Unit Title: Energy	**Content Area:** Physical Science	**Grade Level:** 4

Unit Summary: At the end of this unit students can explain that objects vary in the extent to which they absorb and reflect light and conduct heat (thermal energy) and electricity. Many substances can be changed from one state to another by heating or cooling. Heat (thermal energy), electricity, light, and sound are forms of energy. Heat (thermal energy) results when substances burn, when certain kinds of materials rub against each other, and when electricity flows though wires. Metals are good conductors of heat (thermal energy) and electricity. Increasing the temperature of any substance requires the addition of energy. Energy can be transferred from one place to another. Heat energy is transferred from warmer things to colder things. Light travels in straight lines. When light travels from one substance to another (air and water), it changes direction. Electrical circuits require a complete loop through conducting materials in which an electrical current can pass. Motion can be described as a change in position over a period of time.
The Science and Engineering practices that Students will engage in this unit are Asking Questions , Defining Problems, Planning and Carrying Out Investigations, Constructing Explanations and Designing Solutions, Applying scientific ideas to solve design problems, Obtaining, Evaluating, and Communicating Information.
The crosscutting concepts are "Cause and Effect: Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1)
Energy and Matter: Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

Unit Essential Questions:

- How does conservation of mass apply to the interaction of materials in a closed system?
- How do we know that things have energy?
- How can energy be transferred from one material to another?
- What happens to a material when energy is transferred to it?

Unit Enduring Understandings:

- The structures of materials determine their properties.
- When materials interact within a closed system, the total mass of the system remains the same.
- Energy takes many forms. These forms can be grouped into types of energy that are associated with the motion of mass (kinetic energy), and types of energy associated with the position of mass and with energy fields (potential energy).
- Changes take place because of the transfer of energy.
- Energy is transferred to matter through the action of forces.
- Different forces are responsible for the transfer of the different forms of energy.

Possible Student Misconceptions:

- A common misconception is that energy is a thing.
- That heat and temperature mean the same thing.
- That things use up energy.

NJCCCS: 5.2.4.A.4, 5.2.4.C.1, 5.2.4.C.2, 5.2.4.C.3, 5.2.4.C.4, 5.2.4.D.1, 5.2.4.E.1, 5.2.4.E.2, 5.2.4.E.4,

NGSS Performance Expectations: *Students who demonstrate understanding can…*

- 4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- 4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
- 4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.
- 4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
- 4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

Primary CCSS ELA/Literacy Connections: RI.4.1,RI.4.3,RI.4.9,W.4.2,W.4.7,W.4.8,W.4.9	**Primary CCSS Mathematics Connections:** MP.2 (4-ESS3-1), MP.4 (4-ESS3-1), 4.OA.A.1. (4-ESS3-1),4.OA.A.3

Lesson Pace & Sequence

Lesson Title/Number: 1: Definition of Energy	**Learning Objective(s):** Students Identify the basic forms of energy, describe how energy can cause motion or create change, and explain how energy can be transferred from one form to another.	**Lesson Duration:** 45 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core***

*Elements do not have to be in conducted in sequence.	objective(s)?	activities?	of the learning objective(s)?		ideas?
Elicit: How will you access students' prior knowledge?	Guide students to create KWL chart on Energy. Discuss what they know and would like to know.	• Chart paper • Notebooks	Asking questions and defining problems. (4-PS3-3)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1) Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2),(4-PS3-3)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Encourage groups to generate list of questions they have about energy and different ways that energy is used in life.	• Lesson/hands on ideas on energy: http://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_energy2/cub_energy2_lesson01.xml	-Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	(4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1)
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Guide students to discuss types of energy. Students explain how energy can be traced back to the sun. "Explain energy transfer, starting with the sun to plant to animal. Discuss potential and kinetic energy			4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2),(4-PS3-3) (4-PS3-2)	Energy and Matter § Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Guide students to discuss how Energy can be transformed and transferred from one source to another. Energy can be stored or can be moving We get energy from food Energy makes it possible for things to move and change. Energy cannot be created, nor	• Specific section on Next Gen Standard for energy: http://www.nextgenscience.org/4e-energy	Constructing Explanations and Designing Solutions	PS3.C: Relationship Between Energy and Forces When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3-3)	Energy and Matter § Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

