VOORHEES, NEW JERSEY 08043

SCIENCE

CURRICULUM GUIDE

Sixth through Eighth Grade
Aligned to Next Generation Science Standards

Completed:       June 2015
Board Approved:  September 2015
Implemented:     September 2015
VOORHEES TOWNSHIP PUBLIC SCHOOLS

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VOORHEES TOWNSHIP SCHOOLS
SCIENCE CURRICULUM PHILOSOPHY

The purpose of this curriculum is to provide the science teaching staff with direction and guidance in the teaching of science, as well as correlate the curriculum objectives with the Next Generation Science Standards.

The district curriculum spirals content from the Life, Earth, and the Physical Science fields at every grade level. The principle is held that these sciences are interrelated with technology, engineering, and mathematics (STEM), and that the knowledge and application of one is dependent on the others. Moreover, science is an inter-disciplinary field that affects all aspects of the environment.

Each staff member uses an overview of the curriculum to insure cognitive development, sequence, continuity, and a holistic understanding for the learner. The planning and implementation of science classes utilize an appropriate variety of strategies and media to carry out the objectives in this curriculum. Provisions are made for hands-on experiments, computer programs, and outdoor activities and these are encouraged.

The expected outcome is that students will possess a strong sense of science principles, see their relevance to everyday life, and will thrive, with confidence and success, in the high-tech environment of the twenty-first century.
SCIENCE CURRICULUM GOALS

The science curriculum is designed to nurture and foster these goals:

☐ Provide a curriculum that links instruction to other content areas and real-life experiences.

☐ Utilize numerous resources and technology to provide a variety of learning experiences.

☐ Actively engage students in developing relevant process skills, critical thinking, and decision making to effect problem solving.

☐ Promote science literacy as a functional survival skill, recognizing that altering the environment can bring about negative consequences.

☐ Encourage learners to take an active role in learning and applying science concepts.

☐ Stimulate an interest in science and technology and their impact on society.
BENCHMARK ASSESSMENTS & EVALUATION

The successful attainment of the objectives listed in this guide by students shall be assessed in the following manner:

1. Teacher observation
2. Teacher constructed tests, projects, and activities
3. District approved standardized tests
4. New Jersey State Assessments
5. Grade level benchmark tests (On file in each school and the Admin. Bldg)
6. Completion of technology-infused science project

CURRICULUM ADAPTABLE & MODIFICATIONS

This course of instruction shall be modified for academic enrichment, Special Education, ESL, Bilingual, and Basic Skills students through varying techniques, strategies, materials, etc. to meet the needs of all students. These strategies and techniques will include, but not be limited to the following:

- Instructional modification based on IEP’s, ISIP’s, 504 Plans, etc.
- Providing extra time for assignments, projects, tests, and quizzes
- Segmenting assignments into smaller sections to work on in short time periods
- Provide breaks between assignments so students can refocus on tasks
- Carry out everyday routines consistently
- Develop a reward system for good behavior, completing work on time and class participation
- Use visual and auditory reminders from one activity to the next
- Extend the breadth and depth of the content
- Designing lesson plans that can be modified to fit each student

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• Rewriting assignments, tests, and quizzes at different learning levels
• Develop a system for easy and comprehensive data collection to help monitor lessons and inform practice
• Provide opportunities for cooperative learning
• Created differentiated learning centers focused on remediation and enrichment
• Provide small group instruction

DISTRICT APPROVED SCIENCE PROGRAM/TEXTBOOKS AND MATERIALS

• MacMillan/McGraw-Hill Science; 2005 (6)
• MacMillan/McGraw-Hill Glencoe Science; © 2005 (7-8)
• Numerous internet sites, references, digital media, Discovery Education Streaming Plus
• iTunesU

INTERDISCIPLINARY CONNECTIONS

The New Jersey Student Learning Standards/Common Core State Standards provide a consistent, clear understanding of what students are expected to learn, so teachers and parents know what they need to do to help them. The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that our young people need for success in college and careers. Interdisciplinary learning enables teachers and students to make connections in their education through exploring clear and relevant links across the curriculum. The Voorhees Township School District curriculums provide students opportunities to make connections across all curriculum areas. This allows students opportunities for deepening learning by answering big questions, exploring issues, solving problems or completing final projects. Learning beyond subject boundaries provides students with the opportunity to experience deep, challenging and relevant content.

CCSS Home Page: http://www.corestandards.org

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New Jersey Student Learning Standards Home Page:
https://www.nj.gov/education/cccs/

Voorhees Township School District Curriculum/Program Guides:
Literacy:
https://www.voorhees.k12.nj.us/site/handlers/filedownload.ashx?moduleinstanceid
=41032&dataid=41799&FileName=LAL%20Curriculum%202017.pdf
Math:
https://www.voorhees.k12.nj.us/site/handlers/filedownload.ashx?moduleinstanceid
=41032&dataid=41795&FileName=VTSD%20Math%20Guide%20K8%20Final%209%202017.pdf
Science K-5:
https://www.voorhees.k12.nj.us/site/handlers/filedownload.ashx?moduleinstanceid
=41032&dataid=81381&FileName=VTSD%20Science%20Guide%20K-5%20Final%2092017.docx.pdf
Science 6-8:
https://www.voorhees.k12.nj.us/site/handlers/filedownload.ashx?moduleinstanceid
Social Studies:
https://www.voorhees.k12.nj.us/site/handlers/filedownload.ashx?moduleinstanceid
Educational Technology Plan:
https://www.voorhees.k12.nj.us/site/handlers/filedownload.ashx?moduleinstanceid
=41032&dataid=41787&FileName=Voorhees%20EdTech%20Plan%202016-19.pdf
21st Century Life and Career Guide:
https://www.voorhees.k12.nj.us/site/handlers/filedownload.ashx?moduleinstanceid
=41032&dataid=41794&FileName=VTSD%2021st%20Century%20Life%20and%20Careers%20Final%205-2015.pdf
# PACING GUIDE
## SIXTH GRADE

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# PACING GUIDE

**SEVENTH GRADE**

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6th Grade Next Generation Science Standards

**Matter and Energy in Organisms and Ecosystems (Marking Period 1)**

MS-LS1-6. 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. 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-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

**Interdependent Relationships in Ecosystems (Marking Period 1)**

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

**Structure, Function, and Information Processing (Marking Periods 1-2)**

MS-LS1-1. 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. Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function.

MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.
MS-LS1-8. Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.

**Waves and Electromagnetic Radiation (Marking Period 2)**

MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.

MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

MS-PS4-3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

**Earth's Systems (Marking Periods 2-3)**

MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.

**History of Earth (Marking Periods 2-3)**

MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.

**Human Impact (Marking Period 3)**

MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

**Structures and Properties of Matter (Marking Period 4)**

MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.
MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

**Engineering Design (at the discretion of the individual instructors)**

MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
Earth's Systems (Marking Period 1)
MS-ESS2-4. Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.

Weather and Climate (Marking Period 1)
MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.

MS-ESS2-6. Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.

MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

Human Impact (Marking Period 1)
MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.

Space Systems (Marking Period 2)
MS-ESS1-1. Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.

MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.

Forces and Interaction (Marking Period 3)
MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.
MS-PS2-2. Plan an investigation to provide evidence that the change in an object’s motion depends on the sum of the forces on the object and the mass of the object.

MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

MS-PS2-4. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

MS-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

Energy (Marking Period 4)

MS-PS3-1. Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.

MS-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

MS-PS3-3. Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Human Impact (Marking Period 4)

MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. [Clarification Statement: Examples of evidence include grade-appropriate

**Engineering Design (at the discretion of the individual instructors)**

**MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

**MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

**MS-ETS1-3.** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

**MS-ETS1-4.** Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
8th Grade Next Generation Science Standards

**Chemical Reactions (Marking Period 1)**

MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.

MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.*

**History of Earth (Marking Period 2)**

MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth’s 4.6-billion-year-old history.

MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales.

**Natural Selection and Adaptations (Marking Periods 2-3)**

MS-LS4-1. Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past.

MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.

MS-LS4-3. Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy.
MS-LS4-4. 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. Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.

**Human Impact (Marking Period 3)**
MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.

**Growth, Development, and Reproduction of Organisms (Marking Periods 3-4)**
MS-LS1-4. 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-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

MS-LS3-1. 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. 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-LS4-5. Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.

**Engineering Design (at the discretion of the individual instructor)**
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.
Student Learning Objectives
Grade 6
How can particles combine to produce a substance with different properties?

How does thermal energy affect particles?

Students build understandings of what occurs at the atomic and molecular scale. Students apply understanding that pure substances have characteristic properties and are made from a single type of atom or molecule. They also provide a molecular level accounts to explain states of matter and changes between states. The crosscutting concepts of cause and effect; scale, proportion and quantity; structure and function; interdependence of science, engineering, and technology; and influence of science, engineering and technology on society and the natural world are called out as organizing concepts for these disciplinary core ideas. Students demonstrate proficiency in developing and using models, and obtaining, evaluating, and communicating information. Students use these scientific and engineering practices to demonstrate understanding of the core ideas.

The Grades 3-5 Storyline provides a summary of the understandings that students developed by the end of 5th grade.

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<th>STUDENT LEARNING OBJECTIVES (SLO)</th>
<th>Corresponding DCIs and PEs</th>
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<tr>
<td>1</td>
<td>Identify unknown substances based on data regarding their physical and chemical properties.</td>
<td>PS1.A</td>
</tr>
<tr>
<td>2</td>
<td>Predict the physical and chemical properties of elements based on their positions on the Periodic Table.</td>
<td>PS1.A</td>
</tr>
<tr>
<td>3</td>
<td>Develop models to describe the atomic composition of simple molecules and extended structures. [Clarification Statement: Emphasis is on developing models of molecules that vary in complexity. Examples of simple molecules could include ammonia and methanol. Examples of extended structures could include sodium chloride or diamonds. Examples of molecular-level models could include drawings, 3D ball and stick structures, or computer representations showing different molecules with different types of atoms.] [Assessment Boundary: Assessment does not include valence electrons and bonding energy, discussing the ionic nature of subunits of complex structures, or a complete depiction of all individual atoms in a complex molecule or extended structure.]</td>
<td>MS-PS1-1</td>
</tr>
<tr>
<td>4</td>
<td>Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed. [Clarification Statement: Emphasis is on qualitative molecular-level models of solids, liquids, and gases to show that adding or removing thermal energy increases or decreases kinetic energy of the particles until a change of state occurs. Examples of models could include drawings and diagrams. Examples of particles could include molecules or inert atoms. Examples of pure substances could include water, carbon dioxide, and helium.]</td>
<td>MS-PS1-4</td>
</tr>
</tbody>
</table>
Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. [Clarification Statement: Emphasis is on natural resources that undergo a chemical process to form the synthetic material. Examples of new materials could include new medicine, foods, and alternative fuels.] [Assessment Boundary: Assessment is limited to qualitative information.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

### Science and Engineering Practices
- **Developing and Using Models**
  - Modeling in 6-8 builds on K-5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.
  - Develop a model to predict and/or describe phenomena. (MS-PS1-1), (MS-PS1-4)

- **Obtaining, Evaluating, and Communicating Information**
  - Obtaining, evaluating, and communicating information in 6-8 builds on K-5 and progresses to evaluating the merit and validity of ideas and methods.
  - Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or now supported by evidence. (MS-PS1-3)

### Disciplinary Core Ideas
**PS1.A: Structure and Properties of Matter**
- Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)
  - Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3) [Note: This Disciplinary Core Idea is also addressed by MS-PS1-2.]
  - Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4)
  - In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4)
  - Solids may be formed from molecules, or they may be extended structures with repeating...
subunits (e.g., crystals). (MS-PS1-1)

- The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)

**PS1.B: Chemical Reactions**

- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-3)  
  (Note: This Disciplinary Core Idea is also addressed by MS-PS1-2 and MS-PS1-5.)

**PS3.A: Definitions of Energy**

- The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning: it refers to the energy transferred due to the temperature difference between two objects. (Secondary to MS-PS1-4)

- The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-PS1-3)

**Influence of Science, Engineering and Technology on Society and the Natural World**

- The uses of technologies and any limitation on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-PS1-3)
interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. *(secondary to MS-PS1-4)*

**Connections to other DCIs in this grade-band:**
MS.LS.2.A (MS-PS1-3); MS.LS.4.D (MS-PS1-3); MS.ESS.3.A (MS-PS1-3); MS.ESS.3.C (MS-PS1-3)

**Articulation of DCIs across grade-bands:**
5.PS1.A (MS-PS1-1); HS.PS1.A (MS-PS1-1),(MS-PS1-4); HS.PS1.B (MS-PS1-4); HS.PS3.A (MS-PS1-4); HS.LS2.A (MS-PS1-3); HS.LS4.D (MS-PS1-3); HS.ESS1.A (MS-PS1-1); HS.ESS3.A (MS-PS1-3)

**Common Core State Standards Connections:**

**ELA/Literacy -**
RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. *(MS-PS1-3)*
RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). *(MS-PS1-1),(MS-PS1-4)*
WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. *(MS-PS1-3)*

**Mathematics -**
MP.2 Reason abstractly and quantitatively. *(MS-PS1-1)*
MP.4 Model with mathematics. *(MS-PS1-1)*
6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems. *(MS-PS1-1)*
6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. *(MS-PS1-4)*
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<tr>
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</thead>
<tbody>
<tr>
<td>8.EE.A.3</td>
<td></td>
<td></td>
<td>Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. (MS-PS1-1)</td>
</tr>
</tbody>
</table>
**What are the characteristic properties of waves and how can they be used?**

Students are able to describe and predict characteristic properties and behaviors of waves when the waves interact with matter. Students can apply an understanding of waves as a means to send digital information. The crosscutting concepts of patterns and structure and function are used as organizing concepts for these disciplinary core ideas. These performance expectations focus on students demonstrating proficiency in developing and using models, using mathematical thinking, and obtaining, evaluating and communicating information; and to use these practices to demonstrate understanding of the core ideas.

The Grades 3-5 Storyline provides a summary of the understandings that students developed by the end of 5th grade.

