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**2015 7th Grade Timeline Ocean County Curriculum**

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| **Unit** | **Weeks** |
| Introduction to Engineering and Design | 2 |
| Forces and Interactions | 8 |
| Energy | 10 |
| History of Earth | 10 |
| Earth Systems | 10 |

The sequence of units is recommended based on the 2013 Next Generation Science Standards.

**See the** [**Engineering Design standards**](http://www.nextgenscience.org/msets1-engineering-design) **or the attached hard copy.**

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| ***2015 Ocean County Science Curriculum*** | | |
| ***Grade 7***  ***Unit: Forces and Interactions*** | | |
| ***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. | | |
| **#** | **STUDENT LEARNING OBJECTIVES (SLO)** | **Corresponding**  **PEs** |
| **1** | **Apply Newton’s Third Law to design a solution to a problem involving the motion of two colliding objects.\*** [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.] [*Assessment Boundary: Assessment is limited to vertical or horizontal interactions in one dimension.*] | **MS-PS2-1** |
| **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.** [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.] [*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.]* | **MS-PS2-2** |
| **3** | **Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.** [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.] [*Assessment Boundary: Assessment about questions that require quantitative answers is limited to proportional reasoning and algebraic thinking.*] | **MS-PS2-3** |
| **4** | **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.*] | **MS-PS2-4** |
| **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.** [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.*] | **MS-PS2-5** |

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| The SLOs were developed using [the following elements from the NRC document *A Framework for K-12 Science Education*](http://www.nextgenscience.org/msps-fi-forces-interactions#framework): | | |
| **Science and Engineering Practices**  [**Asking Questions and Defining Problems**](http://www.nap.edu/openbook.php?record_id=13165&page=54)  [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.](http://www.nap.edu/openbook.php?record_id=13165&page=54)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=54)   [**Planning and Carrying Out Investigations**](http://www.nap.edu/openbook.php?record_id=13165&page=59)  [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.](http://www.nap.edu/openbook.php?record_id=13165&page=59)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=59) * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=59)   [**Constructing Explanations and Designing Solutions**](http://www.nap.edu/openbook.php?record_id=13165&page=67)  [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.](http://www.nap.edu/openbook.php?record_id=13165&page=67)   * [Apply scientific ideas or principles to design an object, tool, process or system. (MS-PS2-1)](http://www.nap.edu/openbook.php?record_id=13165&page=67)   [**Engaging in Argument from Evidence**](http://www.nap.edu/openbook.php?record_id=13165&page=71)  [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.](http://www.nap.edu/openbook.php?record_id=13165&page=71)   * [Construct 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 or a solution to a problem. (MS-PS2-4)](http://www.nap.edu/openbook.php?record_id=13165&page=71)   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  ***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)   [***21st Century themes and skills***](http://www.p21.org/storage/documents/21stcskillsmap_science.pdf) ***(This link is taken from the Partnership for 21st Century Skills)***   * creativity and innovation * critical thinking and problem solving * communication * collaboration * information literacy * media literacy * information and communications technology (ICT) * literacy * flexibility and adaptability * initiative and self direction * social and cross cultural skills * productivity and accountability * leadership and responsibility | **Disciplinary Core Ideas**  [**PS2.A: Forces and Motion**](http://www.nap.edu/openbook.php?record_id=13165&page=114)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=114) * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=114) * [All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. (MS-PS2-2)](http://www.nap.edu/openbook.php?record_id=13165&page=114)   [**PS2.B: Types of Interactions**](http://www.nap.edu/openbook.php?record_id=13165&page=116)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=116) * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=116) * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=116) | **Crosscutting Concepts**  [**Cause and Effect**](http://www.nap.edu/openbook.php?record_id=13165&page=87)   * [Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS2-3),(MS-PS2-5)](http://www.nap.edu/openbook.php?record_id=13165&page=87)   [**Systems and System Models**](http://www.nap.edu/openbook.php?record_id=13165&page=91)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=91)   [**Stability and Change**](http://www.nap.edu/openbook.php?record_id=13165&page=98)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=98)      - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  ***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) |

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| ***Connections to other DCIs in this grade-band:***  [**MS.PS3.A**](http://www.nextgenscience.org/msps3-energy) (MS-PS2-2); [**MS.PS3.B**](http://www.nextgenscience.org/msps3-energy) (MS-PS2-2); [**MS.PS3.C**](http://www.nextgenscience.org/msps3-energy) (MS-PS2-1); [**MS.ESS1.A**](http://www.nextgenscience.org/msess1-earth-place-universe) (MS-PS2-4); [**MS.ESS1.B**](http://www.nextgenscience.org/msess1-earth-place-universe) (MS-PS2-4); [**MS.ESS2.C**](http://www.nextgenscience.org/msess2-earth-systems) (MS-PS2-2),(MS-PS2-4) |
| ***Articulation of DCIs across grade-bands:***  [**3.PS2.A**](http://www.nextgenscience.org/3ps2-motion-stability-forces-interactions) (MS-PS2-1),(MS-PS2-2); [**3.PS2.B**](http://www.nextgenscience.org/3ps2-motion-stability-forces-interactions) (MS-PS2-3),(MS-PS2-5); [**5.PS2.B**](http://www.nextgenscience.org/5ps2-motion-stability-forces-interactions) (MS-PS2-4); [**HS.PS2.A**](http://www.nextgenscience.org/hsps2-motion-stability-forces-interactions) (MS-PS2-1),(MS-PS2-2); [**HS.PS2.B**](http://www.nextgenscience.org/hsps2-motion-stability-forces-interactions) (MS-PS2-3),(MS-PS2-4),(MS-PS2-5); [**HS.PS3.A**](http://www.nextgenscience.org/hsps3-energy) (MS-PS2-5); [**HS.PS3.B**](http://www.nextgenscience.org/hsps3-energy) (MS-PS2-2),(MS-PS2-5); [**HS.PS3.C**](http://www.nextgenscience.org/hsps3-energy) (MS-PS2-5); [**HS.ESS1.B**](http://www.nextgenscience.org/hsess1-earth-place-universe) (MS-PS2-2),(MS-PS2-4) |
| ***Interdisciplinary Connections:***   |  |  | | --- | --- | | *ELA/Literacy -* | | | [**RST.6-8.1**](http://www.corestandards.org/ELA-Literacy/RST/6-8) | [Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.](http://www.corestandards.org/ELA-Literacy/RST/6-8) *(MS-PS2-1),(MS-PS2-3)* | | [**RST.6-8.3**](http://www.corestandards.org/ELA-Literacy/RST/6-8) | [Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.](http://www.corestandards.org/ELA-Literacy/RST/6-8) *(MS-PS2-1),(MS-PS2-2),(MS-PS2-5)* | | [**WHST.6-8.1**](http://www.corestandards.org/ELA-Literacy/WHST/6-8) | [Write arguments focused on *discipline-specific content*.](http://www.corestandards.org/ELA-Literacy/WHST/6-8) (MS-PS2-4) | | [**WHST.6-8.7**](http://www.corestandards.org/ELA-Literacy/WHST/6-8) | [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.](http://www.corestandards.org/ELA-Literacy/WHST/6-8) *(MS-PS2-1)*,(MS-PS2-2),*(MS-PS2-5)* | | *Mathematics -* | | | [**MP.2**](http://www.corestandards.org/Math/Practice/MP2) | [Reason abstractly and quantitatively.](http://www.corestandards.org/Math/Practice/MP2) (MS-PS2-1),(MS-PS2-2),(MS-PS2-3) | | [**6.NS.C.5**](http://www.corestandards.org/Math/Content/6/NS) | [Understand that positive and negative numbers are used together to describe quantities having opposite directions or values; use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation.](http://www.corestandards.org/Math/Content/6/NS) (MS-PS2-1) | | [**6.EE.A.2**](http://www.corestandards.org/Math/Content/6/EE) | [Write, read, and evaluate expressions in which letters stand for numbers.](http://www.corestandards.org/Math/Content/6/EE) *(MS-PS2-1),(MS-PS2-2)* | | [**7.EE.B.3**](http://www.corestandards.org/Math/Content/7/EE) | [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.](http://www.corestandards.org/Math/Content/7/EE) *(MS-PS2-1),(MS-PS2-2)* | | [**7.EE.B.4**](http://www.corestandards.org/Math/Content/7/EE) | [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.](http://www.corestandards.org/Math/Content/7/EE) *(MS-PS2-1),(MS-PS2-2)* | |

