENT
		EARTH AND SPACE SCIENCE	PHYSICAL SCIENCE	LIFE SCIENCE
<b>Observations of the Environment</b> This theme focuses on helping students develop the skills for systematic discovery to understand the science of the natural world around them in greater depth by using scientific inquiry.	K	Living and nonliving things have specific physical properties that can be used to sort and classify. The physical properties of air and water are presented as they apply to weather.		
		Daily and Seasonal Changes	Properties of Everyday Objects and Materials	Physical and Behavioral Traits of Living Things
	1	Energy is observed through movement, heating, cooling and the needs of living organisms.		
		Sun, Energy and Weather	Motion and Materials	Basic Needs of Living Things
	2	Living and nonliving things may move. A moving object has energy. Air moving is wind and wind can make a windmill turn. Changes in energy and movement can cause change to organisms and the environments in which they live.		
		The Atmosphere	Changes in Motion	Interactions within Habitats
<b>Interconnections within Systems</b> This theme focuses on helping students explore the components of various systems and then investigate dynamic and sustainable relationships within systems using scientific inquiry.	3	Matter is what makes up all substances on Earth. Matter has specific properties and exists in different states. Earth's resources are made of matter. Matter can be used by living things and can be used for the energy they contain. There are many different forms of energy. Each living component of an ecosystem is composed of matter and uses energy.		
		Earth's Resources	Matter and Forms of Energy	Behavior, Growth and Changes
	4	Heat and electrical energy are forms of energy that can be transferred from one location to another. Matter has properties that allow the transfer of heat and electrical energy. Heating and cooling affect the weathering of Earth's surface and Earth's past environments. The processes that shape Earth's surface and the fossil evidence found can help decode Earth's history.		
		Earth's Surface	Electricity, Heat and Matter	Earth's Living History

**SCIENCE INQUIRY AND APPLICATIONS**

During the years of **grades 5 through 8**, all students must have developed the ability to: Identify questions that can be answered through scientific investigations; Design and conduct a scientific investigation; Use appropriate mathematics, tools and techniques to gather data and information; Analyze and interpret data; Develop descriptions, models, explanations and predictions; Think critically and logically to connect evidence and explanations; Recognize and analyze alternative explanations and predictions; and Communicate scientific procedures and explanations.

THEMES	GRADE	THE PHYSICAL SETTING		THE LIVING ENVIRONMENT
		EARTH AND SPACE SCIENCE	PHYSICAL SCIENCE	LIFE SCIENCE
<b>Interconnections within Systems</b> This theme focuses on helping students explore the components of various systems and then investigate dynamic and sustainable relationships within systems using scientific inquiry.	5	Cycles on Earth, such as those occurring in ecosystems, in the solar system, and in the movement of light and sound result in describable patterns. Speed is a measurement of movement. Change in speed is related to force and mass. The transfer of energy drives changes in systems, including ecosystems and physical systems.		
		<b>Cycles and Patterns in the Solar System</b>	<b>Light, Sound and Motion</b>	<b>Interactions within Ecosystems</b>
<b>Order and Organization</b> This theme focuses on helping students use scientific inquiry to discover patterns, trends, structures and relationships that may be inferred from simple principles. These principles are related to the properties or interactions within and between systems.	6	All matter is made of small particles called atoms. The properties of matter are based on the order and organization of atoms and molecules. Cells, minerals, rocks and soil are all examples of matter.		
		<b>Rocks, Minerals and Soil</b>	<b>Matter and Motion</b>	<b>Cellular to Multicellular</b>
	7	Systems can exchange energy and/or matter when interactions occur within systems and between systems. Systems cycle matter and energy in observable and predictable patterns.		
		<b>Cycles and Patterns of Earth and the Moon</b>	<b>Conservation of Mass and Energy</b>	<b>Cycles of Matter and Flow of Energy</b>
8	Systems can be described and understood by analysis of the interaction of their components. Energy, forces and motion combine to change the physical features of Earth. The changes of the physical Earth and the species that have lived on Earth are found in the rock record. For species to continue, reproduction must be successful.			
	<b>Physical Earth</b>	<b>Forces and Motion</b>	<b>Species and Reproduction</b>	



# Ohio's Learning Standards for Science, Grades K-8

## Kindergarten

### INTRODUCTION TO CONTENT STATEMENTS

#### GRADE BAND THEME: OBSERVATIONS OF THE ENVIRONMENT

This theme focuses on helping students develop the skills for systematic discovery to understand the science of the physical world around them in greater depth by using scientific inquiry.

#### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

## STRANDS

**Strand Connections:** Living and nonliving things have specific physical properties that can be used to sort and classify. The physical properties of air and water are presented as they apply to weather.

EARTH AND SPACE SCIENCE (ESS)	LIFE SCIENCE (LS)	PHYSICAL SCIENCE (PS)
<p><b>Topic: Daily and Seasonal Changes</b> This topic focuses on observing, exploring, describing and comparing weather changes, patterns in the sky and changing seasons.</p>	<p><b>Topic: Physical and Behavioral Traits of Living Things</b> This topic focuses on observing, exploring, describing and comparing living things in Ohio.</p>	<p><b>Topic: Properties of Everyday Objects and Materials</b> This topic focuses on the production of sound and on observing, exploring, describing and comparing the properties of objects and materials with which the student is familiar.</p>
CONDENSED CONTENT STATEMENTS		
<ul style="list-style-type: none"> <li>• Weather changes are long-term and short-term.</li> <li>• The moon, sun and stars can be observed at different times of the day or night.</li> </ul>	<ul style="list-style-type: none"> <li>• Living things have specific characteristics and traits.</li> <li>• Living things have physical traits and behaviors, which influence their survival.</li> </ul>	<ul style="list-style-type: none"> <li>• Objects and materials can be sorted and described by their properties.</li> <li>• Some objects and materials can be made to vibrate and produce sound.</li> </ul>

# Kindergarten

## EARTH AND SPACE SCIENCE (ESS)

### Topic: Daily and Seasonal Changes

This topic focuses on observing, exploring, describing and comparing weather changes, patterns in the sky and changing seasons.

---

#### CONTENT STATEMENT

#### **K.ESS.1: Weather changes are long-term and short-term.**

Weather changes occur throughout the day and from day to day.

Air is a nonliving substance that surrounds Earth and wind is air that is moving.

Wind, temperature and precipitation can be used to document short-term weather changes that are observable.

Yearly weather changes (seasons) are observable patterns in the daily weather changes.

**Note:** *The focus is on observing the weather patterns of seasons. The reason for changing seasons is not appropriate for this grade level; this is found in grade 7.*

---

#### CONTENT ELABORATION

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

# Kindergarten

## EARTH AND SPACE SCIENCE (ESS)

### **Topic: Daily and Seasonal Changes**

This topic focuses on observing, exploring, describing and comparing weather changes, patterns in the sky and changing seasons.

---

#### **CONTENT STATEMENT**

**K.ESS.2: The moon, sun and stars can be observed at different times of the day or night.**

The moon, sun and stars appear in different positions at different times of the day or night. Sometimes the moon is visible during the night, sometimes the moon is visible during the day and at other times the moon is not visible at all. The observable shape of the moon changes in size very slowly throughout the month. The sun is visible only during the day.

The sun's position in the sky appears to change in a single day and from season to season. Stars are visible at night, some are visible in the evening or morning and some are brighter than others.

---

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

# Kindergarten

## LIFE SCIENCE (LS)

### **Topic: Physical and Behavioral Traits of Living Things**

This topic focuses on observing, exploring, describing and comparing living things in Ohio.

---

#### CONTENT STATEMENT

**K.LS.1: Living things have specific characteristics and traits.**

Living things grow and reproduce. Living things are found worldwide.

