**COURSE/SUBJECT**: Science

**LEVEL/GRADE**: 8th Grade

**UNIT/FOCUS:** Structure and Properties of Matter

**TIMEFRAME:** 7 weeks

## Transfer

*Students will be able to independently use their learning to…*

- Develop a model to predict and/or describe phenomena. (MS-PS1-1),(MS-PS1-4)
- Gather, read, and synthesize information from multiple appropriate sources and assess the credibility, accuracy, and possible bias of each publication and methods used, and describe how they are supported or not supported by evidence. (MS-PS1-3)

## Meaning

### Enduring Understandings (EUs)

*Students will understand that…*

- Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4)
- Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small. (MS-PS1-1)
- Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3)

### Essential Questions (EQs)

*Students will keep considering…*

- How do particles combine to form the variety of matter one observes?
- How do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them?
- What is energy?

## Acquisition

### Knowledge

*Students will know…*

- Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1)
- Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-3)
- Gases and liquids are made of molecules or inert atoms that are moving about relative to each other. (MS-PS1-4)
- In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations. (MS-PS1-4)
- Solids may be formed from molecules, or they may be extended structures with repeating subunits (e.g., crystals). (MS-PS1-1)
- The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter. (MS-PS1-4)
- Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-3) (Note: This Disciplinary Core Idea is also addressed by MS-PS1-2 and MS-PS1-5.)
- The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one

### Skills

*Students will be able to…*

- MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.
- MS-PS1-3. Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
- MS-PS1-4. Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

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| object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to MSPS1-4)<br>• The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material. (secondary to MS-PS1-4) | |

**COURSE/SUBJECT**: Science **LEVEL/GRADE**: 8th Grade

## Aligned Concepts, Topics, and Skills

Topics
- Description of matter.
- Measurement of matter.
- Laboratory tools to measure matter.
- Types of changes in matter.
- Forms of energy and how they are related to changes in matter.
- States of matter.
- Physical and chemical changes in states of matter.
- Behavior of gases.
- Mathematical applications in graphing gas behavior.

Phenomenon
- Snow piles melt even though it's freezing outside.
- Sugar in my tea dissolves faster in hot water than in cold water.
- Plastic water bottles filled with ice sweats a lot on some days.
- Soda cans explode when left out in the sun on the picnic table.
- Certain metals rust when they get wet, but others don't.

## Pacing Guide

- Approximately 7 weeks

## 21st Century Life and Career Ready Practices

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP3. Attend to personal health and financial well-being.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP10. Plan education and career paths aligned to personal goals.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

## Interdisciplinary Connections

- Science and Engineering Practices
- Cross-Cutting Concepts

## Instructional Resources

- *Physical Science*, Prentice Hall, 2005
- The Physics classroom: http://www.physicsclassroom.com/
- The Fundamentals of Matter and Force: http://particleadventure.org/
- Atomic Physics and Particle Physics:http://www.windows2universe.org/physical_science/physics/physics.html
- Small Particle Thoery Simulation: http://cpucips.sdsu.edu/simulators/simulators.html
- Properties of Solids Lab: https://drive.google.com/a/mendhamboroschools.org/file/d/0B9mzAWGn5QD9SDNzT2FtWEd5TkkzZlRnRFBnSFRIZ2xfWi04/view?usp=sharing
- Scholastic Science World Physics Lesson: The Zamboni Ice Machine Explained (States of Matter):http://scienceworld.scholastic.com/science-lesson-planning-calendar

## Benchmark / Summative Assessments

Teacher created
- Develop models to describe the atomic composition of simple molecules and extended structures.
- Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
- Develop a model that predicts and describes changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed.

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|---|---|
| • Polymer Chemistry and Biofuels:http://agsci.oregonstate.edu/sites/agsci.oregonstate.edu/files/bioenergy/polymer-chemistry-and-biofuels-activity-v1.3.pdf<br>• Changing State, Melting Lab: http://www.middleschoolchemistry.com/standards/ngss/chapter2/lesson5<br>• NSTA lessons: http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=24( Molecules in Motion, States of Matter Basics, Build-a Molecule, Changes of State)<br>• https://concord.org/stem-resources/subject/chemistry<br>• PHET Simulations: https://phet.colorado.edu/( Build an Atom, Build a Molecule, Concentration Density, Gas Properties, Isotopes and Atomic Mass Models of Hydrogen, Atom Molecule Shapes, Molecules and Light,States of Matter)<br>• http://www.golabz.eu/ | |

