ALCOSS: 8.1
Identify steps within the scientific process.

Mastered:
Students can identify the steps within the scientific process.

Present:
Students will expand their knowledge by exploring more about constructing a table, graph, or chart; analyze control and variable; debate the SI units; consider other uses for a hypothesis outside of scientific experiments; distinguish appropriate instruments used for investigation.

Going Forward:
Students will begin to create and conduct their own experiments and report their data.

Present and Going Forward Vocabulary:
Hypothesis, SI units , experiment, variable, control

Career Connections:
Laboratory Technologist, Scientist, Researcher

Advanced Understanding & Activity (Alternate activity):
Choose one or more of the following activities to complete as alternate activities to the general assignments:

8.1.1 Design a questionnaire and conduct the survey to gather information. You must include a minimum of five questions that are relevant to eighth grade students. Use the data collected to construct a table, chart, or a graph.

8.1.2 1. What? What is a Control?
2. So what? Now that we know what a control is, how does it:
- Affect the experiment? The scientist?
- Can you distinguish between a control and a variable?
- What connections can be made between the control and the variable?
- Are they similar or different? How?

3. Now what?
- Now that we know these things, what do you think would happen in an experiment if there were no control?
- How effective do you think having a control is for an experiment?
- Why is it important to have only one independent variable?

8.1.3 Debate whether the United States should go to a universal system of measurement. Use real world events to defend your position.

8.1.4 List three ways that you would use a hypothesis, other than in a scientific experiment. Explain your answers

8.1.5 **RAFT** (Student page found in Appendix A)
Students will choose one row. They will write about the TOPIC from the perspective of the ROLE to the AUDIENCE using the FORMAT. You can allow students to choose one item from each of the four columns. Provide an audience for the student to present their product. Students may need to plan their product using the organizational tool, Project Planner.

ROLE	AUDIENCE	FORMAT	TOPIC
Beaker	Graduated Cylinder	Conversation	The Difference is in the Detail
Goggles	Students	Wanted poster	Better Safe Than Sorry
Prism	Visible spectrum	Set of directions	How do I get you out of me
Stopwatch	Fingers	Rap	It's about time
Digital balance	Triple beam balance	Debate	Precision and accuracy
Graduated cylinder	Meniscus	Poem	Why can't we see you?

Literature Connections/Resources:

- Carey, Stephen S. A Beginner's Guide to Scientific Method. Wadsworth Publishing. 1997.
- Mak, Don K. Mak, Angela T.,and Mak Anothony. Solving Everyday Problems with the Scientific Method: Thinking Like a Scientist. Hackensack, NJ: World Scientific Publishing Company. 2009.
- Smith, Tod. Investigating the Scientific Method with Max Axiom, Super Scientist. Mankato, MN: Capstone Press. 2008.

ALCOSS: 8.2

Describe the structure of atoms, including the location of protons, neutrons, and electrons.

Mastered:

Students will have mastered the structure of the atom.

Present:

Students will analyze, compare and contrast the differences between Democritus and Dalton concerning the atomic theory. Students will transform their knowledge of the atom through composition of a song.

Going Forward:

Students will research what happens when electrons get free from an atom.

Present and Going Forward Vocabulary:

Atom, proton, neutron, electron, nucleus, orbit, shell, molecule, ion, charge

Career Connections:

Chemist, Quantum Physicist, Atomic Physicist, Molecular Physicist, Teleport Specialist

Advanced Understanding & Activity (Alternate activity):

Choose one or more of the following activities to complete as alternate activities to the general assignments:

8.2.1 Compose a rhythm or put new words to a known melody including information on the subatomic particles of an atom including location, charge, and movement.

8.2.2 Compare and contrast Democritus and Dalton and each of their contributions to the atomic theory using a graphic organizer, such as a Venn Diagram.

Literature Connections/Resources:

- Graybill, George. Atoms, Molecules & Elements. San Diego, CA: Classroom Complete Press. 1997.
- Roxbee Cox, Phil. Atoms and Molecules (Usborne Understanding Science). Tulsa, OK: E.D.C. Publishing 1993.