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| **Grade Level:** 7 | **Title of Unit:**  Force and Interactions |
| **Stage 1 - Desired Results** | |
| **Understandings:**  *Students will understand that…*   * Objects can exert forces on each other even though the objects are not in contact * Gravitational interactions are always attractive but that electrical and magnetic forces can be both attractive and negative * The same basic rules govern the motion of all bodies, from planets and starts to birds and billiard balls | **Essential Questions:**   * How can one describe physical interactions between objects and within systems of objects? |
| **Knowledge:**  *Students will know…*   * an object is in motion if it changes position relative to a reference point * when you know both the speed and the direction of an object’s motion, you know the velocity of the object * acceleration is a change in velocity (increasing speed, decreasing speed, or a change in direction) * a force is described by its strength and by the direction in which it acts. * unbalanced forces acting on an object result in a net force and cause a change in the object’s motion. * balanced forces acting on an object do not change the object’s motion. * two factors affect the gravitational attraction between objects: mass and distance. * an object at rest will remain at rest, and an object moving at a constant velocity will continue moving at a constant velocity, unless it is acted upon by an unbalanced force. * acceleration depends on the object’s mass and on the net force acting on the object. * if one object exerts a force on another object, then the second object exerts a force of equal strength in the opposite direction on the first object. * impact of collisions between two cars and between a car and stationary objects * gravitational interactions are always attractive * when two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object * magnetic forces can be both attractive and negative * objects can exert forces on each other even though the objects are not in contact, through fields * magnetic force depends on the magnitude of the charges, or magnetic strength * electric forces can be both attractive and negative * objects can exert forces on each other even though the objects are not in contact, through fields * strength of electric force depends on magnitude of the current * An electric current produces a magnetic field * A magnetic field produced by a current has 3 distinctive characteristics: field can be turned on or off, have its direction reversed or have its strength changed | **Skills:**  *Students will be able to…*   * apply Newton’s Third Law of Motion to relate forces to explain the motion of objects * apply ideas about gravitational, electrical, and magnetic forces to explain a variety of phenomena * demonstrate proficiency in asking questions, planning and carrying out investigations, designing solutions, and engaging in arguments and to use these practices to demonstrate understanding of the core ideas * describe ways that unbalanced forces cause changes in motion * apply an engineering practice and concept to solve a problem caused when objects collide * describe the difference between mass and weight * investigate ideas that objects can exert forces on each other even though the objects are not in contact, through fields |

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| **Stage 2- Assessment Evidence** |
| **Performance Tasks and other evidence:**   * Summative Assessments   + RST- Research Simulation Task   + Unit tests and quizzes   + Labs and engineering based projects     - Apply Newton’s Laws to create a Lunar Landing System     - Rocket building/launching (bottle, alka seltzer, stomp, etc) * Formative Assessments   + Graphic Organizers & Guided Note Taking   + Directed Reading   + Cooperative Group Learning   + Homework   + Journal Entries |
| **Stage 3 – Learning Plan** |
| **Learning Activities:**   * collision lab * friction investigation (enrichment) * distance time graph (enrichment activity) * motion dot diagrams (differentiated activity) * explain how friction can be helpful and harmful * Electricity and magnetism lab; investigating forces between objects that are not in contact * bubble tube (enrichment) |
| **Digital information and technology integration:** Indicate any special considerations as well as materials, resources (online, print, video, audio) or equipment.   * Force & Motion activity resource: <http://www.t4t.org/wp-content/uploads/2013/08/8th_Grade_Forces-Motion_LessonPlan_Matrix.pdf> * Motion and Stability: Forces and Interactions: <http://www.ck12.org/ngss/middle-school-physical-sciences/motion-and-stability:-forces-and-interactions> * Electricity Unplugged: <http://www.sciport.org/clientuploads/TRGElectricityUnplugged.pdf> * Fun with gravity and center of mass: <http://www.csr.utexas.edu/grace/education/activities/pdf/Fun_Gravity.pdf> * The elephant and the feather: <http://www.physicsclassroom.com/mmedia/newtlaws/efff.cfm> * http://www.ck12.org/ngss/middle-school-physical-sciences/motion-and-stability:-forces-and-interactions |
| **Modifications: (ELLs, Special Education, Gifted and Talented)**  **\***  Follow all IEP modifications/504 plan  \* Teacher tutoring  \* Peer tutoring  \* Cooperative learning groups  \* Modified assignments  \* Differentiated instruction  **Presentation accommodations allow a student to:**  **\*** Listen to audio recordings instead of reading text  \* Learn content from audiobooks, movies, videos and digital media instead of reading print versions  \* Work with fewer items per page or line and/or materials in a larger print size  \* Have a designated reader  \* Hear instructions orally  \* Record a lesson, instead of taking notes  \* Have another student share class notes with him  \* Be given an outline of a lesson  \* Use visual presentations of verbal material, such as word webs and visual organizers  \* Be given a written list of instructions  **Response accommodations allow a student to:**  **\***  Give responses in a form (oral or written) that’s easier for him  \* Dictate answers to a scribe  \* Capture responses on an audio recorder  \* Use a spelling dictionary or electronic spell-checker  \* Use a word processor to type notes or give responses in class  \* Use a calculator or table of “math facts”  **Setting accommodations allow a student to:**  **\*** Work or take a test in a different setting, such as a quiet room with few distractions  \* Sit where he learns best (for example, near the teacher)  \* Use special lighting or acoustics  \* Take a test in small group setting  \* Use sensory tools such as an exercise band that can be looped around a chair’s legs (so fidgety kids can kick it and quietly get their energy out)  **Timing accommodations allow a student to:**  **\***  Take more time to complete a task or a test  \* Have extra time to process oral information and directions  \* Take frequent breaks, such as after completing a task  **Scheduling accommodations allow a student to:**  **\***  Take more time to complete a project  \* Take a test in several timed sessions or over several days  \* Take sections of a test in a different order  \* Take a test at a specific time of day  **Organization skills accommodations allow a student to:**  **\***  Use an alarm to help with time management  \* Mark texts with a highlighter  \* Have help coordinating assignments in a book or planner  \* Receive study skills instruction  **Assignment modifications allow a student to:**  **\*** Complete fewer or different homework problems than peers  \* Write shorter papers  \* Answer fewer or different test questions  \* Create alternate projects or assignments  **Curriculum modifications allow a student to:**  **\***  Learn different material (such as continuing to work on multiplication while classmates move on to fractions)  \* Get graded or assessed using a different standard than the one for classmates |

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| ***2015 Ocean County Science Curriculum*** | | |
| ***Grade 7***  ***Unit: Energy*** | | |
| ***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 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. | | |
| **#** | **STUDENT LEARNING OBJECTIVES (SLO)** | **Corresponding**  **PEs** |
| **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.** [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.] | **MS-PS3-1** |
| **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.** [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.*] | **MS-PS3-2** |
| **3** | **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.*] | **MS-PS3-3** |
| **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.*] | **MS-PS3-4** |
| **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.*] | **MS-PS3-5** |

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| The SLOs were developed using [the following elements from the NRC document *A Framework for K-12 Science Education*](http://www.nextgenscience.org/msps-e-energy#framework): | | |
| **Science and Engineering Practices**  [**Developing and Using Models**](http://www.nap.edu/openbook.php?record_id=13165&page=56)  [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.](http://www.nap.edu/openbook.php?record_id=13165&page=56)   * [Develop a model to describe unobservable mechanisms. (MS-PS3-2)](http://www.nap.edu/openbook.php?record_id=13165&page=56)   [**Planning and Carrying Out Investigations**](http://www.nap.edu/openbook.php?record_id=13165&page=59)  [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.](http://www.nap.edu/openbook.php?record_id=13165&page=59)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=59)   [**Analyzing and Interpreting Data**](http://www.nap.edu/openbook.php?record_id=13165&page=61)  [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.](http://www.nap.edu/openbook.php?record_id=13165&page=61)   * [Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (MS-PS3-1)](http://www.nap.edu/openbook.php?record_id=13165&page=61)   [**Constructing Explanations and Designing Solutions**](http://www.nap.edu/openbook.php?record_id=13165&page=67)  [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.](http://www.nap.edu/openbook.php?record_id=13165&page=67)   * [Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system. (MS-PS3-3)](http://www.nap.edu/openbook.php?record_id=13165&page=67)   [**Engaging in Argument from Evidence**](http://www.nap.edu/openbook.php?record_id=13165&page=71)  [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 worlds.](http://www.nap.edu/openbook.php?record_id=13165&page=71)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=71)   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  ***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)   [***21st Century themes and skills***](http://www.p21.org/storage/documents/21stcskillsmap_science.pdf) ***(This link is taken from the Partnership for 21st Century Skills)***   * creativity and innovation * critical thinking and problem solving * communication * collaboration * information literacy * media literacy * information and communications technology (ICT) * literacy * flexibility and adaptability * initiative and self direction * social and cross cultural skills * productivity and accountability * leadership and responsibility | **Disciplinary Core Ideas**  [**PS3.A: Definitions of Energy**](http://www.nap.edu/openbook.php?record_id=13165&page=120)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=120) * [A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2)](http://www.nap.edu/openbook.php?record_id=13165&page=120) * [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-PS3-4)](http://www.nap.edu/openbook.php?record_id=13165&page=120)   [**PS3.B: Conservation of Energy and Energy Transfer**](http://www.nap.edu/openbook.php?record_id=13165&page=124)   * [When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5)](http://www.nap.edu/openbook.php?record_id=13165&page=124) * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=124) * [Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3)](http://www.nap.edu/openbook.php?record_id=13165&page=124)   [**PS3.C: Relationship Between Energy and Forces**](http://www.nap.edu/openbook.php?record_id=13165&page=126)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=126)   [**ETS1.A: Defining and Delimiting an Engineering Problem**](http://www.nap.edu/openbook.php?record_id=13165&page=204)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=204)   [**ETS1.B: Developing Possible Solutions**](http://www.nap.edu/openbook.php?record_id=13165&page=206)   * [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)*](http://www.nap.edu/openbook.php?record_id=13165&page=206) | **Crosscutting Concepts**  [**Scale, Proportion, and Quantity**](http://www.nap.edu/openbook.php?record_id=13165&page=89)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=89)   [**Systems and System Models**](http://www.nap.edu/openbook.php?record_id=13165&page=91)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=91)   [**Energy and Matter**](http://www.nap.edu/openbook.php?record_id=13165&page=94)   * [Energy may take different forms (e.g. energy in fields, thermal energy, energy of motion). (MS-PS3-5)](http://www.nap.edu/openbook.php?record_id=13165&page=94) * [The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS3-3)](http://www.nap.edu/openbook.php?record_id=13165&page=94) |