**COURSE/SUBJECT**: Science **LEVEL/GRADE**: 8th Grade

| Supports / Modifications for ELLs | Supports / Modifications for Students w/ 504s and or IEPs |
|---|---|
| • Preview content<br>• Utilize visuals, images, actions, and talk<br>• Scaffold development of comprehension process vocabulary AND content-specific vocabulary<br>• Display anchor charts for language structures<br>• Provide assessments with graphic supports<br>• Utilize prepared sentence stems<br>• Graphic organizers<br>• Flexible grouping<br>• Additional time for processing and assessment | • Differentiate content, process, product, and learning environment<br>• Provide alternative or high interest text at student's reading level.<br>• Provide summaries of materials for student.<br>• Shorten assignments and assessments to focus on mastery of key concepts.<br>• Substitute alternatives for written assignments.<br>• Specify and review often exactly what the student will need to learn to pass.<br>• Modify expectations based on student needs.<br>• Provide a "designated notetaker" or photocopy of other student or teacher notes.<br>• Provide a print copy of assignments or notes.<br>• Go over directions orally.<br>• Provide additional time on tests.<br>• Read test materials to the student, and allow oral responses.<br>• Use enlarged graph paper to write problems to help the student keep numbers in columns.<br>• Break long-term assignments into small steps, with daily monitoring and frequent grading.<br>• Use both oral and printed directions. |
| **Supports / Modifications for At Risk Students** | **Supports / Modifications for Gifted & Talented Students** |
| • Review the classroom rules frequently.<br>• Evaluate classroom structure against the student's needs (flexible structure, firm limits, etc.).<br>• Keep workspace clear of unrelated materials.<br>• Keep classroom quiet during intense learning times.<br>• Reduce visual distractions in the classroom (mobiles, etc.).<br>• Seat the student close to the teacher / instruction, and away from distractions.<br>• Keep extra supplies of classroom materials (pencils, books) on hand.<br>• Alert student several minutes before a transition from one activity to another is planned; give several reminders.<br>• Reinforce (often) when a student displays positive behavior.<br>• Develop an individualized behavior intervention plan that consistent with the student's ability and skills.<br>• Arrange for a student to leave the classroom for a designated "safe place" when highly stressed.<br>• Develop a system or a code word to let a student know when behavior is not appropriate.<br>• Ignore behaviors that are not seriously disruptive. | • Provide opportunities to pursue advanced level work<br>• Expose students to higher level thinking skills<br>• Provide enrichment centers<br>• pursue a self-selected interest<br>• work in groups with students having common interests<br>• move to a higher grade for specific subject area instruction<br>• work with students of comparable ability across classrooms at the same grade level<br>• work on an advanced curriculum unit on a teacher-selected topic<br>• participate in competitive programs focusing on thinking skills/problem solving<br>• receive concentrated instruction in critical thinking and creative problem solving |

**COURSE/SUBJECT**: Science **LEVEL/GRADE**: 8th Grade

**UNIT/FOCUS:** Chemical Reactions **TIMEFRAME:** 7 weeks

## Transfer

*Students will be able to independently use their learning to…*

- Develop a model to describe unobservable mechanisms. (MS-PS1-5)
- Analyze and interpret data to determine similarities and differences in findings. (MS-PS1-2)
- Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MSPS1-6

## Meaning

| Enduring Understandings (EUs) | Essential Questions (EQs) |
|---|---|
| *Students will understand that…* | *Students will keep considering…* |
| • Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2)<br>• Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)<br>• The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS1-6) | • How do particles combine to form the variety of matter one observes?<br>• How do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them?<br>• What is the process for developing potential design solutions?<br>• How can the various proposed design solutions be compared and improved? |

## Acquisition

| Knowledge | Skills |
|---|---|
| *Students will know…* | *Students will be able to…* |
| • Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-2)<br>• Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2),(MS-PS1-5)<br>• The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5)<br>• Some chemical reactions release energy, others store energy. (MS-PS1-6)<br>• A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (secondary to MS-PS1-6)<br>• Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process—that is, some of the characteristics may be incorporated into the new design. (secondary to MS-PS1-6)<br>• The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (secondary to MS-PS1-6) | • MS-PS1-2. Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.<br>• MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.<br>• MS-PS1-6. Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. |

**COURSE/SUBJECT**: Science **LEVEL/GRADE**: 8th Grade

## Aligned Concepts, Topics, and Skills

Topics
- Identifying different properties of matter.
- Distinguishing changes in matter.
- Identifying and observing evidence of chemical reactions.
- Writing chemical equations states the action of a chemical reaction.
- Understanding the Law of Conservation of Mass by writing chemical equations
- Balancing chemical equations
- Classifying chemical reactions.
- Recognizing that a change in energy occurs when chemical reactions are related.
- Applying certain variables to the rates of chemical reactions.
- Understanding the importance of fire and fire safety.

