FTSD Gr 7 Science Curriculum Guide

Subject: Science	Grade Level: 7
Unit 1: Matter and Its Interactions	Pacing: 12 weeks
Essential Questions	Enduring Understandings (DCI)
How can one explain the structure, properties, and interactions of matter? • How do particles combine to form the variety of matter one observes? (PS1.A) • How do substances combine or change (react) to make new substances? How does one characterize and explain these reactions and make predictions about them? (PS1.B) • What forces hold nuclei together and mediate nuclear processes? (PS1.C)	PS1.A: Structure and Properties of Matter • Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms. (MS-PS1-1) • Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-2), (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) PS1.B: Chemical Reactions • Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants. (MS-PS1-2), (MS-PS1-3), (MS-PS1-5) • The total number of each type of atom is conserved, and thus the mass does not change. (MS-PS1-5) • Some chemical reactions release energy, others store energy. (MS-PS1-6) PS3.A: Definitions of Energy • The term “heat” as used in everyday language refers both to thermal energy (the motion of atoms or

	molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects. (secondary to MS-PS1-4) • The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the 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) ETS1.B: Developing Possible Solutions • A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (secondary to MS-PS1-6) ETS1.C: Optimizing the Design Solution • Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process - that is, some of the characteristics may be incorporated into the new design. (secondary to MS-PS1-6) • The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (secondary to MS-PS1-6) Patterns • Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2) Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS1-4) Scale, Proportion, and Quantity • Time, space, and energy phenomena can be observed at various scales using models to study systems that

	are too large or too small. (MS-PS1-1) Energy and Matter • Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5) • The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS1-6) Structure and Function • Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS1-3) Interdependence of Science, Engineering, and Technology • Engineering advances have led to important discoveries in virtually every field of science, and scientific discoveries have led to the development of entire industries and engineered systems. (MS-PS1-3) Influence of Science, Engineering and Technology on Society and the Natural World • The uses of technologies and any limitation on their use are driven by individual or societal needs, desires, and values; by the findings of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. Thus technology use varies from region to region and over time. (MS-PS1-3)
NGSS Standards	Classroom Applications

MS-PS1
Matter and Its Interactions
	Objectives:
	• Develop models to describe the atomic composition of simple molecules and extended structures (MS-PS1-1).
	  • Describe the components of the atom and how they combine to form molecules
	
	• Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred. (MS-PS1-2).
	  • Explain the chemical and physical properties of compounds and their

	variations
	
	• Gather and make sense of information to describe that synthetic materials come from natural resources and impact society (MS-PS1-3.).
	  ● Explain that all matter (natural and man-made) is made up of atoms.
	
	• 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 (MS-PS1-4)
	  • Describe how energy changes when matter changes
	
	• Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved. MS-PS1-5.
	  • Define the law of conservation of matter and use it to balance equations
	
	• Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes. * (MS-PS1-6).
	
	• 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-ETS1-1)
	
	• Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (MS-ETS1-2)
	
	• Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success (MS-ETS1-3)
	
	• Develop a model to generate for iterative testing

	and modification of a proposed object, tool, or process such that an optimal design can be achieved. (MS-ETS1-4) Teaching Strategies/Materials: Lesson Structure: Anticipatory Set, Mini-Lesson, Whole Group, Small Group, Independent Work, Closure Strategies: Think-Pair-Share, Read Aloud, Jigsaw, Investigations, Guided Explorations, Projects Materials: http://www.middleschoolchemistry.com/ http://www.t4t.org/lesson-plans/ www.thesciencequeen.net www.sciencespot.net www.sanandreasfault.org http://astro.unl.edu/naap/lps/animations/lps.swf http://www.need.org www.internet4classrooms.com www.smartexchange.com http://ngss.nsta.org/Classroom-Resources.aspx http://www.earthsciweek.org/for-teachers http://education.usgs.gov/index.html Differentiation Strategies/Modifications (i.e. ESL, Special Education, Gifted & Talented): Extra Support: 1:1 teacher redirect / re-teach, peer helper, visual aids, modified tests/quizzes, modified homework Enrichment: computer-based research, high level task, class presentation Limited English Proficiency: vocabulary support, word/picture association, visual aids
Connections to other DCIs in this grade-band: MS.PS3.D (MS-PS1-2),(MS-PS1-6); MS.LS1.C (MS-PS1-2),(MS-PS1-5); MS.LS2.A (MS-PS1-3); MS.LS2.B (MS-PS1-5); MS.LS4.D (MS-PS1-3); MS.ESS2.A (MS-PS1-2),(MS-PS1-5); MS.ESS2.C (MS-PS1-1),(MS-PS1-4); MS.ESS3.A (MS-PS1-3); MS.ESS3.C (MS-PS1-3)	
Articulation of DCIs across grade-bands:	

