8th Grade Science Curriculum Map

Wiki: https://curriculumtk.wikispaces.com/8th+Grade+Science

1. Lab Safety and the Scientific Method	**PERFORMANCE EXPECTATIONS** **Students who demonstrate understanding can:** **MS-ETS1-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.** **MS-ETS1-2: Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.** **MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.** **MS-ETS1-4: Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**

	Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
MS-ETS1-1	***Asking questions (for science) and defining problems (for engineering)*** Define a design problem that can be solved through the development of an object, tool, process, or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. (MS-ETS1-1)	***ETS1.A: Defining and Delimiting Engineering Problems*** 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 considerations of scientific principles and other relevant knowledge likely to limit possible solutions. (MS-ETS1-1)	***Influence of Science, Engineering, and Technology on Society and the Natural Society*** • All human activity draws on natural resources and has both short- and long-term consequences, positive as well as negative, for the health of people and the natural environment. (MS-ETS1-1) • The uses of technologies and limitations on their use are driven by individuals or societal needs, desires, and values; by the finding of scientific research; and by differences in such factors as climate, natural resources, and economic conditions. (MS-ETS1-1)

MS-ETS1-2	***Engaging in argument from evidence*** Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)	***ETS1.B: Developing Possible Solutions*** There are systematic processes from evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2 & MS-ETS1-3)	***1. Patterns*** ***2. Cause and Effect*** ***3. Structure and Function***
MS-ETS1-3	***Analyzing and interpreting data*** Analyze and interpret data to determine similarities and differences in findings. (MS-ETS1-3)	***ETS1.B: Developing Possible Solutions*** • There are systematic processes from evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2 & MS-ETS1-3) • Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3) ***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 those characteristics may be incorporated into the new design. (MS-ETS1-3)	

MS-ETS1-4	***Developing and using models*** Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4)	***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. (MS-ETS1-4) • Models of all kinds are important for testing solutions. (MS-ETS1-4) ***ETS1.C: Optimizing the Design Solution*** The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)	

Essential Questions

1. How do we keep safe in a science classroom?
2. How do we keep safe when conducting an experiment?
3. How do we reason deductively and inductively (scientific method)?
4. What the different ways one can construct an experiment?
5. What are the different ways one can collect, demonstrate, and analyze data?

Project and/or Lab

1. Students will conduct the Balancing Top Lab using the scientific method. The students will construct their own way to conduct this lab and determine their own way to collect data.
2. The culmination of the lab will be a lab report writing by the students.
3. For lab safety, students will create a digital poster for the classroom showing one lab safety rule that will be followed during the year.

Resources
On the wiki, one will find many documents in relation to lab safety and conducting the scientific method with students. For example, you will find: 1. PowerPoint on Lab Rules 2. SpongeBob worksheet on lab safety 3. Lab Safety Quiz 4. Template of a Lab Report 5. Rubric for Grading a Lab Report 6. Paper Towel Test Lab instruction 7. *Project-Based Inquiry Science* by Janet Kolodner 8. 8. National Science Teacher Association Rules on Lab Safety - http://www.nsta.org/safety/ 9. Lab Safety Rules - http://publicationsonline.carnegiescience.edu/first_light_case/horn/labsafety.html

Cross- Curricular Connection	**Connection to Other NGSS DCIs**	**Connection to other Learning Standards**
Social Studies – The History of the Top: http://www.spintastics.com/SSTDocuments/TopHistory%20pdf.pdf ***English Language Arts*** - *The History of Toys: From Spinning Tops to Robots* by Deborah Jaffe	*Same Grade Band:* MS.PS3-3, MS.PS1-6, MS.PS3-3 MS-LS2-5 *Articulation Across Grade Bands:* 3-5.ETS1.A – C; HSETS1.A - C	*Common Core State Standards for English Language Learning* Reading Informational – RI 6.1, RI 6.2, RI 6.4 & RI 6.8 Writing – W 6.1, W 6.2, W 6.4 & W 6.5 Speaking and Listening – SL 6.1 & SL 6.4 Language – L 6.1, L 6.2 & L 6.3

		Reading Standards for Literacy in Science and Technical Subjects – RST 6–8.1 – RST 6-8.10 Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects – WHST 6-8.1, 6-8.2, 6-8.4 – 6-8.10 *Common Core State Standards for Mathematics* Statistics and Probability – 6.SP.4 – 6.SP.5 *Illinois Learning Standards for Social Studies* 15.B.3b

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Unit 1: Describing Motion	**PERFORMANCE EXPECTATIONS** **Students who demonstrate understanding can:** **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-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.**		
	Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
MS-PS2-2	***Planning and Carrying Out Investigations*** Plan an investigation individually and collaboratively and in the design identify independent and dependent variables and controls, what tools are needed to be the gathering, how measurements will be recorded, and how many data are needed to support a claim. (MS-PS2-2)	***PS2.A: Forces and Motion*** • The motion of an object is determined by the sum of the forces acting on it; if they 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)	***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)
MS-PS3-1	***Analyzing and Interpreting Data*** Construct and interpret graphical displays of data of identify linear and non-linear relationships. (MS-PS3-1)	***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)	***Scale, Proportion, and Quantity*** 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)

Essential Questions
1. How do you describe motion? 2. What is speed? 3. What are the different forms of speed? 4. How do you calculate speed? 5. What is the different between speed and acceleration? 6. What are the three forms of acceleration? 7. How do you calculate acceleration? 8. How can you describe the position of an object in two dimensions? 9. What are the ways velocity can change? 10. How can you graph speed, velocity, and acceleration?

Unit Concepts	**Project and/or Lab**
Unit 1: Chapter 1 -Describing Motion *Lesson 1: Position and Motion* • Reference point • Displacement *Lesson 2: Speed and Velocity* • Calculating and Graphing Speed • Constant Speed • Changing Speed • Instantaneous Speed • Velocity	**Lesson 1:** 1. Skateboard Reference Point and Motion Lab - http://www.drskateboard.com/pdf/motion_point_reference.pdf 2. GPS Lab – Students will create an ad or TV commercial for a new idea that uses GPS. (pg. 15) 3. Labs on Force and Motion - http://www.learningscience.org/psc2bmotionforces.htm 4. Force and Motion Virtual Lab - http://phet.colorado.edu/en/simulation/forces-and-motion 5. Moving Bodies Lab on Motion - http://science-class.net/archive/science-class/Lessons/Physics/Force_Motion/Moving_bodies.pdf

• Average Speed *Lesson 3: Acceleration* • Calculating and Graphing Acceleration • Understanding Speed-Time Graphs	6. Describing Motion - http://science-class.net/archive/science-class/Lessons/Physics/Force_Motion/describing_motion_speed.pdf **Lesson 2:** 1. Roller Coaster Lab (pg. 17) – Students will create their own roller coasters. When completed, students will create a marketing plan for their roller coaster. http://science-class.net/archive/science-class/Lessons/Physics/Coaster/RCP_introduction.pdf 2. Making Roller Coasters online 3. Calculate Speed Lab using Wind-Up Toys (pg. 25) – We can modify the lab and calculate the speed of sending a text message through the different cell phone providers. 4. Speed Challenge Lab - http://www.sciencespot.net/Media/speedchall.pdf 5. Bubble Gum Speed Lab - http://www.sciencespot.net/Media/bgumphysics.pdf 6. Average Speed Lab (pg. 34) 7. Domino Dash – Average Speed Lab - http://science-class.net/archive/science-class/Lessons/Physics/Force_Motion/domino_dash.pdf **Lesson 3:** 1. Hot Wheels Lab - http://serc.carleton.edu/sp/mnstep/activities/35700.html 2. Acceleration and Velocity Lab (on the wiki) 3. Acceleration Lab - http://science-class.net/archive/science-class/Lessons/Physics/Force_Motion/acceleration.pdf 4. Another Acceleration Lab - http://science-class.net/archive/science-class/Lessons/Physics/Force_Motion/acceleration_2.pdf
Resources	

On the wiki and/or on the web, you will find:

1. Bubble Gum Trivia Challenge - http://www.sciencespot.net/Media/bgumtrivia.pdf
2. Moving Man: Speed & Acceleration - http://phet.colorado.edu/en/simulation/moving-man
3. Fastest Machines on Earth Speed Worksheet - http://www.sciencespot.net/Media/speedmach.pdf
4. Speed and Acceleration Practice Sheet - http://www.sciencespot.net/Media/speedmach.pdf
5. Toy Car Acceleration Lab- http://www.math.mtu.edu/gk-12/Acceleration.pdf
6. *Project-Based Inquiry Science* by Janet Kolodner
7. *Speed, Acceleration & Friction* from Aries Program
8. More Labs on Force and Motion - http://science-class.net/archive/science-class/Physics/force_motion.htm

Cross- Curricular Connection	**Connection to Other NGSS DCIs**	**Other Learning Standards**
Social Studies: Research the following in connection with the labs: • Roller Coaster • Race Car Driving (i.e. Formula One) • Gum • Fastest Machines on Earth ***English Language Arts:*** 1. *America's Top Roller Coasters and Amusement Parks* by Pete Trabucco	*Same Grade Band:* MS.PS2.A, MS.PS3.A, MS.PS3.B, MS.ESS2.C *Articulation Across Grade Bands:* 3.PS2.A 4.PS3.B HS.PS3.A, HS.PS2.A, HS.PS3.B, HS.ESS1.B	*Common Core State Standards for English Language Arts* Reading Informational: 8.1 - 8.5, 8.8 Writing: 8.1 - 8.6, 8.4 - 8.10 Speaking and Listening: 8.1 - 8.6 Language: 8.1 – 8.6 Reading Standards for Literacy in Science and Technical Subjects – RST 6–8.1 – RST 6-8.10