ALCOSS: 8.3

Determine the number of protons, neutrons, and electrons, and the mass of an element using the periodic table.

Mastered:

Students can use a periodic table to find the necessary information.

Present:

Students will expand their knowledge by exploring more about how the periodic table was created and each individual element.

Going Forward:

Students will begin to predict which elements will bond with each other most easily based on characteristics.

Present and Going Forward Vocabulary:

Periodic table, period, group, periodic law, atomic mass unit, metals, nonmetals, transition metals, metalloids, valence electron, alkali metals, alkali earth metals, halogens, noble gases, metallurgy

Career Connections:
Chemist, Researcher, Metallurgical Engineer

Advanced Understanding & Activity (Alternate activity):

TIC-TAC-TOE (Student page found in Appendix A)

Students will choose three activities in a row, column, or diagonal, just like TIC-TAC-TOE. Then students will complete the contract to submit to their teachers. Students may need to plan their product using the organizational tool, Project Planner.

1. Create an advertisement for one element from the Periodic Table. Include the following information: -number of protons, neutrons, and electrons -mass -is it reactive -is it a metal, nonmetal, metalloid, or noble gas -other interesting facts about the element	2. Can you think of any flaws in the creation of the Periodic Table or corrections that need to be made? List any and explain your thoughts.	3. Create an alphabet book of the Periodic Table.
4. Make a prediction of what the Periodic Table will look like in 50 years. Describe it with a picture or an essay of 500 words or less.	5. Every home should have a Periodic Table of Elements and be able to use it. No one should ingest anything whose elements cannot be identified. Justify the above statement and develop a case to support it.	6. Choose any metalloid and debate whether it should really be a metal or a nonmetal based on characteristics.
7. Develop a scale to score a model of an atom of an element from the Periodic Table. Make sure to assign points to every part.	8. Create one page of a newspaper on the Periodic Table creation. Make sure you are time era and geographically correct.	9. Make a model of one atom of one element from the Periodic Table. Include the correct numbers of electrons in each energy level, and the correct numbers of neutrons and protons.

Literature Connections/Resources:

- Gray, Theodore. The Elements: A Visual Exploration of Every Known Atom in the Universe. NY: Black Dog & Leventhal Publishers. 2007.
- Dynamic Periodic Table: http://ptable.com/
- The Photographic Periodic Table: http://periodictable.com/
- WebElements: http://www.webelements.com/

ALCOSS: 8.4

State the law of conservation of matter.

Mastered:	Present:	Going Forward:
Students have mastered the law of conservation of matter.	Students will justify that their chemical equation is balanced	Students will determine what type of reaction happened in

and develop a math story to accompany the equation.

the equation; if energy was released or absorbed, etc.

Present and Going Forward Vocabulary:

Matter, volume, density, solid, liquid, gas, plasma, physical property, chemical property, viscosity, crystals

Career Connections:
Chemist, Physicist

Advanced Understanding & Activity (Alternate activity):

Students will choose one chemical equation to balance. Write a story and illustrate with drawings to explain or prove that it is balanced. Include the law of conservation of matter and multiplication in your story.

Chemical Equations:

- $CuSO4*5H2O \longrightarrow CuSO4 + H2O$
- $Fe(s) + O2(g) \longrightarrow Fe2O3(s)$
- $HF(g) + SiO2(s) \longrightarrow SiF4(g) + H2O(l)$
- $C2H6(g) + O2(g) \longrightarrow CO2(g) + H2O(l)$
- $H_3BO_3 \longrightarrow H_4B_6O_{11} + H_2O$
- $P_2I_4 + P_4 + H_2O \longrightarrow PH_4I + H_3PO_4$
- $Cr_2O_7^{2-} + H^+ + Fe^{2+} \longrightarrow Cr^{3+} + H_2O + Fe^{3+}$

Literature Connections/Resources:

- Green, Dan. Basher: Chemistry: Getting a Big Reaction. NY: Kingfisher. 2010.
- PHET: Balancing Chemical Equations: http://phet.colorado.edu/en/simulation/balancing-chemical-equations

ALCOSS: 8.5

Differentiate between ionic and covalent bonds.