#### CONTENT ELABORATION

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

# Kindergarten

## LIFE SCIENCE (LS)

### **Topic: Physical and Behavioral Traits of Living Things**

This topic focuses on observing, exploring, describing and comparing living things in Ohio.

---

#### **CONTENT STATEMENT**

**K.LS.2: Living things have physical traits and behaviors, which influence their survival.**

Living things are made up of a variety of structures. Some traits can be observable structures. Some of these structures and behaviors influence their survival.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

# Kindergarten

## PHYSICAL SCIENCE (PS)

### **Topic: Properties of Everyday Objects and Materials**

This topic focuses on the production of sound and on observing, exploring, describing and comparing the properties of objects and materials with which the student is familiar.

---

#### **CONTENT STATEMENT**

**K.PS.1: Objects and materials can be sorted and described by their properties.**

Objects can be sorted and described by the properties of the materials from which they are made. Some of the properties can include color, size and texture.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

# Kindergarten

## PHYSICAL SCIENCE (PS)

### **Topic: Properties of Everyday Objects and Materials**

This topic focuses on the production of sound and on observing, exploring, describing and comparing the properties of objects and materials with which the student is familiar.

---

#### CONTENT STATEMENT

**K.PS.2: Some objects and materials can be made to vibrate to produce sound.**

Sound is produced by touching, blowing or tapping objects. The sounds that are produced vary depending on the properties of objects. Sound is produced when objects vibrate.

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

---



# Grade 1

## INTRODUCTION TO CONTENT STATEMENTS

### GRADE BAND THEME: OBSERVATIONS OF THE ENVIRONMENT

This theme focuses on helping students develop the skills for systematic discovery to understand the science of the physical world around them in greater depth by using scientific inquiry.

### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

## STRANDS

**Strand Connections:** Energy is observed through movement, heating, cooling and the needs of living organisms.

EARTH AND SPACE SCIENCE (ESS)	LIFE SCIENCE (LS)	PHYSICAL SCIENCE (PS)
<p><b>Topic: Sun, Energy and Weather</b></p> <p>This topic focuses on the sun as a source of energy and energy changes that occur to land, air and water.</p>	<p><b>Topic: Basic Needs of Living Things</b></p> <p>This topic focuses on the physical needs of living things in Ohio. Energy from the sun or food, nutrients, water, shelter and air are some of the physical needs of living things.</p>	<p><b>Topic: Motion and Materials</b></p> <p>This topic focuses on the changes in properties that occur in objects and materials. Changes of position of an object are a result of pushing or pulling.</p>
<b>CONDENSED CONTENT STATEMENTS</b>		
<ul style="list-style-type: none"> <li>• The sun is the principal source of energy.</li> <li>• Water on Earth is present in many forms.</li> </ul>	<ul style="list-style-type: none"> <li>• Living things have basic needs, which are met by obtaining materials from the physical environment.</li> <li>• Living things survive only in environments that meet their needs.</li> </ul>	<ul style="list-style-type: none"> <li>• Properties of objects and materials can change.</li> <li>• Objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth.</li> </ul>

# Grade 1

## EARTH AND SPACE SCIENCE (ESS)

### **Topic: Sun, Energy, and Weather**

This topic focuses on the sun as a source of energy and energy changes that occur to land, air and water.

---

#### **CONTENT STATEMENT**

#### **1.ESS.1: The sun is the principal source of energy**

Sunlight warms Earth's land, air and water. The amount of exposure to sunlight affects the amount of warming or cooling of air, water and land.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

# Grade 1

## EARTH AND SPACE SCIENCE (ESS)

### Topic: Sun, Energy, and Weather

This topic focuses on the sun as a source of energy and energy changes that occur to land, air and water.

---

#### CONTENT STATEMENT

#### 1. ESS.2: Water on Earth is present in many forms.

The physical properties of water can change. These changes occur due to changing energy. Water can change from a liquid to a solid and from a solid to a liquid.

**Note:** *Water as a vapor is not introduced until grade 2; the water cycle is reserved for later grades.*

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

# Grade 1

## LIFE SCIENCE (LS)

### **Topic: Basic Needs of Living Things**

This topic focuses on the physical needs of living things in Ohio. Energy from the sun or food, nutrients, water, shelter and air are some of the physical needs of living things.

---

#### **CONTENT STATEMENT**

**1.LS.1: Living things have basic needs, which are met by obtaining materials from the physical environment.**

Living things require energy, water, and a particular range of temperatures in their environments. Plants get energy from sunlight. Animals get energy from plants and other animals. Living things acquire resources from the living and nonliving components of the environment.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

# Grade 1

## LIFE SCIENCE (LS)

### **Topic: Basic Needs of Living Things**

This topic focuses on the physical needs of living things in Ohio. Energy from the sun or food, nutrients, water, shelter and air are some of the physical needs of living things.

---

#### **CONTENT STATEMENT**

##### **1.LS.2: Living things survive only in environments that meet their needs.**

Resources are necessary to meet the needs of an individual and populations of individuals. Living things interact with their physical environments as they meet those needs. Effects of seasonal changes within the local environment directly impact the availability of resources.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

# Grade 1

## PHYSICAL SCIENCE (PS)

### **Topic: Motion and Materials**

This topic focuses on the changes in properties that occur in objects and materials. Changes of position of an object are a result of pushing or pulling.

---

#### **CONTENT STATEMENT**

##### **1.PS.1: Properties of objects and materials can change.**

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

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

# Grade 1

## PHYSICAL SCIENCE (PS)

### **Topic: Motion and Materials**

This topic focuses on the changes in properties that occur in objects and materials. Changes of position of an object are a result of pushing or pulling.

---

#### **CONTENT STATEMENT**

**1.PS.2: Objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth.**

The position of an object can be described by locating it relative to another object or to the object's surroundings. An object is in motion when its position is changing.

The motion of an object can be affected by pushing or pulling. A push or pull is a force that can make an object move faster, slower or go in a different direction. Changes in motion are a result of changes in energy.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---



## Grade 2

### INTRODUCTION TO CONTENT STATEMENTS

#### GRADE BAND THEME: OBSERVATIONS OF THE ENVIRONMENT

This theme focuses on helping students develop the skills for systematic discovery to understand the science of the physical world around them in greater depth by using scientific inquiry.

#### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

## STRANDS

**Strand Connections:** Living and nonliving things may move. A moving object has energy. Air moving is wind and wind can make a windmill turn. Changes in energy and movement can cause change to organisms and the environments in which they live.

EARTH AND SPACE SCIENCE (ESS)	LIFE SCIENCE (LS)	PHYSICAL SCIENCE (PS)
<p><b>Topic: The Atmosphere</b></p> <p>This topic focuses on air and water as they relate to weather and weather changes that can be observed and measured.</p>	<p><b>Topic: Interactions within Habitats</b></p> <p>This topic focuses on how ecosystems work by observations of simple interactions between the biotic/living and abiotic/nonliving parts of an ecosystem. Just as living things impact the environment in which they live, the environment impacts living things.</p>	<p><b>Topic: Changes in Motion</b></p> <p>This topic focuses on observing the relationship between forces and motion.</p>
CONDENSED CONTENT STATEMENTS		
<ul style="list-style-type: none"> <li>• The atmosphere is primarily made up of air.</li> <li>• Water is present in the atmosphere.</li> <li>• Long- and short-term weather changes occur due to changes in energy.</li> </ul>	<ul style="list-style-type: none"> <li>• Living things cause changes on Earth.</li> <li>• All organisms alive today result from their ancestors, some of which may be extinct. Not all kinds of organisms that lived in the past are represented by living organisms today.</li> </ul>	<ul style="list-style-type: none"> <li>• Forces change the motion of an object.</li> </ul>

## Grade 2

### EARTH AND SPACE SCIENCE (ESS)

#### **Topic: The Atmosphere**

This topic focuses on air and water as they relate to weather and weather changes that can be observed and measured.

