

# Curriculum Map: Science 7 2019

Course: SCIENCE 7 Sub-topic: General

Grade(s): 7

**Course Description:** Life Science

**Course Textbooks, Workbooks, Materials Citations:** McGraw Hill Life iScience

## Unit: Nature of Science

Timeline: Week 1 to 4

**Month:** The following is a ROUGH pacing guide for this Unit.

### Nature of Science -

Understanding Science

Measurement and Scientific Tools

## STANDARDS: STANDARDS

STATE: [Pennsylvania State Anchors \(2010\)](#)

[S7.A.1.1.3](#) (Advanced) Use evidence such as observations or experimental results to support inferences.

[S7.A.1.3.1](#) (Advanced) Describe how variables can cause changes in a system over time.

[S7.A.2.2.1](#) (Advanced) Describe the safe and appropriate use of instruments and scales to accurately and safely make measurements under a variety of conditions.

[S7.A.2.2.2](#) (Advanced) Apply measurement systems to record and interpret observations under a variety of conditions.

[S8.A.2.1.3](#) (Advanced) Design a controlled experiment by specifying how the independent variables will be manipulated, how the dependent variable will be measured, and which variables will be held constant.

[S8.A.2.1.4](#) (Advanced) Interpret data/observations; develop relationships among variables based on data/observations to design models as solutions.

[S8.A.2.2.2](#) (Advanced) Apply appropriate measurement systems (e.g., time, mass, distance, volume, temperature) to record and interpret observations under varying conditions.

(\* standards consolidated from Topic level)

## Topic: Understanding Science

**Core Lesson Description:** Students will learn how to setup and conduct a scientific investigation by following the steps of the scientific method.

**Core Lesson Student Learning Objectives:** How do scientists answer questions in a clear and organized manner?

What are the parts of the scientific method?

How do we create a controlled experiment?

How do we pose a properly worded hypothesis?

How do we identify the independent and dependent variables?

**Core Lesson Essential Questions:** What are the steps of the scientific method?  
Why is the scientific method important to follow when completing an investigation?  
How do scientists use observations, predictions, inferences, and classification in investigations?

**Core Lesson Big Ideas:** Well conducted scientific investigations use the steps of the scientific method to answer questions in an organized manner.

**Core Lesson Key Terminology & Definitions:** Hypothesis  
Independent variable  
Dependent variable  
Controlled experiment  
Data  
Observation  
Prediction  
Classification  
Inference

## STANDARDS

STATE: [Pennsylvania State Anchors \(2010\)](#)

[S7.A.1.1.3 \(Advanced\)](#) Use evidence such as observations or experimental results to support inferences.  
[S7.A.1.3.1 \(Advanced\)](#) Describe how variables can cause changes in a system over time.  
[S8.A.2.1.3 \(Advanced\)](#) Design a controlled experiment by specifying how the independent variables will be manipulated, how the dependent variable will be measured, and which variables will be held constant.  
[S8.A.2.1.4 \(Advanced\)](#) Interpret data/observations; develop relationships among variables based on data/observations to design models as solutions.

## Topic: Measurement and Scientific Tools

**Core Lesson Description:** Students will learn how to make measurements using the SI (metric) system in the science laboratory.

**Core Lesson Student Learning Objectives:** Why do scientists use the SI System?  
Why is measuring accurately and precisely important when conducting scientific investigations?

**Core Lesson** What is the metric system?

**Essential Questions:** What are the basic units of the metric system?  
What is length and how is it measured?  
What is mass and how is it measured?  
What is volume and how is it measured?

**Core Lesson Big Ideas:** Making accurate and precise measurements using the SI (metric) system is an important skill needed to collect data while conducting scientific investigations.

**Core Lesson Key Terminology & Definitions:** SI (metric) System  
Length  
Mass  
Volume  
Precision  
Accuracy

## **STANDARDS**

STATE: Pennsylvania State Anchors (2010)

[S7.A.2.2.1 \(Advanced\)](#) Describe the safe and appropriate use of instruments and scales to accurately and safely make measurements under a variety of conditions.

[S7.A.2.2.2 \(Advanced\)](#) Apply measurement systems to record and interpret observations under a variety of conditions.

[S8.A.2.2.2 \(Advanced\)](#) Apply appropriate measurement systems (e.g., time, mass, distance, volume, temperature) to record and interpret observations under varying conditions.

## **Unit: Life: Structure and Function**

**Month:** The following is a ROUGH pacing guide for this Unit.

### **Classifying and Exploring Life - October Week 1, 2, 3**

Characteristics of Life  
Classifying Organisms  
Exploring Life

### **Cell Structure and Function Part I - October Week 4, November Week 1, 2, 3**

Cells and Life  
The Cell

### **Cell Structure and Function Part II - December Week 1, 2, 3**

Moving Cellular Materials  
Cells and Energy

### **From a Cell to an Organism - January Week 1, 2, 3**

The Cell Cycle and Cell Division

Levels of Organization

**Genetics - January Week 4, February Week 1, 2, 3**

Mendel and His Peas

Understanding Inheritance

DNA and Genetics

**The Environment and Change Over Time - February Week 4, March Week 1**

Theory of Evolution by Natural Selection

**STANDARDS: STANDARDS**

STATE: Pennsylvania SAS Academic Standards (2009-2013)

[3.4.7.D2 \(Advanced\)](#) Select and safely use appropriate tools, products and systems for specific tasks.

STATE: Pennsylvania State Anchors (2010)

[S7.A.3.1.2 \(Advanced\)](#) Explain the concept of order in a system (e.g., first to last manufacturing steps; trophic levels; simple to complex—levels of biological organization from cell to organism).

[S6.B.1.1 \(Advanced\)](#) Explain how the cell is the basic unit of structure and function for all living things.

[S6.B.1.1.1 \(Advanced\)](#) Describe how cells carry out the many functions needed to sustain life.

[S6.B.1.1.2 \(Advanced\)](#) Identify examples of unicellular and multi-cellular organisms (i.e., plants, fungi, bacteria, protists, and animals).

[S6.B.1.1.3 \(Advanced\)](#) Explain how many organisms are unicellular and must carry out all life functions in one cell.

[S7.B.1 \(Advanced\)](#) Structure and Function of Organisms

[S7.B.1.1 \(Advanced\)](#) Describe and compare structural and functional similarities and differences that characterize diverse living things.

[S7.B.1.1.1 \(Advanced\)](#) Describe levels of biological organization from cell to organism.

[S7.B.1.1.2 \(Advanced\)](#) Describe how specific structures in living things (from cell to organism) help them function effectively in specific ways

(e.g., chlorophyll in plant cells— photosynthesis; root hairs—increased surface area; beak structures in birds— food gathering; cacti spines—protection from predators).

[S7.B.1.2.1 \(Advanced\)](#) Explain how cells arise from the division of a pre-existing cell.