<table>
<thead>
<tr>
<th>#</th>
<th>STUDENT LEARNING OBJECTIVES (SLO)</th>
<th>Corresponding DCIs and PEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. [Clarification Statement: Emphasis is on describing waves with both qualitative and quantitative thinking.] [Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.]</td>
<td><strong>MS-PS4-1</strong></td>
</tr>
<tr>
<td>2</td>
<td>Explain why we can see the color of an object in space but cannot hear sound.</td>
<td><strong>PS4.B</strong></td>
</tr>
<tr>
<td>3</td>
<td>Use ray diagrams to explain how refracted light and reflected light bring images of distant objects closer and enlarge things that are too small to be observed with an unaided eye.</td>
<td><strong>PS4.B</strong></td>
</tr>
<tr>
<td>4</td>
<td>Create a simple model that explains the mechanism for how wave pulses are used to save, transmit, and receive information.</td>
<td><strong>PS4.C</strong></td>
</tr>
<tr>
<td>5</td>
<td>Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. [Clarification Statement: Emphasis is on both light and mechanical waves. Examples of models could include drawings, simulations, and written descriptions.] [Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.]</td>
<td><strong>MS-PS4-2</strong></td>
</tr>
<tr>
<td>6</td>
<td>Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. [Clarification Statement: Emphasis is on a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of stored binary patterns to make sound or text on a computer screen.] [Assessment Boundary: Assessment does not include binary counting. Assessment</td>
<td><strong>MS-PS4-3</strong></td>
</tr>
</tbody>
</table>
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

### Science and Engineering Practices

**Developing and Using Models**
- Modeling in 6-8 builds on K-5 and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
- Develop and use a model to describe phenomena. (MS-PS4-2)

**Using Mathematics and Computational Thinking**
- Mathematical and computational thinking at the 6-8 level builds on K-5 and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.
- Use mathematical representations to describe and/or support scientific conclusions and design solutions. (MS-PS4-1)

**Obtaining, Evaluating, and Communicating Information**
- Obtaining, evaluating, and communicating

### Disciplinary Core Ideas

**PS4.A: Wave Properties**
- A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)
- A sound wave needs a medium through which it is transmitted. (MS-PS4-2)

**PS4.B: Electromagnetic Radiation**
- When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object’s material and the frequency (color) of the light. (MS-PS4-2)
- The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. (MS-PS4-2)
- A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a

### Crosscutting Concepts

**Patterns**
- Graphs and charts can be used to identify patterns in data. (MS-PS4-1)

**Structure and Function**
- Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS4-2)
- Structures can be designed to serve particular functions. (MS-PS4-3)

**Connections to Engineering, Technology, and Applications of Science**

**Influence of Science, Engineering, and Technology on Society and the Natural World**
- Technologies extend the measurement,
**CONTENT AREA:** Science  
**GRADE:** 6  
**UNIT:** 2  
**UNIT NAME:** Waves and Electromagnetic Radiation

---

**Connections to Nature of Science**

**Scientific Knowledge is Based on Empirical Evidence**
- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS4-1)

---

**Surface between media. (MS-PS4-2)**
- However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2)

**PS4.C: Information Technologies and Instrumentation**
- Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)

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**Connections to Nature of Science**

**Science is a Human Endeavor**
- Advances in technology influence the progress of science and science has influenced advances in technology. (MS-PS4-3)

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**Connections to other DCIs in this grade-band:**
- MS.LS1.D (MS-PS4-2)

**Articulation of DCIs across grade-bands:**
- 4.PS3.A (MS-PS4-1); 4.PS3.B (MS-PS4-1); 4.PS4.A (MS-PS4-1); 4.PS4.B (MS-PS4-2); 4.PS4.C (MS-PS4-3); HS.PS4.A (MS-PS4-1),(MS-PS4-2),(MS-PS4-3); HS.PS4.B (MS-PS4-1),(MS-PS4-2); HS.PS4.C (MS-PS4-3); HS.ESS1.A (MS-PS4-2); HS.ESS2.A (MS-PS4-2); HS.ESS2.C (MS-PS4-2); HS.ESS2.D (MS-PS4-2)

**Common Core State Standards Connections:**
- **ELA/Literacy**
  - RST.6–8.1  Cite specific textual evidence to support analysis of science and technical texts. (MS-PS4-3)
  - RST.6–8.2  Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or
**RST. 6-8.9**  
Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. *(MS-PS4-3)*

**WHST.6-8.9**  
Draw evidence from informational texts to support analysis, reflection, and research. *(MS-PS4-3)*

**SL.8.5**  
Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. *(MS-PS4-1),(MS-PS4-2)*

*Mathematics -*

**MP.2**  
Reason abstractly and quantitatively. *(MS-PS4-1)*

**MP.4**  
Model with mathematics. *(MS-PS4-1)*

**6.RP.A.1**  
Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. *(MS-PS4-1)*

**6.RP.A.3**  
Use ratio and rate reasoning to solve real-world and mathematical problems. *(MS-PS4-1)*

**7.RP.A.2**  
Recognize and represent proportional relationships between quantities. *(MS-PS4-1)*

**8.F.A.3**  
Interpret the equation y = mx + b as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *(MS-PS4-1)*
How do the structures of organisms contribute to life's functions?

Students plan and carry out investigations to develop evidence that living organisms are made of cells and to determine the relationship of organisms to the environment. Students use their understanding of cell theory to develop physical and conceptual models of cells. They construct explanations for the interactions of systems in cells and organisms and how organisms gather and use information from the environment. Students understand that all organisms are made of cells, that special structures are responsible for particular functions in organisms, and that for many organisms the body is a system of multiple interacting subsystems that form a hierarchy from cells to the body. Crosscutting concepts of cause and effect, structure and function, and matter and energy are called out as organizing concepts for these core ideas.

The Grades 3-5 Storyline provides a summary of the understandings that students developed by the end of 5th grade.

<table>
<thead>
<tr>
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<th>STUDENT LEARNING OBJECTIVES (SLO)</th>
<th>Corresponding DCIs and PEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells. [Clarification Statement: Emphasis is on developing evidence that living things are made of cells, distinguishing between living and non-living things, and understanding that living things may be made of one cell or many and varied cells.]</td>
<td>MS-LS1-1</td>
</tr>
<tr>
<td>2</td>
<td>Develop and use a model to describe the function of a cell as a whole and ways parts of cells contribute to the function. [Clarification Statement: Emphasis is on the cell functioning as a whole system and the primary role of identified parts of the cell, specifically the nucleus, chloroplasts, mitochondria, cell membrane, and cell wall.] [Assessment Boundary: Assessment of organelle structure/function relationships is limited to the cell wall and cell membrane. Assessment of the function of the other organelles is limited to their relationship to the whole cell. Assessment does not include the biochemical function of cells or cell parts.]</td>
<td>MS-LS1-2</td>
</tr>
<tr>
<td>3</td>
<td>Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells. [Clarification Statement: Emphasis is on the conceptual understanding that cells form tissues and tissues form organs specialized for particular body functions. Examples could include the interaction of subsystems within a system and the normal functioning of those systems.] [Assessment Boundary: Assessment does not include the mechanism of one body system independent of others. Assessment is limited to the circulatory, excretory, digestive, respiratory, muscular, and nervous systems.]</td>
<td>MS-LS1-3</td>
</tr>
<tr>
<td>CONTENT AREA: Science</td>
<td>GRADE: 6</td>
<td>UNIT: 3</td>
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<tr>
<td>4</td>
<td>Develop a model to explain how senses change energy coming from the environment (light, sound waves, chemicals in gases or food, heat or touch/pressure) into electrical signals in the nerves that go into the brain and spinal cord. [Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.]</td>
<td>LS1.D</td>
</tr>
<tr>
<td>5</td>
<td>Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories. [Assessment Boundary: Assessment does not include mechanisms for the transmission of this information.]</td>
<td>MS-LS1-8</td>
</tr>
</tbody>
</table>

The SLOs were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

**Science and Engineering Practices**
- Developing and Using Models
  - Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
  - Develop and use a model to describe phenomena. (MS-LS1-2)
  - Develop a model to describe unobservable mechanisms. (MS-LS1-7)
- Planning and Carrying Out Investigations
  - Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.
  - Conduct an investigation to produce data to

**Disciplinary Core Ideas**

**LS1. A: Structure and Function**
- All living things are made up of cells, which is the smallest unit that can be said to be alive. An organism may consist of one single cell (unicellular) or many different numbers and types of cells (multicellular). (MS-LS1-1)
- Within cells, special structures are responsible for particular functions, and the cell membrane forms the boundary that controls what enters and leaves the cell. (MS-LS1-2)
- In multicellular organisms, the body is a system of multiple interacting subsystems. These subsystems are groups of cells that work together to form tissues and organs

**Crosscutting Concepts**

**Cause and Effect**
- Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-8)

**Scale, Proportion, and Quantity**
- Phenomena that can be observed at one scale may not be observable at another scale. (MS-LS1-1)

**Systems and System Models**
- Systems may interact with other systems; they may have sub-systems and be a part of larger complex systems. (MS-LS1-3)

**Structure and Function**
- Complex and microscopic structures and systems can be visualized, modeled, and
serve as the basis for evidence that meet the goals of an investigation. (MS-LS1-1)

Engaging in Argument from Evidence
Engaging in argument from evidence in 6-8 builds on K-5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).
- Use an oral and written argument supported by evidence to support or refute an explanation or a model for a phenomenon. (MS-LS1-3)

Obtaining, Evaluating, and Communicating Information
Obtaining, evaluating, and communicating information in 6-8 builds on K-5 experiences and progresses to evaluating the merit and validity of ideas and methods.
- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS1-8)

| that are specialized for particular body functions. (MS-LS1-3) |

LS1.D: Information Processing
- Each sense receptor responds to different inputs (electromagnetic, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. (MS-LS1-8) (SLO 4)

used to describe how their function depends on the relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS1-2)

Connections to Engineering, Technology and Applications of Science
Interdependence of Science, Engineering, and Technology
- Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS1-1)

Connections to Nature of Science
Science is a Human Endeavor
- Scientists and engineers are guided by habits of mind such as intellectual honesty, tolerance of ambiguity, skepticism, and openness to new ideas. (MS-LS1-3)
Connections to other DCIs in this grade-band:
MS.LS3.A (MS-LS1-2)

Articulation of DCIs across grade-bands:
4.LS1.A (MS-LS1-2); 4.LS1.D (MS-LS1-8); HS.LS1.A (MS-LS1-1),(MS-LS1-2),(MS-LS1-3),(MS-LS1-8)

Common Core State Standards Connections:

**ELA/Literacy -**

<table>
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<tr>
<th>Standard</th>
<th>Description</th>
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<tbody>
<tr>
<td>RST.6-8.1</td>
<td>Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-3)</td>
</tr>
<tr>
<td>RST.6-8.2</td>
<td>Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-LS1-5),(MS-LS1-6)</td>
</tr>
<tr>
<td>RI.6.8</td>
<td>Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. (MS-LS1-3)</td>
</tr>
<tr>
<td>WHST.6-8.1</td>
<td>Write arguments focused on discipline content. (MS-LS1-3)</td>
</tr>
<tr>
<td>WHST.6-8.7</td>
<td>Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-LS1-1)</td>
</tr>
<tr>
<td>WHST.6-8.8</td>
<td>Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-LS1-8)</td>
</tr>
<tr>
<td>SL.8.5</td>
<td>Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-LS1-2)</td>
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**Mathematics -**

<table>
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<th>Standard</th>
<th>Description</th>
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<tbody>
<tr>
<td>6.EE.C.9</td>
<td>Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation.</td>
</tr>
<tr>
<td>CONTENT AREA: Science</td>
<td>GRADE: 6</td>
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</tbody>
</table>
Students understand how Earth's geosystems operate by modeling the flow of energy and cycling of matter within and among different systems. Students investigate the controlling properties of important materials and construct explanations based on the analysis of real geoscience data. Of special importance in both topics are the ways that geoscience processes provide resources needed by society but also cause natural hazards that present risks to society; both involve technological challenges, for the identification and development of resources and for the mitigation of hazards. The crosscutting concepts of cause and effect, energy and matter, and stability and change are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate proficiency in developing and using models and constructing explanations; and to use these practices to demonstrate understanding of the core ideas.

The Grades 3-5 Storyline provides a summary of the understandings that students developed by the end of 5th grade.

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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Analyze the characteristics of Earth materials before and after chemical and physical changes that occur during Earth's processes, including the direction of any matter flow.</td>
<td>ESS2.A</td>
</tr>
<tr>
<td>2</td>
<td>Using a systems model, explain how energy from the Sun is transformed or transferred in biological, hydrological, and meteorological systems. [Clarification Statement: A system is an organized group of related objects or components that form a whole. Systems can consist, for example, of fundamental particles, galaxies, ideas, and numbers. Systems have boundaries, components, resources, flow, and feedback. The system models incorporate and make explicit the invisible features of a system, such as interactions, energy flows, or matter transfers. Mathematical ideas, such as ratios and simple graphs, should be seen as tools for making more definitive models.]</td>
<td>ESS2.A</td>
</tr>
<tr>
<td>3</td>
<td>Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. [Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] [Assessment Boundary: Assessment does not include the identification and naming of minerals.]</td>
<td>MS-ESS2-1</td>
</tr>
<tr>
<td>4</td>
<td>Develop a conceptual model to describe the multiple pathways that water cycles through Earth's systems driven by energy from the sun and the force of gravity.</td>
<td>ESS2.C</td>
</tr>
<tr>
<td>5</td>
<td>Analyze and interpret data to deduce the mechanisms that resulted in a variety of rock formations.</td>
<td>ESS2.C</td>
</tr>
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<tr>
<td>6</td>
<td>Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes. [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]</td>
<td>MS-ESS3-1</td>
</tr>
</tbody>
</table>

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

**Science and Engineering Practices**
- Developing and Using Models
  - Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
    - Develop and use a model to describe phenomena. (MS-ESS2-1)
    - Develop a model to describe unobservable mechanisms. (MS-ESS2-4)
- Constructing Explanations and Designing Solutions
  - Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

**Disciplinary Core Ideas**

**ESS2.A: Earth's Materials and Systems**
- All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1)

**ESS2.C: The Roles of Water in Earth's Surface Processes**
- Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4)
- Global movements of water and its changes

**Crosscutting Concepts**

**Cause and Effect**
- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1)

**Energy and Matter**
- Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)

**Stability and Change**
- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (MS-ESS2-1)
<table>
<thead>
<tr>
<th>• Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS3-1)</th>
<th>in form are propelled by sunlight and gravity. (MS-ESS2-4)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ESS3.A: Natural Resources</strong></td>
<td></td>
</tr>
<tr>
<td>• Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)</td>
<td></td>
</tr>
</tbody>
</table>
## Voorhees Township Schools
Science Curriculum Grades 6 - 8