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| ***Connections to other DCIs in this grade-band:***  [**MS.PS1.A**](http://www.nextgenscience.org/hsps1-matter-interactions) (MS-PS3-4); [**MS.PS1.B**](http://www.nextgenscience.org/hsps1-matter-interactions) (MS-PS3-3); [**MS.PS2.A**](http://www.nextgenscience.org/msps2-motion-stability-forces-interactions) (MS-PS3-1),(MS-PS3-4),(MS-PS3-4); [**MS.ESS2.A**](http://www.nextgenscience.org/msess2-earth-systems) (MS-PS3-3); [**MS.ESS2.C**](http://www.nextgenscience.org/msess2-earth-systems) (MS-PS3-3),(MS-PS3-4); [**MS.ESS2.D**](http://www.nextgenscience.org/msess2-earth-systems) (MS-PS3-3),(MS-PS3-4); [**MS.ESS3.D**](http://www.nextgenscience.org/msess3-earth-human-activity) (MS-PS3-4) |
| ***Articulation of DCIs across grade-bands:***  [**4.PS3.B**](http://www.nextgenscience.org/4ps3-energy) (MS-PS3-1),(MS-PS3-3); [**4.PS3.C**](http://www.nextgenscience.org/4ps3-energy) (MS-PS3-4),(MS-PS3-5); [**HS.PS1.B**](http://www.nextgenscience.org/hsps1-matter-interactions) (MS-PS3-4); [**HS.PS2.B**](http://www.nextgenscience.org/hsps2-motion-stability-forces-interactions) (MS-PS3-2); [**HS.PS3.A**](http://www.nextgenscience.org/hsps3-energy) (MS-PS3-1),(MS-PS3-4),(MS-PS3-5); [**HS.PS3.B**](http://www.nextgenscience.org/hsps3-energy) (MS-PS3-1),(MS-PS3-2),(MS-PS3-3),(MS-PS3-4),(MS-PS3-5); [**HS.PS3.C**](http://www.nextgenscience.org/hsps3-energy) (MS-PS3-2) |
| ***Interdisciplinary Connections:***   |  |  | | --- | --- | | *ELA/Literacy -* | | | [**RST.6-8.1**](http://www.corestandards.org/ELA-Literacy/RST/6-8) | [Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.](http://www.corestandards.org/ELA-Literacy/RST/6-8) *(MS-PS3-1),(MS-PS3-5)* | | [**RST.6-8.3**](http://www.corestandards.org/ELA-Literacy/RST/6-8) | [Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.](http://www.corestandards.org/ELA-Literacy/RST/6-8) *(MS-PS3-3)*,(MS-PS3-3) | | [**RST.6-8.7**](http://www.corestandards.org/ELA-Literacy/RST/6-8) | [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).](http://www.corestandards.org/ELA-Literacy/RST/6-8) (MS-PS3-1) | | [**WHST.6-8.1**](http://www.corestandards.org/ELA-Literacy/WHST/6-8) | [Write arguments focused on discipline content.](http://www.corestandards.org/ELA-Literacy/WHST/6-8) *(MS-PS3-5)* | | [**WHST.6-8.7**](http://www.corestandards.org/ELA-Literacy/WHST/6-8) | [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.](http://www.corestandards.org/ELA-Literacy/WHST/6-8) (MS-PS3-3),*(MS-PS3-4)* | | [**SL.8.5**](http://www.corestandards.org/ELA-Literacy/SL/8) | [Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.](http://www.corestandards.org/ELA-Literacy/SL/8) *(MS-PS3-2)* | | *Mathematics -* | | | [**MP.2**](http://www.corestandards.org/Math/Practice/MP2) | [Reason abstractly and quantitatively.](http://www.corestandards.org/Math/Practice/MP2) (MS-PS3-1),(MS-PS3-4),(MS-PS3-5) | | [**6.RP.A.1**](http://www.corestandards.org/Math/Content/6/RP) | [Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities.](http://www.corestandards.org/Math/Content/6/RP) (MS-PS3-1),*(MS-PS3-5)* | | [**6.RP.A.2**](http://www.corestandards.org/Math/Content/6/RP) | [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.](http://www.corestandards.org/Math/Content/6/RP) *(MS-PS3-1)* | | [**7.RP.A.2**](http://www.corestandards.org/Math/Content/7/RP) | [Recognize and represent proportional relationships between quantities.](http://www.corestandards.org/Math/Content/7/RP) (MS-PS3-1),*(MS-PS3-5)* | | [**8.EE.A.1**](http://www.corestandards.org/Math/Content/8/EE) | [Know and apply the properties of integer exponents to generate equivalent numerical expressions.](http://www.corestandards.org/Math/Content/8/EE) (MS-PS3-1) | | [**8.EE.A.2**](http://www.corestandards.org/Math/Content/8/EE) | [Use square root and cube root symbols to represent solutions to equations of the form x2 = p and x3 = p, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that √2 is irrational.](http://www.corestandards.org/Math/Content/8/EE) *(MS-PS3-1)* | | [**8.F.A.3**](http://www.corestandards.org/Math/Content/8/F) | [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.](http://www.corestandards.org/Math/Content/8/F) (MS-PS3-1),*(MS-PS3-5)* | | [**6.SP.B.5**](http://www.corestandards.org/Math/Content/6/SP) | [Summarize numerical data sets in relation to their context.](http://www.corestandards.org/Math/Content/6/SP) *(MS-PS3-4)* | |

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| **Grade Level:** 7 | **Title of Unit:** Energy |
| **Stage 1 - Desired Results** | |
| **Understandings:**  *Students will understand that…*   * interactions of object or system of objects to another and that the total change of energy in any system is always equal to the total energy transferred into or out of the system * moving objects object have kinetic energy * objects may also contain stored energy depending on their relative positions * there is a difference between energy and temperature * there is a relationship between force and energy * energy takes many forms * forms of energy can be grouped into types of energy that are associated with the motion of mass (kinetic energy), and types of energy associated with the position of mass and with energy fields (potential energy) | **Essential Questions:**   * How can energy be transferred from one object or system to another? |
| **Knowledge:**  *Students will know…*   * two basic kinds of energy are kinetic and potential * describe relationship of KE to the mass of an object and to the speed of an object using graphs * explain that as the distance (position) changes the potential energy stored changes * most forms of energy can be transformed into other forms * when two objects interact, each one exerts a force on the other than can cause energy to be transferred to or from the object * temperature is a measure of the average KE 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 | **Skills:**  *Students will be able to…*   * apply an understanding of design to the process of energy transfer * develop and use models to demonstrate that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in a system * plan an energy 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 * analyze and interpret data from investigations * design solutions to energy based problems * engage in evidence based arguments * demonstrate understanding of the core ideas related to energy * describe and model an energy conversion * give examples of how thermal energy is always a results of energy conversions |

