Clinton-Glen Gardner School District

Curriculum Management System

SCIENCE

Grade: 8

August 2016

*** For adoption by all regular education programs as specified and for adoption or adaptation by all Special Education Programs in accordance with Board of Education Policy #2200.**

Board Approved: August 24, 2016

CLINTON-GLEN GARDNER SCHOOL DISTRICT

ADMINISTRATION

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Mrs. Lisa J. Craft, Business Administrator
Mrs. Jacqueline Turner, Assistant Principal
Mrs. Jenine Kastner, Supervisor of Special Services

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Acknowledgments

The following individuals are acknowledged for their assistance in the preparation of this Curriculum Management System:

Writers' Names: **Kate Lascelle**
Stacy Viotto

Clinton-Glen Gardner School District

Mission

The Clinton-Glen Gardner School District is a community who values traditions. Our MISSION is to nurture and cultivate each child to be a compassionate, curious, and creative thinker, entrusted and empowered to build and lead the future.

Philosophy

Science, engineering, and technology influence and permeate every aspect of modern life. Some knowledge of science and engineering is required to engage with the major public policy issues of today as well as to make informed everyday decisions, such as selecting among alternative medical treatments or determining how to invest public funds for water supply options. In addition, understanding science and the extraordinary insights it has produced can be meaningful and relevant on a personal level, opening new worlds to explore and offering lifelong opportunities for enriching people's lives. In these contexts, learning science is important for everyone, even those who eventually choose careers in fields other than science or engineering.

The Next Generation Science Standards (NGSS) are K–12 science content standards. Standards set the expectations for what students should know and be able to do. The NGSS were developed by states to improve science education for all students.

A goal for developing the NGSS was to create a set of research-based, up-to-date K–12 science standards. These standards give local educators the flexibility to design classroom learning experiences that stimulate students' interests in science and prepares them for college, careers, and citizenship. The CPS Science Curriculum is designed to address the goals and philosophy of the New Jersey Next Generation Science Standards.

Grade 8 Science
Scope and Sequence

<table>
<tr><th colspan="2">Quarter I</th></tr>
<tr><th>Unit 1: Structure and Properties of Matter</th><th>Unit 2: Interactions of Matter</th></tr>
<tr><td>(The ones that apply for these units are in bold)

21st Century Skills
1. Creativity & Innovation
2. Critical Thinking & Problem Solving
3. Communication & Collaboration
4. Media Literacy
5. Information Literacy
6. Information, Communication & Technology</td><td>

Cross Cutting Concepts
1. Patterns
2. Cause and Effect
3. Scale, Proportion, and Quantity
4. Systems and System Models
5. Energy and Matter: Flows, Cycles, and Conservation
6. Structure and Function
7. Stability and Change</td></tr>
<tr><td>21st Century Themes
1. Global Awareness
2. Financial, Economic, Business and Entrepreneurial Literacy
3. Civic Literacy
4. Health Literacy
5. Environmental Literacy</td><td>Scientific and Engineering Practices
1. Asking Questions and Defining Problems
2. Developing and Using Models
3. Planning and Carrying Out Investigations
4. Analyzing and Interpreting Data
5. Using Mathematics and Computational Thinking
6. Constructing Explanations and Designing Solutions
7. Engaging in Argument from Evidence
8. Obtaining, Evaluating, and Communicating Information</td></tr>
<tr><td colspan="2">Technology Infusion

http://www.state.nj.us/education/, Internet, Web Quests, content-related websites, wireless laptop computers, computer laboratory, classroom computers, SMART Boards, CDs, DVDs, webinars, video streaming, podcasting</td></tr>
<tr><td colspan="2">Differentiation

Refer to CPS Differentiation Tool Kit</td></tr>
</table>

Assessment

District End of Quarter Performance Based Assessment
District End of Unit Tests
Various opportunities during projects and laboratory investigations for formative assessment and anecdotal notes
During Work Period adjust lessons for individual students and small groups of students based on formative and summative data (Go back and re-teach for those that did not meet standard on benchmark and plan accordingly for those that exceeded benchmark)

