Big Idea: Energy and Electricity (Transfer of Energy) — Quarter 1

Inquiry Questions

Science:

- What are ways that heat is generated and transferred?
- How do we use electrical energy?
- How might conductors and insulators impact energy?
- How is energy transferred? (Les. 1 pages 34-47)
- How do electric currents transfer energy? (Les. 2 pages 48-61)
- How does light transfer energy? (Les. 3 pages 62-75)
- What kinds of problems can be solved by understanding energy transfer? (Les. 4 pages 76-91)

Technology:

- Why is energy used in new technologies developed?
- How is energy used to make materials for products?

Engineering:

- How do products convert energy into use in everyday lives?

Mathematics:

- How can we calculate the amount of energy used in different areas? How are those calculations represented?
- What activities use the most energy? Least energy?

Social Studies:

- How has Indiana's technology evolved to support growth in manufacturing, transportation, and global competition?
- What effect does the sun have on Indiana's climate?

Content Area	Grade Level Standards
Science	4.PS.4 Describe and investigate the different ways in which heat can be generated and/or converted from one form of energy to another form of energy. (thermal energy, sound energy, heat, conduction, convection, radiation, conductor, and insulator) Les. 1 4.PS.5 Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat and electric currents. (circuit, switch, resistor, electric current, electromagnet, generator, series circuit and parallel circuit) Les. 2 (photon, electromagnetic spectrum, visible spectrum, and solar cell) Les. 3 **Note: Words in parenthesis are module and academic standard vocabulary)** **Note: Series circuit and parallel circuit need supplemented as the book doesn't cover them!!!!!!!!!!!!!!!**

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Technology & Engineering	STL 1.C Things that are found in nature differ from things that are human-made in how they are produced and used. STL 2.J Materials have many different properties. STL 3.G When parts of a system are missing, it may not work as planned. STL 16.C Energy comes in different forms. STL 16.D Tools, machines, products, and systems use energy in order to do work.
Mathematics	Math – Students can work with energy topics and math topics by identifying types of energy and the fractions of total energy produced as well as consumed. They can convert measurements of energy and graph their measurements. 4.NF.3.d Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators. 4.NF.6 Use decimal notation for fractions with denominators 10 or 100. 4.NF.7 Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with symbols (<, >, =) and justify the conclusions using a visual model. 4.MD.1 Know relative sizes of measurement units within one system of units including km, m, cm; kg, g; lb. oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit. Record measurement equivalents in a two-column table. 4.MD.4 Make a line lot to display a data set of measurements in fractions of a unit. Solve problems involving addition and subtraction of fractions using information presented in line plots.
Social Studies	4.3.7 Explain the effect of the Earth/sun relationship* on the climate of Indiana. 4.1.11 Identify and describe important events and movements that changed life in Indiana in the early twentieth century. 4.1.14 Research Indiana's modern growth emphasizing manufacturing, new technologies, transportation and global connections
ELA	**Reading: Informational Text** CCSS.ELA-Literacy.RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. CCSS.ELA-Literacy.RI.4.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text. CCSS.ELA-Literacy.RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. CCSS.ELA-Literacy.RI.4.4 Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a *grade 4 topic or subject area*. CCSS.ELA-Literacy.RI.4.5 Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in a text or part of a text. CCSS.ELA-Literacy.RI.4.6 Compare and contrast a firsthand and secondhand account of the same event or topic; describe the differences in focus and the information provided. CCSS.ELA-Literacy.RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears. CCSS.ELA-Literacy.RI.4.8 Explain how an author uses reasons and evidence to support particular points in a text. CCSS.ELA-Literacy.RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably.

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CCSS.ELA-Literacy.RI.4.10 By the end of year, read and comprehend informational texts, including history/social studies, science, and technical texts, in the grades 4–5 text complexity band proficiently, with scaffolding as needed at the high end of the range.

WRITING

CCSS.ELA-Literacy.W.4.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly.

- W.4.2a Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), illustrations, and multimedia when useful to aiding comprehension.
- W.4.2b Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.
- W.4.2c Link ideas within categories of information using words and phrases (e.g., *another*, *for example*, *also*, *because*).
- W.4.2d Use precise language and domain-specific vocabulary to inform about or explain the topic.
- W.4.2e Provide a concluding statement or section related to the information or explanation presented.

CCSS.ELA-Literacy.W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic.