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| **Stage 2- Assessment Evidence** |
| **Performance tasks and other evidence:**   * Summative Assessments   + RST- Research Simulation Task   + Unit tests and quizzes   + Labs and engineering based projects     - Apply scientific principles to design, construct, and test a device that either minimized or maximized thermal energy transfer (penguin igloo lab)     - Apply scientific principles to design, construct, and test a device that demonstrates energy transfer (roller coaster lab)     - Rube Goldberg machine or mousetrap/rubber band car as possible quarterly assessment * Formative Assessments   + Graphic Organizers & Guided Note Taking   + Directed Reading   + Cooperative Group Learning   + Homework   + Journal Entries |
| **Stage 3 – Learning Plan** |
| **Learning Activities:**   * ice melting blocks investigation <http://blog.teachersource.com/2013/08/15/everyone-loves-a-mystery/> * oven mitt investigation <http://serc.carleton.edu/sp/mnstep/activities/27004.html> * bouncing ball demonstration <http://www.leaderboard.com/BOUNBALL.htm> * pendulum demonstration * wind up toy investigation * skate park simulation (online) * friction investigation (enrichment) |
| **Digital information and technology integration:** Indicate any special considerations as well as materials, resources (online, print, video, audio) or equipment.  Kinetic Energy: Relationship between mass and velocity and links   * <http://www.sausd.us/cms/lib5/CA01000471/Centricity/Domain/109/8th%20grade%20science%20Roller%20Coaster%20Physics%20Teachers%20Edition.pdf> * <http://lincoln8science.weebly.com/kinetic-and-potential-energy.html>   Potential Energy Links:   * <http://teachers.egfi-k12.org/build-a-bobsled-racer/> * <http://betterlesson.com/lesson/604113/potentially-amazing-lab-station-rotation>   Transfer of thermal energy links:   * <http://science-class.net/archive/science-class/Physics/energy.htm>   Relationships between transfer of energy, mass, kinetic energy and temperature links:   * <http://lincoln8science.weebly.com/thermal-energy-transfer.html> * <http://gravitategame.com/Resources/MS-PS3-6%20Energy.pdf> |
| **Modifications: (ELLs, Special Education, Gifted and Talented)**  **\*** Follow all IEP modifications/504 plan  \* Teacher tutoring  \* Peer tutoring  \* Cooperative learning groups  \* Modified assignments  \* Differentiated instruction  **Presentation accommodations allow a student to:**  **\*** Listen to audio recordings instead of reading text  \* Learn content from audiobooks, movies, videos and digital media instead of reading print versions  \* Work with fewer items per page or line and/or materials in a larger print size  \* Have a designated reader  \* Hear instructions orally  \* Record a lesson, instead of taking notes  \* Have another student share class notes with him  \* Be given an outline of a lesson  \* Use visual presentations of verbal material, such as word webs and visual organizers  \* Be given a written list of instructions  **Response accommodations allow a student to:**  **\*** Give responses in a form (oral or written) that’s easier for him  \* Dictate answers to a scribe  \* Capture responses on an audio recorder  \* Use a spelling dictionary or electronic spell-checker  \* Use a word processor to type notes or give responses in class  \* Use a calculator or table of “math facts”  **Setting accommodations allow a student to:**  **\*** Work or take a test in a different setting, such as a quiet room with few distractions  \* Sit where he learns best (for example, near the teacher)  \* Use special lighting or acoustics  \* Take a test in small group setting  \* Use sensory tools such as an exercise band that can be looped around a chair’s legs (so fidgety kids can kick it and quietly get their energy out)  **Timing accommodations allow a student to:**  **\*** Take more time to complete a task or a test  \* Have extra time to process oral information and directions  \* Take frequent breaks, such as after completing a task  **Scheduling accommodations allow a student to:**  **\***  Take more time to complete a project  \* Take a test in several timed sessions or over several days  \* Take sections of a test in a different order  \* Take a test at a specific time of day  **Organization skills accommodations allow a student to:**  **\***  Use an alarm to help with time management  \* Mark texts with a highlighter  \* Have help coordinating assignments in a book or planner  \* Receive study skills instruction  **Assignment modifications allow a student to:**  **\*** Complete fewer or different homework problems than peers  \* Write shorter papers  \* Answer fewer or different test questions  \* Create alternate projects or assignments  **Curriculum modifications allow a student to:**  **\*** Learn different material (such as continuing to work on multiplication while classmates move on to fractions)  \* Get graded or assessed using a different standard than the one for classmates |

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| ***2015 Ocean County Science Curriculum*** | | |
| ***Grade 7***  ***Unit: History of Earth*** | | |
| **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. | | |
| **#** | **STUDENT LEARNING OBJECTIVES (SLOs)** | **Corresponding**  **DCIs and PEs** |
| **1** | Use relative dates provided by the fossil record to make claims regarding the appearance or disappearance of organisms. | ESS1.C |
| **2** | Correlate the evolution of organisms and the environmental conditions on Earth as they changed throughout geologic time. | ESS1.C |
| **3** | **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.*] | **MS-ESS1-4** |
| **4** | **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.] | **MS-ESS2-2** |
| **5** | **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** |

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| The SLOs were developed using [the following elements from the NRC document *A Framework for K-12 Science Education*](http://www.nextgenscience.org/msess-he-history-earth#framework): | | |
| **Science and Engineering Practices**  [**Analyzing and Interpreting Data**](http://www.nap.edu/openbook.php?record_id=13165&page=61)  [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.](http://www.nap.edu/openbook.php?record_id=13165&page=61)   * [Analyze and interpret data to provide evidence for phenomena. (MS-ESS2-3)](http://www.nap.edu/openbook.php?record_id=13165&page=61)   [**Constructing Explanations and Designing Solutions**](http://www.nap.edu/openbook.php?record_id=13165&page=67)  [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.](http://www.nap.edu/openbook.php?record_id=13165&page=67)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=67)   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  ***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)   [***21st Century themes and skills***](http://www.p21.org/storage/documents/21stcskillsmap_science.pdf) ***(This link is taken from the Partnership for 21st Century Skills)***   * creativity and innovation * critical thinking and problem solving * communication * collaboration * information literacy * media literacy * information and communications technology (ICT) * literacy * flexibility and adaptability * initiative and self direction * social and cross cultural skills * productivity and accountability * leadership and responsibility | **Disciplinary Core Ideas**  [**ESS1.C: The History of Planet Earth**](http://www.nap.edu/openbook.php?record_id=13165&page=177)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=177) * [Tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches. *(HS.ESS1.C GBE),(secondary to MS-ESS2-3)*](http://www.nap.edu/openbook.php?record_id=13165&page=177)   [**ESS2.A: Earth’s Materials and Systems**](http://www.nap.edu/openbook.php?record_id=13165&page=179)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=179)   [**ESS2.B: Plate Tectonics and Large-Scale System Interactions**](http://www.nap.edu/openbook.php?record_id=13165&page=182)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=182)   [**ESS2.C: The Roles of Water in Earth's Surface Processes**](http://www.nap.edu/openbook.php?record_id=13165&page=184)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=184) | **Crosscutting Concepts**  [**Patterns**](http://www.nap.edu/openbook.php?record_id=13165&page=85)   * [Patterns in rates of change and other numerical relationships can provide information about natural systems. (MS-ESS2-3)](http://www.nap.edu/openbook.php?record_id=13165&page=85)   [**Scale Proportion and Quantity**](http://www.nap.edu/openbook.php?record_id=13165&page=89)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=87) |