Quarter II

Unit 3: Chemical Reactions	Unit 4: Conducting a Scientific Investigation
(The ones that apply for this unit are in bold) 21st Century Skills **1. Creativity & Innovation** **2. Critical Thinking & Problem Solving** **3. Communication & Collaboration** 4. Media Literacy **5. Information Literacy** **6. Information, Communication & Technology**	Cross Cutting Concepts 1. Patterns **2. Cause and Effect** 3. Scale, Proportion, and Quantity 4. Systems and System Models **5. Energy and Matter: Flows, Cycles, and Conservation** 6. Structure and Function 7. Stability and Change
21st Century Themes **1. Global Awareness** **2. Financial, Economic, Business and Entrepreneurial Literacy** **3. Civic Literacy** **4. Health Literacy** **5. Environmental Literacy**	Scientific and Engineering Practices **1. Asking Questions and Defining Problems** **2. Developing and Using Models** **3. Planning and Carrying Out Investigations** **4. Analyzing and Interpreting Data** **5. Using Mathematics and Computational Thinking** **6. Constructing Explanations and Designing Solutions** **7. Engaging in Argument from Evidence** **8. Obtaining, Evaluating, and Communicating Information**

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Differentiation

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Quarter III

Unit 5: Relationships Among Forms of Energy	Unit 6: Thermal Energy
(The ones that apply for this unit are in bold) 21st Century Skills **1. Creativity & Innovation** **2. Critical Thinking & Problem Solving** **3. Communication & Collaboration** 4. Media Literacy **5. Information Literacy** **6. Information, Communication & Technology**	Cross Cutting Concepts 1. Patterns 2. Cause and Effect **3. Scale, Proportion, and Quantity** **4. Systems and System Models** **5. Energy and Matter: Flows, Cycles, and Conservation** 6. Structure and Function 7. Stability and Change
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Quarter IV

Unit 7: Waves and the Electromagnetic Spectrum

(The ones that apply for these units are in bold)

21st Century Skills

1. **Creativity & Innovation**
2. **Critical Thinking & Problem Solving**
3. **Communication & Collaboration**
4. **Media Literacy**
5. **Information Literacy**
6. **Information, Communication & Technology**

Cross Cutting Concepts

1. **Patterns**
2. Cause and Effect
3. Scale, Proportion, and Quantity
4. Systems and System Models
5. Energy and Matter: Flows, Cycles, and Conservation
6. **Structure and Function**
7. Stability and Change

21st Century Themes

1. **Global Awareness**
2. Financial, Economic, Business and Entrepreneurial Literacy
3. **Civic Literacy**
4. **Health Literacy**
5. **Environmental Literacy**

Scientific and Engineering Practices

1. Asking Questions and Defining Problems
2. **Developing and Using Models**
3. Planning and Carrying Out Investigations
4. Analyzing and Interpreting Data
5. **Using Mathematics and Computational Thinking**
6. Constructing Explanations and Designing Solutions
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Suggested days of Instruction	**Curriculum Management System** **<u>Subject/Grade Level</u>:** **Grade 8** **Science**	**Topic: Structure and Properties of Matter** **<u>Goal 1:</u>** The Structure and Properties of Matter Unit is designed to allow students to build an understanding of what occurs at the atomic and molecular level. Students will be able to demonstrate an understanding that pure substances have characteristic properties and are made from a single type of atom or molecule. They will also be able to provide molecular level accounts to explain states of matter and become familiar with changes between states.	
	Objectives / Cluster Concepts / Disciplinary Core Ideas (DCI's) **The student will be able to:**	**Essential Questions,** **Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
Sept. -	1.1 Develop models to describe the atomic composition of simple molecules and extended structures. (MS-PS1-1) 1.2 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. (MS-PS1-2) 1.3 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (MS-ETS1-2)	**Essential Questions:** What is the structure of an atom? What is a pure substance? How can particles combine to produce a substance with different properties? What are elements, and how do they relate to compounds? What information about elements is found in the periodic table? **Conceptual Understandings:** Electrons, protons, and neutrons are the subunits of an atom and have measurable properties, including mass and charge. Pure substances are composed of one type of matter and have a specific set of properties. 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. Each pure substance has characteristic physical and chemical properties that can be used to identify it. These properties can include color, texture, flammability, and reactivity.	**Learning Activities:** Textbook Analysis "Matter" Web Quests Models of Atoms Modeling Compounds activity Exploring Types of Matter "Methods of Separation" lab "Isolating Copper by Electrolysis" lab Alka Seltzer lab Navigating the Periodic Table of Elements Flame Testing lab **Assessment Models:** Comprehension questions Science Journal writing Tests and Quizzes Group Discussions Laboratory Investigations "Structure and Properties of Matter" Group Project "Element Mnemonic" Project Physical vs. Chemical Changes Compare/Contrast Essay **Additional Resources:** *Science World* magazine