	destroyed (except with atomic explosions when mass is converted into energy)				
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Use specific examples to describe some ways in which energy changes form every day.	• Notebooks	Asking questions.	(4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	"Energy and Matter § Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)"
Extend: How will students deepen their conceptual understanding through use in new context?	Students write different ways they can conserve energy and use energy at home.	• Notebooks	"Constructing Explanations and Designing Solutions	PS3.D: Energy in Chemical Processes and Everyday Life The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use. (4-PS3-4)	"Energy and Matter § Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)"

Lesson Pace & Sequence

Lesson Title/Number: 2: Forms of Energy-Heat	**Learning Objective(s):** Students explore the basic forms of energy and describe how heat is transferred from one place to another.	**Lesson Duration:** 60 minutes

Learning Cycle ***What lesson elements will support students’ progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students’ progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students’ application of practices and their understanding of core ideas?***
Elicit: How will you access students’ prior knowledge?	Students write what they know about different forms of energy-heat. Students differentiate between heat and temperature	• Notebooks	Asking Questions and Defining Problems. (4-PS3-3)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1).	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various

					ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Discuss different ways that food get cooked e.g. boiling, baking.e.tc	• K12 Resources and plans: http://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_energy2/cub_energy2_lesson01.xml	Constructing Explanations and Designing Solutions. (4-PS3-1)	. (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Energy and Matter § Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Explore: What hands-on/minds-on common experience(s) will you provide for students?	USE CAUTION WITH THIS LESSON! Using a hotplate, boil water in a pan. Using a metal spoon, wooden spoon, plastic spoon, show students that only the heat can be transferred through a source of conduction (metal spoon) Students discuss how the heat energy transferred to the water. Discuss what is happening to the water temperature. Observe the hotplate glowing. All of these things are examples of heat conduction. Students may be able to feel the heat from the hotplate too.	• Hot plate • Pan • Water • Metal spoon • Wooden spoon • Cup	-Make observations. -Constructing explanations	4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2),(4-PS3-3) (4-PS3-2)	""""Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) """"
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Guide students to explain how heat travels and how heat changes matter. Discuss conduction, convection and Radiation	• Resources for heat transfer: http://www.powersleuth.org/teacher/energy-heats/lesson5-overview	-Constructing Explanations -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2),(4-PS3-3) (4-PS3-2)	Energy and Matter § Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Guide students to discuss Energy conservation and transfer. Conduction, Convection, and Radiation. (Address misconception - Heat is the same as temperature).Heat is flow of thermal energy from one object to another while temperature is a measure of average energy in a substance.	• Resources for heat transfer: http://kateduda.cmswiki.wikispaces.net/file/view/5thGradeScienceLessonsFinal.pdf	-Constructing Explanations. -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2),(4-PS3-3) (4-PS3-2	http://www.nextgenscience.org/4e-energy
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Use examples to explain ways in which heat is transferred.	• Video clips on heat transfer: http://www.teachertube.com/video/radiation-conduction-and-convection-159713	Obtaining, Evaluating, and Communicating , (4-ESS3-1)	4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2),(4-PS3-3) (4-PS3-2)	Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Extend: How will students deepen their conceptual understanding through use in new context?	Research one or more ways that houses are insulated against cold. Determine how and why each method works.	• Lessons about heat insulation: http://beyondpenguins.ehe.osu.edu/issue/keeping-warm/lessons-and-activities-about-heat-and-insulation	-Apply scientific ideas to solve design problems. (4-PS3-4) -Constructing Explanations. -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	(4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