**CONTENT AREA:** Science  
**GRADE:** 6  
**UNIT:** 4  
**UNIT NAME:** Earth's Systems

### Connections to other DCIs in this grade band:

<table>
<thead>
<tr>
<th>DCI</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MS.PS1.A (MS-ESS2-1), (MS-ESS2-4), (MS-ESS3-1)</td>
<td></td>
</tr>
<tr>
<td>MS.PS1.B (MS-ESS2-1), (MS-ESS3-1)</td>
<td></td>
</tr>
<tr>
<td>MS.PS2.B (MS-ESS2-4)</td>
<td></td>
</tr>
<tr>
<td>MS.PS3.A (MS-ESS2-4)</td>
<td></td>
</tr>
<tr>
<td>MS.PS3.B (MS-ESS2-4)</td>
<td></td>
</tr>
<tr>
<td>MS.PS3.D (MS-ESS2-4)</td>
<td></td>
</tr>
<tr>
<td>MS.LS2.B (MS-ESS2-1)</td>
<td></td>
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<tr>
<td>MS.LS2.C (MS-ESS2-1)</td>
<td></td>
</tr>
<tr>
<td>MS.ESS1.B (MS-ESS2-1)</td>
<td></td>
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<tr>
<td>MS.ESS2.D (MS-ESS3-1)</td>
<td></td>
</tr>
<tr>
<td>MS.ESS3.C (MS-ESS2-1)</td>
<td></td>
</tr>
</tbody>
</table>

### Articulation of DCIs across grade bands:

<table>
<thead>
<tr>
<th>DCI</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.PS2.A (MS-ESS2-4)</td>
<td></td>
</tr>
<tr>
<td>4.PS3.B (MS-ESS2-1), (MS-ESS2-4)</td>
<td></td>
</tr>
<tr>
<td>4.PS3.D (MS-ESS3-1)</td>
<td></td>
</tr>
<tr>
<td>4.ESS2.A (MS-ESS2-1)</td>
<td></td>
</tr>
<tr>
<td>4.ESS3.A (MS-ESS3-1)</td>
<td></td>
</tr>
<tr>
<td>5.PS2.B (MS-ESS2-4)</td>
<td></td>
</tr>
<tr>
<td>5.ESS2.A (MS-ESS2-1)</td>
<td></td>
</tr>
<tr>
<td>5.ESS2.C (MS-ESS2-4)</td>
<td></td>
</tr>
<tr>
<td>HS.PS1.B (MS-ESS2-1)</td>
<td></td>
</tr>
<tr>
<td>HS.PS2.B (MS-ESS2-4)</td>
<td></td>
</tr>
<tr>
<td>HS.PS3.B (MS-ESS2-1), (MS-ESS2-4), (MS-ESS3-1)</td>
<td></td>
</tr>
<tr>
<td>HS.PS4.B (MS-ESS2-4)</td>
<td></td>
</tr>
<tr>
<td>HS.LS1.C (MS-ESS2-1), (MS-ESS3-1)</td>
<td></td>
</tr>
<tr>
<td>HS.LS2.B (MS-ESS2-1)</td>
<td></td>
</tr>
<tr>
<td>HS.ESS2.A (MS-ESS2-1), (MS-ESS2-2), (MS-ESS3-1)</td>
<td></td>
</tr>
<tr>
<td>HS.ESS2.B (MS-ESS3-1)</td>
<td></td>
</tr>
<tr>
<td>HS.ESS2.C (MS-ESS2-1), (MS-ESS2-4), (MS-ESS3-1)</td>
<td></td>
</tr>
<tr>
<td>HS.ESS2.D (MS-ESS2-4)</td>
<td></td>
</tr>
<tr>
<td>HS.ESS2.E (MS-ESS2-1)</td>
<td></td>
</tr>
<tr>
<td>HS.ESS3.A (MS-ESS3-1)</td>
<td></td>
</tr>
</tbody>
</table>

### Common Core State Standards Connections:

**ELA/Literacy** -

- **RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts. *(MS-ESS3-1)*
- **WHST.6-8.2** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. *(MS-ESS3-1)*
- **WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research. *(MS-ESS3-1)*

**Mathematics** -

- **6.EE.B.6** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. *(MS-ESS3-1)*
- **7.EE.B.4** Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. *(MS-ESS3-1)*

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How do people figure out that the Earth and life on Earth have changed over time?

How does the movement of tectonic plates impact the surface of Earth?

Students examine geoscience data in order to understand the processes and events in Earth’s history. Important concepts in this topic are "Scale, Proportion, and Quantity" and "Stability and Change," in relation to the different ways geologic processes operate over the long expanse of geologic time. An important aspect of the history of Earth is that geologic events and conditions have affected the evolution of life, but different life forms have also played important roles in altering Earth’s systems. Students are expected to demonstrate proficiency in analyzing and interpreting data, and constructing explanations; and to use these practices to demonstrate understanding of the core ideas.

The Grades 3-5 Storyline provides a summary of the understandings that students developed by the end of 5th grade.

<table>
<thead>
<tr>
<th>#</th>
<th>STUDENT LEARNING OBJECTIVES (SLOs)</th>
<th>Corresponding DCIs and PEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Use relative dates provided by the fossil record to make claims regarding the appearance or disappearance of organisms.</td>
<td>ESS1.C</td>
</tr>
<tr>
<td>2</td>
<td>Correlate the evolution of organisms and the environmental conditions on Earth as they changed throughout geologic time.</td>
<td>ESS1.C</td>
</tr>
<tr>
<td>3</td>
<td>Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth’s 4.6-billion-year-old history. [Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth’s history. Examples of Earth’s major events could range from being very recent (such as the last Ice Age or the earliest fossils of homo sapiens) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]</td>
<td>MS-ESS1-4</td>
</tr>
<tr>
<td>4</td>
<td>Construct an explanation based on evidence for how geoscience processes have changed Earth’s surface at varying time and spatial scales. [Clarification Statement: Emphasis is on how processes change Earth’s surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.]</td>
<td>MS-ESS2-2</td>
</tr>
</tbody>
</table>
CONTENT AREA: Science  GRADE: 6  UNIT: 5  UNIT NAME: History of Earth

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Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. [Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).] [Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed]

MS-ESS2-3

The SLOs were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

### Science and Engineering Practices

**Analyzing and Interpreting Data**
Analyzing data in 6-8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
- Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3)

**Constructing Explanations and Designing Solutions**
Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and

### Disciplinary Core Ideas

**ESS1.C: The History of Planet Earth**
- The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1-4)
- Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (HS.ESS1.C.66E),(secondary to MS-ESS2-3)

**ESS2.A: Earth's Materials and Systems**
- The planet’s systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to

### Crosscutting Concepts

**Patterns**
- Patterns in rates of change and other numerical relationships can provide information about natural systems. (MS-ESS2-3)

**Scale Proportion and Quantity**
- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS1-4),(MS-ESS2-2)
theories.
- Construct a scientific explanation based on valid
  and reliable evidence obtained from sources
  (including the students' own experiments) and
  the assumption that theories and laws that
  describe nature operate today as they did in the
  past and will continue to do so in the future.
  (MS-ESS1-4),(MS-ESS2-2)

connections to nature of science

scientific knowledge is open to revision in light
of new evidence
- Science findings are frequently revised and/or
  reinterpreted based on new evidence. (MS-
  ESS2-3)

billions of years. These interactions have shaped
Earth's history and will determine its future.
(MS-ESS2-2)

ESS2.B: Plate Tectonics and Large-Scale System
Interactions
- Maps of ancient land and water patterns, based
  on investigations of rocks and fossils, make clear
  how Earth’s plates have moved great distances,
  collided, and spread apart. (MS-ESS2-3)

ESS2.C: The Roles of Water in Earth’s Surface
Processes
- Water’s movements—both on the land and
  underground—cause weathering and erosion,
  which change the land’s surface features and
  create underground formations. (MS-ESS2-2)

cleaned connections to other DCIs in this grade band:
MS.PS1.B (MS-ESS2-2); MS.LS2.B (MS-ESS2-2); MS.LS4.C (MS-ESS1-4)

articulation of DCIs across grade-bands:
3.LS4.A (MS-ESS1-4),(MS-ESS2-3); 3.LS4.C (MS-ESS1-4); 3.ESS3.B (MS-ESS2-3); 4.ESS1.C (MS-ESS1-4),(MS-ESS2-2), (MS-ESS2-3); 4.ESS2.A (MS-ESS2-2); 4.ESS2.B (MS-ESS2-3); 4.ESS2.E (MS-ESS2-2); 4.ESS3.B (MS-ESS2-3); 5.ESS2.A (MS-ESS2-2); HS.PS1.C (MS-ESS1-4); HS.PS3.D (MS-ESS2-2); HS.LS2.B (MS-ESS2-2); HS.LS4.A (MS-ESS1-4),(MS-ESS2-3); HS.LS4.C (MS-ESS1-4),(MS-ESS2-3); HS.ESS1.C (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3); HS.ESS2.A (MS-
ESS1-4),(MS-ESS2-2),(MS-ESS2-3); HS.ESS2.B (MS-ESS2-2),(MS-ESS2-3); HS.ESS2.C (MS-ESS2-2); HS.ESS2.D (MS-ESS2-2); HS.ESS2.E (MS-
ESS2-2); HS.ESS3.D (MS-ESS2-2)

common core state standards connections:
ELA/Literacy -
RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3)
| RST.6–8.7 | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS2-3) |
| RST.6–8.9 | Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ESS2-3) |
| WHST.6-8.2 | Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS1-4),(MS-ESS2-2) |
| WHST.6-8.8 | Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. (MS-ESS2-5) |
| SL.8.5 | Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-1),(MS-ESS2-2),(MS-ESS2-6) |

**Mathematics -**

| MP.2 | Reason abstractly and quantitatively. (MS-ESS2-2),(MS-ESS2-3),(MS-ESS2-5) |
| 6.EE.B.6 | Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3) |
| 7.EE.B.4 | Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3) |
How can natural hazards be predicted?  

How do human activities affect Earth systems?  

Students make sense of the ways that human activities impact Earth's other systems. Students use several science and engineering practices to understand the significant and complex issues surrounding human uses of land, energy, mineral, and water resources and the resulting impacts of their development. The crosscutting concepts of patterns; cause and effect; and interdependence of science, engineering, and technology are used as organizing concepts for these disciplinary core ideas.

<table>
<thead>
<tr>
<th>#</th>
<th>STUDENT LEARNING OBJECTIVES</th>
<th>Performance Expectation and DCIs and PEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Use variables to represent quantities in a real-world data, and construct simple equations and inequalities to inform the development of technologies to mitigate the effects of natural hazards. [Clarification Statement: Examples of natural hazards can be taken from severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of hurricanes, tornadoes, forest fires, or floods.]</td>
<td>ESS3.B</td>
</tr>
<tr>
<td>2</td>
<td>Write and present the findings of a student led investigation of human consumption of a natural resource that may alter the biosphere, hydrosphere, atmosphere, or geosphere and the consequences (positive or negative) of that behavior. [Clarification Statement: Students will have gathered relevant information from multiple print and digital sources, using search terms effectively; assessing the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.]</td>
<td>ESS3.C</td>
</tr>
<tr>
<td>3</td>
<td>Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects. [Clarification Statement: Emphasis is on how some natural hazards, such as volcanic eruptions and severe weather, are preceded by phenomena that allow for reliable predictions, but others, such as earthquakes, occur suddenly and with no notice, and thus are not yet predictable. Examples of natural hazards can be taken from interior processes (such as earthquakes and volcanic eruptions), surface processes (such as mass wasting and tsunamis), or severe weather events (such as hurricanes, tornadoes, and floods). Examples of data can include the locations, magnitudes, and frequencies of the natural hazards. Examples of technologies can be global (such as satellite systems to monitor hurricanes or forest fires) or local (such as building basements in tornado-prone regions or reservoirs to mitigate droughts).]</td>
<td>MS-ESS3-2</td>
</tr>
<tr>
<td>4</td>
<td>Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.* [Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could</td>
<td>MS-ESS3-3</td>
</tr>
</tbody>
</table>
reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).

Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth’s systems. [Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth’s systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

**Science and Engineering Practices**

**Analyzing and Interpreting Data**
Analyzing data in 6-8 builds on K-5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
- Analyze and interpret data to determine similarities and differences in findings. (MS-ESS3-2)

**Constructing Explanations and Designing Solutions**
Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence.

**Disciplinary Core Ideas**

**ESS3.B: Natural Hazards**
- Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events. (MS-ESS3-2)

**ESS3.C: Human Impacts on Earth Systems**
- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth’s environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3)
- Typically as human populations and per-capita

**Crosscutting Concepts**

**Patterns**
- Graphs, charts, and images can be used to identify patterns in data. (MS-ESS3-2)

**Cause and Effect**
- Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. (MS-ESS3-3)
- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-4)

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*Connections to Engineering, Technology, and Applications of Science*
consistent with scientific ideas, principles, and theories.
- Apply scientific principles to design an object, tool, process or system. (MS-ESS3-3)

Engaging in Argument from Evidence
Engaging in argument from evidence in 6-8 builds on K-5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).
- Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-ESS3-4)

<table>
<thead>
<tr>
<th>Influence of Science, Engineering, and Technology on Society and the Natural World</th>
</tr>
</thead>
<tbody>
<tr>
<td>- All human activity draws on natural resources and has both short and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ESS3-4)</td>
</tr>
<tr>
<td>- The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-ESS3-2),(MS-ESS3-3)</td>
</tr>
</tbody>
</table>

*Connections to Nature of Science*

**Science Addresses Questions About the Natural and Material World**
- Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. (MS-ESS3-4)
Voorhees Township Schools
Science Curriculum Grades 6 - 8

|-----------------------|----------|---------|------------------------|

**Connections to other DCIs in this grade-band:**

MS.PS3.C (MS-ESS3-2); MS.LS2.A (MS-ESS3-3); MS.LS4.D (MS-ESS3-3); (MS-ESS3-4)

**Articulation of DCIs across grade-bands**

3.LS2.C (MS-ESS3-3); (MS-ESS3-4); 3.LS4.D (MS-ESS3-3); (MS-ESS3-4); 3.ESS3.B (MS-ESS3-2); 4.ESS3.B (MS-ESS3-2); 5.ESS3.C (MS-ESS3-3); (MS-ESS3-4); HS.LS2.A (MS-ESS3-4); HS.LS2.C (MS-ESS3-3); (MS-ESS3-4); HS.LS4.C (MS-ESS3-3); (MS-ESS3-4); HS.LS4.D (MS-ESS3-3); (MS-ESS3-4); HS.ESS2.B (MS-ESS3-2); HS.ESS2.C (MS-ESS3-3); HS.ESS2.D (MS-ESS3-3); (MS-ESS3-4); HS.ESS2.E (MS-ESS3-3); (MS-ESS3-4); HS.ESS3.A (MS-ESS3-4); HS.ESS3.B (MS-ESS3-2); HS.ESS3.C (MS-ESS3-3); (MS-ESS3-4); HS.ESS3.D (MS-ESS3-2); (MS-ESS3-3)

**Common Core State Standards Connections:**

**ELA/Literacy -**

**RST.6-8.1**  Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS3-2); (MS-ESS3-4)

**RST.6-8.7**  Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS3-2)

**WHST.6-8.1**  Write arguments focused on discipline content. (MS-ESS3-4)

**WHST.6-8.7**  Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-ESS3-3)

**WHST.6-8.8**  Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source, and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ESS3-3)

**WHST.6-8.9**  Draw evidence from informational texts to support analysis, reflection, and research. (MS-ESS3-4)

**Mathematics -**

**MP.2**  Reason abstractly and quantitatively. (MS-ESS3-2)

**6.RP.A.1**  Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS3-3); (MS-ESS3-4)

**7.RP.A.2**  Recognize and represent proportional relationships between quantities. (MS-ESS3-3); (MS-ESS3-4)

**6.EE.B.6**  Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-2); (MS-ESS3-3); (MS-ESS3-4)

**7.EE.B.4**  Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS3-2); (MS-ESS3-3); (MS-ESS3-4)
How do organisms obtain and use matter and energy?