Phenomenon
- Certain metals rust when they get wet, but others don't.
- Oil and water do not mix.
- Dish detergents break up grease.
- Enzymes in the stomach do not work in the intestines.
- Air bag technology releasing energy for safety

## Pacing Guide

- Approximately 7 weeks

## 21st Century Life and Career Ready Practices

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP3. Attend to personal health and financial well-being.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP10. Plan education and career paths aligned to personal goals.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

## Interdisciplinary Connections

- Science and Engineering Practices
- Cross-Cutting Concepts

## Instructional Resources

- *Physical Science*, Prentice Hall, 2005
- *Physical Science*, Prentice Hall, 2005
- Middle School Chemistry (ACS) www.middleschoolchemistry.com
- https://www.nbclearn.com/chemistry-now
- Target Gas Law Lab:http://www.flinnsci.com/teacher-resources/teacher-resource-videos/best-practices-for-teaching-chemistry/gas-laws/target-gas-law-lab/
- Gas Law Simulator: https://ch301.cm.utexas.edu/section2.php?target=gases/kmt/gas-simulator.html
- High Oleic Oil: What's all the Fuss? Lab http://grownextgen.org/curriculum/unit/high-oleic-oil-what-s-all-the-fuss/
- Elements 4D Ipad APP:https://itunes.apple.com/us/app/elements-4d-by-daqri/id782713582?mt=8

## Benchmark / Summative Assessments

Teacher created
- Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.
- Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.
- Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.

| | |
|---|---|
| • The Physics classroom: http://www.physicsclassroom.com/<br>• Enzyme Lab: Factors that Affect Enzymes (pH)<br>• K12-Outreach/Food-Science-Experiments/Enzymes-in<br>• Adopt and Element Project: http://sciencespot.net/Media/adtelempjt.pdf<br>• Scholastic Science World Chemistry Lessons: Swallowed by a Mine, Name that Element, Glow Stick Science: http://scienceworld.scholastic.com/science-lesson-planning-calendar<br>• NSTA lessons: http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=25(Can you Copperplate, Balancing Chemical Equations, Energy Changes in Chemical Reactions, Baggie Chemistry, Design and Build a Biosuit)<br>• https://concord.org/stem-resources/subject/chemistry<br>• PHET Simulations: https://phet.colorado.edu/(Chemistry)<br>• http://www.golabz.eu/ | |

**COURSE/SUBJECT**: Science **LEVEL/GRADE**: 8th Grade

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|---|---|
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**COURSE/SUBJECT**: Science

**LEVEL/GRADE**: 8th Grade

**UNIT/FOCUS:** Forces and Interactions

**TIMEFRAME:** 7 weeks

## Transfer

*Students will be able to independently use their learning to…*

- 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)
- Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS2-2)
- Conduct an investigation and evaluate the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation.(MS-PS2-5)
- Apply scientific ideas or principles to design an object, tool, process or system. (MS-PS2-1)
- 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)

## Meaning

### Enduring Understandings (EUs)

*Students will understand that…*

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

### Essential Questions (EQs)

*Students will keep considering…*

- How can one predict an object's continued motion, changes in motion, or stability?
- What underlying forces explain the variety of interactions observed?