Lesson Pace & Sequence

Lesson Title/Number: 3: Forms of Energy-Sound	**Learning Objective(s):** Students describe how sound is produced and travels through a medium. They identify characteristics of sound.	**Lesson Duration:**60 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access	Ask the class what they know	• Sensational Sound activity	Asking Questions and Defining	PS3.A: Definitions of Energy	Cause and Effect

students' prior knowledge?	about sounds and how they are made. Make predictions. We already know that sound can travel through the air (gas). Do you think sound can travel through a solid? Why? Do you think sound can travel through a liquid? Why?	sheet for each student For each pair of kids: • 2 pieces of kite string • A metal coat hanger • Tape • 2 paper clips • 2 paper or plastic cups • A ballpoint pen • You will need 1 flimsy wood or metal ruler • SEE LINK: http://sciencenetlinks.com/afterschool-resources/sensational-sounds/	Problems. (4-PS3-3) Obtaining, Evaluating, and Communicating , (4-ESS3-1)	The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3) (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.)	Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Discuss musical instruments. How can you make a sound on an instrument? What happens to a guitar string when you pluck it? Share background information on sound via link. Review how sound is produced by vibrations	• Cluster of lessons on sound: http://www.edu.gov.mb.ca/k12/cur/science/found/kto4/4c3.pdf	-Asking Questions and Defining Problems. (4-PS3-3) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. .	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Now pairs of kids can do the activity independently. Give each pair of kids a Sensational Sound activity sheet, a coat hanger, 2 pieces of string, a couple pieces of tape, 2 paper clips, and 2 cups. As they do the activity, you may want to walk around and make sure the kids are following the instructions and answering the questions on the activity sheet.	• Lesson ideas about sound: **http://sciencenetlinks.com/afterschool-resources/sensational-sounds/**	-Asking Questions and Defining Problems. (4-PS3-3) -Planning and Carrying Out Investigations. (4-PS3-2) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating, (4-ESS3-1). -Developing and using models	(4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.	Energy and Matter § Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

	They may need a little guidance about what is happening: that the sound is traveling through the string and cup to their ears.				
Explain: How will you help students connect their exploration to the concept/topic under investigation?	When the group is done, ask this question again: “Can sound travel through a solid thing, like a desk?” Let them know that sound can travel through air, solids, and liquids. Discuss Pitch, Amplitude and Volume to show factors that affect the sound produced by vibrating objects.	• PBS Learning media about sound: http://www.pbslearningmedia.org/resource/phy03.sci.phys.howmove.lp_sound/sound-vibrations/	Constructing Explanations. (4-PS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Discuss musical instruments. How can you make a sound on an instrument? What happens to a guitar string when you pluck it? Share background information on sound via link. Review how sound is produced by vibrations	• Activities on sound: http://www.exploratorium.edu/science_explorer/ear_guitar.html	-Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Evaluate: How will students demonstrate their mastery of	Write a script explaining what sound is and how it moves.	• NSTA Journals / Articles: http://www.nsta.org/publicati	Constructing Explanations and Designing Solutions. (4-PS3-1)	(4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and	Cause and Effect Cause and effect relationships

the learning objective(s)?		ons/article.aspx?id=Z349URi8cV4uSDyFBN2UzFgc950dASw4WqeNEpN!plus!FYg=		Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.	are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Extend: How will students deepen their conceptual understanding through use in new context?	Students can research hearing aids and create a poster that shows how the aids work. They can also research how whales communicate with one another by sending sound through the water and ask if they can come up with any other examples. Discuss Sonar.	• Computer • Poster paper	-Asking Questions and Defining Problems. (4-PS3-3) -Planning and Carrying Out Investigations. (4-PS3-2) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Apply scientific ideas to solve design problems. (4-PS3-4) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	(4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. . (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

Lesson Pace & Sequence

Lesson Title/Number: 4: Energy- Light	**Learning Objective(s):** Students Demonstrate that light travels in a straight line. They describe ways that light can be absorbed, reflected or refracted by objects.	**Lesson Duration:** 60 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***

Elicit: How will you access students' prior knowledge?	Have students discuss what they know about light. Types and uses.	• Lesson plans on light: http://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_energy2/cub_energy2_lesson01.xml	-Asking Questions and Defining Problems. (4-PS3-3) -Constructing Explanations	(4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Students flashlight on Transparent, Opaque, and Translucent Materials and describe the behavior of light through those materials.	• Notebooks • Three different materials - wax paper, clear plastic wrap Ziplocs are good, cardboard • Mirror • Clear cup with water • Pencil.	-Asking Questions and Defining Problems. (4-PS3-3) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	(4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "
Explore: What hands-on/minds-on common experience(s) will you provide for students?	- Reflection Use mirrors to explore Reflection. Refraction (Bending Light) - sticking a straight pencil into a clear plastic glass of water, the kids are able to see how the light moves through water and appears to "bend" the pencil. Discuss Absorption of light and why we see the colors we see.	• Games, Videos and lessons on light: http://www.sciencekids.co.nz/light.html	-Asking Questions and Defining Problems. (4-PS3-3) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "