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| ***Connections to other DCIs in this grade band:***  [**MS.PS1.B**](http://www.nextgenscience.org/msps1-matter-interactions) (MS-ESS2-2); **MS.LS2.B** (MS-ESS2-2); [**MS.LS4.C**](http://www.nextgenscience.org/msls4-biological-evolution-unity-diversity) (MS-ESS1-4) |
| ***Articulation of DCIs across grade-bands:***  [**3.LS4.A**](http://www.nextgenscience.org/3ls4-biological-evolution-unity-diversity) (MS-ESS1-4),(MS-ESS2-3); [**3.LS4.C**](http://www.nextgenscience.org/3ls4-biological-evolution-unity-diversity) (MS-ESS1-4); [**3.ESS3.B**](http://www.nextgenscience.org/3ess3-earth-human-activity) (MS-ESS2-3); [**4.ESS1.C**](http://www.nextgenscience.org/4ess1-earth-place-universe) (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3); [**4.ESS2.A**](http://www.nextgenscience.org/4ess2-earth-systems) (MS-ESS2-2); [**4.ESS2.B**](http://www.nextgenscience.org/4ess2-earth-systems) (MS-ESS2-3); [**4.ESS2.E**](http://www.nextgenscience.org/4ess2-earth-systems) (MS-ESS2-2); [**4.ESS3.B**](http://www.nextgenscience.org/4ess3-earth-human-activity) (MS-ESS2-3); [**5.ESS2.A**](http://www.nextgenscience.org/5ess2-earth-systems) (MS-ESS2-2); [**HS.PS1.C**](http://www.nextgenscience.org/hsps1-matter-interactions) (MS-ESS1-4); [**HS.PS3.D**](http://www.nextgenscience.org/hsps3-energy) (MS-ESS2-2); [**HS.LS2.B**](http://www.nextgenscience.org/hsls2-ecosystems-interactions-energy-dynamics) (MS-ESS2-2); [**HS.LS4.A**](http://www.nextgenscience.org/hsls4-biological-evolution-unity-diversity) (MS-ESS1-4),(MS-ESS2-3); [**HS.LS4.C**](http://www.nextgenscience.org/hsls4-biological-evolution-unity-diversity) (MS-ESS1-4),(MS-ESS2-3); [**HS.ESS1.C**](http://www.nextgenscience.org/hsess1-earth-place-universe) (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3); [**HS.ESS2.A**](http://www.nextgenscience.org/hsess2-earth-systems) (MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3); [**HS.ESS2.B**](http://www.nextgenscience.org/hsess2-earth-systems) (MS-ESS2-2),(MS-ESS2-3); [**HS.ESS2.C**](http://www.nextgenscience.org/hsess2-earth-systems) (MS-ESS2-2); [**HS.ESS2.D**](http://www.nextgenscience.org/hsess2-earth-systems) (MS-ESS2-2); [**HS.ESS2.E**](http://www.nextgenscience.org/hsess2-earth-systems) (MS-ESS2-2); [**HS.ESS3.D**](http://www.nextgenscience.org/hsess3-earth-human-activity) (MS-ESS2-2) |
| ***Interdisciplinary Connections:***   |  |  | | --- | --- | | *ELA/Literacy -* | | | [**RST.6-8.1**](http://www.corestandards.org/ELA-Literacy/RST/6-8) | [Cite specific textual evidence to support analysis of science and technical texts.](http://www.corestandards.org/ELA-Literacy/RST/6-8) (MS-ESS1-4),(MS-ESS2-2),*(MS-ESS2-3)* | | [**RST.6-8.7**](http://www.corestandards.org/ELA-Literacy/RST/6-8) | [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).](http://www.corestandards.org/ELA-Literacy/RST/6-8) (MS-ESS2-3) | | [**RST.6-8.9**](http://www.corestandards.org/ELA-Literacy/RST/6-8) | [Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.](http://www.corestandards.org/ELA-Literacy/RST/6-8) (MS-ESS2-3) | | [**WHST.6-8.2**](http://www.corestandards.org/ELA-Literacy/WHST/6-8) | [Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.](http://www.corestandards.org/ELA-Literacy/WHST/6-8) (MS-ESS1-4),(MS-ESS2-2) | | [**WHST.6-8.8**](http://www.corestandards.org/ELA-Literacy/WHST/6-8) | [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.](http://www.corestandards.org/ELA-Literacy/WHST/6-8) *(MS-ESS2-5)* | | [**SL.8.5**](http://www.corestandards.org/ELA-Literacy/SL/8) | [Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.](http://www.corestandards.org/ELA-Literacy/SL/8) *(MS-ESS2-1),(MS-ESS2-2),(MS-ESS2-6)* | | *Mathematics -* | | | [**MP.2**](http://www.corestandards.org/Math/Practice/MP2) | [Reason abstractly and quantitatively.](http://www.corestandards.org/Math/Practice/MP2) (MS-ESS2-2),(MS-ESS2-3),(MS-ESS2-5) | | [**6.EE.B.6**](http://www.corestandards.org/Math/Content/6/EE) | [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.](http://www.corestandards.org/Math/Content/6/EE) *(MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3)* | | [**7.EE.B.4**](http://www.corestandards.org/Math/Content/7/EE) | [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.](http://www.corestandards.org/Math/Content/7/EE) *(MS-ESS1-4),(MS-ESS2-2),(MS-ESS2-3)* | |

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| **Grade Level:** 7 | **Title of Unit:** History of Earth |
| **Stage 1 - Desired Results** | |
| **Understandings:**  *Students will understand that…*   * geoscience data can be used to understand the processes and events in Earth’s history * geologic events and conditions have affected the progression of life * different life forms have also played important roles in altering Earth’s systems | **Essential Questions:**   * 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? |
| **Knowledge:**  *Students will know…*   * tectonic processes continually generate new ocean sea floor at ridges and destroy old sea floor at trenches * maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth’s plates have moved great distance, collided, and spread apart * plate motion; introduce plate boundaries as mountain-, volcano-, trench-, or rift-forming, but do not assess boundary names (divergent, convergent, transform) * understand layers of the Earth * understand the forces that drive plate movement * earthquakes are created by a slow build-up of energy that has been released * earthquakes change the Earth’s surface over time * energy moves through the earth as waves * volcanoes can form at hotspots or boundaries * volcanic belts form along the boundaries of earth's plates * geologist classify volcanic eruptions as quiet or explosive * geologists often use the terms active, dormant, or extinct to describe a volcano’s stage of activity * volcanic eruptions create landforms; shield volcanoes, cinder cone volcanoes, composite volcanoes, and lava plateaus * the fossil record provides evidence about the history of life and past environments on Earth * the fossil record shows that organisms have changed over time * most fossils form when living things die and are buried by sediments, sediments slowly harden into rock and preserve the shape of the organism * 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 | **Skills:**  *Students will be able to…*   * identify the layers of the Earth by composition and physical properties * explain how sea floor spreading provides a way for continent to move * describe how new oceanic lithosphere forms at mid-ocean ridges * describe the forces thought to move tectonic plates * describe the stress that deforms rocks * demonstrate proficiency in analyzing and interpreting data * demonstrate proficiency in constructing explanations and to use these practices to demonstrate understanding core ideas. * use relative dates provided by fossil record to make claims regarding the disappearance of organisms * correlate the progression of organisms and the environmental conditions on Earth as they changed throughout geologic time * analyze evidence of rock formations and the fossils they contain to establish relative ages of major events in Earth’s history examples of Earth’s major events could range from very recent (such as the last ice age or the earliest fossils) to very old * explain how geologic time is recorded in rock layers * explain how the geological column is used in relative dating * construct an explanation based on evidence for 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 * analyze and interpret data that 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) |

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| **Stage 2- Assessment Evidence** |
| **Performance Tasks and other evidence:**   * Summative Assessments   + RST- Research Simulation Task   + Unit tests and quizzes   + Labs and engineering based projects     - Earthquake safe buildings (gummy bear challenge)     - Living near volcanoes engineering challenge * Formative Assessments   + Graphic Organizers & Guided Note Taking   + Directed Reading   + Cooperative Group Learning   + Homework   + Journal Entries |
| **Stage 3 – Learning Plan** |
| **Learning Activities:**   * Model stresses, faults and plates * Pangea puzzle * Investigate thin and thick lava flow in relation to volcanic eruptions and structures |
| **Digital information and technology integration:** Indicate any special considerations as well as materials, resources (online, print, video, audio) or equipment.   * <http://www.ucmp.berkeley.edu/education/explotime.html> * <http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Inside.shtml> * [ftpdata.dnr.sc.gov/geology/Education/PDF/Geologic%20Time.pdf](http://ftpdata.dnr.sc.gov/geology/Education/PDF/Geologic%20Time.pdf) * <http://www.earthsciweek.org/classroom-activities/dating-popcorn> * <http://www.earthsciweek.org/classroom-activities/geologic-time-scale-analogy> * <http://www.earthsciweek.org/classroom-activities/its-about-time> * <http://geocntr.org/education-resources/classroom-activities/> * <http://www.earthsciweek.org/classroom-activities/a-bit-of-engineering> * <http://www.earthsciweek.org/classroom-activities/a-model-of-three-faults> * <http://oceanexplorer.noaa.gov/explorations/07fire/background/edu/media/plates.pdf> |
| **Modifications: (ELLs, Special Education, Gifted and Talented)**  \* Follow all IEP modifications/504 plan  \* Teacher tutoring  \* Peer tutoring  \* Cooperative learning groups  \* Modified assignments  \* Differentiated instruction  **Presentation accommodations allow a student to:**  \* Listen to audio recordings instead of reading text  \* Learn content from audiobooks, movies, videos and digital media instead of reading print versions  \* Work with fewer items per page or line and/or materials in a larger print size  \* Have a designated reader  \* Hear instructions orally  \* Record a lesson, instead of taking notes  \* Have another student share class notes with him  \* Be given an outline of a lesson  \* Use visual presentations of verbal material, such as word webs and visual organizers  \* Be given a written list of instructions  **Response accommodations allow a student to:**  \* Give responses in a form (oral or written) that’s easier for him  \* Dictate answers to a scribe  \* Capture responses on an audio recorder  \* Use a spelling dictionary or electronic spell-checker  \* Use a word processor to type notes or give responses in class  \* Use a calculator or table of “math facts”  **Setting accommodations allow a student to:**  \* Work or take a test in a different setting, such as a quiet room with few distractions  \* Sit where he learns best (for example, near the teacher)  \* Use special lighting or acoustics  \* Take a test in small group setting  \* Use sensory tools such as an exercise band that can be looped around a chair’s legs (so fidgety kids can kick it and quietly get their energy out)  **Timing accommodations allow a student to:**  \* Take more time to complete a task or a test  \* Have extra time to process oral information and directions  \* Take frequent breaks, such as after completing a task  **Scheduling accommodations allow a student to:**  \* Take more time to complete a project  \* Take a test in several timed sessions or over several days  \* Take sections of a test in a different order  \* Take a test at a specific time of day  **Organization skills accommodations allow a student to:**  \* Use an alarm to help with time management  \* Mark texts with a highlighter  \* Have help coordinating assignments in a book or planner  \* Receive study skills instruction  **Assignment modifications allow a student to:**  \* Complete fewer or different homework problems than peers  \* Write shorter papers  \* Answer fewer or different test questions  \* Create alternate projects or assignments  **Curriculum modifications allow a student to:**  \* Learn different material (such as continuing to work on multiplication while classmates move on to fractions)  \* Get graded or assessed using a different standard than the one for classmates |