[S7.B.2.1.1 \(Advanced\)](#) Explain how inherited traits (genes) and/or behaviors help organisms survive and reproduce in different environments.

[S7.B.2.1.3 \(Advanced\)](#) Explain that adaptations within species (physical, behavioral, physiological) are developed over long periods of time.

[S7.B.2.2 \(Advanced\)](#) Explain how a set of genetic instructions determines inherited traits of organisms.

[S7.B.2.2.1 \(Advanced\)](#) Identify and explain differences between inherited and acquired traits.

[S7.B.2.2.2 \(Advanced\)](#) Recognize evidence that the gene is the basic unit of inheritance and explain the effect of dominant and recessive genes on inherited traits.

[S7.B.2.2.3 \(Advanced\)](#) Explain how mutations can alter a gene and are a source of new variations in a population.

[S7.B.2.2.4 \(Advanced\)](#) Describe how selective breeding or biotechnologies can change the genetic makeup of an organism (e.g., domesticated dogs, horses, cows; crops, hybrid plants; integrated pest management).

- [S8.B.1.1.1 \(Advanced\)](#) Describe the structures of living things that help them function effectively in specific ways (e.g., adaptations, characteristics).
- [S8.B.1.1.3 \(Advanced\)](#) Apply knowledge of characteristic structures to identify or categorize organisms (i.e., plants, animals, fungi, bacteria, and protista).
- [S8.B.1.1.4 \(Advanced\)](#) Identify the levels of organization from cell to organism and describe how specific structures (parts), which underlie larger systems, enable the system to function as a whole.
- [S8.B.2.1.2 \(Advanced\)](#) Explain how different adaptations in individuals of the same species may affect survivability or reproduction success.
- [S8.B.2.1.5 \(Advanced\)](#) Explain that adaptations are developed over long periods of time and are passed from one generation to another.
- NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)
- [MS-LS1-1 \(Advanced\)](#) Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.
- [MS-LS1-2 \(Advanced\)](#) Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.
- [MS-LS1-3 \(Advanced\)](#) Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
- [MS-LS1-4 \(Advanced\)](#) Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.
- [MS-LS1-6 \(Advanced\)](#) Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
- [MS-LS1-7 \(Advanced\)](#) Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
- [MS-LS3-1 \(Advanced\)](#) Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.
- [MS-LS3-2 \(Advanced\)](#) Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.
- [MS-LS4-4 \(Advanced\)](#) Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.
- [MS-LS4-5 \(Advanced\)](#) Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.
- [MS-LS4-6 \(Advanced\)](#) Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.
- NGSS Arranged by Topic - Science (2013)
- [MS-LS1-1 \(Advanced\)](#) Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

(\* standards consolidated from Topic level)

**Topic: Characteristics of Life**

**Core Lesson Description:** Students will learn characteristics that all living things share. They will learn how living and non-living organisms differ.

- Core Lesson Student Learning Objectives:**
1. Identify the 6 characteristics of living things. (E)
  2. Living things are made of cells. (C)
  3. Living things can be unicellular or multi-cellular. (E)
  4. Living things grow and develop. (E)
  5. Living things reproduce. (E)
  6. Living things respond to stimuli. (E)
  7. Living things maintain stable internal conditions (homeostasis). (I)
  8. Living things use energy for all processes they perform. (E)

**Core Lesson Essential Questions:** What characteristics do all living things share?

**Core Lesson Big Ideas:** All living things share certain characteristics.

**Core Lesson Key Terminology & Definitions:**

- organism
- cell
- unicellular
- multicellular
- homeostasis

## STANDARDS

STATE: Pennsylvania State Anchors (2010)

[S6.B.1.1 \(Advanced\)](#) Explain how the cell is the basic unit of structure and function for all living things.

[S6.B.1.1.2 \(Advanced\)](#) Identify examples of unicellular and multi-cellular organisms (i.e., plants, fungi, bacteria, protists, and animals).

[S7.B.1 \(Advanced\)](#) Structure and Function of Organisms

[S7.B.1.1 \(Advanced\)](#) Describe and compare structural and functional similarities and differences that characterize diverse living things.

NGSS Arranged by Topic - Science (2013)

[MS-LS1-1 \(Advanced\)](#) Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

## Topic: Classifying Organisms

**Core Lesson Description:** Students will learn how living things are classified, why scientific names are used, and how classification tools can be used to identify organisms.

- Core Lesson Student Learning Objectives:**
1. Identify the domains (3) and kingdoms (6) used to organize life. (I)
  2. Identify how an organism's genus and species determine its scientific name. (E)
  3. Identify how scientific names differ from common names. (C)
  4. Understand how dichotomous keys and cladograms can be used to identify organisms. (I)

**Core Lesson Essential Questions:** What methods are used to classify living things into groups?  
Why does every species have a scientific name?

**Core Lesson Big Ideas:** Living things are classified by their characteristics.

**Core Lesson Key Terminology & Definitions:** binomial nomenclature (E)  
species (C)  
genus (E)  
dichotomous key (E)  
cladogram (I)

## STANDARDS

STATE: [Pennsylvania State Anchors \(2010\)](#)

[S8.B.1.1.3 \(Advanced\)](#) Apply knowledge of characteristic structures to identify or categorize organisms (i.e., plants, animals, fungi, bacteria, and protista).

### Topic: Exploring Life

**Core Lesson Description:** Students will learn how microscopes work, the types of microscopes used in science, and how to use a microscope in the science laboratory.

**Core Lesson Student Learning Objectives:**

1. Explain how a light microscope works. (C)
2. Explain how an electron microscope works. (E)
3. Identify the parts of the light microscope. (E)
4. Explain how microscopes are used in multiple fields. (I)
4. Complete a series of hands-on tasks using the light microscope in the laboratory. (E)

**Core Lesson Essential Questions:** How did microscopes change our ideas about living things?  
What are the types of microscopes, and how do they compare?

**Core Lesson Big Ideas:** Microscopes allow scientists to view cells, which further allow them to explore and classify life.

**Core Lesson Materials:** Microscopes (1 microscope to 2 students)  
Prepared Slides  
Pond Water (student provided)  
Slides, cover slips, wipes

**Core Lesson Key Terminology & Definitions:** Light microscope (C)  
compound microscope (E)  
electron microscope (I)

## STANDARDS

STATE: Pennsylvania SAS Academic Standards (2009-2013)

[3.4.7.D2 \(Advanced\)](#) Select and safely use appropriate tools, products and systems for specific tasks.

### Topic: Cell and Life

**Core Lesson Description:** Students will learn the Cell Theory and the basic substances found in cells.

**Core Lesson Student Learning Objectives:**

1. Explain how Robert Hooke discovered the cell. (I)
2. Explain the 3 parts of the Cell Theory. (E)
3. Identify the importance of water in cells. (C)
4. Explain the role of macromolecules (nucleic acid, proteins, carbohydrates) in cells. (E)

**Core Lesson Essential Questions:** How did scientists understanding of cells develop?  
What basic substances make up a cell?