				(4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Students research and discuss lenses. - Convex and concave lenses. Discuss everyday uses of these lenses.	• Lessons on light: http://www.edu.gov.mb.ca/k12/cur/science/found/kto4/4c2.pdf	-Asking Questions and Defining Problems. (4-PS3-3) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. .	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Discuss relationships between wavelengths and energy. Electromagnetic spectrum		-Asking Questions and Defining Problems. (4-PS3-3) -Constructing Explanations. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. .	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Students prepare a lesson that describes how they will teach a class about the nature of light, reflection and refraction.	• Grade 4 resources for Physical Science: http://hrsbstaff.ednet.ns.ca/webct/science/4science/light.htm	-Planning and Carrying Out Investigations. (4-PS3-2) --Constructing Explanations. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	(4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various

				Chemical Processes and Everyday Life.	ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "
Extend: How will students deepen their conceptual understanding through use in new context?	Research how the human eyes work and present report.	• Computer and notebooks.	-Asking Questions and Defining Problems. (4-PS3-3) -Planning and Carrying Out Investigations. (4-PS3-2) --Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

Lesson Pace & Sequence

Lesson Title/Number: 5: Energy-Electricity	**Learning Objective(s):** Describe characteristics of electrically charged objects. Differentiate between static and current electricity.	**Lesson Duration:** 45 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Students write their questions about electricity. Discuss what they know about electricity.	• Notebooks	-Asking Questions and Defining Problems. (4-PS3-3) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "

				Everyday Life.	
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Allow a few students to Start with demo. Tear off a number of bits of paper of about 1 centimeter square and scatter them on the desk. Run a comb through hair. Hold comb above the bits of paper. Slowly lower the comb until the scraps jump to it. Point out that some force must have been present to overcome the force of gravity. Guide students to discuss the form of energy that must have produced that force.	• Bits of papers • Comb • Human hair	-Asking Questions and Defining Problems. (4-PS3-3) -Planning and Carrying Out Investigations. (4-PS3-2) -Constructing Explanations -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces.	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) """
Explore: What hands-on/minds-on common experience(s) will you provide for students?	How rubbed balloons interact. The students should first make a prediction about the lab. The teacher can ask questions like, "How will the two balloons interact if you rub one balloon with a wool cloth? What if you rub both balloons with the wool cloth?" Tape a piece of string to each inflated balloon. Then, have a partner hold the balloons in the air about 12 inches apart. 2. Rub one balloon about ten times with a piece of wool cloth. 3. Observe 4. Rub the other balloon about ten times with the cloth. 5. Observe 6. Hold the wool cloth between the two balloons. 7. Observe 8. Place your hand between the two balloons. 9. Observe and record observations	• Two inflated balloons • Two pieces of string (12 inches each) • Tape • Wool cloth	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) """

Explain: How will you help students connect their exploration to the concept/topic under investigation?	Explain interaction between electrical charges-positive and negative charges. Discuss static electricity.		Asking Questions and Defining Problems. (4-PS3-3) Planning and Carrying Out Investigations. (4-PS3-2) Constructing Explanations and Designing Solutions. (4-PS3-1) Apply scientific ideas to solve design problems. (4-PS3-4) Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Guide students to discuss How charges move-Electrical Discharge, Lightning and Electric Current		Asking Questions and Defining Problems. (4-PS3-3) Planning and Carrying Out Investigations. (4-PS3-2) Constructing Explanations and Designing Solutions. (4-PS3-1) Apply scientific ideas to solve design problems. (4-PS3-4) Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "

Evaluate: How will students demonstrate their mastery of the learning objective(s)?	The assessment for this lab will be the students' lab notes, with questions and observations. The teacher will determine, whether the student understands the goal from their lob notes		-Asking Questions and Defining Problems. (4-PS3-3) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "
Extend: How will students deepen their conceptual understanding through use in new context?	Have students find out how lightning forms and compare lightning with electricity. Have students report their findings in a drawing or a graphic organizer.	• Lesson plan on electricity: http://www.uen.org/Lessonplan/preview?LPid=2376	Asking Questions and Defining Problems. (4-PS3-3) Planning and Carrying Out Investigations. (4-PS3-2) Constructing Explanations and Designing Solutions. (4-PS3-1) Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "

Lesson Pace & Sequence

Lesson Title/Number: 6: Current Electricity	**Learning Objective(s):** Analyze the behavior of current electricity.	**Lesson Duration:** 60 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Discuss differences between current and static electricity	• Classroom experiments on electricity: http://teachers.egfi-k12.org/brown-bag-electricity/	-Asking Questions and Defining Problems. (4-PS3-3) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Discuss various ways electricity is used in everyday life. Let students discuss flow of electricity. Open and closed circuits.	• Notebooks	-Asking Questions and Defining Problems. (4-PS3-3) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

Explore: What hands-on/minds-on common experience(s) will you provide for students?	1. Give each student or pair of students the battery, bulb, and wire. Instruct students to find a way to light the bulb using only those three items. 2. As groups find ways to light the bulbs, give those further instructions to find four ways to light the bulb. Have them record each of the ways on the journal sheet. Remind students that good technical drawings will be as realistic as possible. The drawings should show important details and include word labels. .This step can be done on a separate day as a complete lesson. Create another circuit using a bulb or motor, battery, wires, and a switch. Discuss how using the switch changes the circuit from complete to incomplete very quickly.	• 1 D--size battery • 1 flashlight size bulb • 1 12-inch length of bare copper wire	-Asking Questions and Defining Problems. (4-PS3-3) -Planning and Carrying Out Investigations. (4-PS3-2) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Apply scientific ideas to solve design problems. (4-PS3-4) -Obtaining, Evaluating, and Communicating, (4-ESS3-1). Developing and using models.	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Explain: How will you help students connect their exploration to the concept/topic under investigation?	As a group, discuss the ways to light the bulb, why some methods did not work and why others did. Through this discussion, lead students to come up with definitions for a complete circuit and an incomplete circuit.	• Notebooks	-Asking Questions and Defining Problems. (4-PS3-3) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). .	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "

Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Once students understand how to make a complete electrical circuit, give them additional materials (insulators and conductors) and see how they affect their ability to make the bulb light. Draw and explain flow of electric currents. Design and construct a switch that can turn a light on and off in a circuit.	• Games on conductors/circuits: http://www.bbc.co.uk/bitesize/ks2/science/physical_processes/circuits_conductors/play/	-Asking Questions and Defining Problems. (4-PS3-3) -Planning and Carrying Out Investigations. (4-PS3-2) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Apply scientific ideas to solve design problems. (4-PS3-4) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Ask students to create a complete circuit and an incomplete circuit. Describe the difference between a complete and an incomplete circuit. Create a Venn Diagram.	• Notebooks	-Planning and Carrying Out Investigations. (4-PS3-2) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating, (4-ESS3-1). -Developing Models	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "
Extend: How will students deepen their conceptual understanding through use in new context?	Research alternative sources of energy and compare effects on environment. Research hybrid cars. Present a report on why you would or would not buy such cars.	• Computer with internet access	-Asking Questions and Defining Problems. (4-PS3-3) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Apply scientific ideas to solve design problems. (4-PS3-4) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and	"Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "

				Everyday Life. (4-PS3-4) ESS3.A: Natural Resources	

Lesson Pace & Sequence

Lesson Title/Number: 7: Series and Parallel Circuits	**Learning Objective(s):** Analyze the behavior of current electricity.				**Lesson Duration:** 60 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	Review current electricity and flow, closed and open circuits.	• 1 D--size battery • 3 flashlight size bulbs • 2 to 3 12-inch length of bare copper wire	Asking Questions (4-PS3-3) Constructing Explanations. (4-PS3-1) Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Instruct each group to assemble a basic circuit consisting of one battery, two wires, and a bulb.2.Before continuing, each student should make a written prediction of what will happen when another battery is included in the circuit.	• Energy Lesson Plan: http://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_energy2/cub_energy2_lesson01.xml	-Asking Questions and Defining Problems. (4-PS3-3) -Planning and Carrying Out Investigations. (4-PS3-2) -Constructing Explanations. (4-PS3-1) -Apply scientific -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-

				and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "
Explore: What hands-on/minds-on common experience(s) will you provide for students?	3. After recording predictions, each group will put an extra battery in the circuit, series style, and then record the result. 4. Continue making predictions and adding batteries. Use caution since too many batteries will burn out the bulbs. 5. Begin again with only one battery. Make predictions about what will happen with more than one bulb or motor. 6. Conclude by making generalizations about the effect of greater loads and the effect of greater power supply. 7. Complete the "Circuit Predictions" data sheet.	• Notebooks • 1 D--size battery • 3 flashlight size bulbs • 2 to 3 12-inch length of bare copper wire	-Asking Questions and Defining Problems. (4-PS3-3) -Planning and Carrying Out Investigations. (4-PS3-2) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Explain: How will you help students connect their exploration to the concept/topic under investigation?	Guide students to discuss what happens when a light bulb is removed form a series circuit. Why does a light bulb stay lit when one is removed from a parallel circuit?	• Lights On! Lesson Plan: http://www.uen.org/Lessonplan/preview?LPid=2707	Asking Questions and Defining Problems. (4-PS3-3) Planning and Carrying Out Investigations. (4-PS3-2) Constructing Explanations and Designing Solutions. (4-PS3-1) Apply scientific ideas to solve design problems. (4-PS3-4) Obtaining, Evaluating, and Communicating , (4-ESS3-1)		Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4) "

Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Students discuss circuits that are used in most homes and explain why. Use evidence from investigation. Discuss fuses and circuit breakers in homes. Students write about which circuits their homes or string of light have. They use evidence from their circuit model to support idea.		-Constructing Explanations and Designing Solutions. (4-PS3-1) -Apply scientific ideas to solve design problems. (4-PS3-4) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Notebook with entries. Responses to what kind of circuits are used in most homes. Use examples to support your answer.		-Constructing Explanations and Designing Solutions. (4-PS3-1) -Apply scientific ideas to solve design problems. (4-PS3-4) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Extend: How will students deepen their conceptual understanding through use in new context?	3. Students create a “city” using milk cartons. Add a power source, loads, and electrical pathways. Nine-volt batteries and small lights with alligator clips work well, but many things would	• Milk cartons • Nine volt batteries • Small light bulbs • Alligator clips	-Asking Questions and Defining Problems. (4-PS3-3) -Planning and Carrying Out Investigations. (4-PS3-2) -Constructing Explanations and Designing Solutions. (4-PS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter

	also work. Students should be encouraged to decorate the city as creatively as possible. This could be a culminating project.		-Apply scientific ideas to solve design problems. (4-PS3-4) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-4) ESS3.A: Natural Resources	Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

Lesson Pace & Sequence

Lesson Title/Number: 8: Motion and Forces	**Learning Objective(s):** Students explain the relationship between Motion, Speed, Velocity and Acceleration.	**Lesson Duration:** 90 minutes

Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access students' prior knowledge?	How do cars move? How can you prove that a car is moving?	• Books, blocks, or other stacking materials • 36" x 12" (1 m x 30.5 cm) pieces of smooth plywood or other sturdy, flat material, 1 per group • Small toy cars with moving wheels, one per student group • Pennies, washers, or other small uniform objects with weight, 6 per student group • Tape 1-foot (30.5 cm) • Sheets of heavy duty sand paper, 3 per student group • 3-foot (1 m) sheets of wax paper, 1 per student group • 3-foot (1 m) sheets of bubble wrap, 1 per student group • Pencils and erasers • Science journals or writing paper • Stop watch (or watch with second hand), 1 per student group	-Asking Questions and Defining Problems. (4-PS3-3) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