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	Objectives / Cluster Concepts / Disciplinary Core Ideas (DCI's) **The student will be able to:**	**Essential Questions,** **Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
		Solids, liquids, and gases differ in the ways their particles are arranged and move. Elements are pure substances that cannot be broken into any other substance; they are the simplest substances. When two or more elements combine chemically, a compound is formed. The Periodic Table organizes the elements into families or groups with similar properties.	*Cool Careers in STEM* book series **Technology Resources:** www.chem4kids.com Periodic Table apps www.ptable.com www.webelements.com

Suggested days of Instruction	Curriculum Management System **Subject/Grade Level:** **Grade 8** **Science**	**Topic: Interactions of Matter** **Goal 2:** The Interactions of Matter Unit will allow students to provide molecular level accounts of changes between states and how chemical reactions involve regrouping of atoms to form new substances. They will also explore various polymers and their impacts on society.	
	Objectives / Cluster Concepts / Disciplinary Core Ideas (DCI's) **The student will be able to:**	**Essential Questions,** **Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
Oct./ Nov.	2.1 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society. (MS-PS1-3) 2.2 Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added. (MS-PS1-4) 2.3 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (MS-ETS1-2) 2.4 Analyze data from tests to determine similarities and differences among several design solutions to identify the	**Essential Questions:** Why are many natural and synthetic materials technologically useful? What is a polymer? What is a phase change, or change in state? How can particles combine to produce a substance with different properties? How are the volume, temperature, and pressure of a gas related? **Conceptual Understandings:** Polymers form when chemical bonds link large numbers of monomers in a repeating pattern. Synthetic polymers are inexpensive to make, strong, and last a long time. The changes of state that occur with variations in temperature or pressure can be described and predicted using models of matter. Boyle's, Charles's, and Lussac's Laws describe the relationships among volume, temperature, and pressure in gases. A phase change involves a change in the state of matter of a substance not a change in its chemical composition.	**Learning Activities:** Textbook Analysis Polymer Exploration Polyester Fleece History Phase Change activities "Instant Snow" lab "Oobleck" lab "Gas Laws" labs **Assessment Models:** Comprehension questions Science Journal writing Tests and Quizzes Group Discussions Laboratory Investigations **Additional Resources:** *Science World* magazine *Cool Careers in STEM* book series **Technology Resources:** www.youtube.com www.chem4kids.com

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	Objectives / Cluster Concepts / Disciplinary Core Ideas (DCI's) **The student will be able to:**	**Essential Questions,** **Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
	best characteristics of each that can be cobined into a new solution to better meet the criteria for success. (MS-ETS1-3) 2.5 Develop a model to generate data for iterative testing and modificaton of a proposed object, tool, or process such that an optimal design can be achieved. (MS-ETS1-4)	A substance changes state when thermal energy is increased or decreased. 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.	

Suggested days of Instruction	Curriculum Management System **Subject/Grade Level:** **Grade 8** **Science**	**Topic: Chemical Reactions** **Goal 3:** In this unit students will be provided with a deeper understanding of how chemical reactions involve regrouping atoms to form new substances and how atoms rearrange during chemical reactions. They will also be able to apply an understanding of the design and process of optimization in engineering to chemical reaction systems.	
	Objectives / Cluster Concepts / Disciplinary Core Ideas (DCI's) **The student will be able to:**	**Essential Questions,** **Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
Dec.	3.1 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-PS1-5) 3.2 Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. (MS-PS1-6) 3.3 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (MS-ETS1-2) 3.4 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each	**Essential Questions:** How do substances react to form new substances? What happens when new substances are formed? What stays the same and what changes in a chemical reaction? **Conceptual Understandings:** 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. The total number of each type of atoms is conserved, and thus the mass does not change The Law of Conservation of Matter is applied here (The mass of the reactants is equal to the mass of the products). Some chemical reactions release energy, others store energy. A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. 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.	**Learning Activities:** Textbook Analysis Distinguishing Between Physical and Chemical Changes "White Before My Eyes" lab Balancing Chemical Equations "Exothermic vs. Endothermic Reactions" lab The Formation of Fireworks "Genie in the Bottle" demonstration "Elephant's Toothpaste" demonstration **Assessment Models:** Comprehension questions Science Journal writing Tests and Quizzes Group Discussions Laboratory Investigations " A Frosty Dilemma" Performance Based Assessment **Additional Resources:** *Science World* magazine *Cool Careers in STEM* book series **Technology Resources:** www.chem4kids.com www.youtube.com