## Acquisition

### Knowledge

*Students will know…*

- For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). (MS-PS2-1)
- The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS-PS2-2)
- All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared
- Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3)
- Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. (MS-PS2-4)

### Skills

*Students will be able to…*

- MS-PS2-1. Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.*
- MS-PS2-2. Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
- MS-PS2-3. Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
- MS-PS2-4. Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
- MS-PS2-5. Conduct an investigation and evaluate the experimental design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

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| • 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) | |

**COURSE/SUBJECT**: Science **LEVEL/GRADE**: 8th Grade

## Aligned Concepts, Topics, and Skills

Topics
- Describing and measuring motion
- Speed and velocity
- Forces: Friction, Electric, Magnetic, Gravitational, Pressure
- Nature of force
- Newton's First, Second and Third Laws of Motion
- Forces and fluids

Phenomenon
- It is harder to climb up a hill then roll down.
- The faster the speed, the harder the impact force.
- Roller blading/ skate boarding

## Pacing Guide

- Approximately 7 weeks

## 21st Century Life and Career Ready Practices

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP3. Attend to personal health and financial well-being.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
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- CRP9. Model integrity, ethical leadership and effective management.
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- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

## Interdisciplinary Connections

- Science and Engineering Practices
- Cross-Cutting Concepts

## Instructional Resources

- *Physical Science*, Prentice Hall, 2005
-
- The Physics classroom: http://www.physicsclassroom.com/
- Forces and Motion Simulation: http://cpucips.sdsu.edu/simulators/simulators.html
- Forces and Motion, One Dimensional Motion, Two Dimensional Motion, Momentum Direct Measurement Videos: http://serc.carleton.edu/dmvideos/videos.html
- Balloon Racers Lab: https://drive.google.com/a/mendhamboroschools.org/file/d/0B9mzAWGn5QD9WTAyZ1F6NkFWU1NUWnNSVG9TSUhCR25vY21v/view?usp=sharing
- What is Acceleration?:http://www.edinformatics.com/math_science/acceleration.htm
- Study of Motion: http://www.school-for-champions.com/science/motion.htm#.V7XTtZMrKRu
- Speed and Velocity: http://www.physicsclassroom.com/class/1DKin/Lesson-1/Speed-and-Velocity
- Forces and Motion: http://www.physicsclassroom.com/class/1DKin/Lesson-1/Speed-and-Velocity
- Friction Basics: http://www.physicsclassroom.com/class/1DKin/Lesson-1/Speed-and-Velocity
- Your Weight in other worlds:http://www.physicsclassroom.com/class/1DKin/Lesson-1/Speed-and-Velocity
- Uniform Circle Motion:http://www.physicsclassroom.com/mmedia/circmot/ucm.cfm

## Benchmark / Summative Assessments

Teacher created
- Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.*
- 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.
- Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.
- Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.
- 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.

| | |
|---|---|
| • NSTA lessons: http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=26(Your weight in Other Worlds, Forces and Motion, Electromagnetic Power!, Inspector Detector Challenge, Floating Static Band's, Science of NHL Hockey, Newton's Three Laws, 3 Puck Chuck, Force and Motion: Newton's Second Law, Newton's Third Law: Complete Toolkit, Acceleration Simulator, Build a Charge Detector, Lift Chair Challenge)<br>• PHET Simulations: https://phet.colorado.edu/(Forces)<br>• http://www.golabz.eu/<br>• https://www.nbclearn.com/science-of-golf/cuecard | |