		• Meter stick, 1 per student group			
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Discuss Motion and different ways of describing Motion- Position, speed, velocity. Discuss forces that affect motion- Push , Pull	• Lesson plan on motion: http://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_energy2/cub_energy2_lesson01.xml	-Asking Questions and Defining Problems. (4-PS3-3) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Apply scientific ideas to solve design problems. (4-PS3-4) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Demonstrate making a ramp by placing one or more books under one end of the plywood. Show students how to gently push the toy car down the ramp and then measure the speed and distance it traveled with a meter stick and stopwatch. Talk about ways to make the car travel faster or go farther. Discuss the forces at work on the car. What makes it move toward the bottom of the ramp? What keeps it from moving faster? Discuss the effects of gravity and friction on the toy car. Give each group pieces of sand paper, wax paper, and bubble wrap. Tell the groups that they will now be experimenting with friction. Have them remove the metal objects taped to the car and tape the wax paper.	• Piece of cardboard/plywood 6in by 24in, • Toy car, • Meter stick, • Timer, • Wax paper, • Sand paper, • Bubble wrap	-Asking Questions and Defining Problems. (4-PS3-3) -Planning and Carrying Out Investigations. (4-PS3-2) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating, (4-ESS3-1) -Developing and using models.	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

	"Repeat the tasks, this time using bubble wrap instead of sand paper. Did the toy car move faster or slower when riding on the bubble wrap? Which of the four surfaces (wood, wax paper, sand paper, or bubble wrap) provided the most friction? Which provided the least? "				
Explain: How will you help students connect their exploration to the concept/topic under investigation?	. Discuss how forces change motion: acceleration, inertia, friction.	• Websites on Forces: http://www.scilinks.org/Harcourt_Hsp/HspStudentRetrieve.aspx?Code=HSP205	-Asking Questions and Defining Problems. (4-PS3-3) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Students create a brochure of motion that describes the route to their house. Include description of the surface and its effect on motion. Highlight suggestions for ideal route.	• Notebooks • Completed recordings and participation	-Asking Questions and Defining Problems. (4-PS3-3) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Apply scientific ideas to solve design problems. (4-PS3-4) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). . (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Notebooks. Completed recordings based on guiding questions above and participation	• Notebooks • Completed recordings and participation		PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life.	
Extend: How will students deepen their conceptual understanding through use in new context?	Ask students provide examples of friction. How does rain affect the roads? How does the traction on different tires change how a car moves? Reexamine what they have learned about motion, mass, forces, speed, and friction	• Quick writes	-Asking Questions and Defining Problems. (4-PS3-3) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Apply scientific ideas to solve design problems. (4-PS3-4) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	PS3.A: Definitions of Energy The faster a given object is moving, the more energy it possesses. (4-PS3-1). (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-2), (4-PS3-4) PS3.C: Relationship Between Energy and Forces. (4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

Lesson Pace & Sequence

Lesson Title/Number: 9: Natural Resources-Renewable and Non-Renewable		**Learning Objective(s):** Student will distinguish between renewable and nonrenewable sources of energy, investigate a variety of renewable energy resources, and compare the benefits and drawbacks of each.			**Lesson Duration:** 90 minutes
Learning Cycle ***What lesson elements will support students' progress towards mastery of the learning objectives(s)?*** ****Elements do not have to be in conducted in sequence.***	***Learning Activities*** ***What specific learning experiences will support ALL students' progress towards mastery of the learning objective(s)?***	***Resources/Materials*** ***What curricular resources/materials are available to facilitate the implementation of the learning activities?***	***Science and Engineering Practices*** ***What specific practices do students need to use in order to progress towards mastery of the learning objective(s)?***	***Disciplinary Core Ideas*** ***What core ideas do students need to understand in order to progress towards mastery of the learning objective(s)?***	***Crosscutting Concepts*** ***What crosscutting concepts will enrich students' application of practices and their understanding of core ideas?***
Elicit: How will you access	Write what you know about	• Renewable and	-Asking Questions and Defining	.	Cause and Effect

