Unit Overview: Grade 4 Physical Science NGSS Transitions

Critical Concepts:
Energy - Gr 4.pdf
Waves and Their Applications in Technologies 2 - Gr 4.pdf
Waves and Their Applications in Technologies 3 - Gr 4.pdf

Lesson 1: Energy Suggested Time (At least 3 - 45 min sessions)	***Lesson 2: Simple Circuits Suggested Time (At least 3 - 45 min sessions)***	***Lesson 3: Electromagnets Suggested Time (At least 3 - 45 min sessions)***	***Lesson 4: Energy in Communicaiton Suggested TIme (At least 2 - 45 min sessions)***
Anchoring Phenomenon: Car crashes can cause a lot of damage. (Note: This phenomenon came from the CA Dept of Ed's Science Instructional Framework. This can be a sensitive topic for students and families so please be aware of and sensitive to student needs. If you need an alternative phenomena, the goal is collisions so look at baseball/softball or kickball/soccer where a collision facilitates the transfer of energy through the system.)			
Investigative Phenomenon: Energy comes from different sources and can change from one form to another as well as transfer from one object to another object. **Guiding Questions:** Why do car crashes cause so much damage? What happens to energy when objects collide?	**Investigative Phenomenon:** Energy can be used to light a lightbulb. **Guiding Question:** What role does light play in how we see?	**Investigative Phenomenon:** Magnets can be made so that you can turn them on or off. **Guiding Questions:** How can magnets be used to move energy?	**Investigative Phenomenon:** A telegraph is used to communicate information using energy in the form of waves **Guiding Questions:**. How can energy be used to communicate?
Lesson Overview: Students are introduced to the anchoring phenomenon. They look at an image of car crashes and begin thinking about what energy is. The students begin investigating the transfer of energy and energy sources.	**Lesson Overview:** Students investigate how a circuit works. They construct their own circuits and connect their investigations to the flow of energy.	**Lesson Overview:** Students learn how to build an electromagnet (needed for next lessons) to see that energy can be moved through electrical currents.	**Lesson Overview:** Students construct explanations related to using energy in the forms of waves to signal over a distance. They then return to the idea of car crashes to track the movement and sources of energy in the collision.
Materials: Physical Science FOSS Transition Kit • 1.1 Materials • 1.2 Materials • 1.3 Materials **Teacher Provided:** • Image of phenomena • Energy Sources Group Sheets • Energy Station Cards • Flashlight Demo Questions • Letter to Parents • Converting Energy Teacher Sheets • Energy Conversion Sheet • Energy Response Sheet • 1.3 Group Sheets • Energy Transfer Cards • Energy Travel Questions • Connections • Slinky (optional) • Interactive Notebook Science: Energy	**Materials:** Physical Science FOSS Transition Kit • 2.2 materials • light bulbs • D cell batteries • Wires **Teacher Provided:** • One Wire or Two? Probe • Lighting Bulbs sheet • Response Sheet - Making Connections • Interactive Notebook Science: Electrical Currents	**Materials:** Physical Science FOSS Transition Kit • 4.1 Materials • 4.2 Materials • 4.3 Materials **Teacher Provided:** • 4.2 Handouts • 4.3 Handouts • 4.3 Extensions	**Materials:** Physical Science FOSS Transition Kit • 5.1 Materials • 5.2 Materials **Teacher Provided:** • STREAM Code • 5.2 Group Sheets

Teacher Guide

Lesson 1: Energy

This lesson introduces the anchoring phenomenon of car crashes. Students are investigating energy sources and how energy flows between sources.

E Stage	Narrative of Teaching and Learning
Engage	Show this image (or similar) of a car crash to the students. [Note: if you look for your image, make sure there are no injured people in the picture - the goal is to be able to visualize the damage to the car and what they hit only.) Example alternatives: (Students could also go out and kick a ball around or watch a video) ● Baseball hitting bat - What happens to a baseball when it is hit by a bat? ● Soccer/kick ball - What happens to a ball when it is kicked? Ask the students *"Why do you think car crashes cause so much damage?"* Have students think and write first and then share their initial thinking with the class. Let students know that you will be investigating ideas that will help them to update their explanations by the end of the unit.
Explore/ Explain 1	Teach as written in 1.1 FOSS Energy Sources pages 56-60 of the teacher guide.
Explore/ Explain 2	Teach as written in 1.2 FOSS Converting Energy pages 66-68 of the teacher guide.
Elaborate	Teach as written in 1.3 FOSS Energy on the Move pages 74-78 of the teacher guide. Optional, use Interactive Notebook Science: Energy [Note: students do NOT need to know that energy is the ability to do work!]
Evaluate	Ask the students to draw a model showing how energy can be added to a **slinky** (spring) and transferred from one side of a slinky (spring) to the other. Then have them write a claim with evidence (scientific explanation) that explains how their model shows the transfer of energy in the spring. Their evidence should come from the investigations completed in class.

Lesson 2: Simple Circuits (Modified from 2.2 Lighting a Bulb)

In this lesson, students investigate the use of a circuit to track the energy flow that allows a light bulb to be lit.