**COURSE/SUBJECT**: Science **LEVEL/GRADE**: 8th Grade

| Supports / Modifications for ELLs | Supports / Modifications for Students w/ 504s and or IEPs |
|---|---|
| • Preview content<br>• Utilize visuals, images, actions, and talk<br>• Scaffold development of comprehension process vocabulary AND content-specific vocabulary<br>• Display anchor charts for language structures<br>• Provide assessments with graphic supports<br>• Utilize prepared sentence stems<br>• Graphic organizers<br>• Flexible grouping<br>• Additional time for processing and assessment | • Differentiate content, process, product, and learning environment<br>• Provide alternative or high interest text at student's reading level.<br>• Provide summaries of materials for student.<br>• Shorten assignments and assessments to focus on mastery of key concepts.<br>• Substitute alternatives for written assignments.<br>• Specify and review often exactly what the student will need to learn to pass.<br>• Modify expectations based on student needs.<br>• Provide a "designated notetaker" or photocopy of other student or teacher notes.<br>• Provide a print copy of assignments or notes.<br>• Go over directions orally.<br>• Provide additional time on tests.<br>• Read test materials to the student, and allow oral responses.<br>• Use enlarged graph paper to write problems to help the student keep numbers in columns.<br>• Break long-term assignments into small steps, with daily monitoring and frequent grading.<br>• Use both oral and printed directions. |
| **Supports / Modifications for At Risk Students** | **Supports / Modifications for Gifted & Talented Students** |
| • Review the classroom rules frequently.<br>• Evaluate classroom structure against the student's needs (flexible structure, firm limits, etc.).<br>• Keep workspace clear of unrelated materials.<br>• Keep classroom quiet during intense learning times.<br>• Reduce visual distractions in the classroom (mobiles, etc.).<br>• Seat the student close to the teacher / instruction, and away from distractions.<br>• Keep extra supplies of classroom materials (pencils, books) on hand.<br>• Alert student several minutes before a transition from one activity to another is planned; give several reminders.<br>• Reinforce (often) when a student displays positive behavior.<br>• Develop an individualized behavior intervention plan that consistent with the student's ability and skills.<br>• Arrange for a student to leave the classroom for a designated "safe place" when highly stressed.<br>• Develop a system or a code word to let a student know when behavior is not appropriate.<br>• Ignore behaviors that are not seriously disruptive. | • Provide opportunities to pursue advanced level work<br>• Expose students to higher level thinking skills<br>• Provide enrichment centers<br>• pursue a self-selected interest<br>• work in groups with students having common interests<br>• move to a higher grade for specific subject area instruction<br>• work with students of comparable ability across classrooms at the same grade level<br>• work on an advanced curriculum unit on a teacher-selected topic<br>• participate in competitive programs focusing on thinking skills/problem solving<br>• receive concentrated instruction in critical thinking and creative problem solving |

**COURSE/SUBJECT**: Science **LEVEL/GRADE**: 8th Grade

**UNIT/FOCUS:** Energy **TIMEFRAME:** 7 weeks

## Transfer

*Students will be able to independently use their learning to…*

- Develop a model to describe unobservable mechanisms. (MS-PS3-2)
- 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)
- Construct and interpret graphical displays of data to identify linear and nonlinear relationships. (MS-PS3-1)
- Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process or system. (MS-PS3-3)
- 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)

## Meaning

| Enduring Understandings (EUs) | Essential Questions (EQs) |
|---|---|
| *Students will understand that…* | *Students will keep considering…* |
| • 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)<br>• 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)<br>• Energy may take different forms (e.g. energy in fields, thermal energy, and energy of motion). (MS-PS3- 5)<br>• The transfer of energy can be tracked as energy flows through a designed or natural system. (MSPS3-3) | • What is energy?<br>• What is meant by conservation of energy?<br>• How are forces related to energy?<br>• What is a design for?<br>• What is the process for developing potential design solutions? |

## Acquisition

| Knowledge | Skills |
|---|---|
| *Students will know…* | *Students will be able to…* |
| • 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)<br>• A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2)<br>• 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)<br>• When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5)<br>• 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)<br>• Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3)<br>• 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) | • MS-PS3-1. Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.<br>• MS-PS3-2. Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.<br>• MS-PS3-3. Apply scientific principles to design,<br>• MS-PS3-4. Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample<br>• MS-PS3-5. Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. |

| | |
|---|---|
| • 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)<br>• 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) | |

**COURSE/SUBJECT**: Science **LEVEL/GRADE**: 8th Grade

| Aligned Concepts, Topics, and Skills | Pacing Guide |
|---|---|
| Topics<br>• Mass and speed<br>• Energy, work and power<br>• Open system vs. closed system<br>• Types of energy<br>• Kinetic energy vs. potential energy<br>• Gravity and elastic<br>• Forms of energy (mechanical, thermal, electrical, chemical, nuclear, electromagnetic)<br>• Energy transformation and conservation of energy<br>• Thermal energy, temperature and heat<br>• Uses of heat<br>• Thermal energy and states of matter<br>• Energy and fossil fuels<br>Phenomenon<br>• Power failures and the use of home generators<br>• Transfer of energy riding a roller coaster<br>• Eating a hot meal regarding heat transfer<br>• Energy needed to move a pole vaulter over the bar<br>• Swinging pendulum<br>• Juggling | • Approximately 7 weeks |
| **21st Century Life and Career Ready Practices** | **Interdisciplinary Connections** |
| • CRP1. Act as a responsible and contributing citizen and employee.<br>• CRP2. Apply appropriate academic and technical skills.<br>• CRP3. Attend to personal health and financial well-being.<br>• CRP4. Communicate clearly and effectively and with reason.<br>• CRP5. Consider the environmental, social and economic impacts of decisions.<br>• CRP6. Demonstrate creativity and innovation.<br>• CRP7. Employ valid and reliable research strategies.<br>• CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.<br>• CRP9. Model integrity, ethical leadership and effective management.<br>• CRP10. Plan education and career paths aligned to personal goals.<br>• CRP11. Use technology to enhance productivity.<br>• CRP12. Work productively in teams while using cultural global competence. | • Science and Engineering Practices<br>• Cross-Cutting Concepts |
| **Instructional Resources** | **Benchmark / Summative Assessments** |
| • *Physical Science*, Prentice Hall, 2005<br>• Energy Calculators: http://www.eia.gov/kids/energy.cfm?page=about_energy_conversion_calculator-basics<br>• Energy Resources:http://www.switchenergyproject.com/topics/energyresources<br>• What is work?:http://auto.howstuffworks.com/auto-parts/towing/towing-capacity/inf<br>• Energy Direct Measurement Videos:http://serc.carleton.edu/dmvideos/videos.html<br>• Energy Info Book: http://www.need.org/files/curriculum/guides/Intermediate%20Energy%20Infobook.pdf | Teacher created<br>• 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.<br>• 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.<br>• Apply scientific principles to design, |