CCSS.ELA-Literacy.W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources.
CCSS.ELA-Literacy.W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
CCSS.ELA-Literacy.W.4.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences

STEM Integrated Concepts: Physical Science | 4th Grade

Science Process Standards	Standards for Mathematical Practice
Science Process Standards ***Nature of Science*** **☒Make predictions and formulate testable questions** **☒Design a fair test.** **☒Plan and carry out investigations—often over a period of several lessons—as a class, in small groups or independently.** **☒Perform investigations using appropriate tools and technologies that will extend the senses.** **☒Use measurement skills and apply appropriate units when collecting data.** **☒Test predictions with multiple trials.** **☒Keep accurate records in a notebook during investigations and communicate findings to others using graphs, charts, maps and models through oral and written reports.** **☒Identify simple patterns in data and propose explanations to account for the patterns.** **☒Compare the results of an investigation with the prediction.** ***Design Process*** **☒Identify a need or problem to be solved.** **☒Brainstorm potential solutions.** **☒Document the design throughout the entire design process.** **☒Select a solution to the need or problem.** **☒Select the most appropriate materials to develop a solution that will meet the need.** **☒Create the solution through a prototype.** **☒Test and evaluate how well the solution meets the goal.** **☒Evaluate and test the design using measurement.** **☒Present evidence by using mathematical representations (e.g. graphs, data tables)** **☒Communicate the solution (including evidence using mathematical representations (graphs, data tables), drawings or protoypes.** **☒Communicate how to improve the solution.**	**Mathematical Practices** ☐MP.1. Make sense of problems and persevere in solving them. ☒MP.2. Reason abstractly and quantitatively. ☒MP. 3 Construct viable arguments and critique the reasoning of others. ☒MP.4. Model with mathematics. ☒MP.5. Use appropriate tools strategically. ☐MP.6. Attend to precision. ☒MP.7 Look for and make use of structure. ☐MP. 8 Look for and express regularity in repeated reasoning.

Plan of Work

Common Misconceptions

What misconceptions might students have with these ideas?

- Energy comes from a switch.
- Energy lasts forever.
- Missing the connection between energy drinks/ humans having energy
- Energy can not be conserved.

Suggested Activities

- Construct a complete circuit through which an electrical current can pass as evidenced by the lighting of a bulb or the ringing of a bell. (using wires, d-cell and bulb)
- Provide students with a bag of test materials to experiment with and identify conductors or insulators of heat and electricity. (i.e. yarn, paper clip, straw, coins etc…)
- Test energy transfer and difference in temperature with regular aluminum foil and aluminum foil painted black under a lamp. What would be different if you painted with other colors?
- Build a solar oven using foil, saran wrap and a pizza box to cook s'mores, cookies or hot dogs while investigating heat and energy transfer .
- Construct a Home - Test different man-made and natural materials based on the ability to conduct heat. Have students document their results. Next have students design a "House" to prevent an ice cube from melting. (heat source=regular light bulb) What if the walls have windows? They will design the house based on their documented results. How has insulation materials effected: how products are made, the environment, and public safety?(topics: asbestos, home safety, disposal of materials)

  Resources:
  - Is Insulation Dangerous? http://home.howstuffworks.com/home-improvement/household-safety/tips/dangerous-insulation.htm
  - Heat & Thermodynamics http://www.experiland.com/html_browse/ph_heat_thermodynamics_1.htm
  - HEAT –Flow of heat, http://scienceforkids.kidipede.com/chemistry/atoms/heat.htm

Suggested Vocabulary	Heat, Energy, Electricity , Circuit, Construct, **Insulator,** Conductor
Resources	http://www.need.org/needpdf/Energy%20Math%20Challenge.pdf http://www.partselect.com/JustForFun/Electric-Math-Numbers-Behind-Appliances.aspx http://www.eia.gov/kids/energy.cfm?page=6

Assessment	
Type of Assessment	Example
☐Observation	Teacher observation of students working and using material data to construct
☐Oral Questioning	Question students during the class periods to check for understanding and communication skills.
☐Exit Slip	
☐Journal	Students journal their experiences with the experiment. They document their designs for the house.
☐Graphic Organizers	
☐Self-Assessment	
☐Writing Prompt	Create a user manual for how to build a circuit.
☐Presentation	Students present their solution and explain how and why they built their solution.
☐Electronic media	
☐Think Pair Share	
☐Whiteboards	
☐Experiment/projects	Collection and explanation of the materials and their ability to transfer heat.
☐Quiz	
☐	Background Knowledge: **Process** **Observe** **Hypothesis** **Scientific Method** **Variable** **Investigation** **Evidence** **Prediction** **Data Analysis**
☐	Extended Activities • Build an electromagnet using d-cell, switch, wires, rivets
☐	