**Core Lesson Big Ideas:** The invention of the microscope led to discoveries about cells.

**Core Lesson Key Terminology & Definitions:** Cell Theory (E)  
Macromolecule (E)  
Nucleic acid (E)  
Protein (E)  
Lipid (E)  
Carbohydrate (E)

## STANDARDS

STATE: Pennsylvania State Anchors (2010)

[S6.B.1.1 \(Advanced\)](#) Explain how the cell is the basic unit of structure and function for all living things.

[S7.B.1.1.2 \(Advanced\)](#) Describe how specific structures in living things (from cell to organism) help them function effectively in specific ways

(e.g., chlorophyll in plant cells— photosynthesis; root hairs—increased surface area; beak structures in birds— food gathering; cacti spines—protection from predators).

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

[MS-LS1-2 \(Advanced\)](#) Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.

## Topic: The Cell

**Core Lesson Description:** Students will learn how the shape of a cell influences its function, the differences between prokaryotic and eukaryotic cells, and the functions of organelles in plant and animal cells.

**Core Lesson Student Learning Objectives:**

1. Describe how cells make up single and multi cellular organisms. (C)
2. Explain how prokaryotic cells lack a nucleus and membrane-bound organelles. (I)
3. Explain how eukaryotic cells have a nucleus and membrane-bound organelles. (I)
4. Identify plant and animal cell organelles and their functions within the cell. (E)

**Core Lesson Essential Questions:** How are prokaryotic cells and eukaryotic cells similar? Different?  
What do the structures in a cell do?

**Core Lesson Big Ideas:** All living things are made of cells. Cells are made of smaller parts called organelles.

**Core Lesson Key Terminology & Definitions:**

- cell membrane (E)
- cell wall (E)
- cytoplasm (E)
- cytoskeleton (I)
- organelle (C)
- nucleus (C)
- chloroplast (E)
- prokaryotic (E)
- eukaryotic (E)
- endoplasmic reticulum (E)
- mitochondria (E)
- vesicle (E)
- vacuole (E)
- nucleolus (E)
- golgi apparatus (E)

## STANDARDS

STATE: Pennsylvania State Anchors (2010)

- [S6.B.1.1 \(Advanced\)](#) Explain how the cell is the basic unit of structure and function for all living things.
- [S6.B.1.1.1 \(Advanced\)](#) Describe how cells carry out the many functions needed to sustain life.
- [S6.B.1.1.3 \(Advanced\)](#) Explain how many organisms are unicellular and must carry out all life functions in one cell.
- [S7.B.1.1.2 \(Advanced\)](#) Describe how specific structures in living things (from cell to organism) help them function effectively in specific ways

- (e.g., chlorophyll in plant cells— photosynthesis; root hairs—increased surface area; beak structures in birds— food gathering; cacti spines—protection from predators).
- [S8.B.1.1.1 \(Advanced\)](#) Describe the structures of living things that help them function effectively in specific ways (e.g., adaptations, characteristics).
- [S8.B.1.1.4 \(Advanced\)](#) Identify the levels of organization from cell to organism and describe how specific structures (parts), which underlie larger systems, enable the system to function as a whole.
- NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)
- [MS-LS1-2 \(Advanced\)](#) Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.

### Topic: Moving Cellular Materials

**Core Lesson Description:** Students will learn how materials needed for cells to function travel through the cell membrane.

**Core Lesson Student Learning Objectives:**

1. Understand that substances move in and out of cells. (C)
2. Explain the mechanisms for passive transport. (E)
3. Explain the mechanisms for active transport. (E)
4. Explain how transport limits the maximum size of a cell. (I)

**Core Lesson Essential Questions:**

How do materials enter and leave cells?

How does cell size affect the transport of materials?

**Core Lesson Big Ideas:** Materials enter and leave cells as required for their survival.

**Core Lesson Key Terminology & Definitions:**

passive transport (C)

diffusion (E)

osmosis (E)

facilitated diffusion (E)

active transport (C)

endocytosis (I)

exocytosis (I)

### STANDARDS

STATE: Pennsylvania State Anchors (2010)

- [S6.B.1.1.1 \(Advanced\)](#) Describe how cells carry out the many functions needed to sustain life.
- [S7.B.1 \(Advanced\)](#) Structure and Function of Organisms
- [S7.B.1.1.2 \(Advanced\)](#) Describe how specific structures in living things (from cell to organism) help them function effectively in specific ways

(e.g., chlorophyll in plant cells— photosynthesis; root hairs—increased surface area; beak structures in birds— food gathering; cacti spines—protection from predators).

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

[MS-LS1-1 \(Advanced\)](#)

Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

[MS-LS1-2 \(Advanced\)](#)

Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.

## Topic: Cells and Energy

### Core Lesson Description:

Students will learn how cells obtain and use energy in order to carry out their life functions.

### Core Lesson Student Learning Objectives:

1. Identify the three ways cells obtain energy. (E)
2. Explain the process of cellular respiration in the mitochondria. (E)
3. Explain the 2 forms of fermentation that can occur in cells. (I)
4. Explain the process of photosynthesis in plant cells. (C)
5. Compare the relationship between photosynthesis and cellular respiration. (E)

### Core Lesson Essential Questions:

Explain the processes cells use to obtain energy.  
Explain how some cells make food molecules.

### Core Lesson Big Ideas:

Cells make energy through one of three ways: Respiration, Fermentation, and/or Photosynthesis.

### Core Lesson Key Terminology & Definitions:

cellular respiration (E)  
glycolysis (I)  
fermentation (I)  
photosynthesis (C)

## STANDARDS

STATE: Pennsylvania State Anchors (2010)

[S6.B.1.1.1 \(Advanced\)](#)

Describe how cells carry out the many functions needed to sustain life.

[S7.B.1.1.2 \(Advanced\)](#)

Describe how specific structures in living things (from cell to organism) help them function effectively in specific ways

(e.g., chlorophyll in plant cells— photosynthesis; root hairs—increased surface area; beak structures in birds— food gathering; cacti spines—protection from predators).

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

[MS-LS1-6 \(Advanced\)](#)

Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

[MS-LS1-7 \(Advanced\)](#)

Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

## Topic: The Cell Cycle and Cell Division

**Core Lesson Description:** Students will learn how cells divide in order to create new new cells.

**Core Lesson Student Learning Objectives:**

1. Explain the importance of the cell cycle. (C)
2. Identify the 2 main phases of the cell cycle. (E)
3. Explain the 3 phases of interphase. (E)
4. Explain the 5 phases of the mitotic phase. (I)
5. Explain how cell division helps maintain healthy organisms. (E)

**Core Lesson Essential Questions:**

What are the phases of the cell cycle?  
Why are the results of the cell cycle important?