| | |
|---|---|
| • Switch Energy research project and energy portfolio:http://www.switchenergyproject.com/about/the-project<br>• Energy Flows Activity: http://www.need.org/files/curriculum/guides/Energy%20Flows.pdf<br>• Energy.gov: http://energy.gov/education-toolbox/search?f[0]=bundle%3Adownload<br>• The Energy Story Interactive Site: http://www.darngoodsolutions.com/energy2/energy_us.html<br>• The Physics classroom: http://www.physicsclassroom.com/<br>• Law of Conservation: http://www.neok12.com/video/Law-of-Conservation/zX0a7f7a41717c595f787f0a.htm<br>• Energy: http://www.physics4kids.com/files/motion_energy.html<br>• Forms of Energy: http://www.eia.gov/Kids/energy.cfm?page=about_forms_of_energy-basics-k.cfm<br>• Mechanical Energy: http://www.physicsclassroom.com/Class/energy/u5l1d.cfm<br>• Transfer of Energy: http://www.physics4kids.com/files/thermo_heat.html<br>• Thermal Energy Facts:http://www.softschools.com/facts/energy/thermal_energy_facts/402/<br>• How does a thermometer work:http://www.energyquest.ca.gov/how_it_works/thermometer.html<br>• Heat Transfer by conductions Gizmo: https://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=388<br>• Fossil Fuels: http://www.fe.doe.gov/education/energylessons/coal/gen_howformed.html<br>• Biomass Energy: http://energyquest.ca.gov/story/chapter10.html<br>• Using and Saving Energy: http://www.eia.gov/kids/energy.cfm?page=3<br>• NSTA Lessons: http://ngss.nsta.org/DisplayStandard.aspx?view=topic&id=27(Energy of Motion, Heat, Temperature, and Conduction, Cooking with the Sun, Energy Skate Park Basics Energy Exploration, Atmospheric Process: Radiation, Save the Penguins)<br>• http://www.golabz.eu/ | • 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<br>• 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. |