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| ***2015 Ocean County Science Curriculum*** | | |
| ***Grade 7***  ***Unit: Earth’s Systems*** | | |
| ***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. | | |
| **#** | **STUDENT LEARNING OBJECTIVES (SLO)** | **CORRESPONDING**  **PEs and DCIs** |
| **1** | 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. | ESS2.A |
| **2** | 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.] | ESS2.A |
| **3** | **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.] | **MS-ESS2-1** |
| **4** | 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. | ESS2.C |
| **5** | Analyze and interpret data to deduce the mechanisms that resulted in a variety of rock formations. | ESS2.C |
| **6** | **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).] | **MS-ESS3-1** |

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| The performance expectations above were developed using [the following elements from the NRC document *A Framework for K-12 Science Education*](http://nextgenscience.org/msess-es-earth-systems#framework): | | |
| **Science and Engineering Practices**  [**Developing and Using Models**](http://www.nap.edu/openbook.php?record_id=13165&page=56)  [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.](http://www.nap.edu/openbook.php?record_id=13165&page=56)   * [Develop and use a model to describe phenomena. (MS-ESS2-1)](http://www.nap.edu/openbook.php?record_id=13165&page=56) * [Develop a model to describe unobservable mechanisms. (MS-ESS2-4)](http://www.nap.edu/openbook.php?record_id=13165&page=56)   [**Constructing Explanations and Designing Solutions**](http://www.nap.edu/openbook.php?record_id=13165&page=67)  [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.](http://www.nap.edu/openbook.php?record_id=13165&page=67)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=67)   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -  ***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)   [***21st Century themes and skills***](http://www.p21.org/storage/documents/21stcskillsmap_science.pdf) ***(This link is taken from the Partnership for 21st Century Skills)***   * creativity and innovation * critical thinking and problem solving * communication * collaboration * information literacy * media literacy * information and communications technology (ICT) * literacy * flexibility and adaptability * initiative and self direction * social and cross cultural skills * productivity and accountability * leadership and responsibility | **Disciplinary Core Ideas**  [**ESS2.A: Earth’s Materials and Systems**](http://www.nap.edu/openbook.php?record_id=13165&page=179)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=179)   [**ESS2.C: The Roles of Water in Earth's Surface Processes**](http://www.nap.edu/openbook.php?record_id=13165&page=184)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=184) * [Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)](http://www.nap.edu/openbook.php?record_id=13165&page=184)   [**ESS3.A: Natural Resources**](http://www.nap.edu/openbook.php?record_id=13165&page=191)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=191) | **Crosscutting Concepts**  [**Cause and Effect**](http://www.nap.edu/openbook.php?record_id=13165&page=87)   * [Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1)](http://www.nap.edu/openbook.php?record_id=13165&page=87)   [**Energy and Matter**](http://www.nap.edu/openbook.php?record_id=13165&page=94)   * [Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)](http://www.nap.edu/openbook.php?record_id=13165&page=94)   [**Stability and Change**](http://www.nap.edu/openbook.php?record_id=13165&page=98)   * [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)](http://www.nap.edu/openbook.php?record_id=13165&page=98) |
| ***Connections to other DCIs in this grade band:***  [**MS.PS1.A**](http://nextgenscience.org/msps1-matter-interactions) (MS-ESS2-1),(MS-ESS2-4),(MS-ESS3-1); [**MS.PS1.B**](http://nextgenscience.org/msps1-matter-interactions) (MS-ESS2-1),(MS-ESS3-1); [**MS.PS2.B**](http://nextgenscience.org/msps2-motion-stability-forces-interactions) (MS-ESS2-4); [**MS.PS3.A**](http://nextgenscience.org/msps3-energy) (MS-ESS2-4); [**MS.PS3.B**](http://nextgenscience.org/msps3-energy) (MS-ESS2-1); [**MS.PS3.D**](http://nextgenscience.org/msls1-molecules-organisms-structures-processes) (MS-ESS2-4); **MS.LS2.B** (MS-ESS2-1); **MS.LS2.C** (MS-ESS2-1); [**MS.ESS1.B**](http://nextgenscience.org/msess-ss-space-systems) (MS-ESS2-1); [**MS.ESS2.D**](http://nextgenscience.org/msess2-earth-systems) (MS-ESS3-1); [**MS.ESS3.C**](http://nextgenscience.org/msess3-earth-human-activity) (MS-ESS2-1) | | |
| ***Articulation of DCIs across grade-bands:***  [**3.PS2.A**](http://nextgenscience.org/3ps2-motion-stability-forces-interactions) (MS-ESS2-4); [**4.PS3.B**](http://nextgenscience.org/4ps3-energy) (MS-ESS2-1),(MS-ESS2-4); [**4.PS3.D**](http://nextgenscience.org/4ps3-energy) (MS-ESS3-1); [**4.ESS2.A**](http://nextgenscience.org/4ess2-earth-systems) (MS-ESS2-1); [**4.ESS3.A**](http://nextgenscience.org/4ess3-earth-human-activity) (MS-ESS3-1); [**5.PS2.B**](http://nextgenscience.org/5ps2-motion-stability-forces-interactions) (MS-ESS2-4); [**5.ESS2.A**](http://nextgenscience.org/5ess2-earth-systems) (MS-ESS2-1); [**5.ESS2.C**](http://nextgenscience.org/5ess2-earth-systems) (MS-ESS2-4); [**HS.PS1.B**](http://nextgenscience.org/hsps1-matter-interactions) (MS-ESS2-1); [**HS.PS2.B**](http://nextgenscience.org/hsps2-motion-stability-forces-interactions) (MS-ESS2-4); [**HS.PS3.B**](http://nextgenscience.org/hsps3-energy) (MS-ESS2-1),(MS-ESS2-4),(MS-ESS3-1); [**HS.PS4.B**](http://nextgenscience.org/hsps4-waves-applications-technologies-information-transfer) (MS-ESS2-4); [**HS.LS1.C**](http://nextgenscience.org/hsls1-molecules-organisms-structures-processes) (MS-ESS2-1),(MS-ESS3-1); [**HS.LS2.B**](http://nextgenscience.org/hsls2-ecosystems-interactions-energy-dynamics) (MS-ESS2-1); [**HS.ESS2.A**](http://nextgenscience.org/hsess2-earth-systems) (MS-ESS2-1),(MS-ESS2-2),(MS-ESS3-1); [**HS.ESS2.B**](http://nextgenscience.org/hsess2-earth-systems) (MS-ESS3-1); [**HS.ESS2.C**](http://nextgenscience.org/hsess2-earth-systems) (MS-ESS2-1),(MS-ESS2-4),(MS-ESS3-1); [**HS.ESS2.D**](http://nextgenscience.org/hsess2-earth-systems) (MS-ESS2-4); [**HS.ESS2.E**](http://nextgenscience.org/hsess2-earth-systems) (MS-ESS2-1); [**HS.ESS3.A**](http://nextgenscience.org/hsess3-earth-human-activity) (MS-ESS3-1) | | |
| ***Interdisciplinary Connections:***   |  |  | | --- | --- | | *ELA/Literacy -* | | | [**RST.6-8.1**](http://www.corestandards.org/ELA-Literacy/RST/6-8) | [Cite specific textual evidence to support analysis of science and technical texts.](http://www.corestandards.org/ELA-Literacy/RST/6-8) (MS-ESS3-1) | | [**WHST.6-8.2**](http://www.corestandards.org/ELA-Literacy/WHST/6-8) | [Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.](http://www.corestandards.org/ELA-Literacy/WHST/6-8) (MS-ESS3-1) | | [**WHST.6-8.9**](http://www.corestandards.org/ELA-Literacy/WHST/6-8) | [Draw evidence from informational texts to support analysis, reflection, and research. (MS-ESS3-1)](http://www.corestandards.org/ELA-Literacy/WHST/6-8) | | [**SL.8.5**](http://www.corestandards.org/ELA-Literacy/SL/8) | [Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.](http://www.corestandards.org/ELA-Literacy/SL/8) *(MS-ESS2-1)* | | *Mathematics -* | | | [**6.EE.B.6**](http://www.corestandards.org/Math/Content/6/EE) | [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.](http://www.corestandards.org/Math/Content/6/EE) *(MS-ESS3-1)* | | [**7.EE.B.4**](http://www.corestandards.org/Math/Content/7/EE) | [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.](http://www.corestandards.org/Math/Content/7/EE) *(MS-ESS3-1)* | | | |