2. *Scientriffic: Roller Coaster Science* by Chris Oxlade 3. *Roller Coasters (Calling All Innovators: a Career for You)* by Kevin Cunningham 4. *Roller Coaster Kid* by Mary Ann Rodma 5. *Thrill Rides Top 10 Roller Coasters in America* by Mark Shulman 6. *DK Eyewitness Books: Car* by Richard Sutton 7. *About Race Cars: A Awesome Amazing Super Spectacular Fact & Photo book on Race Cars for Kids* by Brian Cliette 8. *The Art of Racing in the Rain* by Garth Stein 9. *Pop! The Invention of Bubble Gum* by Meghan McCarthy 10. *One Day in the Life of Bubble Gum* by Mt. Horeb Intermediate Center 11. *Lester Fizz, Bubble-Gum Artist* by Ruth Spiro 12. *Hot Machines: The Fastest, Coolest, Meanest Vehicles on Earth* by Gregory Pop 13. *Thrill Rides! All about Roller Coasters* by Jeff Savage		Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects – WHST 6-8.1, 6-8.2, 6-8.4 – 6-8.10 *Common Core State Standards for Mathematics* Expressions & Equations – 8.EE.A.1, 8.EE.A.2, 8.EE.4, 8.EE.5, 8.EE.7 Functions – 8.F.A.3, 8.F.1, 8.F.4, 8.F.5

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2. The Law of Motion	**PERFORMANCE EXPECTATIONS** **Students who demonstrate understanding can:** **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-PS2-4: 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.**		
	Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
MS-PS2-1	***Constructing Explanations and Designing Solution*** Apply scientific ideas or principles to design an object, tool, process, or system. (MS-PS2-1)	***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)	***Systems and System Models*** Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – an energy and matter flows within systems. (MS-PS2-1 & MS-PS2-4)
MS-PS2-2	**Planning and Carrying Out Investigations** 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)	***PS2.A: Forces and Motion*** 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)	**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)
MS-PS2-4	***Engaging in Argument from Evidence***	***PS2.B: Types of Interactions***	***Systems and System Models***

	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)	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)	Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – an energy and matter flows within systems. (MS-PS2-1 & MS-PS2-4)
MS-PS2-5	***Planning and Carrying Out Investigations*** 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)	***PS2.B: Types of Interactions*** Forces that act at a distance (electrical, 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, a magnet, 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)

Essential Questions

1. What are the forces on Earth that act upon all organisms and objects?
2. What are Newton's Law of Motions?
3. What is the impact of Newton's laws on the forces found on Earth?
4. What is a contact versus non-contact force?
5. What is the law of universal gravitation?
6. How does friction affect the motion of two objects?
7. How is motion related to balanced and unbalanced forces?
8. What effect does inertia have on the motion of an object?
9. What is the law of the conservation of momentum?

Unit Concepts	Project and/or Lab

Unit 1: Chapter 2 – The Laws of Motion

Lesson 1: Gravity and Friction

- Types of Forces
- Law of Universal Gravitation
- Weight
- Mass
- Friction

Lesson 2: Newton's First Law

- Net Forces
- Balance and Unbalances Forces
- Inertia

Lesson 3: Newton's Second Law

- Calculating the 2nd law using the formula acceleration=net force/mass
- Circular motion
- centripetal force

Lesson 4: Newton's Third Law

- Action and reaction
- Calculating Momentum
- The Law of the Conversation of Momentum

Lesson 1:

1. Lab on Universal Gravitation and the Planets - http://homework.northport.k12.ny.us/nhs/science/klibretto/Labs/Regents/Lab_13_Universal_Gravitation.pdf

2. Building the Fastest Cars from Balsa Wood

3. Building the Slowest Rovers with Legos

4. Constructing Soap Box Cars (parental engagement needed)

5. Gravity and Force Virtual Lab - http://phet.colorado.edu/en/simulation/gravity-force-lab

6. Acceleration of Gravity Lab - http://stanford.edu/~ajspakow/downloads/outreach/gravity-student-10-7-09.pdf

7. Lab on Weight versus Mass - http://www.mrjgrom.com/source/matter1_unit/weight%20and%20mass%20lab.pdf

8. Friction Lab - http://www.physicsclassroom.com/getattachment/lab/newtlaws/nl8tg.pdf

9. Lab on Surface Friction - http://www.phy.duke.edu/~kolena/physics/labs/a7sfrict.htm

Lesson 2:

1. Wacky Washers – Lab showing Newton's First Law of Motion - http://www.sciencespot.net/Media/newtonlab.pdf

2. Tricky Tricks – Lab showing Newton's First Law of Motion - http://www.sciencespot.net/Media/newtonlab.pdf

3. Lab on Newton's Laws of Motion - http://www.cmdowns.com/newtons-laws-lab.htm

Lesson 3:

1. Newton's Race – Lab showing Newton's Second Law of Motion – http://www.sciencespot.net/Media/newtonlab.pdf

	2. Designing an Egg Helmet (real world application to football concussions) 3. Exploring the Laws of Motion using skateboarding http://www.exploratorium.edu/skateboarding/ 4. Lab Stations on Newton's Laws of Motion (on the wiki) **Lesson 4:** 1. Bally Rally – Law showing Newton's Third Law of Motion - http://www.sciencespot.net/Media/newtonlab.pdf 2. Water Bottle Rocket Project and Launch 3. Capstone Lab – Modeling Newton's Laws of Motion (pg.76) 4. Hovercraft Project - http://science-class.net/archive/science-class/Lessons/Physics/Force_Motion/Hovercraft%20Project.pdf

Resources

1. *Teaching Physics with Toys* by Beverley Taylor

2. *Project-Based Inquiry Science* by Janet Kolodner

3. *Speed, Acceleration & Friction* by Aries Program

4. More labs on Newton's Laws of Motion – http://www.physicsclassroom.com/lab/newtlaws/NLlabs.cfm

5. Web Quest on Laws of Motion- http://science.kqed.org/quest/video/quest-lab-newtons-laws-of-motion/

6. Introduction to Newton's Laws of Motion - http://www.arborsci.com/cool/introducing-newtons-laws-with-learning-cycles

7. Teaching Newton's Laws of Motion - https://teachingphysics.wordpress.com/tag/newtons-laws/

8. Explanation of Newton's Three Laws of Motion - http://teachertech.rice.edu/Participants/louviere/Newton/

9. Explanation of Gravity - http://www.planetseed.com/laboratory/galileo-drops-ball-virtual-experiment

10. Weight versus Mass Lab - http://pdesas.org/module/content/resources/13979/view.ashx

11. Comparing Mass, Volume, and Weight - http://www.msnucleus.org/membership/html/k-6/as/scimath/3/assm3_6a.html

12. Another Friction Lab - http://colinamiddle.net/dmatras/Chapter%2010/pages/Friction%20Lab.pdf

13. Friction Inquiry - http://www.stemmom.org/2012/09/friction-inquiry-lab.html

Cross- Curricular Connection	**Connection to Other NGSS DCIs**	**Other Learning Standards**
Social Studies: Research the following in connection with the labs: • Rockets • Soap Box Racing • Skateboarding • Roller Coasters • High Speed Trains (Bullet Trains) ***English Language Arts:*** *Isaac Newton and the Laws of Motion* by Andrea Gianopoulos *Force and Motion: An Illustrated Guide to Newton's Laws* by Jason Zimba *Isaac Newton - The Inspirational Life Story of Isaac Newton, an Apple Fell Then Things Pulled Together* by Gregory Watson *What Are Newton's Laws of Motion?* by Denyse O'Leary *Champions, Cheaters, and Childhood Dreams: Memories of the All-American*	*Same Grade Band:* MS.PS3.A – C, MS.ESS1.A – B, MS.ESS2.C *Articulation Across Grade Bands:* 3.PS2.A - B 4.PS3.B 5.PS2.B HS.PS3.A, HS.PS2.A - B, HS.PS3.A - C, HS.ESS1.B	*Common Core State Standards for English Language Arts* Reading Informational: 8.1 - 8.5, 8.8 Writing: 8.1 - 8.6, 8.4 - 8.10 Speaking and Listening: 8.1 - 8.6 Language: 8.1 – 8.6 Reading Standards for Literacy in Science and Technical Subjects – RST 6–8.1 – RST 6-8.10 Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects – WHST 6-8.1, 6-8.2, 6-8.4 – 6-8.10 *Common Core State Standards for Mathematics* Expressions & Equations - 8.EE.4, 8.EE.5, 8.EE.7 Functions – 8.F.1, 8.F.4, 8.F.5

Soap Box Derby by Melanie Payne *Skateboarding: Book of Tricks* by Steve Badillo *The Skateboard: The Good, the Rad, and the Gnarly: An Illustrated History* by Ben Marcus		

8th Grade Science Curriculum Map

Unit 3: Energy, Work, and Simple Machines	**PERFORMANCE EXPECTATIONS** **Students who demonstrate understanding can:** **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.** **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.** **MS-PS3-3: Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.** **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 particles as measured by the temperature of the sample.** **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.**

	Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
MS-PS3-1	***Analyzing and Interpreting Data*** Construct and interpret graphical displays of data to identify linear and non-linear relationships.	***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)	***Scale, Proportion, and Quantity*** 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)
MS-PS3-2	***Developing and Using Models*** Develop a model to describe unobservable mechanisms. (PS-PS3-2)	***PS3.A: Definitions of Energy*** A system of objects may also contain stored (potential) energy, depending on their relative positions. (MS-PS3-2) ***PS3.A: 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)	***Systems and System Models*** Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – an energy and matter flows within systems. (MS-PS3-2)
MS-PS3-3	***Constructing Explanations and***	***PS3.A: Definitions of Energy***	***Energy and Matter***

	Designing Solutions Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process, or system. (MS-PS3-3)	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*** Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3) ***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 include 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 the criteria and constraints of a problem. (secondary to MS-PS3-3)	The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS3-3)
MS-PS3-4	***Planning and Carrying Out Investigations*** 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.	***PS3.B: Conservation of Energy and Energy Transfer*** 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)	***Scale, Proportion, and Quantity*** 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)

	(MS-PS3-4)		
MS-PS3-5	***Engaging in Argument from Evidence*** 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)	***PS3.B: Conservation of Energy and Energy Transfer*** When the kinetic energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5)	***Energy and Matter*** Energy may take different forms (e.g., energy in fields, thermal energy, and energy of motion). (MS-PS3-5)

Essential Questions

1. What is energy?
2. How does energy change form?
3. What are the different forms of energy?
4. How is energy used?
5. What is the law of the conversation of energy?
6. How are energy and work related?
7. What is heat?
8. What are simple machines?
9. How do simple machines amplify work?