students' prior knowledge?	natural resources? What does it mean to renew something?, etc." Accept responses to develop an initial interest or connection.	Nonrenewable Resources flier (from Environment & Ecology Series) – 1 per student or pair of students • Whiteboard or chalkboard • Dry erase markers or chalk • Pencils – 1 per student • Appendix 1 – 1 per student or pair of students	Problems. (4-PS3-3) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	(4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Engage: How will you capture students' interest and get students' minds focused on the concept/topic?	Let students follow link on https://energyquest.ca.gov to read about natural resources and energy. Discuss main ideas in the reading. Discuss examples of environmental effects which could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.	• Resources for Energy quest: http://energyquest.ca.gov/story/index.html	-Asking Questions and Defining Problems. (4-PS3-3) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	. (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Explore: What hands-on/minds-on common experience(s) will you provide for students?	Divide students into teams of three or four and give them the Renewable Energy Systems student sheet. Each team will be responsible for researching Solar, Wind, Geothermal, Biomass, or Hydropower systems.	• Resources for Energy quest: http://energyquest.ca.gov/story/index.html	-Asking Questions and Defining Problems. (4-PS3-3) -Planning and Carrying Out Investigations. (4-PS3-2) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	. (4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Obtaining, Evaluating, and Communicating Information (4-ESS3-1)

Explain: How will you help students connect their exploration to the concept/topic under investigation?	Guide students to distinguish between renewable and nonrenewable energy sources. Discuss ways of conserving natural resources.	• K-12 Energy Engineering Connection: http://www.teachengineering.org/view_lesson.php?url=collection/cub_/lessons/cub_energy2/cub_energy2_lesson01.xml	-Constructing Explanations and Designing Solutions. (4-PS3-1) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	(4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Elaborate: How will students apply their learning and develop a more sophisticated understanding of the concept/topic?	Students complete and present research findings. Students include the response to these guiding questions in research. How does this technology work? How might this energy resource be used? What are some examples of its current use? What is the environmental impact of this technology? What is the cost of this technology? Are there hidden environmental and social costs? Is this technology widely accepted today? Why or why not? What obstacles have to be overcome for it to be accepted	• Resources for Energy quest: http://energyquest.ca.gov/story/index.html	Asking Questions and Defining Problems. (4-PS3-3) Planning and Carrying Out Investigations. (4-PS3-2) Constructing Explanations and Designing Solutions. (4-PS3-1) Apply scientific ideas to solve design problems. (4-PS3-4) Obtaining, Evaluating, and Communicating , (4-ESS3-1)	(4-PS3-2), (4-PS3-3) PS3.B: Conservation of Energy and Energy Transfer. (4-PS3-2), (4-PS3-3), (4-PS3-2). . (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)

Evaluate: How will students demonstrate their mastery of the learning objective(s)?	Group presentations and notebook entry.	• Resources for Energy quest: http://energyquest.ca.gov/story/index.html	Asking Questions and Defining Problems. (4-PS3-3) Planning and Carrying Out Investigations. (4-PS3-2) Constructing Explanations and Designing Solutions. (4-PS3-1) Apply scientific ideas to solve design problems. (4-PS3-4) Obtaining, Evaluating, and Communicating , (4-ESS3-1)	(4-PS3-3) PS3.D: Energy in Chemical Processes and Everyday Life. (4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)
Extend: How will students deepen their conceptual understanding through use in new context?	After all group presentations have been completed and discussed, have students write a persuasive essay in which they recommend a renewable energy technology that could potentially be used in their community. They should offer evidence to support their recommendation, including the environmental and/or economic benefits of this resource.	• Notebooks	-Defining Problems. (4-PS3-3) -Constructing Explanations and Designing Solutions. (4-PS3-1) -Apply scientific ideas to solve design problems. (4-PS3-4) -Obtaining, Evaluating, and Communicating , (4-ESS3-1)	(4-PS3-4) ESS3.A: Natural Resources. (4-ESS3-1) ETS1.A: Defining Engineering Problems. (secondary to 4-PS3-4)	Cause and Effect Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1) Energy and Matter Energy can be transferred in various ways and between objects. (4-PS3-1), (4-PS3-2),(4-PS3-3),(4-PS3-4)