How do matter and energy move through an ecosystem?

Students use conceptual and physical models to explain the transfer of energy and cycling of matter as they construct explanations for the role of photosynthesis in cycling matter in ecosystems. They construct explanations for the cycling of matter in organisms and the interactions of organisms to obtain the matter and energy from the ecosystem to survive and grow. Students have a grade-appropriate understanding and use of the practices of investigations, constructing arguments based on evidence, and oral and written communication. They understand that sustaining life requires substantial energy and matter inputs and the structure and functions of organisms contribute to the capture, transformation, transport, release, and elimination of matter and energy. Adding to these crosscutting concepts is a deeper understanding of systems and system models that ties the performances expectations in this topic together.

The Grades 3-5 Storyline provides a summary of the understandings that students developed by the end of 5th grade.

<table>
<thead>
<tr>
<th>#</th>
<th>STUDENT LEARNING OBJECTIVES (SLO)</th>
<th>Corresponding DCIs and PEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Create a representation the process by which plants, algae and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water.</td>
<td>LSI.2.C</td>
</tr>
<tr>
<td>2</td>
<td>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. [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.] [Assessment Boundary: Assessment does not include the biochemical mechanisms of photosynthesis.]</td>
<td>MS-LS1-6</td>
</tr>
<tr>
<td>3</td>
<td>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. [Clarification Statement: Emphasis is on describing that molecules are broken apart and put back together and that in this process, energy is released.] [Assessment Boundary: Assessment does not include details of the chemical reactions for photosynthesis or respiration.]</td>
<td>MS-LS1-7</td>
</tr>
<tr>
<td>4</td>
<td>Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]</td>
<td>MS-LS2-1</td>
</tr>
<tr>
<td>5</td>
<td>Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy</td>
<td>MS-LS2-3</td>
</tr>
</tbody>
</table>
How do organisms interact with other organisms in the physical environment to obtain matter and energy?

Students construct explanations for the interactions in ecosystems and the scientific, economic, political, and social justifications used in making decisions about maintaining biodiversity in ecosystems. Students use models, construct evidence-based explanations, and use argumentation from evidence. Students understand that organisms and populations of organisms are dependent on their environmental interactions both with other organisms and with nonliving factors. They also understand the limits of resources influence the growth of organisms and populations, which may result in competition for those limited resources. Crosscutting concepts of matter and energy, systems and system models, and cause and effect are used by students to support understanding the phenomena they study.

The Grades 3-5 Storyline provides a summary of the understandings that students developed by the end of 5th grade.

<table>
<thead>
<tr>
<th>#</th>
<th>STUDENT LEARNING OBJECTIVES (SLO)</th>
<th>Corresponding DCIs and PEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Describe how one population of organisms may affect other plants and/or animals in an ecosystem.</td>
<td>LS2.A</td>
</tr>
<tr>
<td>2</td>
<td>Predict the impact of humans altering biotic and abiotic factors has on an ecosystem.</td>
<td>LS2.C</td>
</tr>
<tr>
<td>3</td>
<td>Model the effect of positive and negative changes in population size on a symbiotic pairing.</td>
<td>LS2.A</td>
</tr>
<tr>
<td>4</td>
<td>Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]</td>
<td>MS-LS2-5</td>
</tr>
<tr>
<td>5</td>
<td>Evaluate competing design solutions for maintaining biodiversity and ecosystem services. [Clarification Statement: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]</td>
<td>MS-LS2-2</td>
</tr>
</tbody>
</table>
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

### Science and Engineering Practices
- **Constructing Explanations and Designing Solutions**
  - Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.
  - Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2)

- **Engaging in Argument from Evidence**
  - Engaging in argument from evidence in 6-8 builds on K-5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).
  - Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-LS2-5)

### Disciplinary Core Ideas
- **LS2.A: Interdependent Relationships in Ecosystems**
  - Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared. (MS-LS2-2)

- **LS2.C: Ecosystem Dynamics, Functioning, and Resilience**
  - Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS2-5)

- **LS4.D: Biodiversity and Humans**
  - Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on—for example, water purification and recycling. (Secondary to MS-LS2-5)

### Crosscutting Concepts
- **Patterns**
  - Patterns can be used to identify cause and effect relationships. (MS-LS2-2)

- **Stability and Change**
  - Small changes in one part of a system might cause large changes in another part. (MS-LS2-5)

### Connections to Engineering, Technology, and Applications of Science
- **Influence of Science, Engineering, and Technology on Society and the Natural World**
  - The use of technologies and any limitations on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-LS2-5)

### Connections to Nature of Science
- **Science Addresses Questions About the Natural
**Voorhees Township Public Schools**  
Science Curriculum Grades 6 - 8

**CONTENT AREA:** Science  
**GRADE:** 6  
**UNIT:** 8  
**UNIT NAME:** Interdependent Relationships in Ecosystems

**ETS1.B: Developing Possible Solutions**  
- There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. *(secondary to MS-LS2-5)*

**and Material World**  
- Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that society takes. *(MS-LS2-5)*

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**Connections to other DCIs in this grade-band:**  
MS LS1.B (MS-LS2-2); MS ESS3.C (MS-LS2-5)

**Articulation of DCIs across grade-bands:**  
1. LS1.B (MS-LS2-2); HS LS2.A (MS-LS2-2),(MS-LS2-5); HS LS2.B (MS-LS2-2); HS LS2.C (MS-LS2-5); HS LS2.D (MS-LS2-2); HS LS4.D (MS-LS2-5); HS ESS3.A (MS-LS2-5); HS ESS3.C (MS-LS2-5); HS ESS3.D (MS-LS2-5)

**Common Core State Standards Connections:**

**ELA/Literacy -**  
RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. *(MS-LS2-2)*

RST.6-8.8 Distinguish among facts, reasoned judgment based on research findings, and speculation in a text. *(MS-LS2-5)*

RI.8.8 Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. *(MS-LS2-5)*

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. *(MS-LS2-2)*

WHST.6-8.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. *(MS-LS2-2)*

SL.8.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others’ ideas and expressing their own clearly. *(MS-LS2-2)*

SL.8.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. *(MS-LS2-2)*

**Mathematics -**  
MP.4 Model with mathematics. *(MS-LS2-5)*

6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems. *(MS-LS2-5)*

6.SP.B.5 Summarize numerical data sets in relation to their context. *(MS-LS2-2)*
<table>
<thead>
<tr>
<th>CONTENT AREA: Science</th>
<th>GRADE: 6</th>
<th>UNIT: 8</th>
<th>UNIT NAME: Interdependent Relationships in Ecosystems</th>
</tr>
</thead>
</table>


into and out of various ecosystems, and on defining the boundaries of the system.] [Assessment Boundary: Assessment does not include the use of chemical reactions to describe the processes.]

Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

| The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*: |

<table>
<thead>
<tr>
<th>Developing and Using Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.</td>
</tr>
<tr>
<td>- Develop a model to describe phenomena. (MS-LS2-3)</td>
</tr>
<tr>
<td>- Develop a model to describe unobservable mechanisms. (MS-LS1-7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Analyzing and Interpreting Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyzing data in 6-8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.</td>
</tr>
<tr>
<td>- Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Constructing Explanations and Designing Solutions</th>
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<tbody>
<tr>
<td>Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing</td>
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</table>

<table>
<thead>
<tr>
<th>Disciplinary Core Ideas</th>
</tr>
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<tbody>
<tr>
<td>- Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. (MS-LS1-6)</td>
</tr>
<tr>
<td>- Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. (MS-LS1-7)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LS2.A: Interdependent Relationships in Ecosystems</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1)</td>
</tr>
<tr>
<td>- In any ecosystem, organisms and populations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Crosscutting Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause and Effect</td>
</tr>
<tr>
<td>- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Energy and Matter</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Matter is conserved because atoms are conserved in physical and chemical processes. (MS-LS1-7)</td>
</tr>
</tbody>
</table>

| - Within a natural system, the transfer of energy drives the motion and/or cycling of matter. (MS-LS1-6) |
| - The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3) |

<table>
<thead>
<tr>
<th>Stability and Change</th>
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</thead>
<tbody>
<tr>
<td>- Small changes in one part of a system might cause large changes in another part. (MS-LS2-4)</td>
</tr>
</tbody>
</table>
solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-LS1-6)

Engaging in Argument from Evidence
Engaging in argument from evidence in 6-8 builds on K-5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS2-4)

<table>
<thead>
<tr>
<th>Connections to Nature of Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Knowledge is Based on Empirical Evidence</td>
</tr>
<tr>
<td>Science knowledge is based upon logical connections between evidence and explanations. (MS-LS1-6)</td>
</tr>
<tr>
<td>Science disciplines share common rules of obtaining and evaluating empirical evidence. (MS-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Connections to Nature of Science</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Knowledge Assumes an Order and Consistency in Natural Systems</td>
</tr>
<tr>
<td>Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS2-3)</td>
</tr>
</tbody>
</table>

LS2.B: Cycle of Matter and Energy Transfer in Ecosystems
- Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (MS-LS2-3)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience
- Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)
<table>
<thead>
<tr>
<th>LS2-4</th>
<th>PS3.D: Energy in Chemical Processes and Everyday Life</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. <em>(secondary to MS-LS1-6)</em></td>
</tr>
<tr>
<td></td>
<td>• Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials. <em>(secondary to MS-LS1-7)</em></td>
</tr>
</tbody>
</table>

**Connections to other DCIs in this grade-band:**

MS.PS1.B (MS-LS1-6),(MS-LS1-7),(MS-LS2-3); MS.LS4.C (MS-LS2-4); MS.LS4.A (MS-LS2-4); MS.ESS2.A (MS-LS1-6),(MS-LS3-2),(MS-LS2-4); MS.ESS3.A (MS-LS1-),(MS-LS2-4),(MS-LS2-4)

**Articulation of DCIs across grade-bands:**

3.LS2.C (MS-LS2-1),(MS-LS2-4); 3.LS4.D (MS-LS2-1),(MS-LS2-4); 5.PS3.D (MS-LS1-6),(MS-LS1-7); 5.LS1.C (MS-LS1-6),(MS-LS1-7); 5.LS2.A (MS-LS1-6),(MS-LS1-7); HS.PS3.A (MS-LS1-6),(MS-LS1-7); HS.LS2.B (MS-LS2-3); HS.LS1.B (MS-LS1-6),(MS-LS1-7); HS.PS1.B (MS-LS2-3); HS.LS1.C (MS-LS1-6),(MS-LS1-7); (MS-LS2-3); HS.LS2.A (MS-LS2-1); HS.LS2.B (MS-LS1-6),(MS-LS1-7),(MS-LS2-3); HS.LS2.C (MS-LS2-4); HS.LS4.C (MS-LS2-1),(MS-LS2-4); HS.LS4.D (MS-LS2-1),(MS-LS2-4); HS.LS5.A (MS-LS2-3); HS.ESS2.D (MS-LS1-6); HS.ESS2.E (MS-LS2-4); HS.ESS3.A (MS-LS2-1); HS.ESS3.B (MS-LS2-4); HS.ESS3.C (MS-LS2-4)

**Common Core State Standards Connections:**

ELA/Literacy -

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. *(MS-LS1-6),(MS-LS2-1),(MS-LS2-4)*

RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. *(MS-LS1-6)*

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). *(MS-LS2-1)*

RI.8.8 Trace and evaluate the argument and specific claims in a text, assessing whether the reasoning is sound and the evidence is relevant and sufficient to support the claims. *(MS-LS2-4)*
| WHST.6-8.1  | Write arguments focused on discipline content. *(MS-LS2-4)* |
| WHST.6-8.2  | Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. *(MS-LS1-6)* |
| WHST.6-8.9  | Draw evidence from informational texts to support analysis, reflection, and research. *(MS-LS1-6)* |
| SL.8.5      | Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. *(MS-LS1-7),(MS-LS2-3)* |

**Mathematics**

6.EE.C.9 Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *(MS-LS1-6),(MS-LS2-3)*
How do the materials in and on Earth’s crust change over time? 
How does water influence weather, circulate in the oceans, and shape Earth’s surface?

Students understand how Earth’s geosystems operate by modeling the flow of energy and cycling of matter within and among different systems. Students investigate the controlling properties of important materials and construct explanations based on the analysis of real geoscience data. Of special importance in both topics are the ways that geoscience processes provide resources needed by society but also cause natural hazards that present risks to society; both involve technological challenges, for the identification and development of resources and for the mitigation of hazards. The crosscutting concepts of cause and effect, energy and matter, and stability and change are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate proficiency in developing and using models and constructing explanations; and to use these practices to demonstrate understanding of the core ideas.

The Grades 3-5 Storyline provides a summary of the understandings that students developed by the end of 5th grade.