Unit Concepts	Project and/or Lab
Unit 1: Chapter 3 – Energy, Work, and Simple Machines *Lesson 1: Types of Energy*	**Lesson 1:** 1. Potential and Kinetic Energy Lab - http://teacherweb.com/FL/mkhs/thompkins/potentialandkineticenergylab.pdf

• Kinetic Energy • Potential Energy • Energy from Waves *Lesson 2: Energy Transformations and Work* • Law of the Conversation of Energy • Calculating for Work • Heat *Lesson 3: Machines* • Transfer of Mechanical Energy through the use of Simple and Complex Machines (no math formulas) • Calculate for Efficiency • Application of Laws of Motion to Simple Machines	2. Calculating Potential and Kinetic Energy - http://jersey.uoregon.edu/vlab/PotentialEnergy/ 3. Create a Wind Turbine to see mechanical energy converted into electric energy and a solar energy car 4. What affects an object's potential energy? Lab (pg. 89) 5. Endothermic and Exothermic lab - http://www.education.com/science-fair/article/chemical-reations-absorb-release-energy/ 6. Kinetic Energy Lab with Pulleys - http://www.rtmsd.org/cms/lib/PA01000204/Centricity/Domain/399/Kinetic%20Energy%20lab.pdf 7. Work and Energy Lab - http://people.virginia.edu/~jy2b/2030/Fall2010/Manual/Lab%2006%20Work%20And%20Energy.pdf **Lesson 2:** 1. Energy Transfer Lab (pg. 103) 2. Work and Power Labs (on wiki) 3. Roller Coaster Lab - http://web.stanford.edu/group/lpchscience/cgi-bin/wordpress/roller-coaster-lab.html 4. Virtual Lab on Energy Transformations - http://glencoe.com/sites/common_assets/science/virtual_labs/E04/E04.html 5. Transformations of Energy Lab - http://www.richtherrn.org/physics/energylab.pdf 6. Energy Transformation Lab Stations - http://cedarvalley.roundrockisd.org/UserFiles/Servers/Server_42350/File/Staff_Documents/6th%20Grade/L.%20Thomas/Energy%20-%20Unit%203/Energy%20Transformation%20Lab%20and%20Review_2013_14.pdf 7. Labs on Heat - http://kids.britannica.com/lm/labunits/activities/Unit_10a/product.html 8. Comparing Heat Transfer Lab - http://www.atmos.washington.edu/~durrand/demos/convection_conduction.htm **Lesson 3:** 1. Simple Machines Lab - http://staffweb.plattscsd.org/ksciole/Physical_Science_Handouts_and_PowerPoints/Machines/Simple_Machines_Lab.pdf

	2. Capstone Project - Students will constructing a catapult to launch pumpkins 3. Rube Goldberg Project - http://www.rubegoldberg.com/

Resources

1. *Teaching Physics with Toys* by Beverley Taylor
2. *Project-Based Inquiry Science* by Janet Kolodner
3. *Speed, Acceleration & Friction* by Aries Program
4. *Waterwheels, Windmills & Sunlight* from the Aries Program
5. Kinetic Energy Experiments - http://inspirationlaboratories.com/kinetic-energy-experiments-and-activities/
6. Kinetic and Potential Energy Lab Demonstration - http://lab-portfolio.weebly.com/lab-8-kinetic-and-potential-energy.html
7. Energies at a Skate Park - http://phet.colorado.edu/en/simulation/energy-skate-park
8. Heat Transfer Demonstration Lab - http://mmscrusaders.com/newscirocks/wethrweb/heat2.htm
9. Work and Energy - http://www.physicsclassroom.com/lab/energy/Elabs.cfm
10. Simple Machines from the Museum of Science and Industry - http://www.msichicago.org/education/field-trips/learning-labs/simple-machines/
11. The Science of Simple Machines - http://www.professorbeaker.com/simple.html
12. *Robots* – Movie by Disney
13. Simple and Complex Machines - http://aspire.cosmic-ray.org/Labs/Machines/act2a/lab1.html

Cross- Curricular Connection	Connection to Other NGSS DCIs	Other Learning Standards
Social Studies: Research the following in connection with the labs:	*Same Grade Band:* MS.ESS2.A, MS.ESS2.C,	*Common Core State Standards for English Language Arts*

• U.S. and Illinois trends of converting from fossil fuels to alternative energies • The impact of simple machines on the building of many historic sites such as the pyramids • The use of the catapult as a weapon in medieval history ***English Language Arts:*** *Kinetic and Potential Energy: Understanding Changes Within Physical Systems* by Jennifer Viegas *The City of Ember* by Jeanne DuPrau *Energy Island: How One Community Harnessed the Wind and Changed Their World* by Allan Drummond *The Boy Who Harnessed the Wind* by William Kamkwamba *Energy: Its Forms, Changes, & Functions* by Tom DeRosa *A Clean Planet: The Solar Energy Story* by Robyn C. Friend *Simple Machines, Grades 6 - 12: Force, Motion, and Energy* by John B. Beaver Ph.D. *Zap! Wile E. Coyote Experiments with Energy* by Suzanne Slade *The Art of the Catapult: Build Greek Ballistae, Roman Onagers, English Trebuchets, and More Ancient Artillery* by William Gurstelle *The Invention of Hugo Cabret* by Brian Selznick *Catapult: Harry and I Build a Siege Weapon* by Jim Paul *The Fort on Fourth Street: A Story About the Six Simple Machines* by Lois Spangler *Simple Story of the 3 Pigs and the Scientific Wolf* by Mary Fetzner	MS.ESS2.D, MS.ESS3.D MS.PS1.A, MS.PS1.B, MS. PS2.A, MS.PS3.D *Articulation Across Grade Bands:* 4.PS3.B - C HS.PS1.A, HS.PS1.B, HS.PS3.A – C	Reading Informational: 8.1 - 8.5, 8.8 Writing: 8.1 - 8.6, 8.4 - 8.10 Speaking and Listening: 8.1 - 8.6 Language: 8.1 – 8.6 Reading Standards for Literacy in Science and Technical Subjects – RST 6–8.1 – RST 6-8.10 Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects – WHST 6-8.1, 6-8.2, 6-8.4 – 6-8.10 *Common Core State Standards for Mathematics* Expressions & Equations – 8.EE.A.1-2, 8.EE.4, 8.EE.5, 8.EE.7 Functions – 8.F.A.3, 8.F.1, 8.F.4, 8.F.5

8th Grade Science Curriculum Map

Unit 4: Sound and Light	PERFORMANCE EXPECTATIONS **Students who demonstrate understanding can:** **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.** **MS-PS4-2: Develop and use a model to describe the waves are reflected, absorbed, or transmitted through various materials.** **MS-PS4-3: Integrate qualitative scientific and technical information to support the claim the digitized signals are a more reliable way to encode and transmit information than analog signals.** **MS-LS1-8: Gather and synthesize information that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories.**		
	Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
MS-PS4-1	***Using Mathematics and Computational Thinking*** Use mathematical representations to describe and/or support scientific conclusions and design solutions. (MS-PS4-1)	***PS4.A: Wave Properties*** A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)	***Patterns*** Graphs and charts can be used to identify patterns in data. (MS-PS4-1)
MS-PS4-2	***Developing and Using Models*** Develop and use a model to describe phenomena. (MS-PS4-2)	***PS4.A: Wave Properties*** 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) or the light. (MS-PS4-2)	***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-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)	
MS-PS4-3	***Obtaining, Evaluating, and Communicating Information*** 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)	***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)	***Structure and Function*** Structures can be designed to serve particular functions. (MS-PS4-3)
MS-LS1-8	***Obtaining, Evaluating, and Communicating Information*** Gather, read, and synthesize information from multiple sources and assess the credibility, accuracy, and possible bias of each publication and method used, and describe how they are supported or not supported by the evidence. (LS1-8)	***LS1.D: Information Processing*** Each sense receptor responds to different inputs (electromagnetic,, mechanical, chemical), transmitting them as signals that travel along nerve cells to the brain. The signals are then processed in the brain, resulting in immediate behaviors or memories. (LS1-8)	***Cause and Effect*** Cause and effect relationships may be used to predict phenomena in natural systems. (MS-LS1-8)
Essential Questions			

1. How do humans hear sound?
2. What are the parts of sound waves?
3. How are sound waves produced?
4. Why does the speed of sound waves vary in different mediums?
5. How are light waves different from sound waves?
6. How do waves in the electromagnetic spectrum differ?
7. How do humans see light?
8. What are the parts of light waves?
9. How can we interact with light using mirrors and lenses?