---

#### **CONTENT STATEMENT**

**2.ESS.1: The atmosphere is primarily made up of air.**

Air has properties that can be observed and measured. The transfer of energy in the atmosphere causes air movement, which is felt as wind. Wind speed and direction can be measured.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

## Grade 2

### EARTH AND SPACE SCIENCE (ESS)

#### **Topic: The Atmosphere**

This topic focuses on air and water as they relate to weather and weather changes that can be observed and measured.

---

#### **CONTENT STATEMENT**

##### **2.ESS.2: Water is present in the atmosphere.**

Water is present in the atmosphere as water vapor. When water vapor in the atmosphere cools, it forms clouds, fog, rain, ice, snow, sleet or hail.

**Note:** *The emphasis at this grade level is investigating condensation and evaporation, not memorizing the water cycle itself.*

**Note:** *The emphasis is not in naming cloud types, but in relating the characteristics of the clouds with weather.*

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

## Grade 2

### EARTH AND SPACE SCIENCE (ESS)

#### **Topic: The Atmosphere**

This topic focuses on air and water as they relate to weather and weather changes that can be observed and measured.

---

#### **CONTENT STATEMENT**

**2.ESS.3: Long- and short-term weather changes occur due to changes in energy.**

Changes in energy affect all aspects of weather, including temperature, precipitation, and wind.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

## Grade 2

### LIFE SCIENCE (LS)

#### **Topic: Interactions within Habitats**

This topic focuses on how ecosystems work by observations of simple interactions between the biotic/living and abiotic/nonliving parts of an ecosystem. Just as living things impact the environment in which they live, the environment impacts living things.

---

#### **CONTENT STATEMENT**

##### **2.LS.1: Living things cause changes on Earth.**

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

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

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

## Grade 2

### LIFE SCIENCE (LS)

#### **Topic: Interactions within Habitats**

This topic focuses on how ecosystems work by observations of simple interactions between the biotic/living and abiotic/nonliving parts of an ecosystem. Just as living things impact the environment in which they live, the environment impacts living things.

---

#### **CONTENT STATEMENT**

**2.LS.2: All organisms alive today result from their ancestors, some of which may be extinct. Not all kinds of organisms that lived in the past are represented by living organisms today.**

Some kinds of organisms become extinct when their basic needs are no longer met or the environment changes.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

## Grade 2

### PHYSICAL SCIENCE (PS)

#### Topic: Changes in Motion

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

---

#### CONTENT STATEMENT

##### **2.PS.1: Forces change the motion of an object.**

Motion can increase, change direction or stop depending on the force applied.

The change in motion of an object is related to the size of the force.

Some forces act without touching, such as using a magnet to move an object or objects falling to the ground.

#### CONTENT ELABORATION

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---



# Grade 3

## INTRODUCTION TO CONTENT STATEMENTS

### GRADE BAND THEME: INTERCONNECTIONS WITHIN SYSTEMS

This theme focuses on helping students explore the components of various systems and then investigate dynamic and sustainable relationships within systems using scientific inquiry.

### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

## STRANDS

**Strand Connections:** Matter is what makes up all substances on Earth. Matter has specific properties and exists in different states. Earth's resources are made of matter. Matter can be used by living things and can be used for the energy it contains. There are many different forms of energy. Each living component of an ecosystem is composed of matter and uses energy.

EARTH AND SPACE SCIENCE (ESS)	LIFE SCIENCE (LS)	PHYSICAL SCIENCE (PS)
<p><b>Topic: Earth's Resources</b></p> <p>This topic focuses on Earth's resources. While resources can be living and nonliving, within this strand, the emphasis is on Earth's nonliving resources, such as water, air, rock, soil and the energy resources they represent.</p>	<p><b>Topic: Behavior, Growth and Changes</b></p> <p>This topic explores life cycles of organisms and the relationship between the natural environment and an organism's (physical and behavioral) traits, which affect its ability to survive and reproduce.</p>	<p><b>Topic: Matter and Forms of Energy</b></p> <p>This topic focuses on the relationship between matter and energy. Matter has specific properties and is found in all substances on Earth. Heat is a familiar form of energy that can change the states of matter.</p>
<b>CONDENSED CONTENT STATEMENTS</b>		
<ul style="list-style-type: none"> <li>• Earth's nonliving resources have specific properties.</li> <li>• Earth's resources can be used for energy.</li> <li>• Some of Earth's resources are limited.</li> </ul>	<ul style="list-style-type: none"> <li>• Offspring resemble their parents and each other.</li> <li>• Individuals of the same kind of organism differ in their inherited traits. These differences give some individuals an advantage in surviving and/or reproducing.</li> <li>• Plants and animals have life cycles that are part of their adaptations for survival in their natural environments.</li> </ul>	<ul style="list-style-type: none"> <li>• All objects and substances in the natural world are composed of matter.</li> <li>• Matter exists in different states, each of which has different properties.</li> <li>• Heat, electrical energy, light, sound and magnetic energy are forms of energy.</li> </ul>

## Grade 3

### EARTH AND SPACE SCIENCE (ESS)

#### Topic: Earth's Resources

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

---

#### CONTENT STATEMENT

##### **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 soil 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 can be used to sort or compare, rather than formal classification.*

---

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

## Grade 3

### EARTH AND SPACE SCIENCE (ESS)

#### **Topic: Earth's Resources**

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

---

#### **CONTENT STATEMENT**

##### **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.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

## Grade 3

### EARTH AND SPACE SCIENCE (ESS)

#### **Topic: Earth's Resources**

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

---

#### **CONTENT STATEMENT**

**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.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

## Grade 3

### LIFE SCIENCE (LS)

#### **Topic: Behavior, Growth and Changes**

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

---

#### **CONTENT STATEMENT**

##### **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.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

## Grade 3

### LIFE SCIENCE (LS)

#### **Topic: Behavior, Growth and Changes**

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

---

#### CONTENT STATEMENT

**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.*

---

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

## Grade 3

### LIFE SCIENCE (LS)

#### **Topic: Behavior, Growth and Changes**

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

---

#### **CONTENT STATEMENT**

**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.*

#### **CONTENT ELABORATION**

The content elaboration will appear here once the revised Model Curriculum is adopted.

---



## Grade 3

### PHYSICAL SCIENCE (PS)

#### **Topic: Matter and Forms of Energy**

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

---

#### **CONTENT STATEMENT**

**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.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

## Grade 3

### PHYSICAL SCIENCE (PS)

#### **Topic: Matter and Forms of Energy**

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

---

#### **CONTENT STATEMENT**

**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.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

## Grade 3

### PHYSICAL SCIENCE (PS)

#### **Topic: Matter and Forms of Energy**

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

---

#### **CONTENT STATEMENT**

##### **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.

#### **CONTENT ELABORATION**

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

# Grade 4

## INTRODUCTION TO CONTENT STATEMENTS

### GRADE BAND THEME: INTERCONNECTIONS WITHIN SYSTEMS

This theme focuses on helping students explore the components of various systems and then investigate dynamic and sustainable relationships within systems using scientific inquiry.

### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

## STRANDS

**Strand Connections:** Heat and electrical energy are forms of energy that can be transferred from one location to another. Matter has properties that allow the transfer of heat and electrical energy. Heating and cooling affect the weathering of Earth's surface and Earth's past environments. The processes that shape Earth's surface and the fossil evidence found can help decode Earth's history.