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	Objectives / Cluster Concepts / Disciplinary Core Ideas (DCI's) **The student will be able to:**	**Essential Questions,** **Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
	that can be cobined into a new solution to better meet the criteria for success. (MS-ETS1-3) 3.5 Develop a model to generate data for iterative testing and modificaton of a proposed object, tool, or process such that an optimal design can be achieved. (MS-ETS1-4)	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 the best solution. Science involves practicing productive social interactions with peers, including partner and small-group work.	

Suggested days of Instruction	**Curriculum Management System** **Subject/Grade Level:** **Grade 8** **Science**	**Topic: Conducting a Scientific Investigation** **Goal 4:** This unit focuses primarily on giving students the opportunity to apply the optimization design and process in engineering to a physical science concept. Students will define a problem and develop and carry out a plan to test a scientific hypothesis. They will analyze data to provide the support to prove or disprove the prediction on which the hypothesis is based. Students will also devise alternate possible solutions to achieve optimal results.	
	Objectives / Cluster Concepts / Disciplinary Core Ideas (DCI's) **The student will be able to:**	**Essential Questions,** **Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
Jan.-Feb.	4.1 Define the critieria and constraints of a desiggn 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-ETS1-1) 4.2 Evaluate competing desgn solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (MS-ETS1-2) 4.3 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	**Essential Questions:** What are the appropriate steps involved in conducting a scientific investigation? What is meant by a "fair test"? Why do some variables need to be controlled in an experiment? What are the criteria for a valid conclusion? **Conceptual Understandings:** Not all questions can be scientifically researched. Evidence is generated and evaluated as part of building and refining solutions. Scientific reasoning is used to support scientific conclusions. Scientific conclusions are based on data, both qualitative and quantitative, gathered by repeated tests to solve a problem or answer a question. The tests were designed in an attempt to prove a formulated hypothesis. Trends in the data should either support or disprove hypotheses.	**Learning Activities:** Distinguish between Inventions and Investigations Identify Elements of a Science Fair Project Modeling Steps in a Scientific Investigation Mini-lesson on how to write an experimental procedure Mini-lesson on how to write a scientific conclusion **Assessment Models:** Comprehension questions Science Journal writing Group Discussions "Pair and Share" student interaction Science Fair Project Science Fair participation **Additional Resources:** ExxonMobil guest speaker **Technology Resources:** www.discoveryeducation.com www.sciencebuddies.org

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	Objectives / Cluster Concepts / Disciplinary Core Ideas (DCI's) **The student will be able to:**	**Essential Questions,** **Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
	new solution to better meet the criteria for success. (MS-ETS1-3) 4.4 Develop a model to generate data for iterative testing and modificaton of a proposed object, tool, or process such that an optimal design can be achieved. (MS-ETS1-4)	Recommended revisions in the experimental design encourage further testing. The iterative process of testing the most promising hypotheses and modifying what is suggested by the test results leads to greater refinement and ultimately to an optimal solution. .	

Suggested days of Instruction	**Curriculum Management System** **Subject/Grade Level:** **Grade 8** **Science**	**Topic: Relationships Among Forms of Energy** **Goal 5:** The Relationships Among Forms of Energy Unit is designed to allow students to make sense of the relationship between energy and forces. Students will develop an understanding of important qualitative ideas about the conservation of energy. They will understand that objects that are moving have kinetic energy and that objects may also contain stored (potential) energy, depending on their relative positions.	
	Objectives / Cluster Concepts / Disciplinary Core Ideas (DCI's) **The student will be able to:**	**Essential Questions,** **Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
Feb.-Mar.	5.1 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-PS3-1) 5.2 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-PS3-2) 5.3 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. (MS-PS3-5)	**Essential Questions:** How can energy be transferred from one object to another? What happens to the energy of an object in motion? What is the relationship between potential and kinetic energy? **Conceptual Understandings:** Motion energy is called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. A system of objects may also contain stored (potential) energy, depending on their relative positions. When the motion energy of an object changes, there is some other change in energy at the same time. The Law of Conservation of Energy is applied. Energy is neither lost nor gained; but rather, it is transformed. When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. Newton's Third Law of Motion states, "for every action, there is an equal but opposite reaction."	**Learning Activities:** Textbook Analysis Newton's Cradle demonstration "Egg Drop" lab "Colliding Cars" investigations Building a Digital Rube Goldberg Machine **Assessment Models:** Comprehension questions Science Journal writing Tests and Quizzes Class Discussions Laboratory Investigations "Pendulum" Project **Additional Resources:** *Science World* magazine *Cool Careers in STEM* book series **Technology Resources:** www.physicsclassroom.com www.teachengineering.com