<table>
<thead>
<tr>
<th>#</th>
<th>STUDENT LEARNING OBJECTIVES (GLO)</th>
<th>CORRESPONDING PEs and DCIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Analyze the characteristics of Earth materials before and after chemical and physical changes that occur during Earth's processes, including the direction of any matter flow.</td>
<td>ESS2.A</td>
</tr>
<tr>
<td>2</td>
<td>Using a systems model, explain how energy from the Sun is transformed or transferred in biological, hydrological, and meteorological systems. [Clarification Statement: A system is an organized group of related objects or components that form a whole. Systems can consist, for example, of fundamental particles, galaxies, ideas, and numbers. Systems have boundaries, components, resources, flow, and feedback. The system models incorporate and make explicit the invisible features of a system, such as interactions, energy flows, or matter transfers. Mathematical ideas, such as ratios and simple graphs, should be seen as tools for making more definitive models.]</td>
<td>ESS2.A</td>
</tr>
<tr>
<td>3</td>
<td>Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. [Clarification Statement: Emphasis is on the processes of melting, crystallization, weathering, deformation, and sedimentation, which act together to form minerals and rocks through the cycling of Earth's materials.] [Assessment Boundary: Assessment does not include the identification and naming of minerals.]</td>
<td>MS-ESS2-1</td>
</tr>
<tr>
<td>4</td>
<td>Develop a conceptual model to describe the multiple pathways that water cycles through Earth's systems driven by energy from the sun and the force of gravity.</td>
<td>ESS2.C</td>
</tr>
<tr>
<td>5</td>
<td>Analyze and interpret data to deduce the mechanisms that resulted in a variety of rock formations.</td>
<td>ESS2.C</td>
</tr>
<tr>
<td>6</td>
<td>Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral,</td>
<td>MS-ESS3-1</td>
</tr>
</tbody>
</table>
energy, and groundwater resources are the result of past and current geoscience processes. [Clarification Statement: Emphasis is on how these resources are limited and typically non-renewable, and how their distributions are significantly changing as a result of removal by humans. Examples of uneven distributions of resources as a result of past processes include but are not limited to petroleum (locations of the burial of organic marine sediments and subsequent geologic traps), metal ores (locations of past volcanic and hydrothermal activity associated with subduction zones), and soil (locations of active weathering and/or deposition of rock).]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

### Science and Engineering Practices
**Developing and Using Models**
Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
- Develop and use a model to describe phenomena. (MS-ESS2-1)
- Develop a model to describe unobservable mechanisms. (MS-ESS2-4)

**Constructing Explanations and Designing Solutions**
Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.
- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past. (MS-ESS2-4)

### Disciplinary Core Ideas
**ESS2.A: Earth's Materials and Systems**
- All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1)

**ESS2.C: The Roles of Water in Earth's Surface Processes**
- Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation, and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4)
- Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)

**ESS3.A: Natural Resources**
- Humans depend on Earth's land, ocean,
| Past and will continue to do so in the future. (MS-ESS3-1) | Atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1) |
### Connections to other DCIs in this grade band:

- MS.PS1.A (MS-ESS2-1), (MS-ESS2-4), (MS-ESS3-1)
- MS.PS1.B (MS-ESS2-1), (MS-ESS3-1)
- MS.PS2.B (MS-ESS2-4)
- MS.PS3.A (MS-ESS2-4), (MS-ESS2-1)
- MS.PS3.B (MS-ESS2-4)
- MS.PS3.D (MS-ESS2-4)
- MS.LS2.B (MS-ESS2-1)
- MS.LS2.C (MS-ESS2-1)
- MS.ESS1.B (MS-ESS2-1)
- MS.ESS2.D (MS-ESS3-1)
- MS.ESS3.C (MS-ESS2-1)

### Articulation of DCIs across grade-bands:

- 3.PS2.A (MS-ESS2-4)
- 4.PS3.B (MS-ESS2-1), (MS-ESS2-4), (MS-ESS3-1)
- 4.PS3.D (MS-ESS3-1)
- 4.ESS2.A (MS-ESS2-1), (MS-ESS3-1)
- 4.ESS3.A (MS-ESS2-4)
- 5.PS2.B (MS-ESS2-4)
- 5.ESS2.A (MS-ESS2-1), (MS-ESS2-4)
- HS.PS1.B (MS-ESS2-1), (MS-ESS2-4)
- HS.PS2.B (MS-ESS2-4)
- HS.PS3.B (MS-ESS2-1), (MS-ESS2-4), (MS-ESS3-1)
- HS.PS4.B (MS-ESS2-4)
- HS.LS1.C (MS-ESS2-1), (MS-ESS3-1)
- HS.LS2.B (MS-ESS2-1)
- HS.ESS2.A (MS-ESS2-1), (MS-ESS2-4), (MS-ESS3-1)
- HS.ESS2.B (MS-ESS3-1)
- HS.ESS2.C (MS-ESS2-1), (MS-ESS2-4), (MS-ESS3-1)
- HS.ESS2.D (MS-ESS2-4)
- HS.ESS2.E (MS-ESS2-1)
- HS.ESS3.A (MS-ESS3-1)

### Common Core State Standards Connections:

**ELA/Literacy -**

- **RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS3-1)
- **WHST.6-8.2** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS3-1)
- **WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research. (MS-ESS3-1)

**SL.8.5** Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-1)

**Mathematics -**

- **6.EE.8.6** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-1)
- **7.EE.8.4** Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS3-1)
What factors interact and influence weather and climate?

Students construct and use models to develop understanding of the factors that control weather and climate. They take a systems approach to examining the feedback between systems as energy from the sun is transferred between systems and circulates through the ocean and atmosphere. The crosscutting concepts of cause and effect, systems and system models, and stability and change are called out as organizing concepts for these disciplinary core ideas.

The Grades 3-5 Storyline provides a summary of the understandings that students developed by the end of 5th grade.

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<th>STUDENT LEARNING OBJECTIVES (SLO)</th>
<th>Corresponding PEs and DCIs</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Develop a conceptual model to explain the mechanisms for the Sun’s energy to drive wind and the hydrologic cycle.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions. [Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]</td>
<td>MS-ESS2-5</td>
</tr>
<tr>
<td>3</td>
<td>Explain how variations in density result from variations in temperature and salinity drive a global pattern of interconnected ocean currents.</td>
<td>ESS2.C</td>
</tr>
<tr>
<td>4</td>
<td>Use a model to explain the mechanisms that cause varying daily temperature ranges in a coastal community and in a community located in the interior of the country.</td>
<td>ESS2.C; ESS2.D</td>
</tr>
<tr>
<td>5</td>
<td>Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment</td>
<td>MS-ESS2-6</td>
</tr>
</tbody>
</table>
Boundary: Assessment does not include the dynamics of the Coriolis effect.

| 6 | Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.] | MS-ESS3-5 |

The SLOs above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

### Science and Engineering Practices

- **Asking Questions and Defining Problems**
  - Asking questions and defining problems in grades 6-8 builds on grades K-5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.
  - Ask questions to identify and clarify evidence of an argument. (MS-ESS3-5)

- **Developing and Using Models**
  - Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
  - Develop and use a model to describe phenomena. (MS-ESS2-6)

### Disciplinary Core Ideas

#### ESS2.C: The Roles of Water in Earth's Surface Processes
- The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5)
- Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6)

#### ESS2.D: Weather and Climate
- Weather and climate are influenced by interactions involving sunlight, the ocean,
### Planning and Carrying Out Investigations
Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.
- Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5)

### The Atmosphere, Ice, Landforms, and Living Things
These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6)
- Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)
- The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents. (MS-ESS2-6)

### ESS3.D: Global Climate Change
- Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. (MS-ESS3-5)
### Connections to other DCIs in this grade-band:


### Articulation of DCIs across grade-bands:


### Common Core State Standards Connections:

**ELA/Literacy -**

- **RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-5), (MS-ESS3-5)
- **RST.6-8.9** Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ESS2-5)
- **WHST.6-8.8** Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ESS2-5)
- **SL.8.5** Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-6)

**Mathematics -**

- **MP.2** Reason abstractly and quantitatively. (MS-ESS2-5), (MS-ESS3-5)
- **6.NS.C.5** Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-ESS2-5)
- **6.EE.B.6** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS3-5)
| 7.EE.B.4 | Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-ESS3-5) |

| CONTENT AREA: Science | GRADE: 7 | UNIT: 2 | UNIT NAME: Weather and Climate |
What is Earth’s place in the Universe?

What makes up our solar system and how can the motion of Earth explain seasons and eclipses?

Students examine the Earth’s place in relation to the solar system, Milky Way galaxy, and universe. There is a strong emphasis on a systems approach, using models of the solar system to explain astronomical and other observations of the cyclic patterns of eclipses, tides, and seasons. There is also a strong connection to engineering through the instruments and technologies that have allowed us to explore the objects in our solar system and obtain the data that support the theories that explain the formation and evolution of the universe. The crosscutting concepts of patterns; scale, proportion, and quantity; systems and system models; and interdependence of science, engineering, and technology are called out as organizing concepts for these disciplinary core ideas.

The Grades 3-5 Storyline provides a summary of the understandings that students developed by the end of 5th grade.

<table>
<thead>
<tr>
<th>#</th>
<th>STUDENT LEARNING OBJECTIVES (SLOs)</th>
<th>Corresponding PEs and DCIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Generate and analyze evidence (through simulations or long term investigations) to explain why the Sun’s apparent motion across the sky changes over the course of a year.</td>
<td>ESS1.B</td>
</tr>
<tr>
<td>3</td>
<td>Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons. [Clarification Statement: Examples of models can be physical, graphical, or conceptual.]</td>
<td>MS-ESS1-1</td>
</tr>
<tr>
<td>4</td>
<td>Develop and use a model that shows how gravity causes smaller objects to orbit around larger objects at increasing scales, including the gravitational force of the sun causes the planets and other bodies to orbit around it holding together the solar system.</td>
<td>ESS1.A; ESS1.B</td>
</tr>
<tr>
<td>5</td>
<td>Analyze and interpret data to determine scale properties of objects in the solar system. [Clarification Statement: Emphasis is on the analysis of data from Earth-based instruments, space-based telescopes, and spacecraft to determine similarities and differences among solar system objects. Examples of scale properties include the sizes of an object’s layers (such as crust and atmosphere), surface features (such as volcanoes), and orbital radius. Examples of data include statistical information, drawings and photographs, and models.] [Assessment Boundary: Assessment does not include recalling facts about properties of the planets and other solar system bodies.]</td>
<td>MS-ESS1-3</td>
</tr>
<tr>
<td>6</td>
<td>Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system. [Clarification Statement: Emphasis for the model is on gravity as the force that holds</td>
<td>MS-ESS1-2</td>
</tr>
</tbody>
</table>
### Science and Engineering Practices

**Developing and Using Models**
- Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
  - Develop and use a model to describe phenomena. *(MS-ESS1-1), (MS-ESS1-2)*

**Analyzing and Interpreting Data**
- Analyzing data in 6-8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
  - Analyze and interpret data to determine similarities and differences in findings. *(MS-ESS1-3)*

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### Disciplinary Core Ideas

**ESS1.A: The Universe and Its Stars**
- Patterns of the apparent motion of the sun, the moon, and stars in the sky can be observed, described, predicted, and explained with models. *(MS-ESS1-1)*
- Earth and its solar system are part of the Milky Way galaxy, which is one of many galaxies in the universe. *(MS-ESS1-2)*

**ESS1.B: Earth and the Solar System**
- The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them. *(MS-ESS1-2), (MS-ESS1-3)*
- This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth.

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### Crosscutting Concepts

**Patterns**
- Patterns can be used to identify cause-and-effect relationships. *(MS-ESS1-1)*

**Scale, Proportion, and Quantity**
- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. *(MS-ESS1-3)*

**Systems and System Models**
- Models can be used to represent systems and their interactions. *(MS-ESS1-2)*

---

**Connections to Engineering, Technology, and Applications of Science**

Interdependence of Science, Engineering, and Technology
<table>
<thead>
<tr>
<th>Earth across the year. (MS-ESS1-1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The solar system appears to have formed from a disk of dust and gas, drawn together by gravity. (MS-ESS1-2)</td>
</tr>
<tr>
<td>Engineering advances have led to important discoveries in virtually every field of science and scientific discoveries have led to the development of entire industries and engineered systems. (MS-ESS1-3)</td>
</tr>
</tbody>
</table>

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**Connections to Nature of Science**

**Scientific Knowledge Assumes an Order and Consistency in Natural Systems**

• Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-ESS1-1),(MS-ESS1-2)
Voorhees Township Public Schools  
Science Curriculum Guide Grades 6-8

CONTENT AREA: Science  |  GRADE: 7  |  UNIT: 4  |  UNIT NAME: Space Systems

**Connections to other DCIs in this grade-band:**

MS.PS2.A (MS-ESS1-1),(MS-ESS1-2); MS.PS2.B (MS-ESS1-1),(MS-ESS1-2); MS.ESS2.A (MS-ESS1-3)

**Articulation of DCIs across grade-bands:**

3.PS2.A (MS-ESS1-1),(MS-ESS1-2); 5.PS2.B (MS-ESS1-1),(MS-ESS1-2); 5.ESS1.A (MS-ESS1-2); 5.ESS1.B (MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3); HS.PS2.A (MS-ESS1-1),(MS-ESS1-2); HS.PS2.B (MS-ESS1-1),(MS-ESS1-2); HS.LS4.C (MS-ESS1-4); HS.ESS1.A (MS-ESS1-2); HS.ESS1.B (MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3); HS.ESS2.A (MS-ESS1-3)

**Common Core State Standards Connections:**

**ELA/Literacy -**

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<tr>
<td>RST.6-8.1</td>
<td>Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS1-3)</td>
</tr>
<tr>
<td>RST.6-8.7</td>
<td>Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS1-3)</td>
</tr>
<tr>
<td>SL.8.5</td>
<td>Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS1-1),(MS-ESS1-2)</td>
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**Mathematics -**

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<th>Standard</th>
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<tr>
<td>MP.2</td>
<td>Reason abstractly and quantitatively. (MS-ESS1-3)</td>
</tr>
<tr>
<td>MP.4</td>
<td>Model with mathematics. (MS-ESS1-1),(MS-ESS1-2)</td>
</tr>
<tr>
<td>6.RP.A.1</td>
<td>Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3)</td>
</tr>
<tr>
<td>7.RP.A.2</td>
<td>Recognize and represent proportional relationships between quantities. (MS-ESS1-1),(MS-ESS1-2),(MS-ESS1-3)</td>
</tr>
<tr>
<td>6.EE.B.6</td>
<td>Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-ESS1-2),(MS-ESS1-4)</td>
</tr>
</tbody>
</table>
| 7.EE.B.6 | Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve
| CONTENT AREA: Science | GRADE: 7 | UNIT: 4 | UNIT NAME: Space Systems |

problems by reasoning about the quantities. *(MS-ESS1-2)*
How can one describe physical interactions between objects and within systems of objects?