Mastered:

Students will have an understanding of the difference between ionic and covalent bonds and be able to illustrate them with electron dot diagrams.

Present:

Students will become familiar with common ionic and covalent bonds and some of their characteristics.

Going Forward:

Students will differentiate between other types of bonds and how they are different from ionic and covalent bonds.

Present and Going Forward Vocabulary:

Atom, electron, neutron, proton, element, chemical formula, subscript, compound, ionic bond, ion, covalent bond, molecule, polar covalent bond, metallic bond, hydrogen bond, product, reactant

Career Connections:
Chemist, Researcher

Advanced Understanding & Activity (Alternate activity):

Choose one or more of the following activities to complete as alternate activities to the general assignments:

- Students will design a cartoon or create a graphic organizer to illustrate a common ionic bond, how the bond forms, and how to break the bond.
- Students will design a cartoon or create a graphic organizer to illustrate a common covalent bond, how the bond forms, and how to break the bond.

Literature Connections/Resources:
- Green, Dan. Basher: Chemistry: Getting a Big Reaction. NY: Kingfisher. 2010.

ALCOSS: 8.6

Define solution in terms of solute and solvent.

Mastered:
Students will have an understanding of the terms of a solution.

Present:
Students will use their knowledge to discuss solutions.

Going Forward:
Students will construct experiments to explain solute and solvent.

Present and Going Forward Vocabulary:

Solute, solvent, dissociation, dispersion, ionization, heat of solution, solubility, saturated solution, unsaturated solution, supersaturated solution, concentration, acid, base, indicator, neutralize, salt, pH, buffer, electrolyte, molarity, isotonic, hypertonic, and hypotonic solutions

Career Connections:
Chemists, Researcher, Laboratory Technologist

Advanced Understanding & Activity (Alternate activity):

Choose one or more of the following activities to complete as alternate activities to the general assignments.

1. Students will use their knowledge of the terms of a solution to answer and explain their answers to the following two questions:
   - If you were stranded on a desert island, why is it worse to drink ocean water than no water at all?
   - Why is sugar used to preserve fruit?
2. Students will create a board game centered around acids and bases.

Literature Connections/Resources:
- Green, Dan. Basher: Chemistry: Getting a Big Reaction. NY: Kingfisher. 2010.

ALCOSS: 8.7

Describe states of matter based on kinetic energy of particles in matter.

Mastered:
Students are able to explain and describe the states of matter based on kinetic energy of particles.

Present:
Students will compose and create works based on their knowledge and application of the way kinetic energy particles effect states of matter.

Going Forward:
Students will make informed judgments about the states of matter based on the kinetic energy of particles in matter.

Present and Going Forward Vocabulary:

Energy, kinetic energy, potential energy, mechanical energy, chemical energy, thermal energy light energy, nuclear energy, energy transfer, law of conservation of energy, friction, force, Joule, conduction, convection

Career Connections:
Energy Conservationist, Environmental Engineering, Design Engineering, Electric Engineering, Energy Advisor

Advanced Understanding & Activity (Alternative activity):

TIC-TAC-TOE (Student page found in Appendix A)

Students will compose and create works based on their knowledge and application of the way the kinetic energy of particles effects states of matter. Students will choose three activities in a row, column, or diagonal, just like TIC-TAC-TOE. Then students will complete the contract to submit to their teachers. Students may need to plan their product using the organizational tool, Project Planner.

1. Create an alphabet book of things related to how kinetic energy effects states of matter.	2. Work out a way to link this picture to kinetic energy's effect on states of matter. 	3. If the answer to the question is rate of reaction…. Create five questions that give this answer.
4. Brainstorm or research three solutions or compounds used today that work due to their rate of reaction being changed by either temperature, concentration, surface area or a catalyst.	5. Create a 3D model to explain how one of the following effects rate of reaction: temperature, concentration, surface area, or catalyst.	6. Create a diary entry for water. In it describe changing states and the energy that it involved.
7. Write an Instruction Manual for water. Include a "how to" section on changing states.	8. Create a comic strip about kinetic energy and its effects on an element, compound or mixture of your choice.	9. List three professions and how they would use knowledge about how rate of reaction is affected by temperature, concentration, surface area or a catalyst.