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| **Grade Level:** 7 | **Title of Unit:** Earth’s Systems |
| **Stage 1 - Desired Results** | |
| **Understandings:**  *Students will understand that…*   * Earth is constantly changing due to natural cycles * geoscience provide resources needed by society but also cause natural hazards that present risks to society * technology enables us to better understand Earth’s systems and the impact of Earth’s systems on human activity * the flow of energy from the cycling of matter within and among different systems | **Essential Questions:**   * How do the materials in and on Earth’s crust change over time? * How does water influence and shape Earth’s surface? |
| **Knowledge:**  *Students will know…*   * all Earth processes are the result of energy flowing and matter cycling within and among the planet’s system * rocks are continually cycling from one kind to another due to earth's processes * metamorphic rocks form from the deformation of Earth’s heat and pressure * igneous rock forms from melting, cooling, and crystallization * sedimentary rock forms from weathering, erosion, deposition, compaction, and cementation * soil is a natural uneven distribution of resources as a result of past processes * soil is one of Earth’s most valuable natural resources because everything that lives on land, including humans, depends directly or indirectly on soil * soil comes from weathered rock fragments, minerals and decaying organic material * soil is found in layers, each having a different chemical composition and texture * water’s movements both on the land and underground cause weathering and erosion, which change the land’s surface features and create underground formations * global movements of water and its changes in form are propelled by sunlight and gravity * weathering, erosion and deposition act together in a cycle that wears down and builds up Earth’s surface * most sediment washed or falls into a river as a result of mass movement or run-off * when a glacier melts it deposits the sediment it eroded from the land creating various landforms * waves shape the coast through erosion by breaking down rock and transporting sand and other sediments * wind erosion and deposition may form sand dunes * water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization and precipitation as well as downhill flows on land * global movements of water and its changes in form are propelled by sunlight and gravity | **Skills:**  *Students will be able to…*   * demonstrate proficiency in developing and using models and constructing explanations * develop a conceptual model the rock cycle and how it relates to the change of Earth’s surface over time * develop a conceptual model the water cycle and how it relates to the change of earth's surface over time * investigate weathering and erosion as processes that break down and build up Earth’s surface * construct explanations based on real geoscience data * explain how weathering changes the Earth’s surface over time by breaking rock into smaller pieces * explain that erosion is the wearing away of the Earth’s surface by water, wind, ice and gravity * debate ways that natural resources (water, soil, rocks, etc) are needed and used by society |

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| **Stage 2- Assessment Evidence:** |
| **Performance Tasks and other evidence:**   * Summative Assessments   + RST- Research Simulation Task   + Unit tests and quizzes   + Labs and engineering based projects * Formative Assessments   + Graphic Organizers & Guided Note Taking   + Directed Reading   + Cooperative Group Learning   + Homework   + Journal Entries |
| **Stage 3 – Learning Plan** |
| **Learning Activities:**   * create a model of the rock cycle * create a model of the water cycle * design a water cycle activity to determine if salt evaporates with water * How do glaciers change the land <http://www.classzone.com/science_book/mls_grade7_FL/281_286.pdf> * How does moving air affect sediments <http://mbpms.chatham.k12.nc.us/modules/groups/homepagefiles/cms/2394745/File/8th%20Grade%20Science/S6%20%20Wind.pdf> |
| **Digital information and technology integration:** Indicate any special considerations as well as materials, resources (online, print, video, audio) or equipment.   * <http://tryscience.org/lp> * <http://concord.org/stem-resources/radiant-energy-flow> * <http://www.bioedonline.org/lessons-and-more/lessons-by-topic/matter-and-energy-flow/> * <https://www.teachengineering.org/view_activity.php?url=collection/cub_/activities/cub_energy2/cub_energy2_lesson04_activity2.xml> * <http://www.inquiryinaction.org/classroomactivities/topic.php?topic=Physical%20Change> * <http://www.planetseed.com/laboratory/exploring-petroleum> * <http://utahscience.oremjr.alpine.k12.ut.us/sciber03/middle/8_sciber/geology/html/soil.htm> |
| **Modifications: (ELLs, Special Education, Gifted and Talented)**  \* Follow all IEP modifications/504 plan  \* Teacher tutoring  \* Peer tutoring  \* Cooperative learning groups  \* Modified assignments  \* Differentiated instruction  **Presentation accommodations allow a student to:**  \* Listen to audio recordings instead of reading text  \* Learn content from audiobooks, movies, videos and digital media instead of reading print versions  \* Work with fewer items per page or line and/or materials in a larger print size  \* Have a designated reader  \* Hear instructions orally  \* Record a lesson, instead of taking notes  \* Have another student share class notes with him  \* Be given an outline of a lesson  \* Use visual presentations of verbal material, such as word webs and visual organizers  \* Be given a written list of instructions  **Response accommodations allow a student to:**  \* Give responses in a form (oral or written) that’s easier for him  \* Dictate answers to a scribe  \* Capture responses on an audio recorder  \* Use a spelling dictionary or electronic spell-checker  \* Use a word processor to type notes or give responses in class  \* Use a calculator or table of “math facts”  **Setting accommodations allow a student to:**  \* Work or take a test in a different setting, such as a quiet room with few distractions  \* Sit where he learns best (for example, near the teacher)  \* Use special lighting or acoustics  \* Take a test in small group setting  \* Use sensory tools such as an exercise band that can be looped around a chair’s legs (so fidgety kids can kick it and quietly get their energy out)  **Timing accommodations allow a student to:**  \* Take more time to complete a task or a test  \* Have extra time to process oral information and directions  \* Take frequent breaks, such as after completing a task  **Scheduling accommodations allow a student to:**  \* Take more time to complete a project  \* Take a test in several timed sessions or over several days  \* Take sections of a test in a different order  \* Take a test at a specific time of day  **Organization skills accommodations allow a student to:**  \* Use an alarm to help with time management  \* Mark texts with a highlighter  \* Have help coordinating assignments in a book or planner  \* Receive study skills instruction  **Assignment modifications allow a student to:**  \* Complete fewer or different homework problems than peers  \* Write shorter papers  \* Answer fewer or different test questions  \* Create alternate projects or assignments  **Curriculum modifications allow a student to:**  \* Learn different material (such as continuing to work on multiplication while classmates move on to fractions)  \* Get graded or assessed using a different standard than the one for classmates |