EARTH AND SPACE SCIENCE (ESS)	LIFE SCIENCE (LS)	PHYSICAL SCIENCE (PS)
<p><b>Topic: Earth's Surface</b></p> <p>This topic focuses on the variety of processes that shape and reshape Earth's surface.</p>	<p><b>Topic: Earth's Living History</b></p> <p>This topic focuses on using fossil evidence and living organisms to observe that suitable habitats depend upon a combination of biotic and abiotic factors.</p>	<p><b>Topic: Electricity, Heat and Matter</b></p> <p>This topic focuses on the conservation of matter and the processes of energy transfer and transformation, especially as they relate to heat and electrical energy</p>
CONDENSED CONTENT STATEMENTS		
<ul style="list-style-type: none"> <li>• Earth's surface has specific characteristics and landforms that can be identified.</li> <li>• The surface of Earth changes due to weathering.</li> <li>• The surface of Earth changes due to erosion and deposition.</li> </ul>	<ul style="list-style-type: none"> <li>• Changes in an organism's environment are sometimes beneficial to its survival and sometimes harmful.</li> <li>• Fossils can be compared to one another and to present-day organisms according to their similarities and differences.</li> </ul>	<ul style="list-style-type: none"> <li>• When objects break into smaller pieces, dissolve, or change state, the total amount of matter is conserved.</li> <li>• Energy can be transferred from one location to another or can be transformed from one form to another.</li> </ul>

# Grade 4

## EARTH AND SPACE SCIENCE (ESS)

### Topic: Earth's Surface

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

---

#### CONTENT STATEMENT

**4.ESS.1: Earth's surface has specific characteristics and landforms that can be identified.**

About 70 percent of the Earth's surface is covered with water and most of that is the ocean. Only a small portion of the Earth's water is freshwater, which is found in rivers, lakes, groundwater and glaciers.

Earth's surface can change due to erosion and deposition of soil, rock or sediment.

Catastrophic events such as flooding, volcanoes and earthquakes can create landforms.

---

#### CONTENT ELABORATION

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

## Grade 4

### EARTH AND SPACE SCIENCE (ESS)

#### Topic: Earth's Surface

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

---

#### CONTENT STATEMENT

##### **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.*

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

## Grade 4

### EARTH AND SPACE SCIENCE (ESS)

#### Topic: Earth's Surface

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

---

#### CONTENT STATEMENT

##### **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.

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

---



## Grade 4

### LIFE SCIENCE (LS)

#### **Topic: Earth's Living History**

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

---

#### **CONTENT STATEMENT**

**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.

---

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

## Grade 4

### LIFE SCIENCE (LS)

#### **Topic: Earth's Living History**

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

---

#### **CONTENT STATEMENT**

**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.

---

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

## Grade 4

### PHYSICAL SCIENCE (PS)

#### **Topic: Electricity, Heat and Matter**

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

---

#### CONTENT STATEMENT

**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.*

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

## Grade 4

### PHYSICAL SCIENCE (PS)

#### **Topic: Electricity, Heat and Matter**

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

---

#### **CONTENT STATEMENT**

**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 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.

#### **CONTENT ELABORATION**

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

## Grade 5

### INTRODUCTION TO CONTENT STATEMENTS

#### GRADE BAND THEME: INTERCONNECTIONS WITHIN SYSTEMS

This theme focuses on helping students explore the components of various systems and then investigate dynamic and sustainable relationships within systems using scientific inquiry.

#### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

## STRANDS

**Strand Connections:** Cycles on Earth, such as those occurring in ecosystems, in the solar system, and in the movement of light and sound result in describable patterns. Speed is a measurement of movement. Change in speed is related to force and mass. The transfer of energy drives changes in systems, including ecosystems and physical systems.

EARTH AND SPACE SCIENCE (ESS)	LIFE SCIENCE (LS)	PHYSICAL SCIENCE (PS)
<p><b>Topic: Cycles and Patterns in the Solar System</b></p> <p>This topic focuses on the characteristics, cycles and patterns in the solar system and within the universe.</p>	<p><b>Topic: Interactions within Ecosystems</b></p> <p>This topic focuses on foundational knowledge of the structures and functions of ecosystems.</p>	<p><b>Topic: Light, Sound and Motion</b></p> <p>This topic focuses on the forces that affect motion. This includes the relationship between the change in speed of an object, the amount of force applied and the mass of the object. Light and sound are explored as forms of energy that move in predictable ways, depending on the matter through which they move.</p>
CONDENSED CONTENT STATEMENTS		
<ul style="list-style-type: none"> <li>• The solar system includes the sun and all celestial bodies that orbit the sun. Each planet in the solar system has unique characteristics.</li> <li>• The sun is one of many stars that exist in the universe.</li> <li>• Most of the cycles and patterns of motion between the Earth and sun are predictable.</li> </ul>	<ul style="list-style-type: none"> <li>• Organisms perform a variety of roles in an ecosystem.</li> <li>• All of the processes that take place within organisms require energy.</li> </ul>	<ul style="list-style-type: none"> <li>• The amount of change in movement of an object is based on the mass of the object and the amount of force exerted.</li> <li>• Light and sound are forms of energy that behave in predictable ways.</li> </ul>

## Grade 5

### EARTH AND SPACE SCIENCE (ESS)

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

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

---

#### **CONTENT STATEMENT**

**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 and meteoroids orbit the sun.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

## Grade 5

### EARTH AND SPACE SCIENCE (ESS)

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

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

---

#### **CONTENT STATEMENT**

**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.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---



# Grade 5

## EARTH AND SPACE SCIENCE (ESS)

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

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

---

#### CONTENT STATEMENT

**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.

**Note:** *Moon phases should not be the focus.*

#### CONTENT ELABORATION

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

# Grade 5

## LIFE SCIENCE (LS)

### **Topic: Interconnections within Ecosystems**

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

---

#### CONTENT STATEMENT

#### **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.

#### CONTENT ELABORATION

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

# Grade 5

## LIFE SCIENCE (LS)

### **Topic: Interconnections within Ecosystems**

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

---

#### **CONTENT STATEMENT**

**5.LS.2: All of the processes that take place within organisms require energy.**

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

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

## Grade 5

### PHYSICAL SCIENCE (PS)

#### Topic: Light, Sound and Motion

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

---

#### CONTENT STATEMENT

**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 or direction of an object requires a force and is affected by the mass of the object and the amount of force applied.

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

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

## Grade 5

### PHYSICAL SCIENCE (PS)

#### **Topic: Light, Sound and Motion**

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

---

#### CONTENT STATEMENT

##### **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.*

---

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

# Grade 6

## INTRODUCTION TO CONTENT STATEMENTS

### GRADE BAND THEME: ORDER AND ORGANIZATION

This theme focuses on helping students use scientific inquiry to discover patterns, trends, structures and relationships that may be inferred by simple principles. These principles are related to the properties or interactions within and between systems.

### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

## STRANDS

**Strand Connections:** All matter is made of small particles called atoms. The properties of matter are based on the order and organization of atoms and molecules. Cells, minerals, rocks and soil are all examples of matter.