Literature Connections/Resources:

- Green, Dan. Basher: Chemistry: Getting a Big Reaction. NY: Kingfisher. 2010.
- Viegas, Jennifer. Kinetic And Potential Energy: Understanding Changes Within Physical Systems (Library of Physics). NY: Rosen Publishing Group. 2004.

ALCOSS: 8.8

Identify Newton's three laws of motion.

Mastered:

Students have an understanding of Newton's three laws of motion and can identify each of them.

Present:

Students will develop different types of media to apply their knowledge of Newton's three laws of motion.

Going Forward:

Students will appreciate Newton's three laws of motion and apply them in everyday life situations.

Present and Going Forward Vocabulary:

Force, unbalanced force, balanced force, speed, momentum, net force, gravity, potential energy, velocity, weight, friction, Newton, inertia, kinetic energy, motion, acceleration, mass, law of conservation of matter

Career Connections:

Engineering, Roller coaster Designer, Theme Park Ride Designer, Physicist

Advanced Understanding & Activity (Alternative activity):

Tic-Tac-Toe (Student page found in Appendix A)

Students will develop different types of media to apply their knowledge of Newton's three laws of motion. Students will choose three activities in a row, column, or diagonal, just like TIC-TAC-TOE. Then students will complete the contract to submit to their teachers. Students may need to plan their product using the organizational tool, Project Planner.

1. Pick an object that moves and explain with drawings, labels, and words how Newton's Three Laws apply to that object's motion.	2. Explain how zero gravity would affect Newton's Three Laws of Motion.	3. Create a 3D model to explain one of Newton's Laws of Motion. This model should move. You will demonstrate it to the class and explain.
4. Create/draw a cartoon strip and in it demonstrate one of Newton's Laws. Under the cartoon strip explain to which law you are referring.	5. Create your own "Bill Nye" episode on Newton's Three Laws.	6. Create a computer animation to demonstrate Newton's Three Laws. You will present this to the class and explain.
7. Create a video to demonstrate Newton's Three Laws. You will present this to the class and explain	8. Write a jingle, song, or rap about Newton's Three Laws.	9. Create a timeline of Newton's development of the Three Laws of Motion.

Literature Connections/Resources:

- Gianopoulos, Andrea. Isaac Newton and the Laws of Motion (Inventions and Discovery series). Mankato, M : Capstone Press. 2007.
- Goodstein, Madeline P. Science Fair Success Using Newton's Laws of Motion. Berkeley Heights, NJ: Enslow Publishers. 2002.
- O'Donnell, Kerri. Sir Isaac Newton: Using the Laws of Motion to Solve Problems (Math for the Real World). NY: Rosen Publishing Group. 2005.

ALCOSS: 8.9

Describe how mechanical advantages of simple machine reduce the amount of force needed for work.

Mastered:

Students will be able to detail how mechanical advantages of simple machines reduce the amount of force needed for work.

Present:

Students will create and compose written explanations of how to use simple machines to reduce the amount of force needed for work from their prior knowledge.

Going Forward:

Students will appreciate and verify how simple machines reduce the amount of force needed for work to be accomplished and apply it to everyday life situations.

Present and Going Forward Vocabulary:

Force, friction, fulcrum, inclined plane, lever, load, machine, axle, power, pull, pulley, push, screw, spring, tool, torque, wedge, wheel, work

Career Connections:

Engineer, Physicist, Mechanical Engineer, Mechanical Engineer Technician, Physical Scientist, Robotics Designer, Energy Engineer, Manufacturing Engineer, Design, Engineer

Advanced Understanding & Activity (Alternative activity)

That's Good! That's Bad! Chain Story (Student page found in Appendix A)

Students will research the following questions:

- How are machines used to reduce the amount of force needed for work?
- What kinds of simple machines are used to reduce the amount of force needed for work?
- How are simple machines combined to reduce the amount of force needed for work?