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| MS-ETS1 Engineering Design | | |
| Students who demonstrate understanding can:   |  |  | | --- | --- | | **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.** | | | |
| The performance expectations above were developed using [the following elements from the NRC document *A Framework for K-12 Science Education*](http://www.nextgenscience.org/msets1-engineering-design#framework): | | |
| Science and Engineering Practices[Asking Questions and Defining Problems](http://www.nap.edu/openbook.php?record_id=13165&page=54) [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.](http://www.nap.edu/openbook.php?record_id=13165&page=54)   * [Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)](http://www.nap.edu/openbook.php?record_id=13165&page=54)  [Developing and Using Models](http://www.nap.edu/openbook.php?record_id=13165&page=56) [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.](http://www.nap.edu/openbook.php?record_id=13165&page=56)   * [Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4)](http://www.nap.edu/openbook.php?record_id=13165&page=56)  [Analyzing and Interpreting Data](http://www.nap.edu/openbook.php?record_id=13165&page=61) [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.](http://www.nap.edu/openbook.php?record_id=13165&page=61)   * [Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3)](http://www.nap.edu/openbook.php?record_id=13165&page=61)  [Engaging in Argument from Evidence](http://www.nap.edu/openbook.php?record_id=13165&page=71) [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.](http://www.nap.edu/openbook.php?record_id=13165&page=71)   * [Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)](http://www.nap.edu/openbook.php?record_id=13165&page=71) | Disciplinary Core Ideas[ETS1.A: Defining and Delimiting Engineering Problems](http://www.nap.edu/openbook.php?record_id=13165&page=204)  * [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 are likely to limit possible solutions. (MS-ETS1-1)](http://www.nap.edu/openbook.php?record_id=13165&page=204)  [ETS1.B: Developing Possible Solutions](http://www.nap.edu/openbook.php?record_id=13165&page=206)  * [A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)](http://www.nap.edu/openbook.php?record_id=13165&page=206) * [There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2), (MS-ETS1-3)](http://www.nap.edu/openbook.php?record_id=13165&page=206) * [Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)](http://www.nap.edu/openbook.php?record_id=13165&page=206) * [Models of all kinds are important for testing solutions. (MS-ETS1-4)](http://www.nap.edu/openbook.php?record_id=13165&page=206)  [ETS1.C: Optimizing the Design Solution](http://www.nap.edu/openbook.php?record_id=13165&page=208)  * [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 those characteristics may be incorporated into the new design. (MS-ETS1-3)](http://www.nap.edu/openbook.php?record_id=13165&page=208) * [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. (MS-ETS1-4)](http://www.nap.edu/openbook.php?record_id=13165&page=208) | Crosscutting Concepts[Influence of Science, Engineering, and Technology on Society and the Natural World](http://www.nap.edu/openbook.php?record_id=13165&page=212)  * [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-ETS1-1)](http://www.nap.edu/openbook.php?record_id=13165&page=96) * [The uses of technologies and 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-ETS1-1)](http://www.nap.edu/openbook.php?record_id=13165&page=96) |
| *Connections to MS-ETS1.A: Defining and Delimiting Engineering Problems include:*  **Physical Science:** [MS-PS3-3](http://www.nextgenscience.org/msps3-energy)  *Connections to MS-ETS1.B: Developing Possible Solutions Problems include:*  **Physical Science:** [MS-PS1-6](http://www.nextgenscience.org/msps1-matter-interactions), [MS-PS3-3](http://www.nextgenscience.org/msps3-energy), **Life Science:** [MS-LS2-5](http://www.nextgenscience.org/msls2-ecosystems-interactions-energy-dynamics)  *Connections to MS-ETS1.C: Optimizing the Design Solution include:*  **Physical Science:** [MS-PS1-6](http://www.nextgenscience.org/msps1-matter-interactions) | | |
| *Articulation of DCIs across grade-bands:*  [**3-5.ETS1.A**](http://www.nextgenscience.org/3-5ets1-engineering-design) (MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3); [**3-5.ETS1.B**](http://www.nextgenscience.org/3-5ets1-engineering-design) (MS-ETS1-2),(MS-ETS1-3),(MS-ETS1-4); [**3-5.ETS1.C**](http://www.nextgenscience.org/3-5ets1-engineering-design) (MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3),(MS-ETS1-4);[**HS.ETS1.A**](http://www.nextgenscience.org/hsets1-engineering-design) (MS-ETS1-1),(MS-ETS1-2); [**HS.ETS1.B**](http://www.nextgenscience.org/hsets1-engineering-design) (MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3),(MS-ETS1-4); [**HS.ETS1.C**](http://www.nextgenscience.org/hsets1-engineering-design) (MS-ETS1-3),(MS-ETS1-4) | | |
| *Common Core State Standards Connections:*   |  |  | | --- | --- | | *ELA/Literacy -* |  | | [**RST.6-8.1**](http://www.corestandards.org/ELA-Literacy/RST/6-8) | [Cite specific textual evidence to support analysis of science and technical texts.](http://www.corestandards.org/ELA-Literacy/RST/6-8) (MS-ETS1-1),*(MS-ETS1-2),(MS-ETS1-3)* | | [**RST.6-8.7**](http://www.corestandards.org/ELA-Literacy/RST/6-8) | [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).](http://www.corestandards.org/ELA-Literacy/RST/6-8) *(MS-ETS1-3)* | | [**RST.6-8.9**](http://www.corestandards.org/ELA-Literacy/RST/6-8) | [Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.](http://www.corestandards.org/ELA-Literacy/RST/6-8)(MS-ETS1-2),(MS-ETS1-3) | | [**WHST.6-8.7**](http://www.corestandards.org/ELA-Literacy/WHST/6-8) | [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.](http://www.corestandards.org/ELA-Literacy/WHST/6-8) (MS-ETS1-2) | | [**WHST.6-8.8**](http://www.corestandards.org/ELA-Literacy/WHST/6-8) | [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.](http://www.corestandards.org/ELA-Literacy/WHST/6-8) (MS-ETS1-1) | | [**WHST.6-8.9**](http://www.corestandards.org/ELA-Literacy/WHST/6-8) | [Draw evidence from informational texts to support analysis, reflection, and research.](http://www.corestandards.org/ELA-Literacy/WHST/6-8) *(MS-ETS1-2)* | | [**SL.8.5**](http://www.corestandards.org/ELA-Literacy/SL/8) | [Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.](http://www.corestandards.org/ELA-Literacy/SL/8) *(MS-ETS1-4)* | | *Mathematics -* |  | | [**MP.2**](http://www.corestandards.org/Math/Practice/MP2) | [Reason abstractly and quantitatively.](http://www.corestandards.org/Math/Practice/MP2) *(MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3),(MS-ETS1-4)* | | [**7.EE.3**](http://www.corestandards.org/Math/Content/7/EE) | [Solve multi-step real-life and mathematical problems posed with positive and negative rational numbers in any form (whole numbers, fractions, and decimals), 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.](http://www.corestandards.org/Math/Content/7/EE) *(MS-ETS1-1),(MS-ETS1-2),(MS-ETS1-3)* | | [**7.SP**](http://www.corestandards.org/Math/Content/7/SP) | [Develop a probability model and use it to find probabilities of events. Compare probabilities from a model to observed frequencies; if the agreement is not good, explain possible sources of the discrepancy.](http://www.corestandards.org/Math/Content/7/SP) *(MS-ETS1-4)* | | | |
| **Digital information and technology integration:** Indicate any special considerations as well as materials, resources (online, print, video, audio) or equipment.   * [*http://www.ciese.org/materials/k12/*](http://www.ciese.org/materials/k12/) *These compelling lessons and projects promote problem-based learning, collaboration, higher order thinking skills, and critical analysis through the integration of science, technology, engineering, mathematics and other core subjects.* * [*https://www.teachengineering.org/*](https://www.teachengineering.org/) *TeachEngineering curriculum provides innovative resources and ideas for teachers using NGSS.* * [*http://tryengineering.org/lesson-plans*](http://tryengineering.org/lesson-plans) *TryEngineering offers a variety of lesson plans that align with education standards to allow teachers and students to apply engineering principles in the classroom.* * [*https://www.nsf.gov/news/classroom/engineering.jsp*](https://www.nsf.gov/news/classroom/engineering.jsp) *NSDL is the National Science Foundation's online library of resources for science, technology, engineering, and mathematics education.* * [*http://pbskids.org/designsquad/parentseducators/index.html*](http://pbskids.org/designsquad/parentseducators/index.html) *The goal of Design Squad is to give kids a stronger understanding of the design process, and the connection between engineering and the things we all use in everyday life. The DESIGN SQUAD NATION website equips kids with science and math skills, inspires them, and lays the foundation they need to participate in engineering activities later in life.* * [*http://teachers.egfi-k12.org/category/lessons/grades-6-8-lessons/*](http://teachers.egfi-k12.org/category/lessons/grades-6-8-lessons/) *eGFI is proudly brought to you by the* [*American Society for Engineering Education*](http://asee.org/) *(*[*ASEE*](http://asee.org/)*). We are committed to promoting and enhancing efforts to improve K-12 STEM and engineering education.* * [*http://stem-works.com/*](http://stem-works.com/) *a resource for teachers, mentors, parents, STEM professionals, volunteers, and everyone passionate about getting children eager to learn about science, technology, engineering, and math.* * [*http://www.sciencebuddies.org/science-fair-projects/teacher\_resources.shtml#scienceactivities*](http://www.sciencebuddies.org/science-fair-projects/teacher_resources.shtml#scienceactivities) *Each activity comes with student instructions, and a facilitator guide with just enough information to help anyone lead a good discussion on the science behind the activity.* * [*https://vimeo.com/43038579*](https://vimeo.com/43038579) *The invisible bicycle helmet video clip (Girls in Engineering)* * [*http://stemcollaborative.org/additionalResources.html*](http://stemcollaborative.org/additionalResources.html) *a wealth of worthy STEM resources readily available on the web* | | |

\* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

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\*Taken directly from: <http://www.nextgenscience.org/msets1-engineering-design>.