5.PS1.A (MS-PS1-1); 5.PS1.B (MS-PS1-2),(MS-PS1-5); HS.PS1.A (MS-PS1-1),(MS-PS1-3),(MS-PS1-4),(MS-PS1-6); HS.PS1.B (MS-PS1-2),(MS-PS1-4),(MS-PS1-5),(MS-PS1-6); HS.PS3.A (MS-PS1-4),(MS-PS1-6); HS.PS3.B (MS-PS1-6); HS.PS3.D (MS-PS1-6); HS.LS2.A (MS-PS1-3); HS.LS4.D (MS-PS1-3); HS.ESS1.A (MS-PS1-1);HS.ESS3.A (MS-PS1-3)

Common Core State Standards Connections:
ELA/Literacy –

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.(MS-PS1-2),(MS-PS1-3)

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

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PS1-1),(MS-PS1-2),(MS-PS1-4),(MS-PS1-5)

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

WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-PS1-3)

Mathematics -

MP.2 Reason abstractly and quantitatively. (MS-PS1-1),(MS-PS1-2),(MS-PS1-5)

MP.4 Model with mathematics. (MS-PS1-1),(MS-PS1-5)

6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems. (MS-PS1-1),(MS-PS1-2),(MS-PS1-5)

6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-PS1-4)

8.EE.A.3 Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. (MS-PS1-1)

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

6.SP.B.5 Summarize numerical data sets in relation to their context. (MS-PS1-2)

Subject: Science	Grade Level: 7
Unit 2: Motion and Stability: Forces and Interactions	Pacing:10 weeks
Essential Questions	Enduring Understandings (DCI)
● How can one explain and predict interactions between objects and within systems of objects? ● How can one predict an object's continued motion, changes in motion, or stability? (PS2.A) ● What underlying forces explain the variety of interactions observed? (PS2.B) ● Why are some physical systems more stable than others? (PS2.C)	PS2.A: Forces and Motion • For any pair of interacting objects, the force exerted by the first object on the second object is equal in strength to the force that the second object exerts on the first, but in the opposite direction (Newton's third law). (MS-PS2-1) • The motion of an object is determined by the sum of the forces acting on it; if the total force on the object is not zero, its motion will change. The greater the mass of the object, the greater the force needed to achieve the same change in motion. For any given object, a larger force causes a larger change in motion. (MS-PS2-2) • All positions of objects and the directions of forces and motions must be described in an arbitrarily chosen reference frame and arbitrarily chosen units of size. In order to share information with other people, these choices must also be shared. (MS-PS2-2) PS2.B: Types of Interactions • Electric and magnetic (electromagnetic) forces can be attractive or repulsive, and their sizes depend on the magnitudes of the charges, currents, or magnetic strengths involved and on the distances between the interacting objects. (MS-PS2-3) • Gravitational forces are always attractive. There is a gravitational force between any two masses, but it is very small except when one or both of the objects have large mass—e.g., Earth and the sun. (MS-PS2-4) • Forces that act at a distance (electric, magnetic, and

	gravitational) can be explained by fields that extend through space and can be mapped by their effect on a test object (a charged object, or a ball, respectively). (MS-PS2-5) Cause and Effect • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-PS2-3), (MS-PS2-5) Systems and System Models • Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy and matter flows within systems. (MS-PS2-1), (MS-PS2-4) Stability and Change • Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales. (MS-PS2-2) 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)
NGSS Standards	Classroom Applications

MS-PS2
Motion and Stability: Forces and Interactions
	Objectives:
	• Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects. (MS-PS2-1).
	  • Explain the principles of Newton's 3 laws
	  • Describe how the motion of an object is determined by the sum of the forces acting on it
	  • Explain how mass and acceleration influence force
	
	• 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-PS2-2).
	