Unit Concepts	**Project and/or Lab**
Unit 1: Chapter 4 – Sound and Light *Lesson 1: Sound* • Parts of a Sound wave • Speed of Sound waves • Anatomy of the Human Ear • Pitch • Loudness • Technological Application of Sound waves **(Supplement with digital and analog signals)** *Lesson 2: Light* • The Electromagnetic Spectrum • Reflection • Scattering • Refraction	**Lesson 1:** 1. Modeling Sound waves using the lab on page 123 (How is sound produced?) and using drums as well as Slinkys (pg. 125) 2. Sound waves Lab - http://www.cedarville.edu/personal/lee/project/labs/lab-sound.pdf 3. Can you hear sound through water? (lab) - Students will dunk their heads in a plastic basin of water to hear how sound is diffused when traveling through a liquid versus a gas. 4. Making a Straw Clarinet -http://www.andybrain.com/sciencelab/2008/05/28/make-some-noise-learn-about-sound-with-a-straw-clarinet/ 5. Create a deconstructive wave device that will block the sound coming from the Stevenson Expression/Archer Avenue/Harlem Avenue. 6. **Supplement to Digital and Analog Signals:**

Lesson 3: Mirrors, Lenses, and the Eye • Regular and Diffuse Reflection • Types of Mirrors • Types of Lenses • Anatomy of the Human Eye • Color	http://www.diffen.com/difference/Analog_vs_Digital and http://electronics.howstuffworks.com/digital-versus-analog1.htm **Lesson 2**: 1. Pour water in a glass and make it ½ full. Put a pencil in the water resting on the side of the glass. Students will notice that the pencil looks bent. The light has changed speed by changing mediums (air to water) and slowed down. 2. The Reflection of Light waves Lab- http://k12.phys.virginia.edu/Labs/Lab04.pdf 3. Refraction Labs (on wiki) 4. Scattering of Light Lab on pg. 137 **Lesson 3:** 1. Have students practice using mirrors (convex and concave) as well as lens to see how light alters the image through them. 2. The Images Formed by a Lens lab on page. 150 3. Dissecting a Cow's Eyeball - http://www.exploratorium.edu/learning_studio/cow_eye/ 4. Rainbow Lab (on the wiki) 5. Light & Color Labs (on the wiki) 6. Have students use color films and paddles to see what happens when color mix. 7. Create a color wheel and spin it. When the color wheel is spun, it creates white light.

Resources

1. Jumpstart Music Video "Echolocation" from Batney Spears

2. The Science of Light http://www.learner.org/teacherslab/science/light/

3. Labs using lenses, mirrors, and color paddles (may need to seek resources from high school)

4. Have students use art to discuss the reflection of light waves. For example, using the "Cloud Gate" sculpture in Grant park, students can predict what happens to light waves when they strike the surface. (What is the surface of "Cloud Gate"?)

5. *Exploring Light & Color* – Aries Program

6. *The Physics of Sound* from Foss

7. *Invisible Universe* by GEMS Program

8. *Exploring Sound* by Aries Program

9. How light is made - http://zebu.uoregon.edu/~soper/Light/atomspectra.html

Cross- Curricular Connection	**Connection to Other NGSS DCIs**	**Other Learning Standards**
Social Studies: Research the following in connection with the labs: • The use of sound as a biological weapon • The issue of light pollution • The new Google glasses • The use of mirrors in magic • The discovery of the incandescent light bulb • Biography of Beethoven	*Same Grade Band:* MS. PS2.A MS.LS1.D *Articulation Across Grade Bands:* 4.PS3.A - C, 4.PS4.A – C, 4.LS1.D HS.PS3.A – B, HS.PS4.A – C, HS.LS1.A, HS.ESS1.A, HS.ESS2.A, HS.ESS2.C - D	*Common Core State Standards for English Language Arts* Reading Informational: 8.1 - 8.5, 8.8 Writing: 8.1 - 8.6, 8.4 - 8.10 Speaking and Listening: 8.1 - 8.6 Language: 8.1 – 8.6

• Invention of hearing aids and cochlear implants • Genetic tie of colorblindness • Tinnitus and rock concert ***English Language Arts:*** *The People of Sparks* by Jeanne DuPrau *Helen Keller: The Story of My Life* by Helen Keller and Candace Ward *Gossamer* by Lois Lowry *Tale of Despereaux* by Kate DiCamillo *Light The Lights! A Story About Celebrating Hanukkah And Christmas* by Margaret Moorman *The Great Gatsby* by F. Scott Fitzgerald *Day Light, Night Light: Where Light Comes From* by Franklyn M. Branley *All About Light* by Lisa Trumbauer *Light: Shadows, Mirrors, and Rainbows* by Natalie M. Rosinsky *Sound Waves* by Ian F. Mahaney *Bats* by Gail Gibbons *Light in the Attic* by Shel Silverstein *Perseus: The Hunt for Medusa's Head: A Greek Myth* by Paul D. Storrie		Reading Standards for Literacy in Science and Technical Subjects – RST 6–8.1 – RST 6-8.10 Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects – WHST 6-8.1, 6-8.2, 6-8.4 – 6-8.10 *Common Core State Standards for Mathematics* Expressions & Equations - 8.EE.4, 8.EE.5, 8.EE.7 Functions – 8.F.A.3, 8.F.1, 8.F.4, 8.F.5

8th Grade Science Curriculum Map

Unit 5: Thermal Energy	PERFORMANCE EXPECTATIONS **Students who demonstrate understanding can:** **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.** **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.** **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.** **MS-PS1-6: Undertake a design project to construct, test, and modify a device that either releases or absorbs thermal energy by chemical processes.** **MS-PS3-3: Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.** **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 particles as measured by the temperature of the sample.** **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.**		
	Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
MS-PS1-2	***Analyzing and Interpreting Data*** Analyze and interpret data to determine similarities and differences in finding. (MS-PS1-2)	***1. PS1.A: Structure and Properties of Matter*** 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) ***2. PS1.B: Chemical Reactions*** Substances react chemically in characteristics 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	***Patterns*** Macroscopic patterns are related to the nature of microscopic and atomic-level structure. (MS-PS1-2)

		of the reactants. (MS-PS1-2, MS-PS1-3 & MS-PS1-5)	
MS-PS1-4	***Developing and Using Models*** Develop a model to predict and/or describe phenomena. (MS-PS1-1 & MS-PS1-4)	***1. PS1.A: Structure and Properties of Matter*** • 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) • 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) ***2. 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) • Temperature is not a measure of energy; the relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. (secondary to MS-PS1-4)	***Cause and Effect*** Cause and effect relationships may be used to predict phenomena in natural or designed systems.
MS-PS1-5	***Developing and Using Models*** Develop a model to describe unobservable mechanisms. (MS-PS1-5)	***PS1.B: Chemical Reactions*** • Substances react chemically in characteristics 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)	***Energy and Matter*** Matter is conserved because atoms are conserved in physical and chemical processes. (MS-PS1-5)

MS-PS1-6	***Constructing Explanations and Designing Solutions*** Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints. (MS-PS1-6)	***1. PS1.B: Chemical Reactions*** Some chemical reactions release energy; other store energy. (MS-PS1-6) ***2. 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. (MS-PS1-6) ***3. 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 those 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)	***Energy and Matter*** The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS1-6)
MS-PS3-3	***Constructing Explanations and Designing Solutions*** Apply scientific ideas or principles to design, construct, and test a design of an object, tool, process, or system. (MS-PS3-3)	***PS3.A: Definitions of Energy*** 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*** Energy is spontaneously transferred out of hotter regions or objects and into colder ones. (MS-PS3-3) ***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 include 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	***Energy and Matter*** The transfer of energy can be tracked as energy flows through a designed or natural system. (MS-PS3-3)

		results in order to improve it. There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary to MS-PS3-3)	
MS-PS3-4	***Planning and Carrying Out Investigations*** 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)	***PS3.B: Conservation of Energy and Energy Transfer*** 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)	***Scale, Proportion, and Quantity*** 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)
MS-PS3-5	***Engaging in Argument form Evidence*** Construct, use, and represent 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)	***PS3.B: Conservation of Energy and Energy Transfer*** When the kinetic energy of an object changes, there is inevitably some other change in energy at the same time. (MS-PS3-5)	***Energy and Matter*** Energy may take different forms (e.g., energy in fields, thermal energy, energy of motion). (MS-PS3-5)

Essential Questions

1. How do we obtain heat?
2. How does heat travel or move?
3. How can we contain heat?
4. How are temperature and kinetic energy related?
5. How do heat and thermal energy differ?

6. In what ways can thermal energy be transferred?

7. What happens to a material when it is heated?

8. What is the effect of the states of matter in nature?

9. How do states of matter change form?

10. How are temperature and thermal energy different?

11. How do gases behave in nature?

12. How does the kinetic molecular theory describe the behavior of a gas?

13. How does temperature, pressure, and volume affect a gas?

Unit Resources	**Project and/or Lab**
Unit 2: Chapter 5 – Thermal Energy *Lesson 1: Thermal Energy, Temperature, and Heat* • Thermal Energy • Temperature • Heat *Lesson 2: Thermal Energy Transfers Radiation* • Conduction • Insulators • Specific Heat • Thermal Expansion • Thermal Contraction • Convection	**Chapter 5 – Lesson 1** 1. Insulated pop cans – Students will create a container to slow the loss of heat from a pop can. 2. Thermal Energy Ice Cream Lab - http://www.gk12.iastate.edu/classroom_projects/documents/ThermalEnergyLabPresentation_Edwards2010.pdf 3. Thermal Energy Unit Plan - http://www.mrhayden.com/pdfs/8in09.pdf **Chapter 5 – Lesson 2** 1. Have students place shredded pieces of paper in a beaker of water. Heat the water so students can observe the convention circle firsthand. 2. With the greenhouse (provided by Tara), have students create an 8 x 8 insulted barrier to prevent heat from entering the secondary chamber. 3. Have students create an insulated container that will hold the heat of hot water poured into a pop can. The goal

Unit 2: Chapter 6 – States of Matter

Lesson 1: Solids, Liquids, and Gases

- Solid
- Liquid
- Gas
- **Supplement 4th state of matter: Plasma**
- Forces between particles
- Viscosity
- Surface Tension
- Vapors

Lesson 2: Changes in State

- Melting
- Freezing
- Boiling
- Evaporation
- Condensation
- Thermal Energy
- Sublimation
- Deposition
- Conservation of Mass and Energy

Lesson 3 – The Behavior of Gases

- Kinetic Molecular Theory
- Pressure
- Volume
- Boyle's Law
- Charles Law

is to avoid heat loss.