EARTH AND SPACE SCIENCE (ESS)	LIFE SCIENCE (LS)	PHYSICAL SCIENCE (PS)
<p><b>Topic: Rocks, Minerals and Soil</b></p> <p>This topic focuses on the study of rocks, minerals and soil, which make up the lithosphere. Classifying and identifying different types of rocks, minerals and soil can decode the past environment in which they formed.</p>	<p><b>Topic: Cellular to Multicellular</b></p> <p>This topic focuses on the study of the basics of Modern Cell Theory. All organisms are composed of cells, which are the fundamental unit of life. Cells carry on the many processes that sustain life. All cells come from pre-existing cells.</p>	<p><b>Topic: Matter and Motion</b></p> <p>This topic focuses on the study of foundational concepts of the particulate nature of matter, linear motion, and kinetic and potential energy.</p>
<b>CONDENSED CONTENT STATEMENTS</b>		
<ul style="list-style-type: none"> <li>• Minerals have specific, quantifiable properties.</li> <li>• Igneous, metamorphic and sedimentary rocks have unique characteristics that can be used for identification and/or classification.</li> <li>• Igneous, metamorphic and sedimentary rocks form in different ways.</li> <li>• Soil is unconsolidated material that contains nutrient matter and weathered rock.</li> <li>• Rocks, mineral and soils have common and practical uses.</li> </ul>	<ul style="list-style-type: none"> <li>• Cells are the fundamental unit of life.</li> <li>• All cells come from pre-existing cells.</li> <li>• Cells carry on specific functions that sustain life.</li> <li>• Living systems at all levels of organization demonstrate the complementary nature of structure and function.</li> </ul>	<ul style="list-style-type: none"> <li>• Matter is made up of small particles called atoms.</li> <li>• Changes of state are explained by a model of matter composed of particles that are in motion.</li> <li>• There are two categories of energy: kinetic and potential.</li> <li>• An object's motion can be described by its speed and the direction in which it is moving.</li> </ul>

## Grade 6

### EARTH AND SPACE SCIENCE (ESS)

#### **Topic: Rocks, Minerals and Soil**

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

---

#### **CONTENT STATEMENT**

##### **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.

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

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---



## Grade 6

### EARTH AND SPACE SCIENCE (ESS)

#### **Topic: Rocks, Minerals and Soil**

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

---

#### **CONTENT STATEMENT**

**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).

#### **CONTENT ELABORATION**

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

# Grade 6

## EARTH AND SPACE SCIENCE (ESS)

### **Topic: Rocks, Minerals and Soil**

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

---

#### **CONTENT STATEMENT**

#### **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.

#### **CONTENT ELABORATION**

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

## Grade 6

### EARTH AND SPACE SCIENCE (ESS)

#### **Topic: Rocks, Minerals and Soil**

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

---

#### **CONTENT STATEMENT**

**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.*

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

## Grade 6

### EARTH AND SPACE SCIENCE (ESS)

#### **Topic: Rocks, Minerals and Soil**

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

---

#### **CONTENT STATEMENT**

**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.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

# Grade 6

## LIFE SCIENCE (LS)

### Topic: Cellular to Multicellular

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

---

#### CONTENT STATEMENT

##### 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.*

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

## Grade 6

### LIFE SCIENCE (LS)

#### **Topic: Cellular to Multicellular**

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

---

#### **CONTENT STATEMENT**

##### **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.*

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

# Grade 6

## LIFE SCIENCE (LS)

### Topic: Cellular to Multicellular

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

---

#### CONTENT STATEMENT

##### **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.*

---

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

## Grade 6

### LIFE SCIENCE (LS)

#### **Topic: Cellular to Multicellular**

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

---

#### **CONTENT STATEMENT**

**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 of its parts function as a whole to perform the tasks necessary for the survival of the organism.

Organisms have diverse body plans, symmetry and internal structures that contribute to their being able to survive in their environments.

---

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**



# Grade 6

## PHYSICAL SCIENCE (PS)

### Topic: Matter and Motion

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

---

#### CONTENT STATEMENT

#### **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.

#### CONTENT ELABORATION

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

# Grade 6

## PHYSICAL SCIENCE (PS)

### Topic: Matter and Motion

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

---

#### CONTENT STATEMENT

**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.*

---

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

## Grade 6

### PHYSICAL SCIENCE (PS)

#### Topic: Matter and Motion

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

---

#### CONTENT STATEMENT

**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.*

#### CONTENT ELABORATION

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

## Grade 6

### PHYSICAL SCIENCE (PS)

#### Topic: Matter and Motion

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

---

#### CONTENT STATEMENT

**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 and speed can be measured and graphed as a function of time.

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

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

# Grade 7

## INTRODUCTION TO CONTENT STATEMENTS

### GRADE BAND THEME: ORDER AND ORGANIZATION

This theme focuses on helping students use scientific inquiry to discover patterns, trends, structures and relationships that may be inferred by simple principles. These principles are related to the properties or interactions within and between systems.

### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

## STRANDS

**Strand Connections:** Systems can exchange energy and/or matter when interactions occur within systems and between systems. Systems cycle matter and energy in observable and predictable patterns.

EARTH AND SPACE SCIENCE (ESS)	LIFE SCIENCE (LS)	PHYSICAL SCIENCE (PS)
<p><b>Topic: Cycles and Patterns of Earth and the Moon</b></p> <p>This topic focuses on Earth's hydrologic cycle, patterns that exist in atmospheric and oceanic currents, the relationship between thermal energy and the currents, and the relative position and movement of the Earth, sun and moon.</p>	<p><b>Topic: Cycles of Matter and Flow of Energy</b></p> <p>This topic focuses on the impact of matter and energy transfer within the biotic component of ecosystems.</p>	<p><b>Topic: Conservation of Mass and Energy</b></p> <p>This topic focuses on the empirical evidence for the arrangements of atoms on the Periodic Table of Elements, conservation of mass and energy, transformation and transfer of energy.</p>
CONDENSED CONTENT STATEMENTS		
<ul style="list-style-type: none"> <li>• The hydrologic cycle illustrates the changing states of water as it moves through the lithosphere, biosphere, hydrosphere and atmosphere.</li> <li>• Thermal-energy transfers in the ocean and the atmosphere contribute to the formation of currents, which influence global climate patterns.</li> <li>• The atmosphere has different properties at different elevations and contains a mixture of gases that cycle through the lithosphere, biosphere, hydrosphere and atmosphere.</li> <li>• The relative patterns of motion and positions of Earth, moon and sun cause solar and lunar eclipses, tides and phases of the moon.</li> <li>• The relative positions of Earth and the sun cause patterns we call seasons.</li> </ul>	<ul style="list-style-type: none"> <li>• Energy flows and matter is transferred continuously from one organism to another and between organisms and their physical environments.</li> <li>• In any particular biome, the number, growth and survival of organisms and populations depend on biotic and abiotic factors.</li> </ul>	<ul style="list-style-type: none"> <li>• Elements can be organized by properties.</li> <li>• Matter can be separated or changed, but in a closed system, the number and types of atoms remains constant.</li> <li>• Energy can be transformed or transferred but is never lost.</li> <li>• Energy can be transferred through a variety of ways.</li> </ul>

## Grade 7

### EARTH AND SPACE SCIENCE (ESS)

#### **Topic: Cycles and Patterns of Earth and the Moon**

This topic focuses on Earth's hydrologic cycle, patterns that exist in atmospheric and oceanic currents, the relationship between thermal energy and the currents, and the relative position and movement of the Earth, sun and moon.

---

#### **CONTENT STATEMENT**

**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.

#### **CONTENT ELABORATION**

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

## Grade 7

### EARTH AND SPACE SCIENCE (ESS)

#### **Topic: Cycles and Patterns of Earth and the Moon**

This topic focuses on Earth's hydrologic cycle, patterns that exist in atmospheric and oceanic currents, the relationship between thermal energy and the currents, and the relative position and movement of the Earth, sun and moon.

---

#### **CONTENT STATEMENT**

**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.

---

#### **CONTENT ELABORATION**

The content elaboration will appear here once the revised Model Curriculum is adopted.



## Grade 7

### EARTH AND SPACE SCIENCE (ESS)

#### **Topic: Cycles and Patterns of Earth and the Moon**

This topic focuses on Earth's hydrologic cycle, patterns that exist in atmospheric and oceanic currents, the relationship between thermal energy and the currents, and the relative position and movement of the Earth, sun and moon.