**Core Lesson Big Ideas:** The cell cycle and cell division allows for multicellular organisms to grow from a single cell.

**Core Lesson Key Terminology & Definitions:**

cell cycle (C)  
interphase (E)  
sister chromatid (I)  
centromere (I)  
mitosis (E)  
cytokinesis (E)  
daughter cell (E)

## STANDARDS

STATE: [Pennsylvania State Anchors \(2010\)](#)

[S7.B.1.2.1 \(Advanced\)](#) Explain how cells arise from the division of a pre-existing cell.

NGSS Arranged by [Disciplinary Core Idea \(DCI\) - Science \(2013\)](#)

[MS-LS1-2 \(Advanced\)](#) Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.

## Topic: Levels of Organization

**Core Lesson Description:** Students will learn how cells function and are organized in becoming an organism.

**Core Lesson Student Learning Objectives:**

1. Explain how organisms are made of cells that each have specific functions. (C)
2. Differentiate between eukaryotes and prokaryotes. (E)
3. Explain the process of cell differentiation. (I)
4. Describe how cells function as tissue, organs, organ systems, and organisms. (C)
5. Identify basic characteristics of the skeletal, respiratory, nervous, muscular, skeletal, and digestive systems. (E)

**Core Lesson Essential Questions:** How do unicellular and multicellular organisms differ?  
How does cellular differentiation lead to the organization within a multicellular organism?

**Core Lesson Big Ideas:** Organisms are made up of many types of cells that work together to carry out specific functions.

**Core Lesson Key Terminology & Definitions:** cell differentiation (I)  
stem cell (I)  
cell (C)  
tissue (C)  
organ (E)  
organ system (E)

## STANDARDS

STATE: Pennsylvania State Anchors (2010)

[S7.A.3.1.2 \(Advanced\)](#) Explain the concept of order in a system (e.g., first to last manufacturing steps; trophic levels; simple to complex—levels of biological organization from cell to organism).

[S7.B.1 \(Advanced\)](#) Structure and Function of Organisms

[S7.B.1.1.1 \(Advanced\)](#) Describe levels of biological organization from cell to organism.

[S7.B.1.1.2 \(Advanced\)](#) Describe how specific structures in living things (from cell to organism) help them function effectively in specific ways

(e.g., chlorophyll in plant cells— photosynthesis; root hairs—increased surface area; beak structures in birds— food gathering; cacti spines—protection from predators).

[S8.B.1.1.4 \(Advanced\)](#) Identify the levels of organization from cell to organism and describe how specific structures (parts), which underlie larger systems, enable the system to function as a whole.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

[MS-LS1-2 \(Advanced\)](#) Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.

[MS-LS1-3 \(Advanced\)](#) Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

## Topic: Mendel and His Peas

**Core Lesson Description:** Students will learn how Mendel conducted pea plant experiments to explain the passing of traits from parents to offspring.

**Core Lesson Student Learning Objectives:**

1. Explain Mendel's methods of cross-pollinating pea plants and what he hoped to achieve. (I)
2. Explain the patterns Mendel observed when he cross-pollinated pea plants. (E)
3. Summarize the conclusions Mendel made about his pea plant experiments. (E)
4. Explain the differences between dominant and recessive traits. (C)

**Core Lesson Essential Questions:** Why did Mendel perform cross-pollination experiments?  
What did Mendel conclude about inherited traits?

How do dominant and recessive factors interact?

**Core Lesson Big Ideas:** Mendel's pea plant experiments set the groundwork for modern genetics.

**Core Lesson Key Terminology & Definitions:** heredity (E)  
genetics (C)  
dominant trait (E)  
recessive trait (E)

## STANDARDS

STATE: Pennsylvania State Anchors (2010)

[S7.B.2.2 \(Advanced\)](#) Explain how a set of genetic instructions determines inherited traits of organisms.

[S7.B.2.2.1 \(Advanced\)](#) Identify and explain differences between inherited and acquired traits.

[S7.B.2.2.2 \(Advanced\)](#) Recognize evidence that the gene is the basic unit of inheritance and explain the effect of dominant and recessive genes on inherited traits.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

[MS-LS1-4 \(Advanced\)](#) Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.

[MS-LS3-1 \(Advanced\)](#) Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

[MS-LS4-5 \(Advanced\)](#) Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.

## Topic: Understanding Inheritance

**Core Lesson Description:** Students will learn how genetics allows for the prediction of patterns of inheritance from parents to offspring.

**Core Lesson Student Learning Objectives:**

1. How do alleles (genes) determine the expression of traits? (C)
2. How can a Punnett square be used to predict possible genotypes and phenotypes of offspring? (E)
3. How can a pedigree be used to help identify genotypes and phenotypes? (E)
4. What is the difference between incomplete dominance and co-dominance? (I)

**Core Lesson Essential Questions:** What determines the expression of traits?  
How can inheritance be modeled?  
How do some patterns of inheritance differ from Mendel's models?

**Core Lesson Big Ideas:** An organism's traits are passed from parents to offspring.

**Core Lesson Key Terminology & Definitions:** genen(C)  
allele (E)

phenotype (E)  
genotype (E)  
homozygous (E)  
heterozygous (E)  
Punnett square (E)  
incomplete dominance (I)  
codominance (I)

## STANDARDS

STATE: Pennsylvania State Anchors (2010)

[S7.B.2.1.1 \(Advanced\)](#) Explain how inherited traits (genes) and/or behaviors help organisms survive and reproduce in different environments.

[S7.B.2.2 \(Advanced\)](#) Explain how a set of genetic instructions determines inherited traits of organisms.

[S7.B.2.2.2 \(Advanced\)](#) Recognize evidence that the gene is the basic unit of inheritance and explain the effect of dominant and recessive genes on inherited traits.

[S7.B.2.2.3 \(Advanced\)](#) Explain how mutations can alter a gene and are a source of new variations in a population.

[S7.B.2.2.4 \(Advanced\)](#) Describe how selective breeding or biotechnologies can change the genetic makeup of an organism (e.g., domesticated dogs, horses, cows; crops, hybrid plants; integrated pest management).

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

[MS-LS3-1 \(Advanced\)](#) Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

[MS-LS3-2 \(Advanced\)](#) Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.

[MS-LS4-4 \(Advanced\)](#) Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

[MS-LS4-5 \(Advanced\)](#) Gather and synthesize information about technologies that have changed the way humans influence the inheritance of desired traits in organisms.

## Topic: DNA and Genetics

### Core Lesson Description:

Students will learn about the structure and replication of the DNA molecule.