Chapter 6 – Lesson 1

1. Viscosity Marble Lab - http://www.sciencebuddies.org/science-fair-projects/project_ideas/Chem_p055.shtml#procedure

2. Race the Corn Syrup Viscosity Lab- http://www.corvallis.k12.mt.us/middle/staff/jillw/Volcanoes/Viscosity%20Lab.htm

3.Penny Surface Tension Lab - http://www.biologycorner.com/worksheets/pennylab.html

4. Paper Surface Tension Lab - http://www.stevespanglerscience.com/lab/experiments/sink-or-swim-surface-tension

5. How Can You Make Bubble Films? Pg. 203

6. What's the Matter Lab - http://www.hschem.org/Honors/CH01/labs/Matter-%20Chemical%20and%20Physical%20Changes.pdf

Chapter 6 – Lesson 2

1. Students will melt ice in a beaker. Every minute, they will record the temperature change and graph the results.

2. How does dissolving substances in water change its freezing point? (pg. 216)

3. Change of States Lab - http://kicp-yerkes.uchicago.edu/2003-winter/pdf/ywi2003-states.pdf

4. Changing States of Matter Lab - http://scientificjam.com/SCIENCE404WEB/science404web_unit3/8thwebfiles/LAB_changestateomatter.pdf

5. **Supplement for Plasma:** http://www.chem4kids.com/files/matter_plasma.html; http://kidsneedscience.tumblr.com/post/12196290467/plasma; and http://pluto.space.swri.edu/IMAGE/glossary/plasma.html

	Chapter 6 – Lesson 3 1. Are Volume and Pressure of a Gas Related? (pg. 218) 2. Charles's Law Lab - http://scientificjam.com/SCIENCE404WEB/science404web_unit3/8thwebfiles/LAB_Charles%20law.pdf 3. Boyle's Law Virtual Lab - http://www.grc.nasa.gov/WWW/K-12/BGP/Sheri_Z/boyleslaw_act.htm 4. Labs on the Gas Laws - http://www.nclark.net/GasLaws 5. The Collapsing Can Lab – http://scifun.chem.wisc.edu/HOMEEXPTS/COLLAPSE.html

Resources

1. *Teaching Physics with Toys* by Beverley Taylor
2. *Project-Based Inquiry Science* by Janet Kolodner
3. 3. *Teaching Chemistry with Toys* by Jerry L. Sarquis
4. *The Science of Energy* from the NEED Project (ComEd)
5. Virtual Lab on Thermal Energy - http://www.glencoe.com/sites/common_assets/science/virtual_labs/PS06/PS06.html
6. Boyles' Law animation - http://www.grc.nasa.gov/
7. Boyle's Law animation - http://www.chem.iastate.edu/group/Greenbowe/
8. Animated Charles and Gay-Lussac's Laws - http://www.grc.nasa.gov/
9. Gas Law Calculators: http://www.1728.org/indexche.htm

10. Charles's Law animation - http://www.chem.iastate.edu/group/Greenbowe/

11. A "Crush the Can" animation to show what's happening inside the can molecularly - http://www.chem.iastate.edu/group/Greenbowe/

12. A Gas Law tutorial with animation and audio - http://legacyweb.chemistry.ohio-state.edu/betha/nealGasLaw/index.html

13. Animation of the way air pressure affects a balloon as it rises - http://kids.earth.nasa.gov/archive/air_pressure/balloon.html

14. Tutorial about gases - http://antoine.frostburg.edu/chem/senese/101/gases/index.shtml

15. How the gas laws can make you a better diver - http://www.aquaholic.com/gasses/laws.htm

Cross- Curricular Connection	**Connection to Other NGSS DCIs**	**Other Learning Standards**
Social Studies: Research the following in connection with the labs: • The history of refrigeration • The history of glass containers versus aluminum containers for Coke • Heating and cooling systems in buildings • Use of gas pressure to make steam engines and pressure cookers • The adventure of Sir Ernest Shackleton and the Endurance • Effects of gases on the blood when diving • Effects of gases when in different altitudes (hypoxia) ***English Language Arts:*** *Steam Train, Dream Train* by Sherri Duskey Rinke *Keeping Things Cool: The Story of Refrigeration and Air Conditioning* (Inventions That Changed Our Lives) by Barbara Ford *The Sparkling Story of Coca-Cola: An Entertaining History including Collectibles, Coke Lore, and*	*Same Grade Band:* MS.ESS2.A, MS.ESS2.C, MS.ESS2.D, MS.ESS3.D MS.PS1.A, MS.PS1.B, MS. PS2.A, MS.PS3.D MS.LS1.C, MS.LS2.B *Articulation Across Grade Bands:* 4.PS3.B 5.PS1.A - B HS.PS1.A, HS.PS1.B, HS.PS2.B, HS.PS3.A – C, HS.PS3.D	*Common Core State Standards for English Language Arts* Reading Informational: 8.1 - 8.5, 8.8 Writing: 8.1 - 8.6, 8.4 - 8.10 Speaking and Listening: 8.1 - 8.6 Language: 8.1 – 8.6 Reading Standards for Literacy in Science and Technical Subjects – RST 6–8.1 – RST 6-8.10 Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects – WHST 6-8.1, 6-8.2, 6-8.4 – 6-8.10

Calendar Girls by Gyvel Young-Witzel and Michael Karl Witzel *Trapped by the Ice! Shackleton's Amazing Antarctic Adventure* by Michael McCurd *Twelve Kinds of Ice* by Ellen Bryan Obed *The Solid Truth about States of Matter with Max Axiom, Super Scientist* (Graphic Science) by Agnieszka Biskup		*Common Core State Standards for Mathematics* Expressions & Equations – 8.EE.A.1 - 3, 8.EE.4, 8.EE.5, 8.EE.7 Functions – 8.F.A.3, 8.F.1, 8.F.4, 8.F.5

8th Grade Science Curriculum Map

Unit 6: Understanding the Atom	**Performance Expectations** **Students who demonstrate understanding can:** **MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.**		
	Science & Engineering Practices	**Disciplinary Core Ideas**	**Cross-Cutting Concepts**
MS-PS1-1	***Developing and Using Models*** Develop a model to predict and/or describe phenomena. (MS-PS1-1 & MS-PS1-4)	***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) • Solids may be formed from molecules, or they may be extended structures with repeating sub-units (e.g., crystals). (MS-PS1-1)	***Scale, Proportion, and Quantity*** Time, space, and energy phenomena can be observed at various scales used models to study systems that are too large or too small. (MS-PS1-1)

Essential Questions

1. What is an atom?
2. What are the parts of an atom?
3. How do atoms bond?
4. How has the atomic model changed over time?
5. How we organize atoms on the periodic table?
6. How do scientists use atoms to contribute to society?
7. How does a neutral atom change when its number of protons, electrons, or neutrons changes?
8. How is an electron's energy related to its distance from the nucleus?

9. Why do atoms gain, lose, or share electrons?

10. How do elements differ from the compounds they form?

11. Why is water a polar compound?

Unit Concepts	Project and/or Lab
Unit 2: Chapter 7 – Understanding the Atom *Lesson 1 – Discovering Parts of an Atom* • atom • electron • nucleus • proton • neutron cloud • electron cloud • Dalton's Atomic model • Thomson's Atomic model • Gold Foil Experiment • Bohr's Atomic model • modern atomic model *Lesson 2 – Protons, Neutrons, and Electrons* – How Atoms Differ • atomic number • isotope • mass number • average atomic mass • radioactive • nuclear decay • ion **Unit 2: Chapter 8 – Elements and Chemical Bonds** *Lesson 1 – Electrons and Energy Levels* • chemical bond	**Chapter 7 – Lesson 1** 1. Atomic Coatings - The Size of an Atom - Student Laboratory Kit from Flinn Scientific (AP6628) 2. Atomic Target Practice - Rutherford Scattering and the Nuclear Atom from Flinn Scientific (AP6496) 3. Virtual Lab on Atoms - http://education.jlab.org/atomtour/fact1.html 4. Build an Atom - http://phet.colorado.edu/en/simulation/build-an-atom **Chapter 7 – Lesson 2** 1. M & M Atomic Model Lab (on wiki) 2. The Edible Atom - http://lessonplanspage.com/scienceedibleatomlab-forperiodictableatomsgoodidea46-htm/ 3. Labs on the Periodic Table - http://www.nclark.net/PeriodicTable.html **Chapter 8 – Lesson 1** 1. How does an electron's energy relate to its position in an atom? (pg. 272) 2. Unit Plan on Atomic Bonding - http://www.mrhayden.com/pdfs/8in06.pdf **Chapter 8 – Lesson 2** 1. How is a compound different from its elements? (pg. 276) 2. How do compounds form? (pg. 280)

• valence electron • electron dot diagram • period • group • noble gases *Lesson 2 – Compounds, Chemical Formulas, and Covalent Bonds* • Covalent bond • Molecule • Polar molecule • Chemical formula *Lesson 3 – Ionic and Metallic Bonds* • Ion • Ionic bond • Metallic bond	3. How can you model compounds? (pg. 282) 4. Chemical bonding lab (on wiki) 5. Atomic Bonding with Skittles - http://web.eccrsd.us/quinn/public/Honors_Biology/Unit_2_-_Inorganic_Chemistry_-_Part_1_Basic_Chemistry_files/Lab%20-%20Modeling%20Atomic%20Structure%20and%20Bonding%20w-Skittles.pdf **Chapter 8 – Lesson 3** 1. How can atoms form compounds by gaining and losing electrons? (pg. 284) 2. How many ionic compounds can you make? (pg. 287) 3. Ions in Solution (pg. 290 – 291) 4. Virtual Lab on Bonding - http://www.glencoe.com/sites/common_assets/science/virtual_labs/E20/E20.html

Resources

1. Practice with the periodic table - http://www.funbrain.com/periodic/index.html
2. Practice with electron dot diagrams - http://www.elmhurst.edu/~ksagarin/honors/lewispractice.pdf
3. *Teaching Chemistry with Toys* by Jerry L. Sarquis
4. Jefferson Lab's "All About Atoms" - http://education.jlab.org/atomtour/index.html
5. The discovery of the electron - http://www.aip.org/history/electron
6. Visualization of molecular structure - http://www.cs.brown.edu/courses/cs237/2000/1999/gu_pramod.pdf
7. "Dream Journey Into the Atom" - http://www.pparc.ac.uk/pbl/pdf/AtomNotes.doc
8. Orbital Viewer-Download: http://www.orbitals.com/orb/ov.htm