---

#### CONTENT STATEMENT

**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 the 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.*

---

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

## Grade 7

### EARTH AND SPACE SCIENCE (ESS)

#### **Topic: Cycles and Patterns of Earth and the Moon**

This topic focuses on Earth's hydrologic cycle, patterns that exist in atmospheric and oceanic currents, the relationship between thermal energy and the currents, and the relative position and movement of the Earth, sun and moon.

---

#### CONTENT STATEMENT

**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.

---

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

## Grade 7

### EARTH AND SPACE SCIENCE (ESS)

#### **Topic: Cycles and Patterns of Earth and the Moon**

This topic focuses on Earth's hydrologic cycle, patterns that exist in atmospheric and oceanic currents, the relationship between thermal energy and the currents, and the relative position and movement of the Earth, sun and moon.

---

#### **CONTENT STATEMENT**

##### **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  $23.5^\circ$ . 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.

#### **CONTENT ELABORATION**

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

# Grade 7

## LIFE SCIENCE (LS)

### **Topic: Cycles of Matter and Flow of Energy**

This topic focuses on the impact of matter and energy transfer within the biotic component of ecosystems.

---

#### CONTENT STATEMENT

**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 they need 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.*

---

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

# Grade 7

## LIFE SCIENCE (LS)

### **Topic: Cycles of Matter and Flow of Energy**

This topic focuses on the impact of matter and energy transfer within the biotic component of ecosystems.

---

#### **CONTENT STATEMENT**

**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.

---

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

## Grade 7

### PHYSICAL SCIENCE (PS)

#### **Topic: Cycles of Mass and Energy**

This topic focuses on the empirical evidence for the arrangements of atoms on the Periodic Table of Elements, conservation of mass and energy, transformation and transfer of energy.

---

#### **CONTENT STATEMENT**

##### **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.*

#### **CONTENT ELABORATION**

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

# Grade 7

## PHYSICAL SCIENCE (PS)

### Topic: Cycles of Mass and Energy

This topic focuses on the empirical evidence for the arrangements of atoms on the Periodic Table of Elements, conservation of mass and energy, transformation and transfer of energy.

---

#### CONTENT STATEMENT

**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 form a mixture, which can be separated through physical processes.

**Note:** *Under these standards, classifying specific changes as chemical or physical is not appropriate.*

---

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

## Grade 7

### PHYSICAL SCIENCE (PS)

#### **Topic: Cycles of Mass and Energy**

This topic focuses on the empirical evidence for the arrangements of atoms on the Periodic Table of Elements, conservation of mass and energy, transformation and transfer of energy.

---

#### **CONTENT STATEMENT**

##### **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.

#### **CONTENT ELABORATION**

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---



## Grade 7

### PHYSICAL SCIENCE (PS)

#### **Topic: Cycles of Mass and Energy**

This topic focuses on the empirical evidence for the arrangements of atoms on the Periodic Table of Elements, conservation of mass and energy, transformation and transfer of energy.

---

#### CONTENT STATEMENT

##### **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:** *Energy transfers should be experiential and observable at this grade level.*

---

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

# Grade 8

## INTRODUCTION TO CONTENT STATEMENTS

### GRADE BAND THEME: ORDER AND ORGANIZATION

This theme focuses on helping students explore the components of various systems and then investigate dynamic and sustainable relationships within systems using scientific inquiry.

### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

## STRANDS

**Strand Connections:** Systems can be described and understood by analysis of the interaction of their components. Energy, forces and motion combine to change the physical features of the Earth. The changes of the physical Earth and the species that have lived on Earth are found in the rock record. For species to continue, reproduction must be successful.

EARTH AND SPACE SCIENCE (ESS)	LIFE SCIENCE (LS)	PHYSICAL SCIENCE (PS)
<p><b>Topic: Physical Earth</b></p> <p>This topic focuses on the physical features of Earth and how they formed. This includes the interior of Earth, the rock record, plate tectonics and landforms.</p>	<p><b>Topic: Species and Reproduction</b></p> <p>This topic focuses on continuation of the species.</p>	<p><b>Topic: Forces and Motion</b></p> <p>This topic focuses on forces and motion within, on and around the Earth and within the universe.</p>
CONDENSED CONTENT STATEMENTS		
<ul style="list-style-type: none"> <li>• The composition and properties of Earth's interior are identified by the behavior of seismic waves.</li> <li>• Earth's lithosphere consists of major and minor tectonic plates that move relative to each other.</li> <li>• A combination of constructive and destructive geologic processes formed Earth's surface.</li> <li>• Evidence of the dynamic changes of Earth's surface through time is found in the geologic record.</li> </ul>	<ul style="list-style-type: none"> <li>• Diversity of species, a result of variation of traits, occurs through the process of evolution and extinction over many generations. The fossil records provide evidence that changes have occurred in number and types of species.</li> <li>• Every organism alive today comes from a long line of ancestors who reproduced successfully every generation.</li> <li>• The characteristics of an organism are a result of inherited traits received from parent(s).</li> </ul>	<ul style="list-style-type: none"> <li>• Objects can experience a force due to an external field such as magnetic, electrostatic, or gravitational fields.</li> <li>• Forces can act to change the motion of objects.</li> </ul>

# Grade 8

## EARTH AND SPACE SCIENCE (ESS)

### Topic: Physical Earth

This topic focuses on the physical features of Earth and how they formed. This includes the interior of Earth, the rock record, plate tectonics and landforms.

---

#### CONTENT STATEMENT

##### **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.*

---

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

# Grade 8

## EARTH AND SPACE SCIENCE (ESS)

### Topic: Physical Earth

This topic focuses on the physical features of Earth and how they formed. This includes the interior of Earth, the rock record, plate tectonics and landforms.

---

#### CONTENT STATEMENT

**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 movements 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.

---

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

## Grade 8

### EARTH AND SPACE SCIENCE (ESS)

#### **Topic: Physical Earth**

This topic focuses on the physical features of Earth and how they formed. This includes the interior of Earth, the rock record, plate tectonics and landforms.

---

#### **CONTENT STATEMENT**

**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.

#### **CONTENT ELABORATION**

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

# Grade 8

## EARTH AND SPACE SCIENCE (ESS)

### Topic: Physical Earth

This topic focuses on the physical features of Earth and how they formed. This includes the interior of Earth, the rock record, plate tectonics and landforms.

---

#### CONTENT STATEMENT

**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.

---

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

# Grade 8

## LIFE SCIENCE (LS)

### Topic: Species and Reproduction

This topic focuses on continuation of the species.

---

#### CONTENT STATEMENT

**8.LS.1: Diversity of species, a result of variation of traits, occurs through the process of evolution and extinction over many generations. The fossil records provide evidence that changes have occurred in number and types of species.**

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 statistic mathematics to predict changes in a gene pool are reserved for high school Biology.*

---

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.



# Grade 8

## LIFE SCIENCE (LS)

### Topic: Species and Reproduction

This topic focuses on continuation of the species.

---

#### CONTENT STATEMENT

**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.

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

# Grade 8

## LIFE SCIENCE (LS)

### Topic: Species and Reproduction

This topic focuses on continuation of the species.

---

#### CONTENT STATEMENT

**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.*

---

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

# Grade 8

## PHYSICAL SCIENCE (PS)

### Topic: Forces and Motion

This topic focuses on forces and motion within, on and around the Earth and within the universe.

---

#### CONTENT STATEMENT

**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.

#### CONTENT ELABORATION

The content elaboration will appear here once the revised Model Curriculum is adopted.