### Core Lesson Student Learning Objectives:

How does DNA relate to chromosomes and genes? (C)

What is the shape of a DNA molecule? (E)

What nucleotides make up a DNA molecule and how do they pair? (E)

What can cause a genetic mutation and how do they affect organisms? (I)

### Core Lesson Essential Questions:

1. What is DNA?

2. What is the role of RNA in protein production?

3. How do changes in the sequence of DNA affect traits?

**Core Lesson Big Ideas:** DNA is an organism's genetic material which provides all information needed for an organism to grow, maintain itself, and reproduce.

**Core Lesson Key Terminology & Definitions:** DNA  
nucleotide  
replication  
RNA  
transcription  
translation  
mutation

## STANDARDS

STATE: Pennsylvania State Anchors (2010)

[S7.B.2.2 \(Advanced\)](#) Explain how a set of genetic instructions determines inherited traits of organisms.

[S7.B.2.2.1 \(Advanced\)](#) Identify and explain differences between inherited and acquired traits.

[S7.B.2.2.2 \(Advanced\)](#) Recognize evidence that the gene is the basic unit of inheritance and explain the effect of dominant and recessive genes on inherited traits.

[S7.B.2.2.3 \(Advanced\)](#) Explain how mutations can alter a gene and are a source of new variations in a population.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

[MS-LS3-1 \(Advanced\)](#) Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

## Topic: Theory of Evolution by Natural Selection

**Core Lesson Description:** Students will learn the origin, mechanisms, and results of the theory of evolution by natural selection.

**Core Lesson Student Learning Objectives:** Identify Charles Darwin and explain how his observations of related organism on the Galapagos Islands lead to the theory of evolution by natural selection. (E)

Explain the role genetic variation plays in the theory of evolution by natural selection. (E)

Explain what an adaptation is and the three types commonly observed in organisms. (C)

Explain how humans have taken advantage of genetic variations through selective breeding. (I)

**Core Lesson Essential Questions:**

1. Who was Charles Darwin?
2. How does Darwin's theory of evolution by natural selection explain how species change over time?
3. How are adaptations evidence of natural selection?

**Core Lesson Big Ideas:** Natural selection is the mechanism for causing animal adaptations and, eventually, evolutionary change.

**Core Lesson Key** naturalist (E)

**Terminology & Definitions:**

variation (E)  
natural selection (E)  
adaptation (C)  
camouflage (E)  
mimicry (C)  
selective breeding (I)

**STANDARDS**

STATE: Pennsylvania State Anchors (2010)

[S7.B.2.1.3 \(Advanced\)](#) Explain that adaptations within species (physical, behavioral, physiological) are developed over long periods of time.

[S7.B.2.2.3 \(Advanced\)](#) Explain how mutations can alter a gene and are a source of new variations in a population.

[S7.B.2.2.4 \(Advanced\)](#) Describe how selective breeding or biotechnologies can change the genetic makeup of an organism (e.g., domesticated dogs, horses, cows; crops, hybrid plants; integrated pest management).

[S8.B.1.1.1 \(Advanced\)](#) Describe the structures of living things that help them function effectively in specific ways (e.g., adaptations, characteristics).

[S8.B.2.1.2 \(Advanced\)](#) Explain how different adaptations in individuals of the same species may affect survivability or reproduction success.

[S8.B.2.1.5 \(Advanced\)](#) Explain that adaptations are developed over long periods of time and are passed from one generation to another.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

[MS-LS4-4 \(Advanced\)](#) Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.

[MS-LS4-6 \(Advanced\)](#) Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

**Unit: Interactions of Life**

Timeline: Week 6

**Month:** The following is a ROUGH pacing guide for this Unit.

**From a Cell to an Organism - March Week 2, 3, 4**

Abiotic Factors

Cycles of Matter

Energy in Ecosystems

**Populations and Communities - April Week 1, 2, 3**

Populations

Changing Populations

Communities

**Biomes and Ecosystems April Week 4, May Week 1, 2, 3**

Land Biomes

Aquatic Biomes

**STANDARDS: STANDARDS**

STATE: Pennsylvania State Anchors (2010)

[S4.A.2.1.3](#)  
(Advanced) Observe a natural phenomenon (e.g., weather changes, length of daylight/night, movement of shadows, animal migrations, growth of plants), record observations, and then make a prediction based on those observations.

[S5.A.3.2.1](#)  
(Advanced) Describe how models are used to better understand the relationships in natural systems (e.g., water cycle, Sun-Earth- Moon system, ecosystems, observe and draw a diagram to show the effects of flowing water in a watershed).

[S7.A.1.3.2](#)  
(Advanced) Use evidence, observations, or explanations to make inferences about changes in systems over time (e.g., carrying capacity, succession, fossil evidence in the geologic time scale).

[S8.A.1.3.2](#)  
(Advanced) Use evidence, observations, or explanations to make inferences about change in systems over time (e.g., carrying capacity, succession, population dynamics, loss of mass in chemical reactions, indicator fossils in geologic time scale) and the variables affecting these changes.

[S4.B.3.1.2](#)  
(Advanced) Describe interactions between living and nonliving components (e.g. plants – water, soil, sunlight, carbon dioxide, temperature; animals – food, water, shelter, oxygen, temperature) of a local ecosystem.

[S6.B.2.1.2](#)  
(Advanced) Recognize that extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival.

[S7.B.2.1.2](#)  
(Advanced) Describe how natural selection is an underlying factor in a population's ability to adapt to change.

[S7.B.2.2.3](#)  
(Advanced) Explain how mutations can alter a gene and are a source of new variations in a population.

[S7.B.3.1](#) (Advanced) Compare the biotic and abiotic factors of different ecosystems and explain relationships between and these factors.

[S7.B.3.1.1](#)  
(Advanced) Describe relationships (e.g., predator/prey competition, symbiosis) between organisms in different ecosystems.

[S7.B.3.1.2](#)  
(Advanced) Identify the major biomes (terrestrial and aquatic) and describe their characteristic biotic and abiotic factors.

[S7.B.3.2.1](#)  
(Advanced) Identify and describe factors that cause and/or influence changes in populations (e.g., deforestation, disease, land use, natural disaster, invasive species).

[S7.B.3.2.4](#)  
(Advanced) Explain how changes in environmental conditions can affect the survival of a population and entire species (e.g., climate, hibernation, migration, coloration).

[S7.B.3.3](#) (Advanced) Explain how renewable and nonrenewable resources provide for human needs and how these needs impact the environment.

[S8.B.3.1](#) (Advanced) Explain the relationships among and between organisms in different ecosystems and their abiotic and biotic components.

[S8.B.3.1.1](#)  
(Advanced) Explain the flow of energy through an ecosystem (e.g., food chains, food webs).

[S8.B.3.1.3](#)  
(Advanced) Explain relationships among organisms (e.g., producers/consumers, predator/prey) in an ecosystem.