9. The Rutherford Experiment- http://micro.magnet.fsu.edu/electromag/java/rutherford/

10. Atom Builder - http://www.pbs.org/wgbh/aso/tryit/atom/

11. Tutorial on atomic structure - http://web.jjay.cuny.edu/~acarpi/NSC/3-atoms.htm

12. Tutorials on electron configurations and atomic orbitals - http://library.thinkquest.org/3659/structures/electronconfig.html

13. Demonstration of filling of orbitals - http://intro.chem.okstate.edu/WorkshopFolder/Electronconfnew.html

14. Atomic radius animation with audio - http://www.mhhe.com/physsci/chemistry/essentialchemistry/flash/atomic4.swf

Cross- Curricular Connection	**Connection to Other NGSS DCIs**	**Other Learning Standards**
Social Studies: Research the following in connection with the labs: • The Hindenburg • The history and importance of salt • The Atomic Bomb ***English Language Arts:*** *Bomb: The Race to Build – and Steal- the World's Most Dangerous Weapon* by Steve Sheinkin *Sadako and the Thousand Paper Cranes* by Eleanor Coerr *The Manhattan Project: The Birth of the Atomic Bomb in the Words of Its Creators, Eyewitnesses, and Historians* by Cynthia C. Kelly *The Hindenburg* by Patrick O'Brien *The Story of Salt* by Mark Kurlansky	*Same Grade Band:* MS.ESS2.C *Articulation Across Grade Bands:* 5.PS1.A HS.PS1.A, HS.ESS1.A	*Common Core State Standards for English Language Arts* Reading Informational: 8.1 - 8.5, 8.8 Writing: 8.1 - 8.6, 8.4 - 8.10 Speaking and Listening: 8.1 - 8.6 Language: 8.1 – 8.6 Reading Standards for Literacy in Science and Technical Subjects – RST 6–8.1 – RST 6-8.10 Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects – WHST 6-8.1, 6-8.2, 6-8.4 – 6-8.10

		Common Core State Standards for Mathematics Expressions & Equations – 8.EE.A.3, 8.EE.4, 8.EE.5, 8.EE.7 Functions – 8.F.1, 8.F.4, 8.F.5

8th Grade Science Curriculum Map

Unit 7: Interactions Within Ecosystems	**Performance Expectations** **Students who demonstrate understanding can:** **MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.** **MS-ESS2-4: Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.** **MS-ESS2-6: Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates.** **MS-ESS3-1: Construct a scientific explanation based on evidence for how the even distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.** **MS-ESS3-2: Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.** **MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.** **MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.** **MS-ESS3-5: Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.** **MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.** **MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.** **MS-LS2-3: Develop a model to describe the cycling of matter and flow of energy among living and non-living parts of an ecosystem.** **MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.** **MS-LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services.**

	Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
MS-ESS2-1	***Developing and Using Models*** Develop and use a model to describe phenomena. (MS-ESS2-1)	***ESS2.A: Earth's Materials and Systems*** All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and the matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1)	***Stability and Change*** Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (MS-ESS2-1)
MS-ESS2-4	***Developing and Using Models*** Develop a model to describe unobservable mechanisms. (MS-ESS2-4)	***ESS2.C: The Roles of Water in Earth's Surface*** • Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4) • Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)	***Energy and Matter*** Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)
MS-ESS2-6	***Developing and Using Models*** Develop and use a model to describe phenomena. (MS-ESS2-6)	***ESS2.C: The Roles of Water in Earth's Surface*** Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents. (MS-ESS2-6) ***ESS2.D: Weather and Climate*** • Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. The interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6) • The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time,	***Systems and System Models*** Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy, matter, and information flows within systems. (MS-ESS2-6)

		and globally redistributing it through ocean currents. (MS-ESS2-6)	
MS-ESS3-1	***Constructing Explanations and Designing Solutions*** Construct a scientific explanations based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe that natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS3-1)	***ESS3.A: Natural Resources*** Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)	***Cause and Effect*** Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1)
MS-ESS3-2	***Analyzing and Interpreting Data*** Analyze and interpret data to determine similarities and differences in findings. (MS-ESS3-2)	***ESS3.B: Natural Hazards*** Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces, can help forecast the locations and likelihoods of future events. (MS-ESS3-2)	***Patterns*** Graphs, charts, and images can be used to identify patterns in data. (MS-ESS3-2)
MS-ESS3-3	***Constructing Explanations and Designing Solutions*** Apply scientific principles to design an object, tool, process, or system. (MS-ESS3-3)	***ESS3.C: Human Impacts on Earth Systems*** • Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3) • Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth, unless the activities and technologies involved are engineered others. (MS-ESS3-3 & MS-ESS3-4)	***Cause and Effect*** Relationships can be classified as casual or correlational, and correlation does not necessarily imply causation. (MS-ESS3-3)
MS-ESS3-4	***Engaging in Argument from Evidence*** Construct an oral and written argument supported by empirical	***ESS3.C: Human Impacts on Earth Systems*** Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on	***Cause and Effect*** Cause and effect relationships may be used to predict phenomena in natural or

	evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-ESS3-4)	Earth, unless the activities and technologies involved are engineered others. (MS-ESS3-3 & MS-ESS3-4)	designed systems. (MS-ESS3-1 & MS-ESS3-4)
MS-ESS3-5	***Asking Questions and Defining Problems*** Ask questions to identify and clarify evidence of an argument. (MS-ESS3-5)	***ESS3.D: Global Climate Change*** Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kids of knowledge, such as understanding human behavior and applying that knowledge wisely in decisions and activities. (MS-ESS3-5)	***Stability and Change*** Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (MS-ESS3-5)
MS-LS2-1	***Analyzing and Interpreting Data*** Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1)	***LS2.A: Interdependent Relationships in Ecosystems*** • Organisms, and populations of organisms, are dependent on their environmental interactions both with living things and with non-living factors. (MS-LS2-1) • In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constraints their growth and reproduction. (MS-LS2-1) • Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)	***Cause and Effect*** Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)
MS-LS2-2	***Constructing Explanations and Designing Solutions*** Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2)	***LS2.A: Interdependent Relationships in Ecosystems*** Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficially interactions vary across	***Patterns*** Patterns can be used to identify cause and effect relationships. (MS-LS2-2)

		ecosystems, the patters of interactions of organisms with their environments, both living and non-living, are shared. (MS-LS2-2)	
MS-LS2-3	***Developing and Using Models*** Develop a model to describe phenomena. (MS-LS2-3)	***LS2.B: Cycle of Matter and Energy Transfer in Ecosystems*** Food webs are models that demonstrate how matter and energy are transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into an out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and non-living parts of the ecosystem. (MS-LS2-3)	***Energy and Matter*** The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3)
MS-LS2-4	***Engaging in Argument from Evidence*** Construct an oral and written argument 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-LS2-4)	***LS2.C: Ecosystem Dynamics, Functioning, and Resilience*** Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)	***Stability and Change*** Small changes in one part of a system might cause large changes in another part. (MS-LS2-4 & MS-LS2-5)
MS-LS2-5	***Engaging in Argument from Evidence*** Evaluate competing design solutions based on jointly developed and agreed upon design criteria. (MS-LS2-5)	***LS2.C: Ecosystem Dynamics, Functioning, and Resilience*** Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS2-5) ***LS4.D: Biodiversity and Humans*** Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on – for example, water purification and recycling. (secondary to MS-LS2-5) ***ETS1.B: Developing Possible Solutions*** There are systematic processes for evaluating solutions with	***Stability and Change*** Small changes in one part of a system might cause large changes in another part. (MS-LS2-4 & MS-LS2-5)

		respect to how well they meet the criteria and constraints of a problem. (secondary to MS-LS2-5)	

Essential Questions

1. How do living and non-living organisms interact in an ecosystem?
2. What is the importance of energy flows in an ecosystem?
3. Why does the Earth consist of different biomes?
4. What are the ways do humans affect ecosystems?
5. How can humans protect ecosystems and biomes?
6. How do population changes affect ecosystems?
7. How does matter move through an ecosystem?
8. How do ecosystems change over time?

Unit Concepts	Project and/or Lab
Unit 5: Chapter 18 – Interactions Within Ecosystems *Lesson 1 – Ecosystems* • Habitat • Abiotic • Biotic • Population • Community • Niche • Predation • Symbiosis • Carrying capacity	**Chapter 18: Lesson 1 – Ecosystems** 1. What did the rabbits do? (pg. 651) 2. River Repair (pg. 653) – Students will chose a natural area in Summit or Bedford Park that is in need of restoration. Students will create a plan of why it should be restored and how to restore it. 3. Research and debate the impact of urban/suburban spread on coyotes, geese, barn owls, and bats. **Chapter 18: Lesson 2 – Energy and Matter** 1. Who's in the web? (pg. 658)

Lesson 2 – Energy and Matter • Producer • Consumer • Detritivore or Decomposers • Food web • Energy pyramids • Nitrogen cycle • Water cycle • Oxygen cycle • Carbon dioxide cycle *Lesson 3 – Humans and Ecosystems* • Cyanobacteria • Renewable Resources • Nonrenewable Resources • Resource depletion • Pollution • Carbon Footprint • Environmental laws (The Endangered Species Act; The Clean Air Act; and the Clean Water Act) • 5 Rs – Restore, Rethink, Reduce, Reuse, and Recycle **Unit 5: Chapter 19 – Biomes and Ecosystems** *Lesson 1 – Land Biomes* • Biome • Desert • Grassland • Temperate • Taiga • Tundra • Tropical rainforest	2. How much water can be conserved in greenhouses and nurseries? (pg. 663) 3. Food Web Lab - https://sites.google.com/a/cfsd16.org/lang-bio/assignments/foodchainlab 4. Nitrogen Cycle Lab: There's Something Fishy - http://www.umsl.edu/~microbes/pdf/There%27s%20Something%20Fishy.pdf 4. Various labs on the oxygen and carbon cycle exchanges - http://serc.carleton.edu/earthlabs/carbon/lab_1.html 5. Measure Your Carbon Footprint (pg. 672 – 673) **Chapter 18: Lesson 3 – Human and Ecosystems** 1. How can you conserve resources by reusing items? (pg. 665) 2. Science Projects in Renewable Energy and Energy Efficiency - http://www.nrel.gov/docs/gen/fy08/42236.pdf 3. Lab on Resource Depletion - http://blue.wths.net/faculty/hsmith/ILS/6_rocks_minerals/Mineral%20Depletion%20Lab.pdf 4. Students will create a public service announcement on one of the three U.S. environmental laws. 5. Create less trash at school project- http://www.pca.state.mn.us/index.php/view-document.html?gid=11345 **Chapter 19: Lesson 1 – Land Biomes** 1. What is the climate in China? (pg. 683) 2. How hot is sand? (pg. 684) 3. Which biome is it? (pg. 691) 4. Biomes in a Baggie - http://pbskids.org/zoom/activities/sci/biomeinabaggie.html 5. Unique Plants of the Biomes Research - http://www.discoveryeducation.com/teachers/free-lesson-plans/unique-plants-of-the-biomes.cfm