Students are able to apply Newton's Third Law of Motion to relate forces to explain the motion of objects. Students also apply ideas about gravitational, electrical, and magnetic forces to explain a variety of phenomena including beginning ideas about why some materials attract each other while other repel. In particular, students develop the understanding that gravitational interactions are always attractive but that electrical and magnetic forces can be both attractive and negative. Students also develop ideas that objects can exert forces on each other even though the objects are not in contact, through fields. Students apply engineering practices and concept to solve a problem caused when objects collide. The crosscutting concepts of cause and effect; system and system models; stability and change; and the influence of science, engineering, and technology on society and the natural world serve as organizing concepts for these disciplinary core ideas. In these performance expectations, students are expected to demonstrate proficiency in asking questions, planning and carrying out investigations, and designing solutions, and engaging in argument; and to use these practices to demonstrate understanding of the core ideas.

The *Grades 3-5 Storyline* provides a summary of the understandings that students developed by the end of 5th grade.

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<th>STUDENT LEARNING OBJECTIVES (SLO)</th>
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<tbody>
<tr>
<td>1</td>
<td>Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. [<em>Clarification Statement: Examples of practical problems could include the impact of collisions between two cars, between a car and stationary objects, and between a meteor and a space vehicle.</em>] [<em>Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.</em>]</td>
<td>MS-PS2-1</td>
</tr>
<tr>
<td>2</td>
<td>Plan an investigation to provide evidence that the change in an object’s motion depends on the sum of the forces on the object and the mass of the object. [<em>Clarification Statement: Emphasis is on balanced (Newton’s First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton’s Second Law), frame of reference, and specification of units.</em>] [<em>Assessment Boundary: Assessment is limited to forces and changes in motion in one-dimension in an inertial reference frame and to change in one variable at a time. Assessment does not include the use of trigonometry.</em>]</td>
<td>MS-PS2-2</td>
</tr>
<tr>
<td>3</td>
<td>Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. [<em>Clarification Statement: Examples of devices that use electric and magnetic forces could include electromagnets, electric motors, or generators. Examples of data could include the effect of the number of turns of wire on the strength of an electromagnet, or the effect of increasing the number or strength of magnets on the speed of an electric motor.</em>] [<em>Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.</em>]</td>
<td>MS-PS2-3</td>
</tr>
<tr>
<td>4</td>
<td>Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. [Clarification Statement: Examples of evidence for arguments could include data generated from simulations or digital tools; and charts displaying mass, strength of interaction, distance from the Sun, and orbital periods of objects within the solar system.] [Assessment Boundary: Assessment does not include Newton's Law of Gravitation or Kepler's Laws.]</td>
<td>MS-PS2-4</td>
</tr>
<tr>
<td>---</td>
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</tr>
<tr>
<td>5</td>
<td>Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact. [Clarification Statement: Examples of this phenomenon could include the interactions of magnets, electrically-charged strips of tape, and electrically-charged pith balls. Examples of investigations could include first-hand experiences or simulations.] [Assessment Boundary: Assessment is limited to electric and magnetic fields, and limited to qualitative evidence for the existence of fields.]</td>
<td>MS-PS2-5</td>
</tr>
</tbody>
</table>

The SLOs were developed using the following elements from the NRC document A Framework for K-12 Science Education:

### Science and Engineering Practices
<table>
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<th>Asking Questions and Defining Problems</th>
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<tbody>
<tr>
<td>Asking questions and defining problems in grades 6-8 builds from grades K-5 experiences and progresses to specifying relationships between variables, and clarifying arguments and models.</td>
</tr>
<tr>
<td>- Ask questions that can be investigated within the scope of the classroom, outdoor environment, and museums and other public facilities with available resources and, when appropriate, frame a hypothesis based on observations and scientific principles. (MS-PS2-3)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Planning and Carrying Out Investigations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning and carrying out investigations to answer questions or test solutions to problems in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide</td>
</tr>
</tbody>
</table>

### Disciplinary Core Ideas

#### PS2.A: Forces and Motion
- For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). (MS-PS2-1)
- The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS-PS2-2)
- All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and

### Crosscutting Concepts

#### Cause and Effect
- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS2-3),(MS-PS2-5)

#### Systems and System Models
- Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. (MS-PS2-1),(MS-PS2-4)

#### Stability and Change
- Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. (MS-PS2-2)
evidence to support explanations or design solutions.

- Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS2-2)

- Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation. (MS-PS2-5)

**Constructing Explanations and Designing Solutions**

Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific ideas or principles to design an object, tool, process or system. (MS-PS2-1)

**Engaging in Argument from Evidence**

Engaging in argument from evidence in 6-8 builds from K-5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world.

- Construct and present oral and written arguments supported by empirical evidence and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. (MS-PS2-2)

**PS2.B: Types of Interactions**

- Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3)

- Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. (MS-PS2-4)

- Forces that act at a distance (electric, magnetic, and gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). (MS-PS2-5)

**Connections to Engineering, Technology, and Applications of Science**

**Influence of Science, Engineering, and Technology on Society and the Natural World**

- The uses of technologies and any limitations on their use are driven by individual or societal needs, desires, and values: by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-PS2-1)
Scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-PS2-4)

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Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence
- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS2-2),(MS-PS2-4)

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Connections to other DCIs in this grade-band:
MS.PS3.A (MS-PS2-2); MS.PS3.B (MS-PS2-2); MS.PS3.C (MS-PS2-1); MS.ESS1.A (MS-PS2-4); MS.ESS1.B (MS-PS2-4); MS.ESS2.C (MS-PS2-2),(MS-PS2-4)

Articulation of DCIs across grade-bands:
3.PS2.A (MS-PS2-1),(MS-PS2-2); 3.PS2.B (MS-PS2-3),(MS-PS2-5); 5.PS2.B (MS-PS2-4); HS.PS2.A (MS-PS2-1),(MS-PS2-2); HS.PS2.B (MS-PS2-3),(MS-PS2-4),(MS-PS2-5); HS.PS3.A (MS-PS2-5); HS.PS3.B (MS-PS2-2),(MS-PS2-5); HS.PS3.C (MS-PS2-5); HS.ESS1.B (MS-PS2-2),(MS-PS2-4)

Common Core State Standards Connections:

ELA/Literacy -
RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-PS2-1),(MS-PS2-3)
RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS2-1),(MS-PS2-2),(MS-PS2-5)
WHST.6-8.1 Write arguments focused on discipline-specific content. (MS-PS2-4)
WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS2-1),(MS-PS2-2),(MS-PS2-5)

Mathematics -
MP.2 Reason abstractly and quantitatively. (MS-PS2-1),(MS-PS2-2),(MS-PS2-3)
6.NS.C. Understand that positive and negative numbers are used together to describe quantities having opposite directions or values; use positive
<table>
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<td>5</td>
<td>and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. <em>(MS-PS2-1)</em></td>
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<tr>
<td>6.EE.A.</td>
<td>Write, read, and evaluate expressions in which letters stand for numbers. <em>(MS-PS2-1),(MS-PS2-2)</em></td>
</tr>
<tr>
<td>2</td>
<td>Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form, using tools strategically. Apply properties of operations to calculate with numbers in any form; convert between forms as appropriate; and assess the reasonableness of answers using mental computation and estimation strategies. <em>(MS-PS2-1),(MS-PS2-2)</em></td>
</tr>
<tr>
<td>7.EE.B.4</td>
<td>Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. <em>(MS-PS2-1),(MS-PS2-2)</em></td>
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**How can energy be transferred from one object or system to another?**

Students understand qualitative ideas about energy including that the interactions of objects can be explained and predicted using the concept of transfer of energy from one object or system of objects to another, and that that the total change of energy in any system is always equal to the total energy transferred into or out of the system. Students also understand that when objects are moving they have kinetic energy and that objects may also contain stored (potential) energy, depending on their relative positions. Students know the difference between energy and temperature, and begin to develop an understanding of the relationship between force and energy. Students are also able to apply an understanding of design to the process of energy transfer. The crosscutting concepts of scale, proportion, and quantity; systems and system models; and energy are called out as organizing concepts for these disciplinary core ideas. Students demonstrate proficiency in developing and using models, planning investigations, analyzing and interpreting data, and designing solutions, and engaging in argument from evidence; and to use these practices to demonstrate understanding of the core ideas in Energy.

The Grades 3-5 Storyline provides a summary of the understandings that students developed by the end of 5th grade.

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<tr>
<td>1</td>
<td>Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object. [Clarification Statement: Emphasis is on descriptive relationships between kinetic energy and mass separately from kinetic energy and speed. Examples could include riding a bicycle at different speeds, rolling different sizes of rocks downhill, and getting hit by a wiffle ball versus a tennis ball.]</td>
<td>MS-PS3-1</td>
</tr>
<tr>
<td>2</td>
<td>Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. [Clarification Statement: Emphasis is on relative amounts of potential energy, not on calculations of potential energy. Examples of objects within systems interacting at varying distances could include: the Earth and either a roller coaster cart at varying positions on a hill or objects at varying heights on shelves, changing the direction/orientation of a magnet, and a balloon with static electrical charge being brought closer to a classmate's hair. Examples of models could include representations, diagrams, pictures, and written descriptions of systems.] [Assessment Boundary: Assessment is limited to two objects and electric, magnetic, and gravitational interactions.]</td>
<td>MS-PS3-2</td>
</tr>
<tr>
<td>3</td>
<td>Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.* [Clarification Statement: Examples of devices could include an insulated box, a solar cooker, and a Styrofoam cup.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.]</td>
<td>MS-PS3-3</td>
</tr>
<tr>
<td>CONTENT AREA: Science</td>
<td>GRADE: 7</td>
<td>UNIT: 6</td>
</tr>
<tr>
<td>-----------------------</td>
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</tbody>
</table>

4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. [Clarification Statement: Examples of experiments could include comparing final water temperatures after different masses of ice melted in the same volume of water with the same initial temperature, the temperature change of samples of different materials with the same mass as they cool or heat in the environment, or the same material with different masses when a specific amount of energy is added.] [Assessment Boundary: Assessment does not include calculating the total amount of thermal energy transferred.]

5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. [Clarification Statement: Examples of empirical evidence used in arguments could include an inventory or other representation of the energy before and after the transfer in the form of temperature changes or motion of object.] [Assessment Boundary: Assessment does not include calculations of energy.]

The SLOs were developed using the following elements from the NRC document *A Framework for K-12 Science Education*.

### Science and Engineering Practices
- **Developing and Using Models**
  - Modeling in 6-8 builds on K-5 and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.
  - Develop a model to describe unobservable mechanisms. (MS-PS3-2)

- **Planning and Carrying Out Investigations**
  - Planning and carrying out investigations to answer questions or test solutions to problems in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or design solutions.

### Disciplinary Core Ideas
<br />
**PS3.A: Definitions of Energy**
- Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. (MS-PS3-1)
- A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2)
- Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3), (MS-

### Crosscutting Concepts
<br />
**Scale, Proportion, and Quantity**
- Proportional relationships (e.g. speed as the ratio of distance traveled to time taken) among different types of quantities provide information about the magnitude of properties and processes. (MS-PS3-1), (MS-PS3-4)

**Systems and System Models**
- Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy and matter flows within systems. (MS-PS3-2)

**Energy and Matter**
- Energy may take different forms (e.g. energy in
## Cognitively Demands

- Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS3-4)

### Analyzing and Interpreting Data

Analyzing data in 6-8 builds on K-5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (MS-PS3-1)

### Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system. (MS-PS3-3)

### Engaging in Argument from Evidence

Engaging in argument from evidence in 6-8 builds on K-5 experiences and progresses to constructing a convincing argument that supports or refutes claims.

- PS3-A) PS3.8: Conservation of Energy and Energy Transfer
  - When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5)
  - The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4)
  - Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3)

- PS3.C: Relationship Between Energy and Forces
  - When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2)

- ETS1.A: Defining and Delimiting an Engineering Problem
  - The more precisely a design task’s criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions. (secondary to MS-PS3-3)

- ETS1.B: Developing Possible Solutions

- The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS3-3)
for either explanations or solutions about the natural and designed worlds.
- Construct, use, and present oral and written arguments supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon. (MS-PS3-5)

- A solution needs to be tested, and then modified on the basis of the test results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem. (Secondary to MS-PS3-3)

Connections to Nature of Science

Scientific Knowledge is Based on Empirical Evidence
- Science knowledge is based upon logical and conceptual connections between evidence and explanations (MS-PS3-4), (MS-PS3-5)

Connections to other DCIs in this grade-band:
MS.PS1.A (MS-PS3-4); MS.PS1.B (MS-PS3-3); MS.PS2.A (MS-PS3-1), (MS-PS3-4), (MS-PS3-4); MS.ESS2.A (MS-PS3-3); MS.ESS2.C (MS-PS3-3), (MS-PS3-4); MS.ESS3.D (MS-PS3-3), (MS-PS3-4); MS.ESS3.D (MS-PS3-4)

Articulation of DCIs across grade-bands:
4.PS3.B (MS-PS3-1), (MS-PS3-3); 4.PS3.C (MS-PS3-4), (MS-PS3-5); HS.PS1.B (MS-PS3-4); HS.PS2.B (MS-PS3-2); HS.PS3.A (MS-PS3-1), (MS-PS3-4), (MS-PS3-5); HS.PS3.B (MS-PS3-1), (MS-PS3-2), (MS-PS3-3), (MS-PS3-4), (MS-PS3-5); HS.PS3.C (MS-PS3-2)

Common Core State Standards Connections:
ELA/Literacy -
RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-PS3-1), (MS-PS3-5)
RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS3-3), (MS-PS3-3)
| RST.6-8.7 | Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PS3-1) |
| WHST.6-8.1 | Write arguments focused on discipline content. (MS-PS3-5) |
| WHST.6-8.7 | Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS3-3),(MS-PS3-4) |
| SL.8.5 | Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS3-2) |
| Mathematics - | |
| MP.2 | Reason abstractly and quantitatively. (MS-PS3-1),(MS-PS3-4),(MS-PS3-5) |
| 6.RP.A.1 | Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS3-1),(MS-PS3-5) |
| 6.RP.A.2 | Understand the concept of a unit rate a/b associated with a ratio a:b with b ≠ 0, and use rate language in the context of a ratio relationship. (MS-PS3-1) |
| 7.RP.A.2 | Recognize and represent proportional relationships between quantities. (MS-PS3-1),(MS-PS3-5) |
| 8.EE.A.1 | Know and apply the properties of integer exponents to generate equivalent numerical expressions. (MS-PS3-1) |
| 8.EE.A.2 | Use square root and cube root symbols to represent solutions to equations of the form \( x^2 = p \) and \( x^3 = p \), where \( p \) is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that \( \sqrt{2} \) is irrational. (MS-PS3-1) |
| 8.F.A.3 | Interpret the equation \( y = mx + b \) as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (MS-PS3-1),(MS-PS3-5) |
| 6.SP.B.5 | Summarize numerical data sets in relation to their context. (MS-PS3-4) |
Student Learning Objectives
Grade 8
What happens when new materials are formed? What stays the same and what changes?