	• Ask questions about data to determine the factors that affect the strength of electric and magnetic forces. (MS-PS2-3).
	  • Explain the factors that determine attraction and repulsion in magnets
	
	• Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects. (MS-PS2-4).
	  • Explain Newton's Law of gravitational forces between 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. (MS-PS2-5).
	
	• 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-ETS1-1)
	
	• Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (MS-ETS1-2)
	
	• Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success (MS-ETS1-3)
	
	• Develop a model to generate for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (MS-ETS1-4)

	Teaching Strategies/Materials: Lesson Structure: Anticipatory Set, Mini-Lesson, Whole Group, Small Group, Independent Work, Closure Strategies: Think-Pair-Share, Read Aloud, Jigsaw, Investigations, Guided Explorations, Projects Materials: http://www.middleschoolchemistry.com/ http://www.t4t.org/lesson-plans/ www.thesciencequeen.net www.sciencespot.net www.sanandreasfault.org http://astro.unl.edu/naap/lps/animations/lps.swf http://www.need.org www.internet4classrooms.com www.smartexchange.com http://ngss.nsta.org/Classroom-Resources.aspx http://www.earthsciweek.org/for-teachers http://education.usgs.gov/index.html Differentiation Strategies/Modifications (i.e. ESL, Special Education, Gifted & Talented): Extra Support: 1:1 teacher redirect / re-teach, peer helper, visual aids, modified tests/quizzes, modified homework Enrichment: computer-based research, high level task, class presentation Limited English Proficiency: vocabulary support, word/picture association, visual aids
Connections to other DCIs in this grade-band: MS.PS3.A (MS-PS2-2); MS.PS3.B (MS-PS2-2); MS.PS3.C (MS-PS2-1); MS. ESS1.A (MS-PS2-4); MS. ESS1.B (MS-PS2-4); MS. ESS2.C (MS-PS2-2), (MS-PS2-4)	
Articulation of DCIs across grade-bands: 3.PS2.A (MS-PS2-1),(MS-PS2-2); 3.PS2.B (MS-PS2-3),(MS-PS2-5); 5.PS2.B (MS-PS2-4); HS.PS2.A (MS-PS2-1),(MS-PS2-2); HS.PS2.B (MS-PS2-3),(MS-PS2-4),(MS-PS2-5); HS.PS3.A (MS-PS2-5); HS.PS3.B (MS-PS2-2),(MS-PS2-5); HS.PS3.C (MS-PS2-5); HS.ESS1.B (MS-PS2-2),(MS-PS2-4)	
Common Core State Standards Connections:	

ELA/Literacy -

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-PS2-1),(MS-PS2-3)

RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS2-1),(MS-PS2-2),(MS-PS2-5)

WHST.6-8.1 Write arguments focused on discipline-specific content. (MS-PS2-4)

WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS2-1),(MS-PS2-2),(MS-PS2-5)

Mathematics -

MP.2 Reason abstractly and quantitatively. (MS-PS2-1),(MS-PS2-2),(MS-PS2-3)

6.NS.C.5 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. (MS-PS2-1)

6.EE.A.2 Write, read, and evaluate expressions in which letters stand for numbers. (MS-PS2-1),(MS-PS2-2)

7.EE.B.3 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. (MS-PS2-1),(MS-PS2-2)

7.EE.B.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities. (MS-PS2-1),(MS-PS2-2)

Subject: Science	Grade Level: 7
Unit 3: Energy	Pacing:10 weeks
Essential Questions	Enduring Understandings (DCI)
• How is energy transferred and conserved? • What is energy? (PS3.A) • What is meant by conservation of energy? (PS3.B)	PS3.A: Definitions of Energy • Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed. (MS-PS3-1)