[S8.B.3.2.1](#)  
(Advanced) Use evidence to explain factors that affect changes in populations (e.g., deforestation, disease, land use, natural disaster, invasive species).

<a href="#">S8.B.3.2.3 (Advanced)</a>	Describe the response of organisms to environmental changes (e.g., changes in climate, hibernation, migration, coloration) and how those changes affect survival.
<a href="#">S8.B.3.3 (Advanced)</a>	Explain how renewable and nonrenewable resources provide for human needs or how these needs impact the environment.
<a href="#">S11.B.3.1.5 (Advanced)</a>	Predict how limiting factors (e.g., physical, biological, chemical) can affect organisms.
<a href="#">S7.C.2.1 (Advanced)</a>	Describe how energy flows through the living world.
<a href="#">S7.C.2.1.1 (Advanced)</a>	Describe how energy is obtained and used by organisms throughout their lives.
<a href="#">S7.C.2.1.3 (Advanced)</a>	Describe energy transformations within an ecosystem.
<a href="#">S7.D.1.2.1 (Advanced)</a>	Compare the different water systems on Earth (e.g., wetland, watershed, ocean, river).
<a href="#">S8.D.1.3.1 (Advanced)</a>	Describe the water cycle and the physical processes on which it depends (i.e., evaporation, condensation, precipitation, transpiration, runoff, infiltration, energy inputs, and phase changes).
<a href="#">S8.D.1.3.3 (Advanced)</a>	Distinguish among different water systems (e.g., wetland systems, ocean systems, river systems, watersheds) and describe their relationships to each other as well as to landforms.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

<a href="#">MS-LS1-6 (Advanced)</a>	Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
<a href="#">MS-LS2-1 (Advanced)</a>	Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
<a href="#">MS-LS2-2 (Advanced)</a>	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
<a href="#">MS-LS2-3 (Advanced)</a>	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
<a href="#">MS-LS2-4 (Advanced)</a>	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
<a href="#">MS-LS2-5 (Advanced)</a>	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

(\* standards consolidated from Topic level)

**Topic: Abiotic Factors**

**Core Lesson Description:** Students will learn how the nonliving parts of an ecosystem influence the living things in the ecosystem.

**Core Lesson Student Learning Objectives:** Explain the difference between living and nonliving factors in an ecosystem. (C)

Summarize the 6 components of non-living parts of an ecosystem. (E)

Explain how the nonliving parts of an ecosystem affect the living parts of an ecosystem. (E)

**Core Lesson Essential Questions:** 1. What is an ecosystem?

2. What are the nonliving parts of an ecosystem?

**Core Lesson Big Ideas:** Ecosystems are made of both living and non-living factors.

**Core Lesson Key Terminology & Definitions:** ecosystem (C)  
biotic factor (E)  
abiotic factor (E)  
climate (E)  
atmosphere (E)

## STANDARDS

STATE: [Pennsylvania State Anchors \(2010\)](#)

[S7.B.3.1 \(Advanced\)](#) Compare the biotic and abiotic factors of different ecosystems and explain relationships between and these factors.

[S8.B.3.1 \(Advanced\)](#) Explain the relationships among and between organisms in different ecosystems and their abiotic and biotic components.

NGSS Arranged by [Disciplinary Core Idea \(DCI\) - Science \(2013\)](#)

[MS-LS2-1 \(Advanced\)](#) Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

## Topic: Cycles of Matter

**Core Lesson Description:** Students will learn how water, nitrogen, oxygen, and carbon cycle through the environment.

**Core Lesson Student Learning Objectives:** Describe the forms water takes as it travels through an ecosystem. (C)  
Describe the processes that water undergoes as it moves through an ecosystem. (E)  
Summarize the nitrogen cycle and how it impacts ecosystems. (I)  
Summarize the oxygen cycle and how it impacts organisms. (E)  
Summarize the carbon cycle and how it impacts ecosystems. (I)

**Core Lesson Essential Questions:**

1. How does water move in ecosystems?
2. How does nitrogen move in ecosystems?
3. How does oxygen move in ecosystems?
4. How does carbon move in ecosystems?

**Core Lesson Big Ideas:** A variety of matter continuously cycles through the environment affecting both living and nonliving components of an ecosystem.

**Core Lesson Key Terminology & Definitions:** evaporation (E)  
condensation (E)  
precipitation (E)  
nitrogen fixation (I)

## STANDARDS

STATE: Pennsylvania State Anchors (2010)

[S4.B.3.1.2 \(Advanced\)](#) Describe interactions between living and nonliving components (e.g. plants – water, soil, sunlight, carbon dioxide, temperature; animals – food, water, shelter, oxygen, temperature) of a local ecosystem.

[S8.D.1.3.1 \(Advanced\)](#) Describe the water cycle and the physical processes on which it depends (i.e., evaporation, condensation, precipitation, transpiration, runoff, infiltration, energy inputs, and phase changes).

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

[MS-LS1-6 \(Advanced\)](#) Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

[MS-LS2-3 \(Advanced\)](#) Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

## Topic: Energy in Ecosystems

**Core Lesson Description:** Students will learn the roles of producers and consumers in the flow of energy through ecosystems.

**Core Lesson Student Learning Objectives:** Explain how the flow of energy and the flow of matter differ in ecosystems. (E)

Identify organisms in an ecosystem as producers and consumers. (C)

Contrast the processes of photosynthesis and chemosynthesis. (I)

Understand the similarities and differences in how food chains, food webs, and energy pyramids illustrate how energy travels through ecosystems. (E)

**Core Lesson Essential Questions:**

1. How does energy move in ecosystems?
2. How is the movement of energy in an ecosystem modeled?

**Core Lesson Big Ideas:** Energy moves through ecosystems by producers creating energy from the sun and consumers taking in that energy by eating producers and/or other consumers.

**Core Lesson Key Terminology & Definitions:**

- photosynthesis (C)
- chemosynthesis (I)
- food web (E)
- food chain (I)
- energy pyramid (E)

## STANDARDS

STATE: Pennsylvania State Anchors (2010)

[S8.B.3.1.1 \(Advanced\)](#) Explain the flow of energy through an ecosystem (e.g., food chains, food webs).

[S8.B.3.1.3 \(Advanced\)](#) Explain relationships among organisms (e.g., producers/consumers, predator/prey) in an ecosystem.

[S7.C.2.1 \(Advanced\)](#) Describe how energy flows through the living world.

[S7.C.2.1.1 \(Advanced\)](#) Describe how energy is obtained and used by organisms throughout their lives.

<a href="#">S7.C.2.1.3 (Advanced)</a>	Describe energy transformations within an ecosystem.
<u>NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)</u>	
<a href="#">MS-LS1-6 (Advanced)</a>	Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
<a href="#">MS-LS2-1 (Advanced)</a>	Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
<a href="#">MS-LS2-3 (Advanced)</a>	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

**Topic: Populations**

**Core Lesson Description:** Students will learn how individuals in an ecosystem interact with each other in a population and within communities.