**COURSE/SUBJECT**: Science **LEVEL/GRADE**: 8th Grade

| Supports / Modifications for ELLs | Supports / Modifications for Students w/ 504s and or IEPs |
|---|---|
| • Preview content<br>• Utilize visuals, images, actions, and talk<br>• Scaffold development of comprehension process vocabulary AND content-specific vocabulary<br>• Display anchor charts for language structures<br>• Provide assessments with graphic supports<br>• Utilize prepared sentence stems<br>• Graphic organizers<br>• Flexible grouping<br>• Additional time for processing and assessment | • Differentiate content, process, product, and learning environment<br>• Provide alternative or high interest text at student's reading level.<br>• Provide summaries of materials for student.<br>• Shorten assignments and assessments to focus on mastery of key concepts.<br>• Substitute alternatives for written assignments.<br>• Specify and review often exactly what the student will need to learn to pass.<br>• Modify expectations based on student needs.<br>• Provide a "designated notetaker" or photocopy of other student or teacher notes.<br>• Provide a print copy of assignments or notes.<br>• Go over directions orally.<br>• Provide additional time on tests.<br>• Read test materials to the student, and allow oral responses.<br>• Use enlarged graph paper to write problems to help the student keep numbers in columns.<br>• Break long-term assignments into small steps, with daily monitoring and frequent grading.<br>• Use both oral and printed directions. |
| **Supports / Modifications for At Risk Students** | **Supports / Modifications for Gifted & Talented Students** |
| • Review the classroom rules frequently.<br>• Evaluate classroom structure against the student's needs (flexible structure, firm limits, etc.).<br>• Keep workspace clear of unrelated materials.<br>• Keep classroom quiet during intense learning times.<br>• Reduce visual distractions in the classroom (mobiles, etc.).<br>• Seat the student close to the teacher / instruction, and away from distractions.<br>• Keep extra supplies of classroom materials (pencils, books) on hand.<br>• Alert student several minutes before a transition from one activity to another is planned; give several reminders.<br>• Reinforce (often) when a student displays positive behavior.<br>• Develop an individualized behavior intervention plan that consistent with the student's ability and skills.<br>• Arrange for a student to leave the classroom for a designated "safe place" when highly stressed.<br>• Develop a system or a code word to let a student know when behavior is not appropriate.<br>• Ignore behaviors that are not seriously disruptive. | • Provide opportunities to pursue advanced level work<br>• Expose students to higher level thinking skills<br>• Provide enrichment centers<br>• pursue a self-selected interest<br>• work in groups with students having common interests<br>• move to a higher grade for specific subject area instruction<br>• work with students of comparable ability across classrooms at the same grade level<br>• work on an advanced curriculum unit on a teacher-selected topic<br>• participate in competitive programs focusing on thinking skills/problem solving<br>• receive concentrated instruction in critical thinking and creative problem solving |

**COURSE/SUBJECT**: Science

**LEVEL/GRADE**: 8th Grade

**UNIT/FOCUS:** Waves and Electromagnetic Radiation

**TIMEFRAME:** 7 weeks

## Transfer

*Students will be able to independently use their learning to…*

- Develop and use a model to describe phenomena. (MS-PS4-2)
- Use mathematical representations to describe and/or support scientific conclusions and design solutions. (MS-PS4-1)
- Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings. (MS-PS4-3)

## Meaning

| Enduring Understandings (EUs) | Essential Questions (EQs) |
|---|---|
| *Students will understand that…* | *Students will keep considering…* |
| • Graphs and charts can be used to identify patterns in data. (MS-PS4- 1)<br>• Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS4-2)<br>• Structures can be designed to serve particular functions. (MS-PS4-3) | • What are the characteristic properties and behaviors of waves?<br>• What is light?<br>• How can one explain the varied effects that involve light?<br>• What other forms of electromagnetic radiation are there?<br>• How are instruments that transmit and detect waves used to extend human senses? |

## Acquisition

| Knowledge | Skills |
|---|---|
| *Students will know…* | *Students will be able to…* |
| • A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)<br>• A sound wave needs a medium through which it is transmitted. (MS-PS4-2) PS4.B:<br>• When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2)<br>• The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. (MS-PS4-2)<br>• A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2)<br>• However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2) PS4.C: Information Technologies and Instrumentation<br>• Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information.<br>• (MS-PS4-3) | • MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.<br>• MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.<br>• MS-PS4-3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. |

**COURSE/SUBJECT**: Science **LEVEL/GRADE**: 8th Grade

## Aligned Concepts, Topics, and Skills

Topics
- Wave properties
- Describe and predict characteristic properties of waves and behaviors of waves
- Interactions of waves: reflection, refraction, and diffraction
- Interference
- Electromagnetic Radiation – nature of the electromagnetic waves, waves of EM spectrum
- Information Technologies – wireless communication
- Instrumentation – apply wave behavior to send digital information.

Phenomenon
- Infrared cameras
- Broadcasting waves- radio and television
- Microwave cooking
- UV radiation and SPF for sunscreen

## Pacing Guide

- Approximately 7 weeks

## 21st Century Life and Career Ready Practices

- CRP1. Act as a responsible and contributing citizen and employee.
- CRP2. Apply appropriate academic and technical skills.
- CRP3. Attend to personal health and financial well-being.
- CRP4. Communicate clearly and effectively and with reason.
- CRP5. Consider the environmental, social and economic impacts of decisions.
- CRP6. Demonstrate creativity and innovation.
- CRP7. Employ valid and reliable research strategies.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
- CRP9. Model integrity, ethical leadership and effective management.
- CRP10. Plan education and career paths aligned to personal goals.
- CRP11. Use technology to enhance productivity.
- CRP12. Work productively in teams while using cultural global competence.