• How is energy transferred between objects or systems? (PS3.B) • How are forces related to energy? (PS3.C) • How do food and fuel provide energy? (PS3.D) • If energy is conserved, why do people say it is produced or used? (PS3.D)	• A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2) • Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (MS-PS3-3), (MS-PS3-4) PS3.B: Conservation of Energy and Energy Transfer • When the motion energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5) • The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matter, the size of the sample, and the environment. (MS-PS3-4) • Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3) PS3.C: Relationship Between Energy and Forces • When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. (MS-PS3-2) ETS1.A: Defining and Delimiting an Engineering Problem • The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that is likely to limit possible solutions. (secondary to MS-PS3-3) ETS1.B: Developing Possible Solutions • 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)
NGSS Standards	Classroom Applications
MS - PS3 Earth and Human Activity	Objectives: • Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an

	object. (MS-PS3-1). • develop a graph that correlates the variables of mass and speed • Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. (MS-PS3-2). • Explain the relationship between position and mass (gravitational potential energy) • Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. (MS-PS3-3). • Analyze factors that affect energy transfer • Compare and contrast convection, conduction, and radiation • Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample. (MS-PS3-4) • Understand and implement kinetic theory of matter • Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object. (MS-PS3-5). • Explain the law of conservation of energy • 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-ETS1-1) • Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (MS-ETS1-2) • Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be

	combined into a new solution to better meet the criteria for success (MS-ETS1-3) • Develop a model to generate for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (MS-ETS1-4) Teaching Strategies/Materials: Lesson Structure: Anticipatory Set, Mini-Lesson, Whole Group, Small Group, Independent Work, Closure Strategies: Think-Pair-Share, Read Aloud, Jigsaw, Investigations, Guided Explorations, Projects Materials: http://www.middleschoolchemistry.com/ http://www.t4t.org/lesson-plans/ www.thesciencequeen.net www.sciencespot.net www.sanandreasfault.org http://astro.unl.edu/naap/lps/animations/lps.swf http://www.need.org www.internet4classrooms.com www.smartexchange.com http://ngss.nsta.org/Classroom-Resources.aspx http://www.earthsciweek.org/for-teachers http://education.usgs.gov/index.html Differentiation Strategies/Modifications (i.e. ESL, Special Education, Gifted & Talented): Helper, visual aids, modified tests/quizzes, modified homework Enrichment: computer-based research, high level task, class presentation Limited English Proficiency: vocabulary support, word/picture association, visual aids
Connections to other DCIs in this grade-band: MS.PS1.A (MS-PS3-4); MS.PS1.B (MS-PS3-3); MS.PS2.A (MS-PS3-1),(MS-PS3-4),(MS-PS3-5); MS.ESS2.A (MS-PS3-3); MS.ESS2.C (MS-PS3-3),(MS-PS3-4);MS.ESS2.D (MS-PS3-3),(MS-PS3-4); MS.ESS3.D (MS-PS3-4)	
Articulation of DCIs across grade-bands:	

4.PS3.B (MS-PS3-1),(MS-PS3-3); 4.PS3.C (MS-PS3-4),(MS-PS3-5); HS.PS1.B (MS-PS3-4); HS.PS2.B (MS-PS3-2); HS.PS3.A (MS-PS3-1),(MS-PS3-4),(MS-PS3-5);HS.PS3.B (MS-PS3-1),(MS-PS3-2),(MS-PS3-3),(MS-PS3-4),(MS-PS3-5); HS.PS3.C (MS-PS3-2)

Common Core State Standards Connections:

ELA/Literacy -

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. (MS-PS3-1),(MS-PS3-5)

RST.6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks. (MS-PS3-3),(MS-PS3-4)

RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table). (MS-PS3-1)

WHST.6-8.1 Write arguments focused on discipline content. (MS-PS3-5)

WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. (MS-PS3-3),(MS-PS3-4)

SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-PS3-2)

Mathematics -

MP.2 Reason abstractly and quantitatively. (MS-PS3-1),(MS-PS3-4),(MS-PS3-5)

6.RP.A.1 Understand the concept of ratio and use ratio language to describe a ratio relationship between two quantities. (MS-PS3-1),(MS-PS3-5)

6.RP.A.2 Understand the concept of a unit rate a/b associated with a ratio a:b with $b \neq 0$, and use rate language in the context of a ratio relationship. (MS-PS3-1)