• deciduous *Lesson 2 – Aquatic Ecosystems* • Salinity • Wetland • Estuary • Intertidal zone • Coral reef • Freshwater *Lesson 3 – How Ecosystems Change* • Ecological succession (primary, secondary, and aquatic) • Climax community • Pioneer species • Eutrophication	6. Habitats of the World - http://www.discoveryeducation.com/teachers/free-lesson-plans/habitats-of-the-world.cfm **Chapter 19: Lesson 2 – Aquatic Ecosystems** 1. What happens when rivers and ocean mix? (pg. 693) 2. How do ocean ecosystems differ? (pg. 699) 3. Saving an Underwater Wilderness (pg. 701) 4. A Biome for Radishes (pg. 708) **Chapter 19: Lesson 3 – How Ecosystems Change** 1. Capstone Project - Students will create a travel brochure to their assigned biome. 2. Ecosystem Changes Lab - http://utahscience.oremjr.alpine.k12.ut.us/Sciber06/9th/Stand_2/html/2_2f.htm

Resources

1. Food Webs - http://www.gould.edu.au/foodwebs/kids_web.htm
2. Virtual Ecosystems - http://mhhe.com/biosci/genbio/virtual_labs/BL_02/BL_02.html
3. Ecosystems Labs - http://ecosystemslab.disl.org/projects.htm
4. Nitrogen Cycle - http://www.h2ou.com/h2nitrogencycle.htm
5. Movie – *Earth 2100*
6. Field Trip a forest preserve or Little Red Schoolhouse
7. Virtual Biome Lab - http://www.glencoe.com/sites/common_assets/science/virtual_labs/LS19/LS19.html

8. Virtual Biome Lab - http://earthobservatory.nasa.gov/Experiments/Biome/

9. *Environments* Kit from Foss

10. Biomes and Ecosystems Labs - http://www.juliantrubin.com/encyclopedia/ecology/ecosystem.html

11. Aquatic Biodiversity Study Guide - http://magee-science.homestead.com/APES/APES_Notes/Skeleton_Notes/Notes-CHAP8-Aquatic_Biodiversity.pdf

12. What is the Intertidal Zone? - http://www.untamedscience.com/biology/biomes/intertidal-zone-aquatic-biome/

13. Videos on Aquatic Biomes - http://www.onlinemathlearning.com/aquatic-biomes.html

14. Aquatic Biomes Web links- http://www.westranchhighschool.com/Library/Science%20Dept/Solarez/Aquatic%20Biome%20Weblinks.pdf

15. Virtual Lab on Ecosystem Changes - http://concord.org/stem-resources/experiment-ecosystems

16. Ecosystem Experiments from the Department of Energy - http://science.energy.gov/~/media/ber/pdf/Ecosystem_experiments.pdf

17. Online game called Recycle City: Create a sustainable community - http://www3.epa.gov/recyclecity/

18. Resources and ways students can incorporate the 5 Rs in their community - http://www.kidsrecycle.org/kids_links.php

Cross- Curricular Connection	Connection to Other NGSS DCIs	Other Learning Standards
Social Studies: Research the following in connection with the labs: • The introduction of pigs, kudzu, and Asian carp to the U.S. What has it done to the environment? ***English Language Arts:*** *When the Tides Went Out* by Charles Eric Maine *The Burning World* by J.G. Ballard	*Same Grade Band:* MS.PS1.A – B, MS-PS2.A - B, MS.PS3.A – C, MS-PS3.D, MS.PS4.B MS.LS4.A, MS-LS4.D, MS.LS2.B – C, MS.LS3.A, MS.LS2.A MSESS1.B, MS-ESS3.C, MS.ESS2.D, MS.ESS2.A *Articulation Across Grade*	*Common Core State Standards for English Language Arts* Reading Informational: 8.1 - 8.5, 8.8 Writing: 8.1 - 8.6, 8.4 - 8.10 Speaking and Listening: 8.1 - 8.6 Language: 8.1 – 8.6

Ecosystems (Ecology & the Environment) by Angela Wagner *What If There Were No Bees?: A Book About the Grassland Ecosystem (Food Chain Reactions)* by Suzanne Slade and Carol Schwartz *Exploring Ecosystems with Max Axiom, Super Scientist (Graphic Science)* by Agnieszka Biskup and Todd G Smith *Many Biomes, One Earth* by Sneed B. Collard III *What If There Were No Gray Wolves?: A Book About the Temperate Forest Ecosystem (Food Chain Reactions)* by Suzanne Slade and Carol Schwartz *Biomes and Ecosystems* by Barbara J. Davis *What If There Were No Sea Otters?: A Book About the Ocean Ecosystem (Food Chain Reactions)* by Suzanne Slade and Carol Schwartz *What Is a Biome?* by Bobbie Kalman *The World of Food Chains with Max Axiom, Super Scientist (Graphic Science)* by Liam O'Donnell, Bill Anderson and Cynthia Martin *What Are Food Chains and Webs?* by Bobbie Kalman and Jacqueline Langille *Ecology: The Study of Ecosystems* by Susan Heinrichs Gray *The Serengeti Migration: Africa's Animals on the Move* by Lisa Lindblad *Grassland* by April Pulley Sayre *The Kingdon Field Guide to African Mammals* by Jonathan Kingdon *The Temperate Forest (Deep Green Planet)* by Lorenzo Fornasari, Renato Massa, and Monica Carabella	*Bands:* 3.PS2.A, 3ESS2.D, 3.ESS3.B, 3.LS2.C, 3.LS4.D, 3.LS1.B, 3.KS3.A 4.PS3.B, 4.PS3.D, 4.ESS3.A - B, 4.ESS2.A, 4.LS1.A, 4.LS1.D 5.PS2.B, 5.PS3.D, 5.LS1.C, 5.LS2.A –B, 5.ESS2.A, 5.ESS2.C, 5.ESS3.C HS.PS1.B, HS.PS2.B, HS.PS3.B, HS.PS3.D, HS.PS4.B HS.LS1.A, HS.LS1.C, HS.LS2.A – C, HS.LS4.C, HS.LS4.D HS.ESS1.B, HS.ESS2.A, HS.ESS2.B, HS.ESS2.C, HS.ESS2.D, HS.ESS2.E, HS.ESS3.A – C, HS.ESS3.D	Reading Standards for Literacy in Science and Technical Subjects – RST 6–8.1 – RST 6-8.10 Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects – WHST 6-8.1, 6-8.2, 6-8.4 – 6-8.10 *Common Core State Standards for Mathematics* Expressions & Equations - 8.EE.4, 8.EE.5, 8.EE.7 Functions – 8.F.1, 8.F.4, 8.F.5

Vanishing Forests by Helen J. Challand *Tropical Rain Forest* by April Pulley Sayre *Welcome to the Green House* by Jane Yolen *The Most Beautiful Roof in the World: Exploring the Rainforest Canopy* by Kathryn Lasky *Rainforest (Biomes of the World)* by Edward R. Ricciuti *Antarctica (Enchantment of the World)* by Henry Billings *What's a Penguin Doing in a Place Like This?* by Miriam Schlein		

8th Grade Science Curriculum Map

Unit 8 – Environmental Impacts	**Performance Expectations** **Students who demonstrate understanding can:** **MS-ESS2-1: Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.** **MS-ESS2-4: Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.** **MS-ESS2-5: Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions.** **MS-ESS3-1: Construct a scientific explanation based on evidence for how the even distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.** **MS-ESS3-2: Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.** **MS-ESS3-3: Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.** **MS-ESS3-4: Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.** **MS-ESS3-5: Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.** **MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.** **MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.** **MS-LS2-3: Develop a model to describe the cycling of matter and flow of energy among living and non-living parts of an ecosystem.** **MS-LS2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.** **MS-LS2-5: Evaluate competing design solutions for maintaining biodiversity and ecosystem services.**