Students understand what occurs at the atomic and molecular scale during chemical reactions. Students provide molecular level accounts to explain that chemical reactions involve regrouping of atoms to form new substances, and that atoms rearrange during chemical reactions. Students are also able to apply an understanding of the design and the process of optimization in engineering to chemical reaction systems. The crosscutting concepts of patterns and energy and matter are called out as organizing concepts for these disciplinary core ideas. In these performance expectations, students are expected to demonstrate proficiency in developing and using models, analyzing and interpreting data, and designing solutions. Students use these scientific and engineering practices to demonstrate understanding of the core ideas.

The Grades 3-5 Storyline provides a summary of the understandings that students developed by the end of 5th grade.

<table>
<thead>
<tr>
<th>#</th>
<th>STUDENT LEARNING OBJECTIVES (SLO)</th>
<th>Corresponding DCIs and PE(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design qualitative investigations to differentiate between physical and chemical changes in matter.</td>
<td>PS1.A; PS1.B</td>
</tr>
<tr>
<td>2</td>
<td>Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. [Clarification Statement: Examples of reactions could include burning sugar or steel wool, fat reacting with sodium hydroxide, and mixing zinc with hydrogen chloride.] [Assessment Boundary: Assessment is limited to analysis of the following properties: density, melting point, boiling point, solubility, flammability, and odor.]</td>
<td>MS-PS1-2</td>
</tr>
<tr>
<td>3</td>
<td>Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. [Clarification Statement: Emphasis is on law of conservation of matter and on physical models or drawings, including digital forms that represent atoms.] [Assessment Boundary: Assessment does not include the use of atomic masses, balancing symbolic equations, or intermolecular forces.]</td>
<td>MS-PS1-5</td>
</tr>
<tr>
<td>4</td>
<td>Compare the properties of reactants with the properties of the products when two or more substances are combined and react chemically.</td>
<td>PS1.B</td>
</tr>
<tr>
<td>5</td>
<td>Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.* [Clarification Statement: Emphasis is on the design, controlling the transfer of energy to the environment, and modification of a device using factors such as type and concentration of a substance. Examples of designs could involve chemical reactions such as dissolving ammonium chloride or calcium chloride.] [Assessment Boundary: Assessment is limited to the criteria of amount, time, and temperature of substance in testing the device.]</td>
<td>MS-PS1-6</td>
</tr>
</tbody>
</table>
The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

<table>
<thead>
<tr>
<th>Science and Engineering Practices</th>
<th>Disciplinary Core Ideas</th>
<th>Crosscutting Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Developing and Using Models</strong></td>
<td><strong>PS1.A: Structure and Properties of Matter</strong></td>
<td><strong>Patterns</strong></td>
</tr>
<tr>
<td>Modeling in 6-8 builds on K-5 and progresses to developing, using and revising models to describe, test, and predict more abstract phenomena and design systems.</td>
<td>Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-2) (Note: This Disciplinary Core Idea is also addressed by MS-PS1-3.)</td>
<td>Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2)</td>
</tr>
<tr>
<td>• Develop a model to predict and/or describe phenomena. (MS-PS1-1),(MS-PS1-4)</td>
<td><strong>PS1.B: Chemical Reactions</strong></td>
<td><strong>Energy and Matter</strong></td>
</tr>
<tr>
<td>• Develop a model to describe unobservable mechanisms. (MS-PS1-5)</td>
<td>Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2),(MS-PS1-5) (Note: This Disciplinary Core Idea is also addressed by MS-PS1-3.)</td>
<td>Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)</td>
</tr>
<tr>
<td><strong>Analyzing and Interpreting Data</strong></td>
<td>• The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5)</td>
<td>• The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS1-6)</td>
</tr>
<tr>
<td>Analyzing data in 6-8 builds on K-5 and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.</td>
<td>• Some chemical reactions release energy, others store energy. (MS-PS1-6)</td>
<td></td>
</tr>
<tr>
<td>• Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2)</td>
<td><strong>ETS1.B: Developing Possible Solutions</strong></td>
<td></td>
</tr>
</tbody>
</table>
solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

- Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MS-PS1-6)

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**Connections to Nature of Science**

**Scientific Knowledge** is Based on Empirical Evidence

- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS1-2)

**Science Models, Laws, Mechanisms, and Theories**

- Laws are regularities or mathematical descriptions of natural phenomena. (MS-PS1-5)

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- A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (secondary to MS-PS1-6)

**ETS1.C: Optimizing the Design Solution**

- Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process - that is, some of the characteristics may be incorporated into the new design. (secondary to MS-PS1-6)

- The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (secondary to MS-PS1-6)

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**Connections to other DCIs in this grade-band:**

MS.PS3.D (MS-PS1-2) (MS-PS1-6); MS.LS1.C (MS-PS1-2) (MS-PS1-5); MS.LS2.B (MS-PS1-5); MS.ESS2.A (MS-PS1-2) (MS-PS1-5)

**Articulation of DCIs across grade-bands:**

5.PS1.B (MS-PS1-2) (MS-PS1-5); HS.PS1.A (MS-PS1-6); HS.PS1.B (MS-PS1-2) (MS-PS1-5) (MS-PS1-6); HS.PS3.A (MS-PS1-6); HS.PS3.B (MS-PS1-6); HS.PS3.D (MS-PS1-6)

**Common Core State Standards Connections:**

ELA/Literacy -
### RST.6-8.1
Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. *(MS-PS1-2)*

### RST.6-8.3
Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. *(MS-PS1-6)*

### RST.6-8.7
Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). *(MS-PS1-2), (MS-PS1-5)*

### WHST.6-8.7
Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. *(MS-PS1-6)*

### Mathematics

#### MP.2
Reason abstractly and quantitatively. *(MS-PS1-2), (MS-PS1-5)*

#### MP.4
Model with mathematics. *(MS-PS1-5)*

#### 6.RP.A.3
Use ratio and rate reasoning to solve real-world and mathematical problems. *(MS-PS1-2), (MS-PS1-5)*

#### 6.SP.B.4
Display numerical data in plots on a number line, including dot plots, histograms, and box plots. *(MS-PS1-2)*

#### 6.SP.B.5
Summarize numerical data sets in relation to their context. *(MS-PS1-2)*
How do people figure out that the Earth and life on Earth have changed over time?

How does the movement of tectonic plates impact the surface of Earth?

Students examine geoscience data in order to understand the processes and events in Earth's history. Important concepts in this topic are "Scale, Proportion, and Quantity" and "Stability and Change," in relation to the different ways geologic processes operate over the long expanse of geologic time. An important aspect of the history of Earth is that geologic events and conditions have affected the evolution of life, but different life forms have also played important roles in altering Earth's systems. Students are expected to demonstrate proficiency in analyzing and interpreting data, and constructing explanations; and to use these practices to demonstrate understanding of the core ideas.

The Grades 3-5 Storyline provides a summary of the understandings that students developed by the end of 5th grade.

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</thead>
<tbody>
<tr>
<td>1</td>
<td>Use relative dates provided by the fossil record to make claims regarding the appearance or disappearance of organisms.</td>
<td>ESS1.C</td>
</tr>
<tr>
<td>2</td>
<td>Correlate the evolution of organisms and the environmental conditions on Earth as they changed throughout geologic time.</td>
<td>ESS1.C</td>
</tr>
<tr>
<td>3</td>
<td>Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history. [Clarification Statement: Emphasis is on how analyses of rock formations and the fossils they contain are used to establish relative ages of major events in Earth's history. Examples of Earth's major events could range from being very recent (such as the last Ice Age or the earliest fossils of hominids) to very old (such as the formation of Earth or the earliest evidence of life). Examples can include the formation of mountain chains and ocean basins, the evolution or extinction of particular living organisms, or significant volcanic eruptions.] [Assessment Boundary: Assessment does not include recalling the names of specific periods or epochs and events within them.]</td>
<td>MS-ESS1-4</td>
</tr>
<tr>
<td>4</td>
<td>Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales. [Clarification Statement: Emphasis is on how processes change Earth's surface at time and spatial scales that can be large (such as slow plate motions or the uplift of large mountain ranges) or small (such as rapid landslides or microscopic geochemical reactions), and how many geoscience processes (such as earthquakes, volcanoes, and meteor impacts) usually behave gradually but are punctuated by catastrophic events. Examples of geoscience processes include surface weathering and deposition by the movements of water, ice, and wind. Emphasis is on geoscience processes that shape local geographic features, where appropriate.]</td>
<td>MS-ESS2-2</td>
</tr>
</tbody>
</table>
Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions. [Clarification Statement: Examples of data include similarities of rock and fossil types on different continents, the shapes of the continents (including continental shelves), and the locations of ocean structures (such as ridges, fracture zones, and trenches).] [Assessment Boundary: Paleomagnetic anomalies in oceanic and continental crust are not assessed.]

Science and Engineering Practices
Analyzing and Interpreting Data
Analyzing data in 6-8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.

- Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3)

Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future.

Disciplinary Core Ideas
ESS1.C: The History of Planet Earth
- The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale. (MS-ESS1-4)
- Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. (HS.ESS1.C.6BE),(secondary to MS-ESS2-3)

ESS2.A: Earth's Materials and Systems
- The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future. (MS-ESS2-2)

ESS2.B: Plate Tectonics and Large-Scale System Interactions
- Maps of ancient land and water patterns, based

Crosscutting Concepts
Patterns
- Patterns in rates of change and other numerical relationships can provide information about natural systems. (MS-ESS2-3)

Scale Proportion and Quantity
- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-ESS1-4),(MS-ESS2-2)
Voorhees Township Public Schools  
Science Curriculum Guide Grades 6-8  

<table>
<thead>
<tr>
<th>CONTENT AREA: Science</th>
<th>GRADE: 8</th>
<th>UNIT: 2</th>
<th>UNIT NAME: History of Earth</th>
</tr>
</thead>
</table>

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<thead>
<tr>
<th>(MS-ESS1-4),(MS-ESS2-2)</th>
<th>on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart. (MS-ESS2-3)</th>
</tr>
</thead>
</table>

**Connections to Nature of Science**

Scientific Knowledge is Open to Revision in Light of New Evidence

- Science findings are frequently revised and/or reinterpreted based on new evidence. (MS-ESS2-3)

**ESS2.C: The Roles of Water in Earth's Surface Processes**

- Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations. (MS-ESS2-2)

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**Connections to other DCIs in this grade band:**

MS.PS1.B (MS-ESS2-2); MS.LS2.B (MS-ESS2-2); MS.LS4.C (MS-ESS1-4)

**Articulation of DCIs across grade-bands:**

3.LS4.A (MS-ESS1-4),(MS-ESS2-3); 3.LS4.C (MS-ESS1-4); 3.ESS2.B (MS-ESS2-3); 4.ESS1.C (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3); 4.ESS2.A (MS-ESS2-2); 4.ESS2.B (MS-ESS2-3); 4.ESS2.E (MS-ESS2-2); 4.ESS3.B (MS-ESS2-3); 5.ESS2.A (MS-ESS2-2); HS.PS1.C (MS-ESS1-4); HS.PS3.D (MS-ESS2-2); HS.LS2.B (MS-ESS2-2); HS.LS4.A (MS-ESS1-4),(MS-ESS2-3); HS.LS4.C (MS-ESS1-4),(MS-ESS2-3); HS.ESS1.C (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3); HS.ESS2.A (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3); HS.ESS2.B (MS-ESS2-3); HS.ESS2.C (MS-ESS2-2); HS.ESS2.D (MS-ESS2-2); HS.ESS2.E (MS-ESS2-2); HS.ESS3.D (MS-ESS2-2)

**Common Core State Standards Connections:**

**ELA/Literacy -**

RST.6-8.1 Get specific textual evidence to support analysis of science and technical texts. (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-ESS2-3)

RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ESS2-3)

WHST.6-8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-ESS1-4),(MS-ESS2-2)

WHST.6-8.2 Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and
<table>
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<tbody>
<tr>
<td>8.8</td>
<td>conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources. <em>MS-ESS2-5</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SL.8.5</td>
<td>Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. <em>MS-ESS2-1, MS-ESS2-2, MS-ESS2-6</em></td>
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</tr>
<tr>
<td><strong>Mathematics</strong></td>
<td><strong>MP.2</strong></td>
<td>Reason abstractly and quantitatively. <em>MS-ESS2-2, MS-ESS2-3, MS-ESS2-5</em></td>
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</tr>
<tr>
<td>6.EE.B.6</td>
<td>Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. <em>MS-ESS1-4, MS-ESS2-2, MS-ESS2-3</em></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.EE.B.4</td>
<td>Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. <em>MS-ESS1-4, MS-ESS2-2, MS-ESS2-3</em></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
How does genetic variation among organisms in a species affect survival and reproduction?

How does the environment influence genetic traits in populations over multiple generations?

Students analyze data from the fossil record to describe evidence of the history of life on Earth and construct explanations for similarities in organisms. They have a beginning understanding of the role of variation in natural selection and how this leads to speciation. They have a grade-appropriate understanding and use of the practices of analyzing graphical displays; using mathematical models; and gathering, reading, and communicating information. The crosscutting concept of cause and effect is central to this topic.

The Grades 3-5 Storyline provides a summary of the understandings that students developed by the end of 5th grade.

<table>
<thead>
<tr>
<th>#</th>
<th>STUDENT LEARNING OBJECTIVES (SLO)</th>
<th>Corresponding PEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth under the assumption that natural laws operate today as in the past. [Clarification Statement: Emphasis is on finding patterns of changes in the level of complexity of anatomical structures in organisms and the chronological order of fossil appearance in the rock layers.] [Assessment Boundary: Assessment does not include the names of individual species or geological eras in the fossil record.]</td>
<td>MS-LS4-1</td>
</tr>
<tr>
<td>2</td>
<td>Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships. [Clarification Statement: Emphasis is on explanations of the evolutionary relationships among organisms in terms of similarity or differences of the gross appearance of anatomical structures.]</td>
<td>MS-LS4-2</td>
</tr>
<tr>
<td>3</td>
<td>Analyze displays of pictorial data to compare patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy. [Clarification Statement: Emphasis is on inferring general patterns of relatedness among embryos of different organisms by comparing the macroscopic appearance of diagrams or pictures.] [Assessment Boundary: Assessment of comparisons is limited to gross appearance of anatomical structures in embryological development.]</td>
<td>MS-LS4-3</td>
</tr>
<tr>
<td>4</td>
<td>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. [Clarification Statement: Emphasis is on using simple probability statements and proportional reasoning to construct explanations.]</td>
<td>MS-LS4-4</td>
</tr>
</tbody>
</table>
Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time. [Clarification Statement: Emphasis is on using mathematical models, probability statements, and proportional reasoning to support explanations of trends in changes to populations over time.] [Assessment Boundary: Assessment does not include Hardy Weinberg calculations.]