---

# Grade 8

## PHYSICAL SCIENCE (PS)

### Topic: Forces and Motion

This topic focuses on forces and motion within, on and around the Earth and within the universe.

---

#### CONTENT STATEMENT

##### **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 new force on an object is the sum of all of 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.

#### CONTENT ELABORATION

**The content elaboration will appear here once the revised Model Curriculum is adopted.**

---

# Ohio's Learning Standards for Science, High School

## Physical Science

### INTRODUCTION AND SYLLABUS

#### 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 three one-unit courses. Each course should include 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.

#### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

#### COURSE CONTENT

The following information may be taught in any order; there is no ODE-recommended sequence.

### PS.M: STUDY OF MATTER

#### PS.M.1: Classification of matter

- Heterogeneous vs. homogeneous
- Properties of matter
- States of matter and its changes

#### PS.M.2: Atoms

- Models of the atom (components)
- Ions (cations and anions)
- Isotopes

#### PS.M.3: Periodic trends of the elements

- Periodic law
- Representative groups

#### PS.M.4: Bonding and compounds

- Bonding (ionic and covalent)
- Nomenclature

#### PS.M.5: Reactions of matter

- Chemical reactions
- Nuclear reactions

## PS.EW: ENERGY AND WAVES

### PS.EW.1: Conservation of energy

- Quantifying kinetic energy
- Quantifying gravitational potential energy

### PS.EW.2: Transfer and transformation of energy (including work)

### PS.EW.3: Waves

- Refraction, reflection, diffraction, absorption, superposition
- Radiant energy and the electromagnetic spectrum
- Doppler shift

### PS.EW.4: Thermal energy

### PS.EW.5: Electricity

- Movement of electrons
- Current
- Electric potential (voltage)
- Resistors and transfer of energy

## PS.FM: FORCES AND MOTION

### PS.FM.1: Motion

- Introduction to one-dimensional vectors
- Displacement, velocity (constant, average and instantaneous) and acceleration
- Interpreting position vs. time and velocity vs. time graphs

### PS.FM.2: Forces

- Force diagrams
- Types of forces (gravity, friction, normal, tension)
- Field model for forces at a distance

### PS.FM.3: Dynamics (how forces affect motion)

- Objects at rest
- Objects moving with constant velocity
- Accelerating objects

## PS.U: THE UNIVERSE

### PS.U.1: History of the universe

### PS.U.2: Galaxies

### PS.U.3: Stars

- Formation: stages of evolution
- Fusion in stars

# Biology

## INTRODUCTION AND SYLLABUS

### COURSE DESCRIPTION

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 three one-unit courses. Each course should include inquiry-based laboratory experience that engages students in asking valid scientific questions and gathering and analyzing information.

Biology 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.

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.

### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

### COURSE CONTENT

The following information may be taught in any order; there is no ODE-recommended sequence.

#### B.H: HEREDITY

**B.H.1:** Cellular genetics

**B.H.2:** Structure and function of DNA in cells

**B.H.3:** Genetic mechanisms and inheritance

**B.H.4:** Mutations

**B.H.5:** Modern genetics

#### B.E: EVOLUTION

**B.E.1:** Mechanisms

- Natural selection
- Mutation
- Genetic drift
- Gene flow (immigration, emigration)
- Sexual selection

**B.E.2:** Speciation

- Biological classification expanded to molecular evidence
- Variation of organisms within species due to population genetics and gene frequency

## **B.DI: DIVERSITY AND INDEPENDENCE OF LIFE**

### **B.DI.1: Biodiversity**

- Genetic diversity
- Species diversity

### **B.DI.2: Ecosystems**

- Equilibrium and disequilibrium
- Carrying capacity

### **B.DI.3: Loss of Diversity**

- Climate change
- Anthropocene effects
- Extinction
- Invasive species

## **B.C: CELLS**

### **B.C.1: Cell structure and function**

- Structure, function and interrelatedness of cell organelles
- Eukaryotic cells and prokaryotic cells

### **B.C.2: Cellular processes**

- Characteristics of life regulated by cellular processes
- Photosynthesis, chemosynthesis, cellular respiration, biosynthesis of macromolecules



# Chemistry

## INTRODUCTION AND SYLLABUS

### 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 three one-unit courses. Each course should include inquiry-based laboratory experience that engages students in asking valid scientific questions and gathering and analyzing information.

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.

### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

### COURSE CONTENT

The following information may be taught in any order; there is no ODE-recommended sequence.

### C.PM: STRUCTURE AND PROPERTIES OF MATTER

#### C.PM.1: Atomic structure

- Evolution of atomic models/theory
- Electrons
- Electron configurations

#### C.PM.2: Periodic Table

- Properties
- Trends

#### C.PM.3: Chemical bonding

- Ionic
- Polar/covalent

#### C.PM.4: Representing compounds

- Formula writing
- Nomenclature
- Models and shapes (Lewis structures, ball and stick, molecular geometries)

#### C.PM.5: Quantifying matter

#### C.PM.6: Intermolecular forces of attraction

- Types and strengths
- Implications for properties of substances
  - Melting and boiling point
  - Solubility
  - Vapor pressure

### C.IM: INTERACTIONS OF MATTER

#### C.IM.1: Chemical reactions

- Types of reactions
- Kinetics
- Energy

- Equilibrium
- Acids/bases

**C.IM.2:** Gas laws

- Pressure, volume and temperature
- Ideal gas law

**C.IM.3:** Stoichiometry

- Molecular calculations
- Solutions
- Limiting reagents

# Environmental Science

## INTRODUCTION AND SYLLABUS

### COURSE DESCRIPTION

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 three one-unit courses. Each course should include inquiry-based laboratory experience that engages students in asking valid scientific questions and gathering and analyzing information.

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

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.

### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

### COURSE CONTENT

The following information may be taught in any order; there is no ODE-recommended sequence.

## EARTH SYSTEMS: INTERCONNECTED SPHERES OF EARTH

### ENV.ES.1: Biosphere

- Evolution and adaptation in populations
- Biodiversity
- Ecosystems (equilibrium, species interactions, stability)
- Population dynamics

### ENV.ES.2: Atmosphere

- Atmospheric properties and currents

### ENV.ES.3: Lithosphere

- Geologic events and processes

### ENV.ES.4: Hydrosphere

- Oceanic currents and patterns (as they relate to climate)
- Surface and ground water flow patterns and movement
- Cryosphere

### ENV.ES.5: Movement of matter and energy through the hydrosphere, lithosphere, atmosphere and biosphere

- Energy transformation on global, regional and local scales
- Biogeochemical cycles
- Ecosystems
- Weather
- Climate

## EARTH'S RESOURCES

### ENV.ER.1: Energy resources

- Renewable and nonrenewable energy sources and efficiency

- Alternate energy sources and efficiency
- Resource availability
- Mining and resource extraction

**ENV.ER.2:** Air and air pollution

- Primary and secondary contaminants
- Greenhouse gases
- Clean Air Act

**ENV.ER.3:** Water and water pollution

- Potable water and water quality
- Hypoxia, eutrophication
- Clean Water Act
- Point source and non-point source contamination

**ENV.ER.4:** Soil and land

- Desertification
- Mass movement and erosion
- Sediment contamination
- Land use and land management (including food production, agriculture and zoning)
- Solid and hazardous waste

**ENV.ER.5:** Wildlife and wilderness

- Wildlife and wilderness management
  - Endangered species
- Invasive Species
- Introduced Species

**ENV.GP: GLOBAL ENVIRONMENTAL PROBLEMS AND ISSUES****ENV.GP.1:** Human Population**ENV.GP.2:** Potable water quality, use and availability**ENV.GP.3:** Climate change**ENV.GP.4:** Sustainability**ENV.GP.5:** Species depletion and extinction**ENV.GP.6:** Air quality**ENV.GP.7:** Food production and availability**ENV.GP.8:** Deforestation and loss of biodiversity**ENV.GP.9:** Waste management (solid and hazardous)

# Physical Geology

## INTRODUCTION AND SYLLABUS

### 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 three one-unit courses. Each course should include 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.

### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

### COURSE CONTENT

The following information may be taught in any order; there is no ODE-recommended sequence.

#### PG.M: MINERALS

**PG.M.1:** Atoms and elements

**PG.M.2:** Chemical bonding (ionic, covalent, metallic)

**PG.M.3:** Crystallinity (crystal structure)

**PG.M.4:** Criteria of a mineral (crystalline solid, occurs in nature, inorganic, defined chemical composition)

**PG.M.5:** Properties of minerals (hardness, luster, cleavage, streak, crystal shape, fluorescence, flammability, density/specific gravity, malleability)

#### PG.IMS: IGNEOUS, METAMORPHIC AND SEDIMENTARY ROCKS

##### PG.IMS.1: Igneous

- 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)

**PG.IMS.2:** Metamorphic

- Pressure, stress, temperature and compressional forces
- Foliated (regional), non-foliated (contact)
- Parent rock and degrees of metamorphism
- Metamorphic zones (where metamorphic rocks are found)

**PG.IMS.3:** Sedimentary

- Division of sedimentary rocks and minerals (chemical, clastic/physical, organic)
- Depositional environments

**PG.IMS.4:** 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
- Transgressing and regressing sea levels
- Streams (channels, streambeds, floodplains, cross-bedding, alluvial fans, deltas)

**PG.EH: EARTH'S HISTORY****PG.EH.1:** The geologic rock record

- Relative and absolute age
- Principles to determine relative age
  - Original horizontality
  - Superposition
  - Cross-cutting relationships
- Absolute age
  - Radiometric dating (isotopes, radioactive decay)
  - Correct uses of radiometric dating
- Combining relative and absolute age data
- The geologic time scale
  - Comprehending geologic time
  - Climate changes evident through the rock record
  - Fossil record

**PG.PT: PLATE TECTONICS****PG.PT.1:** Internal Earth

- Seismic waves
  - S and P waves
  - Velocities, reflection, refraction of waves

**PG.PT.2:** Structure of Earth (Note: specific layers were part of grade 8)

- Asthenosphere
- Lithosphere
- Mohorovicic boundary (Moho)
- Composition of each of the layers of Earth

- Gravity, magnetism and isostasy
- Thermal energy (geothermal gradient and heat flow)

**PG.PT.3:** Historical review (Note: this would include a review of continental drift and sea-floor spreading found in grade 8)

- Paleomagnetism and magnetic anomalies
- Paleoclimatology

**PG.PT.4:** Plate motion (Note: introduced in grade 8)

- Causes and evidence of plate motion
- Measuring plate motion
- Characteristics of oceanic and continental plates
- Relationship of plate movement and geologic events
- Mantle plumes

## PG.ER: EARTH'S RESOURCES

**PG.ER.1:** Energy resources

- Renewable and nonrenewable energy sources and efficiency
- Alternate energy sources and efficiency
- Resource availability
- Mining and resource extraction

**PG.ER.2:** Air

- Primary and secondary contaminants
- Greenhouse gases

**PG.ER.3:** Water

- Potable water and water quality
- Hypoxia, eutrophication

**PG.ER.4:** Soil and sediment

- Desertification
- Mass wasting and erosion
- Sediment and contamination

## PG.GG: GLACIAL GEOLOGY

**PG.GG.1:** Glaciers and glaciation

- 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

# Physics

## INTRODUCTION AND SYLLABUS

### 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 three one-unit courses. Each course should include 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.

### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

### COURSE CONTENT

The following information may be taught in any order; there is no ODE-recommended sequence.

#### P.M: MOTION

##### P.M.1: Motion Graphs

- Position vs. time
- Velocity vs. time
- Acceleration vs. time

##### P.M.2: Problem Solving

- 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)

##### P.M.3: Projectile Motion

- Independence of horizontal and vertical motion
- Problem-solving involving horizontally launched projectiles

### P.F: MOMENTUM AND MOTION

#### P.F.1: Newton's laws applied to complex problems

#### P.F.2: Gravitational force and fields

#### P.F.3: Elastic forces

#### P.F.4: Friction force (static and kinetic)

#### P.F.5: Air resistance and drag

#### P.F.6: Forces in two dimensions

- Adding vector forces
- Motion down inclines
- Centripetal forces and circular motion

#### P.F.7: Momentum, impulse and conservation of momentum

### P.E: ENERGY

#### P.E.1: Gravitational potential energy

#### P.E.2: Energy in springs



**P.E.3:** Work and power

**P.E.4:** Conservation of energy

**P.E.5:** Nuclear energy

## **P.W: WAVES**

**P.W.1:** Wave properties

- Conservation of energy
- Reflection
- Refraction
- Interference
- Diffraction

**P.W.2:** Light phenomena

- Ray diagrams (propagation of light)
- Law of reflection (equal angles)
- Snell's law
- Diffraction patterns
- Wave—particle duality of light
- Visible spectrum of color

## **P.EM: ELECTRICITY AND MAGNETISM**

**P.EM.1:** Charging objects (friction, contact and induction)

**P.EM.2:** Coulomb's law

**P.EM.3:** Electric fields and electric potential energy

**P.EM.4:** DC circuits

- Ohm's law
- Series circuits
- Parallel circuits

- Mixed circuits

- Applying conservation of charge and energy (junction and loop rules)

**P.EM.5:** Magnetic fields

**P.EM.6:** Electromagnetic interactions

# Human Anatomy and Physiology

## INTRODUCTION AND SYLLABUS

### COURSE DESCRIPTION

Human Anatomy and Physiology 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 three one-unit courses. Each course should include inquiry-based laboratory experience that engages students in asking valid scientific questions and gathering and analyzing information.

Human Anatomy and Physiology comprises a systematic study in which students will examine human anatomy and physical functions, as well as homeostatic imbalances. They will analyze descriptive results of abnormal physiology and evaluate clinical consequences. A workable knowledge of medical terminology will be demonstrated.

Investigations are used to understand and explain the human body in a variety of investigative scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications.

### SCIENCE INQUIRY AND APPLICATION

This section is being updated to include the Nature of Science and will be available once the revised Model Curriculum is adopted.

### COURSE CONTENT

The following information may be taught in any order; there is no ODE-recommended sequence.

#### AP.LO: LEVELS OF ORGANIZATION

**AP.LO.1:** Hierarchy of Organization

**AP.LO.2:** Types of Tissues

**AP.LO.3:** Homeostasis

**AP.LO.4:** Anatomical Terminology

#### AP.SM: SUPPORT AND MOTION

**AP.SM.1:** Integumentary System

**AP.SM.2:** Skeletal System

**AP.SM.3:** Muscular System

#### AP.IC: INTEGRATION AND COORDINATION

**AP.IC.1:** Nervous System

**AP.IC.2:** Special Senses

- Sense of Sight
- Senses of Hearing and Balance
- Senses of Taste and Smell

**AP.IC.3:** Endocrine System

**AP.T: TRANSPORT**

**AP.T.1:** Blood

**AP.T.2:** Cardiovascular System

**AP.T.3:** Lymphatic and Immune Systems

**AP.AE: ABSORPTION AND EXCRETION**

**AP.AE.1:** Digestive System

**AP.AE.2:** Respiratory System

**AP.AE.3:** Urinary System

**AP.R: REPRODUCTION**

**AP.R.1:** Reproductive System