**Core Lesson Student Learning Objectives:** Explain the relationship between a population and a community. (E)

Explain the role of competition between individuals and species in ecosystems. (C)

Describe the limiting factors that affect the size of a population. (E)

Summarize the methods scientists use to estimate population sizes. (E)

Explain what the carrying capacity of an ecosystem is and how it can change over time. (E)

Explain how overpopulation can affect an ecosystem. (I)

**Core Lesson Essential Questions:**

1. What defines a population?
2. What factors affect the size of a population?

**Core Lesson Big Ideas:** Organisms reside within communities which share resources and, are therefore, limited in their potential growth.

**Core Lesson Key Terminology & Definitions:**

- biosphere (E)
- community (E)
- population (C)
- competition (E)
- limiting factor (E)
- population density (E)
- biotic potential (I)
- carrying capacity (E)

**STANDARDS**

STATE: Pennsylvania State Anchors (2010)

[S8.A.1.3.2 \(Advanced\)](#) Use evidence, observations, or explanations to make inferences about change in systems over time (e.g., carrying capacity, succession, population dynamics, loss of mass in chemical reactions, indicator fossils in geologic time scale) and the variables affecting these changes.

<a href="#">S7.B.2.1.2 (Advanced)</a>	Describe how natural selection is an underlying factor in a population's ability to adapt to change.
<a href="#">S7.B.3.1.1 (Advanced)</a>	Describe relationships (e.g., predator/prey competition, symbiosis) between organisms in different ecosystems.
<a href="#">S7.B.3.2.1 (Advanced)</a>	Identify and describe factors that cause and/or influence changes in populations (e.g., deforestation, disease, land use, natural disaster, invasive species).
<a href="#">S7.B.3.2.4 (Advanced)</a>	Explain how changes in environmental conditions can affect the survival of a population and entire species (e.g., climate, hibernation, migration, coloration).
<a href="#">S8.B.3.2.1 (Advanced)</a>	Use evidence to explain factors that affect changes in populations (e.g., deforestation, disease, land use, natural disaster, invasive species).
<a href="#">S11.B.3.1.5 (Advanced)</a>	Predict how limiting factors (e.g., physical, biological, chemical) can affect organisms.
<u>NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)</u>	
<a href="#">MS-LS2-4 (Advanced)</a>	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

## Topic: Changing Populations

**Core Lesson Description:** Students will learn the factors associated with population changes in animal and human communities.

**Core Lesson Student Learning Objectives:**

- Explain how birthrate and death rate affect the populations within an ecosystem. (E)
- Explain why a population cannot experience continuous exponential growth. (I)
- Summarize the ways scientists classify organism populations on a worrisome decline. (E)
- Describe the factors that cause organisms to move from one area to another. (C)
- Describe how human population has changed throughout history and what allowed these changes to occur. (E)
- Describe the factors that have allowed for human populations to increase quickly. (E)

**Core Lesson Essential Questions:**

1. How do populations change?
2. Why do human populations change?

**Core Lesson Big Ideas:** Animal and human populations continuously change through growth, decline, and movement.

**Core Lesson Key Terminology & Definitions:**

- birthrate (E)
- death rate (E)
- extinct species (C)
- endangered species (C)
- threatened species (E)
- migration (E)

## STANDARDS

STATE: Pennsylvania State Anchors (2010)

[S4.A.2.1.3 \(Advanced\)](#) Observe a natural phenomenon (e.g., weather changes, length of daylight/night, movement of shadows, animal migrations, growth of plants), record observations,

	and then make a prediction based on those observations.
<a href="#">S6.B.2.1.2 (Advanced)</a>	Recognize that extinction of a species occurs when the environment changes and the adaptive characteristics of a species are insufficient to allow its survival.
<a href="#">S7.B.3.2.4 (Advanced)</a>	Explain how changes in environmental conditions can affect the survival of a population and entire species (e.g., climate, hibernation, migration, coloration).
<a href="#">S8.B.3.2.3 (Advanced)</a>	Describe the response of organisms to environmental changes (e.g., changes in climate, hibernation, migration, coloration) and how those changes affect survival.
<u>NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)</u>	
<a href="#">MS-LS2-1 (Advanced)</a>	Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
<a href="#">MS-LS2-4 (Advanced)</a>	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
<a href="#">MS-LS2-5 (Advanced)</a>	Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

## Topic: Communities

**Core Lesson Description:** Students will learn how populations within a community interact with each other in both positive and negative ways.

**Core Lesson Student Learning Objectives:** Explain how a habitat provides the necessary resources for a community. (C)  
 Identify the roles of producers and consumers in moving energy through an ecosystem. (E)  
 Compare food chains and food webs. (E)  
 Explain and provide examples of organisms that participate in a predator-prey relationship, cooperative relationship, and symbiotic relationship. (E)  
 Explain and provide examples of symbiotic relationships including mutualism, commensalism, and parasitism. (I)

**Core Lesson Essential Questions:**

1. What defines a community?
2. How do the populations in a community interact?

**Core Lesson Big Ideas:** Multiple populations interact with each other within communities.

**Core Lesson Key Terminology & Definitions:**

- habitat (E)
- niche (I)
- producer (E)
- consumer (E)
- symbiosis (E)
- mutualism (I)
- commensalism (I)
- parasitism (I)

## STANDARDS

STATE: Pennsylvania State Anchors (2010)

- [S7.B.2.2.3 \(Advanced\)](#) Explain how mutations can alter a gene and are a source of new variations in a population.
- [S7.B.3.1.1 \(Advanced\)](#) Describe relationships (e.g., predator/prey competition, symbiosis) between organisms in different ecosystems.
- [S8.B.3.1.1 \(Advanced\)](#) Explain the flow of energy through an ecosystem (e.g., food chains, food webs).
- [S8.B.3.1.3 \(Advanced\)](#) Explain relationships among organisms (e.g., producers/consumers, predator/prey) in an ecosystem.
- [S8.B.3.2.1 \(Advanced\)](#) Use evidence to explain factors that affect changes in populations (e.g., deforestation, disease, land use, natural disaster, invasive species).

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

- [MS-LS2-1 \(Advanced\)](#) Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- [MS-LS2-2 \(Advanced\)](#) Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
- [MS-LS2-5 \(Advanced\)](#) Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

## Topic: Land Biomes

**Core Lesson Description:** Students will learn the terrestrial biomes on Earth and representative features of each such as climate, biodiversity, and resources.