## Interdisciplinary Connections

- Science and Engineering Practices
- Cross-Cutting Concepts

## Instructional Resources

- *Physical Science*, Prentice Hall, 2005
- The Physics classroom: http://www.physicsclassroom.com/
- Oscillations and Waves: http://www.falstad.com/mathphysics.html
- Electricity and Magnetism: http://www.windows2universe.org/physical_science/physics/physics.html
- Waves/ Electricity/ Circuit Simulations:http://cpucips.sdsu.edu/simulators/simulators.html
- Waves, Sound, and Light Direct Measurement Videos: http://serc.carleton.edu/dmvideos/videos.html
- Electricity and Magetism Tutorials: http://micro.magnet.fsu.edu/electromag/java/index.html
- Faradays Law: http://www.physics4kids.com/files/elec_faraday.html
- Electric Motors: http://electronics.howstuffworks.com/motor3.htm
- Magnetism: http://www.school-for-champions.com/science/magnetism.htm
- https://concord.org/stem-resources/subject/physics
- PHET Simulations: https://phet.colorado.edu/(Waves, Sound, Light, Water)
- http://www.golabz.eu/

## Benchmark / Summative Assessments

Teacher created
- Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave.
- Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.
- Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals.

**COURSE/SUBJECT**: Science **LEVEL/GRADE**: 8th Grade

| Supports / Modifications for ELLs | Supports / Modifications for Students w/ 504s and or IEPs |
|---|---|
| • Preview content<br>• Utilize visuals, images, actions, and talk<br>• Scaffold development of comprehension process vocabulary AND content-specific vocabulary<br>• Display anchor charts for language structures<br>• Provide assessments with graphic supports<br>• Utilize prepared sentence stems<br>• Graphic organizers<br>• Flexible grouping<br>• Additional time for processing and assessment | • Differentiate content, process, product, and learning environment<br>• Provide alternative or high interest text at student's reading level.<br>• Provide summaries of materials for student.<br>• Shorten assignments and assessments to focus on mastery of key concepts.<br>• Substitute alternatives for written assignments.<br>• Specify and review often exactly what the student will need to learn to pass.<br>• Modify expectations based on student needs.<br>• Provide a "designated notetaker" or photocopy of other student or teacher notes.<br>• Provide a print copy of assignments or notes.<br>• Go over directions orally.<br>• Provide additional time on tests.<br>• Read test materials to the student, and allow oral responses.<br>• Use enlarged graph paper to write problems to help the student keep numbers in columns.<br>• Break long-term assignments into small steps, with daily monitoring and frequent grading.<br>• Use both oral and printed directions. |
| **Supports / Modifications for At Risk Students** | **Supports / Modifications for Gifted & Talented Students** |
| • Review the classroom rules frequently.<br>• Evaluate classroom structure against the student's needs (flexible structure, firm limits, etc.).<br>• Keep workspace clear of unrelated materials.<br>• Keep classroom quiet during intense learning times.<br>• Reduce visual distractions in the classroom (mobiles, etc.).<br>• Seat the student close to the teacher / instruction, and away from distractions.<br>• Keep extra supplies of classroom materials (pencils, books) on hand.<br>• Alert student several minutes before a transition from one activity to another is planned; give several reminders.<br>• Reinforce (often) when a student displays positive behavior.<br>• Develop an individualized behavior intervention plan that consistent with the student's ability and skills.<br>• Arrange for a student to leave the classroom for a designated "safe place" when highly stressed.<br>• Develop a system or a code word to let a student know when behavior is not appropriate.<br>• Ignore behaviors that are not seriously disruptive. | • Provide opportunities to pursue advanced level work<br>• Expose students to higher level thinking skills<br>• Provide enrichment centers<br>• pursue a self-selected interest<br>• work in groups with students having common interests<br>• move to a higher grade for specific subject area instruction<br>• work with students of comparable ability across classrooms at the same grade level<br>• work on an advanced curriculum unit on a teacher-selected topic<br>• participate in competitive programs focusing on thinking skills/problem solving<br>• receive concentrated instruction in critical thinking and creative problem solving |