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Suggested days of Instruction	Curriculum Management System **Subject/Grade Level:** **Grade 8** **Science**	**Topic: Thermal Energy** **Goal 6:** In the unit on Thermal Energy students will develop, conduct, and analyze data from investigations to differentiate between energy and temperature. Students will use these practices to understand the total change of energy in any system is always equal to the total energy tranferred into or out of the system.	
	Objectives / Cluster Concepts / Disciplinary Core Ideas (DCI's) **The student will be able to:**	**Essential Questions,** **Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
Apr.	6.1 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. (MS-LS3-3) 6.2 Plan an investigation to determine the relationship 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-LS3-4) 6.3 Define the critieria and constraints of a desiggn 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.	**Essential Questions:** What are some forms of energy that are related to changes in matter? How is chemical energy related to thermal energy? What is thermal energy? How does thermal energy affect particles? **Conceptual Understandings:** In an exothermic chemical change, chemical energy can be transformed and released in the form of thermal energy. Thermal energy is the total energy of all of the particles in an object. The term "heat" as used in everyday language refers both to thermal energy and the transfer of that thermal energy from one object to another. 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. 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. Energy is spontaneously transferred out of hotter regions or objects and into colder ones. The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or	**Learning Activities:** Textbook Analysis Heat Transfer labs "Seltzer Reaction Rates" lab **Assessment Models:** Comprehension questions Science Journal writing Tests and Quizzes Group Discussions Laboratory Investigations "Feel the Heat" project **Additional Resources:** *Science World* magazine *Cool Careers in STEM* book series **Technology Resources:** www.pbs.org www.explorelearning.com

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Suggested days of Instruction	Curriculum Management System **Subject/Grade Level:** **Grade 8** **Science**	**Topic: Waves and the Electromagnetic Spectrum** **Goal 7:** In this unit of study, students will describe and predict characteristic properties and behaviors of waves. Students will also apply their undertanding of waves as a means of sending digital information. Students will have the opportunity to explore sound and light in multitudinous ways.	
	Objectives / Cluster Concepts / Disciplinary Core Ideas (DCI's) **The student will be able to:**	**Essential Questions,** **Conceptual Understandings**	**Instructional Tools / Materials / Technology / Resources / Learning Activities / Interdisciplinary Activities / Assessment Model**
May-June	7.1 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-PS4-1) 7.2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. (MS-PS4-2) 7.3 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. (MS-PS4-3) *7.4* Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and	**Essential Questions:** What are the characteristics and types of waves and how are they utilized? What is the Electromagnetic Spectrum? How does sound travel and how is it utilized? How does light travel and how is it utilized? **Conceptual Understandings:** A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. Waves can be used for communication purposes. A sound wave needs a medium through which it is transmitted. It travels through a series of compressions and rarefactions of the particles in the medium. When light shine 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. The path light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g. air and water, water and glass) where the light path refracts. A wave model of light is useful for explaining brightness, color and the frequency-dependent bending of light at a surface between media. However, because light can travel through space, it cannot be a matter wave, like sound or	**Learning Activities:** Textbook Analysis Wave exploration activities using springs and ropes "Ripple Tank" lab Using prisms to refract light Using mirrors to reflect light Infrared investigations Analog vs. Digital Systems comparisons **Assessment Models:** Comprehension questions Science Journal writing Tests and Quizzes Group Discussions Laboratory Investigations **Additional Resources:** *Science World* magazine *Cool Careers in STEM* book series **Technology Resources:** www.pbs.org www.explorelearning.com www.physicsclsassroom.com www.youtube.com

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	constraints of the problem. (MS-ETS1-2) 7.5 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-ETS1-3)	water waves. Digitized signals (sent as wave impulses) are a more reliable way to encode and transmit information.	