Then students will read the That's Good! That's Bad! scenario. Students will write and illustrate the chain of events to show the positive and negative situations surrounding how are machines used to reduce the amount of force needed for work in the scenario. You may use additional sheets of paper in order to complete your story.

SCENARIO:

Two men and a truck are moving a large safe. They choose to use hand trucks to move the safe. As they begin to unload the safe at their destination, the safe comes loose from the hand truck and falls over breaking the wheel off of the hand trucks in the process. Oh, that's bad!

Literature Connections/Resources:

- Adkins, Jan. Moving Heavy Things. Brooklin, Maine: Wooden Boat Publications 2004.
- Friedhoffer, Bob. Physics Lab in a Hardware Store (Physical Science Labs). London: Franklin Watts. 1997.
- Sadler, Wendy. Using Wheels and Axles (Machines Inside Machines). Mankato, MN: Heinemann-Raintree. 2005.

ALCOSS: 8.10

Differentiate between potential and kinetic energy.

Mastered:

Students will examine and determine the difference between potential and kinetic energy.

Present:

Students will create illustrations showing their assessment of the types of potential and kinetic energy and the changes that take place.

Going Forward:

Students will be able to interpret the differences between potential and kinetic energy and apply it to everyday events.

Present and Going Forward Vocabulary:

Energy, kinetic energy, potential energy, mechanical energy, chemical energy, thermal energy light energy, nuclear energy, energy transfer, law of conservation of energy, friction, force, Joule, conduction, convection

Career Connections:

Energy Conservationist, Environmental Engineering, Design Engineering, Electric Engineering, Energy Advisor

Advanced Understanding & Activity (Alternative activity)

Students will create illustrations showing their assessment of the types of potential and kinetic energy and the changes that take place.

- There are different forms of kinetic and potential energy. Make a list of at least three forms of each, describe either their movement (if it is a form of kinetic) or how the energy is stored (if it is potential), and create an illustration of each. One example of kinetic energy would be electrical energy (movement of electrons).

Literature Connections/Resources:

- Pearson Education. Science Explorer: Motion, Forces, and Energy: Student Edition. Upper Saddle River, New Jersey: Prentice Hall. 2006.

ALCOSS: 8.11

Explain the law of conservation of energy and its relationship to energy transformation, including chemical to electrical, chemical to heat, electric to light, electric to mechanical, and electric to sound.

Mastered:

Students will be able to identify and describe the law of conservation of energy and its relationship to energy transformation.

Present:

Students will apply their knowledge of the law of conservation of energy to produce and create different forms of media.

Going Forward:

Students will be able to prove the law of conservation of energy and its relationship to energy transformation.

Present and Going Forward Vocabulary:

Energy, chemical energy, electric energy, mechanical energy, nuclear energy, radiant energy, thermal energy, law of conservation of energy

Career Connections:

Energy Conservationist, Mechanical Engineer, Automotive Systems Technician, Race Car Performance Technician, Power Plant Operator, Nuclear Engineer, Petroleum Engineer, Biomedical Engineer, Thermodynamics

Advanced Understanding & Activity (Alternative activity)

TIC-TAC-TOE (Student page found in Appendix A)

Students will apply their knowledge of the law of conservation of energy to produce and create different forms of media by choosing three activities in a row, column, or diagonal, just like TIC-TAC-TOE. Then students will complete the contract to submit to their teachers. Students may need to plan their product using the organizational tool, Project Planner.

1. Create a video demonstrating at least three transformations of energy. Narrate the video and explain the energy transformations as they happen.	2. Write what you think the world would be like if the law of conservation of energy did not exist. List at least three changes that would impact your daily life.	3. Create five icons (meaningful images) for energy transformations. Example: create one icon for chemical energy transforming into mechanical.
4. Develop your own "Bill Nye" episode to explain the law of conservation of energy. Make sure to include at least one experiment along with safety precautions.	5. Keep a log or journal for one hour of all the energy transformations you observe that affect you.	6. Develop a survey with five questions about the law of conservation of energy and energy transformations. Interview ten random people of varying ages and determine how well they understand the concept.
7. Research two professions that would involve the law of conservation of energy.	8. Create an alphabet book relating to the law of conservation of energy and energy transformations.	9. Write an advice column entry from the point of view of chemical energy to electrical energy. The topic should be "How can I become you?"