	Science & Engineering Practices	Disciplinary Core Ideas	Cross-Cutting Concepts
MS-ESS2-1	***Developing and Using Models*** Develop and use a model to describe phenomena. (MS-ESS2-1)	***ESS2.A: Earth's Materials and Systems*** All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and the matter that cycles produce chemical and physical changes in Earth's materials and living organisms. (MS-ESS2-1)	***Stability and Change*** Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale. (MS-ESS2-1)
MS-ESS2-4	***Developing and Using Models*** Develop a model to describe unobservable mechanisms. (MS-ESS2-4)	***ESS2.C: The Roles of Water in Earth's Surface*** • Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4) • Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4)	***Energy and Matter*** Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)
MS-ESS2-5	***Planning and Carrying Investigations*** Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5)	***1. ESS2.C: The Roles of Water in Earth's Surface*** The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) ***2. ESS2.D: Weather and Climate*** Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)	***Systems and System Models*** Models can be used to represent systems and their interactions – such as inputs, processes, and outputs – and energy, matter, and information flows within systems. (MS-ESS2-6)
MS-ESS3-1	***Constructing Explanations and Designing Solutions*** Construct a scientific explanations based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws	***ESS3.A: Natural Resources*** Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. (MS-ESS3-1)	***Cause and Effect*** Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1)

	that describe that natural world operate today as they did in the past and will continue to do so in the future. (MS-ESS3-1)		
MS-ESS3-2	***Analyzing and Interpreting Data*** Analyze and interpret data to determine similarities and differences in findings. (MS-ESS3-2)	***ESS3.B: Natural Hazards*** Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces, can help forecast the locations and likelihoods of future events. (MS-ESS3-2)	***Patterns*** Graphs, charts, and images can be used to identify patterns in data. (MS-ESS3-2)
MS-ESS3-3	***Constructing Explanations and Designing Solutions*** Apply scientific principles to design an object, tool, process, or system. (MS-ESS3-3)	***ESS3.C: Human Impacts on Earth Systems*** • Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (MS-ESS3-3) • Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth, unless the activities and technologies involved are engineered others. (MS-ESS3-3 & MS-ESS3-4)	***Cause and Effect*** Relationships can be classified as casual or correlational, and correlation does not necessarily imply causation. (MS-ESS3-3)
MS-ESS3-4	***Engaging in Argument from Evidence*** Construct an oral and written argument 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-ESS3-4)	***ESS3.C: Human Impacts on Earth Systems*** Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth, unless the activities and technologies involved are engineered others. (MS-ESS3-3 & MS-ESS3-4)	***Cause and Effect*** Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS3-1 & MS-ESS3-4)
MS-ESS3-5	***Asking Questions and Defining Problems*** Ask questions to identify and clarify evidence of an argument. (MS-ESS3-5)	***ESS3.D: Global Climate Change*** Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the	***Stability and Change*** Stability might be disturbed either by sudden events or gradual changes that accumulate over time. (MS-ESS3-5)

		understanding of climate science, engineering capabilities, and other kids of knowledge, such as understanding human behavior and applying that knowledge wisely in decisions and activities. (MS-ESS3-5)	
MS-LS2-1	***Analyzing and Interpreting Data*** Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1)	***LS2.A: Interdependent Relationships in Ecosystems*** • Organisms, and populations of organisms, are dependent on their environmental interactions both with living things and with non-living factors. (MS-LS2-1) • In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constraints their growth and reproduction. (MS-LS2-1) • Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)	***Cause and Effect*** Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1)
MS-LS2-2	***Constructing Explanations and Designing Solutions*** Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena. (MS-LS2-2)	***LS2.A: Interdependent Relationships in Ecosystems*** Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficially interactions vary across ecosystems, the patters of interactions of organisms with their environments, both living and non-living, are shared. (MS-LS2-2)	***Patterns*** Patterns can be used to identify cause and effect relationships. (MS-LS2-2)
MS-LS2-3	***Developing and Using Models*** Develop a model to describe phenomena. (MS-LS2-3)	***LS2.B: Cycle of Matter and Energy Transfer in Ecosystems*** Food webs are models that demonstrate how matter and energy are transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into an out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial	***Energy and Matter*** The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3)

		environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and non-living parts of the ecosystem. (MS-LS2-3)	
MS-LS2-4	***Engaging in Argument from Evidence*** Construct an oral and written argument 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-LS2-4)	***LS2.C: Ecosystem Dynamics, Functioning, and Resilience*** Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)	***Stability and Change*** Small changes in one part of a system might cause large changes in another part. (MS-LS2-4 & MS-LS2-5)
MS-LS2-5	***Engaging in Argument from Evidence*** Evaluate competing design solutions based on jointly developed and agreed upon design criteria. (MS-LS2-5)	***LS2.C: Ecosystem Dynamics, Functioning, and Resilience*** Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health. (MS-LS2-5) ***LS4.D: Biodiversity and Humans*** Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystem services that humans rely on – for example, water purification and recycling. (secondary to MS-LS2-5) ***ETS1.B: Developing Possible Solutions*** There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (secondary to MS-LS2-5)	***Stability and Change*** Small changes in one part of a system might cause large changes in another part. (MS-LS2-4 & MS-LS2-5)

Essential Questions

1. How do humans negatively affect the environment?

2. What can humans do to reverse their negative impact on the environment?

3. What is the relationship between resource availability and human population growth?

4. How do humans use land, air, and water as a resource?

Unit Concepts	Project and/or Lab
Unit 5: Chapter 20 – Environmental Impacts *Lesson 1 – People and the Environment* • Population • Carrying capacity *Lesson 2 – Impact on the Land* • Deforestation • Desertification • Urban sprawl • Reforestation • Reclamation • Waste management *Lesson 3 – Impacts on Water* • Point-source pollution • Nonpoint-source pollution *Lesson 4 – Impacts on the Atmosphere* • Photochemical smog • Acid precipitation • Particulate matter • Global warming • Greenhouse effect • Air quality index • Global warming • CFCs • Carbon Monoxide • The Greenhouse Effect	**Lesson 1 – People and the Environment** 1. What happens as populations increase in size? (pg. 719) 2. What amount of Earth's resources do you use in a day? (pg. 723) 3. Population Virtual Lab - http://biologycorner.com/worksheets/virtual_lab_population.html **Lesson 2 – Impact on the Land** 1. How can items be reused? (pg. 725) 2. What happens when you mine? (pg. 727) 3. How will you design an environmentally safe landfill? (pg. 733) 4. Solid Waste Lab - http://web.eps.utk.edu/~faculty/103/103_Lab11_SolidWaste.pdf 5. Labs on waste management, water, leaky landfill, and trash: http://www.purdue.edu/discoverypark/gk12/downloads/Environmental-Science.pdf 6. How Do Oil Spills Harm the Land Lab - http://www.education.com/pdf/oil-spills-harm-wildlife/ **Lesson 3 – Impacts on Water** 1. Which water filter is the most effective? (pg. 735) 2. Dead Zones – What causes lifeless areas in the ocean? (pg. 741) 3. Water Quality Lab - http://www.ehow.com/how_8597347_test-water-lab.html

	4. Clean the Water using the Sun Lab: http://www.education.com/activity/article/Cleaning_Water_middle/ **Lesson 4 – Impacts on the Atmosphere** 1. Where's the air? (pg. 743) 2. What's in the air? (pg. 747) 3. Capstone Projects: • Design a Green City (pg. 750 – 751) • Recycling in Summit • Environmental Changes in the Area (What was Summit like 50 years ago?) 4. Labs on Acid Rain - http://www.juliantrubin.com/encyclopedia/environment/acidrain.html 5. Labs on Air Pollution - http://www.juliantrubin.com/encyclopedia/environment/airpollution.html

Resources

1. *Environments* from Foss

2. Movie – *An Inconvenient Truth* by Al Gore

3. The movie *WALL-E*

4. *The Science of Energy* from the NEED Project (ComEd)

5. Debating Deforestation - http://www.nwf.org/News-and-Magazines/Media-Center/News-by-Topic/Global-Warming/2011/12-05-11-Debating-Deforestation-at-Durban.aspx

6. Human Impact on the Environment - http://www.thehenryford.org/education/erb/HumanImpactonEcosystems.pdf

7. How does an iPod affect polar bears? - http://msms.ehe.osu.edu/category/environmental-issues/

8. Articles on Climate Change - http://www.climatechangeeducation.org/k-12_schools/curriculum/middle_school.html

8. Environmental Impact Labs - http://www.juliantrubin.com/encyclopedia/topics/environmentalsciences.html

Cross- Curricular Connection	Connection to Other NGSS DCIs	Other Learning Standards
Social Studies: Research the following in connection with the labs: • Exxon Valdez disaster 1989 • BP oil spill in the Gulf of Mexico • Chernobyl • Fukushima • The impact of the interstate highway system on the environment in the U.S. • Car emissions • Rise of electrical cars or flex fuel cars • Global warming impact on coral reefs and the ice shelves ***English Language Arts:*** *Dune* by Frank Herbert *Human Impact on the Environment* by Elizabeth Rose *Changing Planet: What is the Environmental Impact of Human Migration and Settlement?* by Sally Morgan *An Inconvenient Truth: The Crisis of Global Warming* by Al Gore *The Human Impact on the Natural Environment: Past, Present, and Future* by Andrew S. Goudie *An Introduction to Human-Environment Geography: Local Dynamics and Global Processes* by William G. Moseley	*Same Grade Band:* MS.PS1.A – B, MS-PS2.A - B, MS.PS3.A – C, MS-PS3.D, MS.PS4.B MS.LS4.A, MS-LS4.D, MS.LS2.B – C, MS.LS3.A, MS.LS2.A MSESS1.B, MS-ESS3.C, MS.ESS2.D, MS.ESS2.A *Articulation Across Grade Bands:* 3.PS2.A, 3ESS2.D, 3.ESS3.B, 3.LS2.C, 3.LS4.D, 3.LS1.B, 3.KS3.A 4.PS3.B, 4.PS3.D, 4.ESS3.A - B, 4.ESS2.A, 4.LS1.A, 4.LS1.D 5.PS2.B, 5.PS3.D, 5.LS1.C, 5.LS2.A –B, 5.ESS2.A, 5.ESS2.C, 5.ESS3.C HS.PS1.B, HS.PS2.B, HS.PS3.B, HS.PS3.D, HS.PS4.B HS.LS1.A, HS.LS1.C, HS.LS2.A – C, HS.LS4.C, HS.LS4.D HS.ESS1.B, HS.ESS2.A, HS.ESS2.B, HS.ESS2.C, HS.ESS2.D, HS.ESS2.E, HS.ESS3.A – C, HS.ESS3.D	*Common Core State Standards for English Language Arts* Reading Informational: 8.1 - 8.5, 8.8 Writing: 8.1 - 8.6, 8.4 - 8.10 Speaking and Listening: 8.1 - 8.6 Language: 8.1 – 8.6 Reading Standards for Literacy in Science and Technical Subjects – RST 6–8.1 – RST 6-8.10 Writing Standards for Literacy in History/Social Studies, Science, and Technical Subjects – WHST 6-8.1, 6-8.2, 6-8.4 – 6-8.10 *Common Core State Standards for Mathematics* Expressions & Equations - 8.EE.4, 8.EE.5, 8.EE.7 Functions – 8.F.1, 8.F.4, 8.F.5