E Stage	Narrative of Teaching and Learning
Engage	Show students the **light bulb, D cell battery,** and a **wire**. Ask them to share what they know about these items. See Probe page 55 “Administering the Probe” on One Wire or Two? Probe Provide copies of Probe page 53 to students to put in their Science Notebooks. After students have selected the person with whom they agree the most and written their own explanations, conduct a class discussion. [See Probes and Science Talk]
Explore/ Explain 1	Let students know that they will have **two wires**, a **battery** and **2 light bulbs** to share in their pair. Challenge the students to investigate how to use the battery to light up the bulb. - Ask students to share their original thinking (prediction) in a diagram or model before they start working with the materials. After students have a plan diagrammed, have them try their plan, revise it, and try new plans until they are able to light up the bulb. - Have students write one or two sentences about what they think is allowing the battery to be able to light up the bulb. They should discuss energy transfer in this sentence. Challenge students to light up the bulb with two wires and with one wire. - Ask them to share their thinking at their table and track the transfer of energy in the system.
Explore/ Explain 2 (optional)	Use the Lighting Bulbs sheet to have students make predictions and then test their ideas.
Elaborate	Ask the students to think about why light (turning on a light, using a flashlight, etc) changes what they can see in a given area. - Why is the light important to being able to see? - How do you think light energy moves based on your understanding of energy from the first lesson? Optional: Use the Response Sheet - Making Connections Optional: Interactive Notebook Science: Electrical Currents
Evaluate	Have students draw a final model of their two wire solution and their one wire solution to lighting up the light bulb. This model should include arrows showing how the students think that the energy is moving through the battery, bulb, and wire(s). Ask students to answer the following questions using “Individual Think - Partner Talk - Class Share”. ● What do you think an electrical circuit is? ● If you can’t see electricity, how do you know it is moving through the circuit? ● What is the same about your one wire circuit and your two wire circuit? ● What is different about your one wire circuit and your two wire circuit? ● What other examples of circuits have you seen in your life?

Lesson 3: Electromagnets

E Stage	Narrative of Teaching and Learning
Engage	Ask students to think about how energy is used in communication. Facilitate a class discussion by asking *What allows televisions and cellular phones to get signals?*
Explore/ Explain 1	Teach as written in FOSS Building an Electromagnet pages 178-185 of the teacher guide.
Extend	Teach as written in FOSS Number of Winds pages 186 - 191 of the teacher guide. (Nice math connections with data collection and graphing.) Teach as written in FOSS More Electromagnets pages 192 - 198 of the teacher guide.

Lesson 4: Energy in Communication

Students construct explanations of the use of energy, in the form of waves to communicate a signal over a distance.

E Stage	Narrative of Teaching and Learning
Engage	Ask students to think about how energy is used in communication. Facilitate a class discussion by asking *What allows televisions and cellular phones to get signals?*
Explore/ Explain 1	Teach as written in FOSS Reinventing the Telegraph pages 211-214 of the teacher guide.
Explore/ Explain 2	Teach as written in FOSS Long Distance Messages pages 219-221 of the teacher guide.
Evaluate	Show **phenomena image** (car crash, sports) from Lesson 1 again. Ask the students to look at their initial thinking about "Why do you think car crashes cause so much damage?" Ask students to update their thinking based on their new learnings in their notebook and then share that update with a partner. - They should add their understanding of the sources of energy. - They should also show how the energy flows or transfers. - Students should also explain where they think the energy goes to at the end of the collision. Students should back up their thinking using evidence gathered from the investigations in this unit.

Resources Used/Referenced to Develop this Unit

FOSS Teacher Editions: Matter and Energy AND Magnetism and Electricity [Full Kit Inventory 1 of 2 and 2 of 2]

Matter and Energy (Kit 1 of 2)	
Investigation 1: Energy Teacher Background	Part 1, page 52 Energy Sources
	Part 2, page 63 Converting Energy
	Part 3, page 75 Energy on the Move
Magnetism and Electricity (Kit 2 of 2)	
Investigation 2: Making Connections Teacher Background	Part 2, page 107 Lighting a Bulb
Investigation 4: Current Attractions Teacher Background	Part 1, page 178 Building an Electromagnet
	Page 2, page 186 FOSS Number of Winds
	Part 3, page 192 FOSS More Electromagnets
Investigation 5: Click It Teacher Background	Part 1, page 209 Reinventing the Telegraph
	Part 2, page 217 Long Distance Messages

NGSS Three Dimensions: Evidence Statements

Focus SEPs	Focus DCIs	Focus CCCs
Asking Questions and Defining Problems Constructing Explanations and Designing Solutions Planning and Carrying out Investigations Obtaining, Evaluating and Communicating Information	**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) **PS3.B: Conservation of Energy and Energy Transfer** • Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. (4-PS3-2),(4-PS3-3) • Light also transfers energy from place to place. (4-PS3-2) • Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy. (4-PS3-2),(4-PS3-4) **PS3.C: Relationship Between Energy and Forces** • When objects collide, the contact forces transfer energy so as to change the object's motions. (4-PS3-3) **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) **PS4.A: Wave Properties** • Waves, which are regular patterns of motion, can be made in water by disturbing the surface. When waves move across the surface of deep water, the water goes up and down in place; there is no net motion in the direction of the wave except when the water meets the beach. (Note: This grade band endpoint was moved from K–2.) (4-PS4-1) • Waves of the same type can differ in amplitude (height of the wave) and wavelength (spacing between wave peaks). (4-PS4-1) **PS4.B: Electromagnetic Radiation** • An object can be seen when light reflected from its surface enters the eyes. (4-PS4-2) **PS4.C: Information Technologies and Instrumentation** • Digitized information can be transmitted over long distances without significant degradation. High-tech devices, such as computers or cell phones, can receive and decode information—convert it from digitized form to voice—and vice versa. (4-PS4-3)	Energy and Matter Cause and Effect

CA Science Framework, Chapter 4 Grade 4: (Chapter 4: Grades Three Through Five)

	1 Car Crashes	Students investigate the energy of motion and how it transfers during collisions. They ask questions about the factors that affect energy changes during collisions.
	2 Renewable Energy	Students investigate different devices that convert energy from one form to another and then design their own device. They obtain information about how we convert natural resources into usable energy and the environmental impacts of doing so.