The SLOs were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

### Science and Engineering Practices

**Analyzing and Interpreting Data**
- Analyzing data in 6-8 builds on K-5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis.
  - Analyze displays of data to identify linear and nonlinear relationships. (MS-LS4-3)
  - Analyze and interpret data to determine similarities and differences in findings. (MS-LS4-1)

**Using Mathematics and Computational Thinking**
- Mathematical and computational thinking in 6-8 builds on K-5 experiences and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments.
  - Use mathematical representations to support scientific conclusions and design solutions. (MS-LS4-6)

### Disciplinary Core Ideas

**LS4.A: Evidence of Common Ancestry and Diversity**
- The collection of fossils and their placement in chronological order (e.g., through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth. (MS-LS4-1)
  - Anatomical similarities and differences between various organisms living today and between them and organisms in the fossil record, enable the reconstruction of evolutionary history and the inference of lines of evolutionary descent. (MS-LS4-2)
  - Comparison of the embryological development of different species also reveals similarities that show relationships not evident in the fully-formed anatomy. (MS-LS4-3)

### Crosscutting Concepts

**Patterns**
- Patterns can be used to identify cause and effect relationships. (MS-LS4-2)
- Graphs, charts, and images can be used to identify patterns in data. (MS-LS4-1),(MS-LS4-3)

**Cause and Effect**
- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS4-4),(MS-LS4-6)

**Connections to Nature of Science**

**Scientific Knowledge Assumes an Order and Consistency in Natural Systems**
- Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement.
Constructing Explanations and Designing Solutions
Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

- Apply scientific ideas to construct an explanation for real-world phenomena, examples, or events. (MS-LS4-2)
- Construct an explanation that includes qualitative or quantitative relationships between variables that describe phenomena. (MS-LS4-4)

Connections to Nature of Science
Scientific Knowledge is Based on Empirical Evidence
- Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-LS4-1)

LS4.B: Natural Selection
- Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4)

LS4.C: Adaptation
- Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS-LS4-6)
Voorhees Township Public Schools  
Science Curriculum Grades 6-8

**CONTENT AREA:** Science  **GRADE:** 8  **UNIT:** 3  **UNIT NAME:** Natural Selection and Adaptations

**Connections to other DCIs in this grade-band:**
- MS.LS2.A (MS-LS4-1),(MS-LS4-6); MS.LS2.C (MS-LS4-6); MS.LS3.A (MS-LS4-2),(MS-LS4-4); MS.LS3.B (MS-LS4-2),(MS-LS4-4),(MS-LS4-6); MS.ESS1.C (MS-LS4-1),(MS-LS4-2),(MS-LS4-6); MS.ESS2.B (MS-LS4-1)

**Articulation of DCIs across grade-bands:**
- 3.LS3.B (MS-LS4-4); 3.LS4.A (MS-LS4-1),(MS-LS4-2); 3.LS4.B (MS-LS4-4); 3.LS4.C (MS-LS4-6); HS.LS2.A (MS-LS4-4),(MS-LS4-6); HS.LS2.C (MS-LS4-6); HS.LS3.B (MS-LS4-4),(MS-LS4-6); HS.LS4.A (MS-LS4-1),(MS-LS4-2),(MS-LS4-3); HS.LS4.B (MS-LS4-4),(MS-LS4-6); HS.LS4.C (MS-LS4-4),(MS-LS4-6); HS.ESS1.C (MS-LS4-1),(MS-LS4-2)

**Common Core State Standards Connections:**

**ELA/Literacy -**
- **RST.6-8.1** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-LS4-1),(MS-LS4-2),(MS-LS4-3),(MS-LS4-4)
- **RST.6-8.7** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-LS4-1),(MS-LS4-3)
- **RST.6-8.9** Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-LS4-3),(MS-LS4-4)
- **WHST.6-8.2** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. (MS-LS4-2),(MS-LS4-4)
- **WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research. (MS-LS4-2),(MS-LS4-4)

**SL.8.1** Engage effectively in a range of collaborative discussions (one-on-one, in groups, teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others' ideas and expressing their own clearly. (MS-LS4-2),(MS-LS4-4)

**SL.8.4** Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation. (MS-LS4-2),(MS-LS4-4)

**Mathematics -**
- **MP.4** Model with mathematics. (MS-LS4-6)
- **6.RP.A.1** Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities. (MS-LS4-4),(MS-LS4-6)
- **6.SP.B.5** Summarize numerical data sets in relation to their context. (MS-LS4-4),(MS-LS4-6)
- **6.EE.B.6** Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set. (MS-LS4-1),(MS-LS4-2)
- **7.RP.A.2** Recognize and represent proportional relationships between quantities. (MS-LS4-4),(MS-LS4-6)
| CONTENT AREA: Science | GRADE: 8 | UNIT: 3 | UNIT NAME: Natural Selection and Adaptations |
How do organisms grow, develop, and reproduce?

Students understand how the environment and genetic factors determine the growth of an individual organism. They also demonstrate understanding of the genetic implications for sexual and asexual reproduction. Students develop evidence to support their understanding of the structures and behaviors that increase the likelihood of successful reproduction by organisms. They have a beginning understanding of the ways humans can select for specific traits, the role of technology, genetic modification, and the nature of ethical responsibilities related to selective breeding. At the end of the unit, students can explain how selected structures, functions, and behaviors of organisms change in predictable ways as they progress from birth to old age.

The Grades 3-5 Storyline provides a summary of the understandings that students developed by the end of 5th grade.

<table>
<thead>
<tr>
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<th>STUDENT LEARNING OBJECTIVES (SLO)</th>
<th>CORRESPONDING PEs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>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. [Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.]</td>
<td>MS-LS1-4</td>
</tr>
<tr>
<td>2</td>
<td>Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.] [Assessment Boundary: Assessment does not include genetic mechanisms, gene regulation, or biochemical processes.]</td>
<td>MS-LS1-5</td>
</tr>
<tr>
<td>3</td>
<td>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 organisms.</td>
<td>MS-LS3-1</td>
</tr>
<tr>
<td>CONTENT AREA: Science</td>
<td>GRADE: 8</td>
<td>UNIT: 6</td>
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<tr>
<td>the structure and function of the organism. [Clarification Statement: Emphasis is on conceptual understanding that changes in genetic material may result in making different proteins.] [Assessment Boundary: Assessment does not include specific changes at the molecular level, mechanisms for protein synthesis, or specific types of mutations.]</td>
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</tr>
<tr>
<td>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. [Clarification Statement: Emphasis is on using models such as Punnett squares, diagrams, and simulations to describe the cause and effect relationship of gene transmission from parent(s) to offspring and resulting genetic variation.]</td>
<td>4</td>
<td>MS-LS3-2</td>
</tr>
<tr>
<td>Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms. [Clarification Statement: Emphasis is on synthesizing information from reliable sources about the influence of humans on genetic outcomes in artificial selection (such as genetic modification, animal husbandry, gene therapy); and, on the impacts these technologies have on society as well as the technologies leading to these scientific discoveries.]</td>
<td>5</td>
<td>MS-LS4-5</td>
</tr>
</tbody>
</table>

The SLOs were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

<table>
<thead>
<tr>
<th>Science and Engineering Practices</th>
<th>Disciplinary Core Ideas</th>
<th>Crosscutting Concepts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Developing and Using Models</td>
<td>LS1.B: Growth and Development of Organisms</td>
<td>Cause and Effect</td>
</tr>
<tr>
<td>Modeling in 6-8 builds on K-5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.</td>
<td>- Organisms reproduce, either sexually or asexually, and transfer their genetic information to their offspring. (secondary to MS-LS3-2)</td>
<td>- Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS3-2)</td>
</tr>
<tr>
<td>- Develop and use a model to describe phenomena. (MS-LS3-1),(MS-LS3-2)</td>
<td>- Animals engage in characteristic behaviors that increase the odds of reproduction. (MS-LS1-4)</td>
<td>- Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. (MS-LS1-4),(MS-LS1-5),(MS-LS4-5)</td>
</tr>
<tr>
<td>Constructing Explanations and Designing Solutions</td>
<td>- Plants reproduce in a variety of ways, sometimes depending on animal behavior and</td>
<td>Structure and Function</td>
</tr>
<tr>
<td>Constructing explanations and designing solutions in 6-8 builds on K-5 experiences and</td>
<td></td>
<td>- Complex and microscopic structures</td>
</tr>
</tbody>
</table>
progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific knowledge, principles, and theories.

- Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future. (MS-LS1-5)

Engaging in Argument from Evidence
Engaging in argument from evidence in 6–8 builds on K-5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS1-4)

Obtaining, Evaluating, and Communicating Information
Obtaining, evaluating, and communicating information in 6–8 builds on K-5 experiences and progresses to evaluating the merit and validity of ideas and methods.

specialized features for reproduction. (MS-LS1-4)

- Genetic factors as well as local conditions affect the growth of the adult plant. (MS-LS1-5)

LS3.A: Inheritance of Traits
- Genes are located in the chromosomes of cells, with each chromosome pair containing two variants of each of many distinct genes. Each distinct gene chiefly controls the production of specific proteins, which in turn affects the traits of the individual. Changes (mutations) to genes can result in changes to proteins, which can affect the structures and functions of the organism and thereby change traits. (MS-LS3-1)

- Variations of inherited traits between parent and offspring arise from genetic differences that result from the subset of chromosomes (and therefore genes) inherited. (MS-LS3-2)

LS3.B: Variation of Traits
- In sexually reproducing organisms, each parent contributes half of the genes acquired (at random) by the offspring. Individuals have two of each chromosome and hence two alleles of each gene, one acquired from each parent. These versions may be identical or may differ from each other. Differences in these versions can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts, therefore complex natural structures/systems can be analyzed to determine how they function. (MS-LS3-1)

Connections to Engineering, Technology, and Applications of Science

Interdependence of Science, Engineering, and Technology
Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-LS4-5)

Connections to Nature of Science

Scientific Knowledge Assumes an Order and Consistency in Natural Systems
Science assumes that objects and events in natural systems occur in consistent patterns that are understandable through measurement and observation. (MS-LS4-1),(MS-LS4-2)

Science Addresses Questions About the Natural and Material World
Scientific knowledge can describe the consequences of actions but does not necessarily prescribe the decisions that
### Voorhees Township Public Schools
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**CONTENT AREA:** Science  
**GRADE:** 8  
**UNIT:** 6  
**UNIT NAME:** Growth, Development, and Reproduction of Organisms

- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-LS4-5)

- In addition to variations that arise from sexual reproduction, genetic information can be altered because of mutations. Though rare, mutations may result in changes to the structure and function of proteins. Some changes are beneficial, others harmful, and some neutral to the organism. (MS-LS3-1)

- **LS4.B: Natural Selection**
  - In artificial selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. (MS-LS4-5)

<table>
<thead>
<tr>
<th>Connections to other DCIs in this grade-band:</th>
</tr>
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<tbody>
<tr>
<td>MS.LS1.A (MS-LS3-1); MS.LS2.A (MS-LS1-4), (MS-LS1-5); MS.LS4.A (MS-LS3-1)</td>
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<th>Articulation of DCIs across grade-bands:</th>
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<td>3.LS1.B (MS-LS1-4), (MS-LS1-5); 3.LS3.A (MS-LS1-5), (MS-LS3-1), (MS-LS3-2); 3.LS3.B (MS-LS3-1), (MS-LS3-2); HS.LS1.A (MS-LS3-1); HS.LS1.B (MS-LS3-1), (MS-LS3-2); HS.LS2.A (MS-LS1-4), (MS-LS1-5); HS.LS2.D (MS-LS1-4); HS.LS3.A (MS-LS3-1), (MS-LS3-2); HS.LS3.B (MS-LS3-1), (MS-LS3-2), (MS-LS4-5); HS.LS4.C (MS-LS4-5)</td>
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<tbody>
<tr>
<td>ELA/Literacy -</td>
</tr>
<tr>
<td>RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-LS1-4), (MS-LS1-5), (MS-LS3-1), (MS-LS3-2), (MS-LS4-5)</td>
</tr>
</tbody>
</table>

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<table>
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</tr>
</thead>
</table>

2) \( (MS\text{-}LS4\text{-}5) \)

**RST.6-8.2** Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. \( (MS\text{-}LS1\text{-}5) \)

**RST.6-8.4** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics. \( (MS\text{-}LS3\text{-}1),(MS\text{-}LS3\text{-}2) \)

**RST.6-8.7** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). \( (MS\text{-}LS3\text{-}1),(MS\text{-}LS3\text{-}2) \)

**RI.6.8** Trace and evaluate the argument and specific claims in a text, distinguishing claims that are supported by reasons and evidence from claims that are not. \( (MS\text{-}LS1\text{-}4) \)

**WHST.6-8.1** Write arguments focused on discipline content. \( (MS\text{-}LS1\text{-}4) \)

**WHST.6-8.2** Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content. \( (MS\text{-}LS1\text{-}5) \)

**WHST.6-8.8** Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. \( (MS\text{-}LS4\text{-}5) \)

**WHST.6-8.9** Draw evidence from informational texts to support analysis, reflection, and research. \( (MS\text{-}LS1\text{-}5) \)

**SL.8.5** Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. \( (MS\text{-}LS3\text{-}1),(MS\text{-}LS3\text{-}2) \)

**Mathematics -**

**MP.4** Model with mathematics. \( (MS\text{-}LS3\text{-}2) \)

**6.SP.A.2** Understand that a set of data collected to answer a statistical question has a distribution which can be described by its center, spread, and overall shape. \( (MS\text{-}LS1\text{-}4),(MS\text{-}LS1\text{-}5) \)

**6.SP.B.4** Summarize numerical data sets in relation to their context. \( (MS\text{-}LS1\text{-}4),(MS\text{-}LS1\text{-}5) \)
<table>
<thead>
<tr>
<th>6.SP.B.5</th>
<th>Summarize numerical data sets in relation to their context. (MS-LS3-2)</th>
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CONTENT AREA: Science  
GRADE: 8  
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Link to
Next Generation Science Standards

Evidence Statements
Grades 6 - 8

http://www.nextgenscience.org/evidence-statements