Literature Connections/Resources:

- Ade, Chris, Wertheim, Jane, Stockley, Corinne, & Rogers, Kirsteen. The Usborne Illustrated Dictionary of Physics (Usborne Illustrated Dictionaries). Tulsa, OK: Usborne Books. 2002.

ALCOSS: 8.12
Classify waves as mechanical or electromagnetic.

Mastered:
Students will be able to determine the difference between and classify mechanical and electromagnetic waves.

Present:
Students will use their knowledge of the classification of waves to make deductions, create materials, and appraise situations.

Going Forward:
Students will be able to discriminate between mechanical and electromagnetic waves.

Present and Going Forward Vocabulary:
Energy, heat, conservation of energy, electric charge, kinetic energy, energy conversion, electric field, temperature, mechanical energy, potential energy, chemical energy, static electricity, electromagnetic energy, conduction, radiation, sound, current.

Career Connections:
Electrical engineer, Magnetic Engineer, Design Engineer, Engineer Manager, Nuclear Engineer, Solar Engineer, Wind Engineer, Hydropower Engineer

Advanced Understanding & Activity (Alternative activity):

Thinker Keys (Student page found in Appendix A)

Students will apply their knowledge of the classification of waves to make deductions, create materials, and appraise situations. The teacher and student will agree on the number of "keys" to accomplish. The student chooses the keys and completes the contract. Students may need to plan their product using the organizational tool, Project Planner.

What If?	What if a person was born in the Middle Ages with the ability to see infrared radiation? What would have happened to them? Would there be a difference between a male and a female and their outcome or acceptance?	**Ridiculous**	Justify the following idea by developing a case to support it: All earthquakes are beneficial.
Reverse Listing	Which waves cannot travel through the core of the Earth and why?	**Commonality**	Using a Venn diagram find five common points between the following two concepts and explain: mechanical waves and electromagnetic waves.
Dis-advantages	Brainstorm various ways of correcting or eliminating the disadvantages of the following: earthquake waves, ultraviolet light, water waves.	**Question**	Think of five questions to go with one of the answers below: Wavelength, frequency, amplitude
Combination	Combine the attributes of one of the following pairs into a singular wave and describe the outcome: Earthquake waves and visible light waves, sound waves and ultraviolet waves, water waves and X rays.	**Brainstorming**	Brainstorm a list of practical, creative or innovative solutions on how better to maintain water waves and erosion from them.
BAR-Bigger, Add, Replace	Seismograph Make a seismograph bigger,	**Inventions**	Outline an idea of how to use microwaves for a purpose other

	add to it to make it more efficient or better, or replace something on it to improve it.
Alphabet	Compile a list of words with a picture or explanation of each from A-Z. All words should be on the topic of Waves.
Variations	How many ways can you describe how waves transfer energy?
Picture	Link this picture to waves in five sentences or less. Then take this picture and transform it into something related to waves. 
Prediction	Predict where the next major earthquakes will occur within the next six months to a year. Use real life information and data to back up your prediction.
Different Uses	List three different uses for visible light, ultraviolet light, infrared light.

	than to cook food. You may write in paragraphs or draw your ideas.
Brick Wall	"Break down the wall" by outlining other ways to deal with this situation: We must have visible light in order to live happy healthy lives.
Construction	Produce a model of a longitudinal wave and a transverse wave.
Forced Relationships	Create a way to measure either wavelength, frequency, or amplitude using a spoon, a rubber band and a paint stirrer.
Alternative	Work out three ways to determine if any type of wave is traveling through a plastic bottle.
Interpretation	Think of two different ways to explain one of the following situations: You can see ultraviolet light. Visible light becomes invisible.

Literature Connections/Resources:

- Categories of Waves-The Physics Classroom: http://www.physicsclassroom.com/Class/waves/u10l1c.cfm#emmech
- Earthguide-Waves: http://earthguide.ucsd.edu/wav/index.html