**Core Lesson Student Learning Objectives:** For each biome (desert, grassland, tropical rainforest, temperate rainforest, temperate deciduous forest, taiga, tundra) explain the following:

- general description of climate/conditions
- examples of plant and animal biodiversity
- human impacts on the biome

**Core Lesson Essential Questions:**

1. How do Earth's land biomes differ?
2. How do humans impact land biomes?

**Core Lesson Big Ideas:** The world's land masses are made up of a diverse range of biomes which vary in climate, biodiversity, and resources.

**Core Lesson Key Terminology & Definitions:**

- biome
- desert
- grassland
- temperate
- taiga
- tundra

## STANDARDS

STATE: Pennsylvania State Anchors (2010)

[S7.B.3.1.2 \(Advanced\)](#) Identify the major biomes (terrestrial and aquatic) and describe their characteristic biotic and abiotic factors.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

[MS-LS2-5 \(Advanced\)](#) Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

## Topic: Aquatic Ecosystems

**Core Lesson Description:** Students will learn the aquatic ecosystems on Earth and representative features of each such as locations, biodiversity, and resources.

**Core Lesson Student Learning Objectives:** For each aquatic ecosystem (Freshwater: Streams and Rivers, Freshwater: Ponds and Lakes, Wetlands, Estuaries, Ocean: Open Ocean, Ocean: Coastal Ocean, Ocean: Coral Reef) explain the following:

- general description of conditions and locations
- examples of plant and animal biodiversity
- human impacts on the ecosystem

**Core Lesson Essential Questions:**

1. How do Earth's aquatic ecosystems differ?
2. How do humans impact aquatic ecosystems?

**Core Lesson Big Ideas:** The Earth features a diverse range of aquatic ecosystems which vary in water type, location, biodiversity, and natural resources.

**Core Lesson Key Terminology & Definitions:**

- salinity
- wetland
- estuary
- intertidal zone
- coral reef

## STANDARDS

STATE: Pennsylvania State Anchors (2010)

[S7.B.3.1.2 \(Advanced\)](#) Identify the major biomes (terrestrial and aquatic) and describe their characteristic biotic and abiotic factors.

[S7.B.3.3 \(Advanced\)](#) Explain how renewable and nonrenewable resources provide for human needs and how these needs impact the environment.

[S8.B.3.3 \(Advanced\)](#) Explain how renewable and nonrenewable resources provide for human needs or how these needs impact the environment.

[S7.D.1.2.1 \(Advanced\)](#) Compare the different water systems on Earth (e.g., wetland, watershed, ocean, river).

[S8.D.1.3.3 \(Advanced\)](#) Distinguish among different water systems (e.g., wetland systems, ocean systems, river systems, watersheds) and describe their relationships to each other as well as to landforms.

NGSS Arranged by Disciplinary Core Idea (DCI) - Science (2013)

[MS-LS2-5 \(Advanced\)](#)

Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

**Topic: How Ecosystems Change**

**Core Lesson Description:** Students will learn how ecosystems respond to varying levels of change brought upon by human impacts and natural disasters.

**Core Lesson Student Learning Objectives:** Summarize the two types of ecological succession in a terrestrial ecosystem including what causes each and how the environment responds. (E)

Summarize the process of aquatic succession. (I)

Identify the characteristics of a climax community. (E)

Explain how eutrophication affects aquatic ecosystems. (I)

**Core Lesson Essential Questions:**

1. How do land ecosystems change over time?
2. How do aquatic ecosystems change over time?

**Core Lesson Big Ideas:** Ecosystems are constantly changing and responding to naturally occurring events and human impacts.

**Core Lesson Key Terminology & Definitions:**

- ecological succession (E)
- climax community (E)
- pioneer species (E)
- eutrophication (E)

**STANDARDS**

STATE: [Pennsylvania State Anchors \(2010\)](#)

[S5.A.3.2.1 \(Advanced\)](#) Describe how models are used to better understand the relationships in natural systems (e.g., water cycle, Sun-Earth- Moon system, ecosystems, observe and draw a diagram to show the effects of flowing water in a watershed).

[S7.A.1.3.2 \(Advanced\)](#) Use evidence, observations, or explanations to make inferences about changes in systems over time (e.g., carrying capacity, succession, fossil evidence in the geologic time scale).

NGSS Arranged by [Disciplinary Core Idea \(DCI\) - Science \(2013\)](#)

[MS-LS2-1 \(Advanced\)](#) Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

[MS-LS2-4 \(Advanced\)](#) Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

**Topic:**

**Unit: Immunity and Disease**

**Month:** The following is a ROUGH pacing guide for this Unit.

**Immunity and Disease - May Week 4, June Week 1**

Diseases

The Immune System

Staying Healthy

**Topic: Diseases**

**Core Lesson Description:** Students will learn the multiple ways humans can become ill.

**Core Lesson Student Learning Objectives:** Explain what is a pathogen. (C)  
Compare and contrast infectious vs. noninfectious diseases. (E)  
Describe how cancer cells can form and how they affect/spread throughout the body. (E)

**Core Lesson Essential Questions:** 1. Why do we get diseases?  
2. How do the two types of diseases differ?

**Core Lesson Big Ideas:** Humans become ill as a result of diseases or conditions that are either infectious or noninfectious.

**Core Lesson Key Terminology & Definitions:** Pathogen (C)  
Pasteurization (I)  
Infectious Disease (E)  
Vector (I)  
Noninfectious Disease (E)  
Cancer (E)

**Topic: The Immune System**

**Core Lesson Description:** Students will learn how the body's immune system builds up defenses against disease and pathogens.

**Core Lesson Student Learning Objectives:** Explain the parts of the human immune system. (C)  
Summarize first-line and second-line defense systems within the body. (E)  
Define immunity and describe how it is built up in the human body. (E)

**Core Lesson Essential Questions:** 1. What does the immune system do?  
2. How do the parts of the immune system work together?  
3. How does the immune system interact with other body systems?

**Core Lesson Big Ideas:** The body's immune system works to protect the body from pathogens.

**Core Lesson Key Terminology & Definitions:** Inflammation (E)  
Antigen (E)  
Antibody (E)  
Allergy (E)  
Immunity (C)  
Active Immunity (I)  
Passive Immunity (I)  
Vaccination (E)

**Topic: Staying Healthy**

**Core Lesson Description:** Students will learn the importance of staying healthy and how modern medicine allows for certain types of illnesses to be treated chemically.

**Core Lesson Student Learning Objectives:** Provide examples of how humans can keep their body healthy. (C)  
Explain how sanitation helps to keep the body health and free from disease. (E)  
Explain the ways doctors can treat disease using chemicals like antibiotics and chemotherapy. (I)

**Core Lesson Essential Questions:**

1. How can healthful habits and healthful choices affect diseases?
2. How do sanitation practices affect human health?
3. How can chemicals affect the human body?

**Core Lesson Big Ideas:** Maintaining healthy habits is the simplest way to prevent diseases.

**Core Lesson Key Terminology & Definitions:** antibiotic (E)  
chemotherapy (I)