7.RP.A.2 Recognize and represent proportional relationships between quantities. (MS-PS3-1),(MS-PS3-5)

8.EE.A.1 Know and apply the properties of integer exponents to generate equivalent numerical expressions. (MS-PS3-1)

8.EE.A.2 Use square root and cube root symbols to represent solutions to equations of the form $x2 = p$ 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 $\sqrt{2}$ is irrational. (MS-PS3-1)

8.F.A.3 Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (MS-PS3-1),(MS-PS3-5)

6.SP.B.5 Summarize numerical data sets in relation to their context. (MS-PS3-4)

Subject: Science	Grade Level: 7
Unit 4: Waves and Their Applications in Technology for Information Transfer	Pacing:4 weeks
Essential Questions	Enduring Understandings
• How are waves used to transfer energy and information? • What are the characteristic properties and behaviors of waves? (PS4.A) • What is light? (PS4.B) • How can one explain the varied effects that involve light? (PS4.B) • What other forms of electromagnetic radiation are there? PS4.B) • How are instruments that transmit and detect waves used to extend human senses? (PS4.C).	PS4.A: Wave Properties • A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1) • A sound wave needs a medium through which it is transmitted. (MS-PS4-2) PS4.B: Electromagnetic Radiation • When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2) • The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air and glass) where the light path bends. (MS-PS4-2) • A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2) • However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2) PS4.C: Information Technologies and Instrumentation • Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)
NGSS Standards	Classroom Applications
Waves and Their Applications in Technology	Objectives:

for Information Transfer	• Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. (MS-PS4-1).
	  • Explain the different types of waves and their properties
	  • Explain how a wave's speed is related to its wavelength and frequency
	
	• Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. (MS-PS4-2)
	  • Describe how reflection, refraction and diffraction change a wave's direction
	  • State different types of interference
	
	• Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. (MS-PS4-3).
	  • Compare and contrast digital and analog signals using a data table
	
	• 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-ETS1-1)
	• Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. (MS-ETS1-2)
	• Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success (MS-ETS1-3)
	• Develop a model to generate for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved. (MS-ETS1-4)

	Teaching Strategies/Materials: Lesson Structure: Anticipatory Set, Mini-Lesson, Whole Group, Small Group, Independent Work, Closure Strategies: Think-Pair-Share, Read Aloud, Jigsaw, Investigations, Guided Explorations, Projects Materials: http://www.middleschoolchemistry.com/ http://www.t4t.org/lesson-plans/ www.thesciencequeen.net www.sciencespot.net www.sanandreasfault.org http://astro.unl.edu/naap/lps/animations/lps.swf http://www.need.org www.internet4classrooms.com www.smartexchange.com http://ngss.nsta.org/Classroom-Resources.aspx http://www.earthsciweek.org/for-teachers http://education.usgs.gov/index.htmlns Differentiation Strategies/Modifications (i.e. ESL, Special Education, Gifted & Talented): Extra Support: 1:1 teacher redirect / re-teach, peer helper, visual aids, modified tests/quizzes, modified homework Enrichment: computer-based research, high level thinking tasks, class presentations Limited English Proficiency: vocabulary support, word/picture association, visual aids
Connections to other DCIs in this grade-band: MS.LS1.D (MS-PS4-2)	
Articulation of DCIs across grade-bands: 4.PS3.A (MS-PS4-1); 4.PS3.B (MS-PS4-1); 4.PS4.A (MS-PS4-1); 4.PS4.B (MS-PS4-2); 4.PS4.C (MS-PS4-3); HS.PS4.A (MS-PS4-1),(MS-PS4-2),(MS-PS4-3); HS.PS4.B(MS-PS4-1),(MS-PS4-2); HS.PS4.C (MS-PS4-3); HS.ESS1.A (MS-PS4-2); HS.ESS2.A (MS-PS4-2); HS.ESS2.C (MS-PS4-2); HS.ESS2.D (MS-PS4-2)	
Common Core State Standards Connections: ELA/Literacy - RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-PS4-3)	

RST.6-8.2 Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions. (MS-PS4-3)

RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-PS4-3)

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

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

Mathematics -

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

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

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

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

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

8.F.A.3 Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. (MS-PS4-1)