4th Grade

Unit 2: Physical Science **Duration: 8-16 weeks**

Energizing Everything- Energy & Motion

Desired Results

ESTABLISHED GOALS/ STANDARDS:

4-PS3-1
Use evidence to construct an explanation relating the speed of an object to the energy of that object. [*Assessment Boundary: Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.*

4-PS3-2
Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents. [*Assessment Boundary: Assessment does not include quantitative measurements of energy.*]

4-PS3-3
Ask questions and predict outcomes about the changes in energy that occur when objects collide. [Clarification Statement: Emphasis is on the change in the energy due to the change in speed, not on the forces, as objects interact.] [*Assessment Boundary: Assessment does not include quantitative measurements of energy.*]

Transfer

Meaning
ENDURING UNDERSTANDINGS: Crosscutting Concepts
Students will understand that…

- ***Students explore how energy can be stored and released using a rubber band. The amount of energy that is put into the system is related to the speed that the model spins around.***
- ***Students consider how energy is stored and released in a system as they experiment with their marble roller coasters.***
- ***Students consider how energy is stored and released in a system as they experiment with their marble roller coasters.***
- ***Students consider the ways in which energy can be stored and released as they trace the path of energy through a chain reaction.***
- ***Students consider the ways in which energy can be stored and released as they trace the path of energy through a chain reaction.***
- ***Electricity is a form of energy that can be stored (such as in batteries) and transferred via wires, where it is used to produce not only movement, but also light, heat, and more.***
- ***Heat is a form of energy that can be transferred to create movement.***
- ***Natural resources such as coal, the sun, wind, and wood can be used for energy. Using these resources (cause) can damage the environment (effect).***

Meaning

Acquisition
Disciplinary Core Ideas
Students will know…

Science and Engineering Practices
Students will be skilled at…

- **Students build a model of an**

4-PS3-4 **Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.* [Clarification Statement: Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.] [*Assessment Boundary: Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.*]** **4-ETS1-1** **Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.** **4-ETS1-2** **Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.** **4-ETS1-3** **Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.** **4-ESS3-1** **Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses**	• When something is moving, it has energy. Moving things get their energy from stored energy, and energy can be stored in different ways (gasoline, batteries, food, springs, and rubber bands). Students discover that the faster an object is moving, the more energy it has. They compare models that use thin rubber bands and thick rubber bands to determine how differences in stored energy impact the speed of the ride they are building. DCIs: PS3.B, Foundational for PS3.A • Giving something "height" (putting it up high) is another way to store energy in something. When the object falls or drops, that stored energy is released: this explains why roller coasters work, but also bicycling downhill, skiing, skydiving, even meteors. The higher up you place an object, the more energy you store in it, and the faster it goes when released or dropped. DCIs: PS3.A • Something that's falling only has as much energy as was stored in it in the first place. This is why the first hill of a rollercoaster is always the highest. When an object collides with another object, some of its energy is transferred. DCIs: PS3.B • We can invent devices that convert stored energy into movement, and transfer that energy to various other objects along a pathway. DCIs: PS3.A, PS3.C, ETS1.A	**amusement park ride called the Twist-o-matic. They use the model to carry out an investigation to examine the relationship between energy and speed. Students analyze and interpret data from their models, comparing the speed of the ride using a thin versus thick rubber band.** • **Students build a model of a roller coaster and carry out an investigation using marbles. Students analyze and interpret data from the model to explain the connection between height, energy and motion.** • **Students conduct an investigation using a model roller coaster to determine how energy can be stored in the hills of the coaster and how that energy is released to make the marbles go different distances. Students analyze and interpret data from the model to explain how the heights of different hills give marbles the energy to roll.** • **Students begin to design a chain reaction machine. They start by figuring out how to connect two components of the chain reaction: the lever and the slide. This is the basis of the machine they will further develop in Mystery 5.** • **Students design a chain reaction machine that displays a message at the end. The chain reaction**

affect the environment. [Clarification Statement: Examples of renewable energy resources could include wind energy, water behind dams, and sunlight; non-renewable energy resources are fossil fuels and fissile materials. Examples of environmental effects could include loss of habitat due to dams, loss of habitat due to surface mining, and air pollution from burning of fossil fuels.]	• Engineers are people who design or invent solutions to problems by using knowledge of science. All engineers think about what their goal is, come up with multiple ideas, test those ideas out, and repeatedly fail until they figure out what works. DCIs: PS3.A, PS3.C, ETS1.A • Electricity--the stuff from our outlets and batteries--is a form of energy that we use to produce movement, but also light, heat, and more. Just like the energy in a chain reaction machine, electricity moves along a path and so can be transferred from one place to another. We can use such knowledge about electrical energy to design solutions to problems (such as flashlights for seeing in the dark). DCIs: PS3.B, ETS1.A • The invention of the engine was a monumental step forward for human transportation; it used heat energy released from burning fuel to move people and goods over long distances much more safely, cheaply, and quickly. Engines are chain reaction machines--heat is transferred through a device to create movement! DCIs: PS3.B, PS3.D • Some natural resources such as wood, coal, and natural gases can be burned to release energy. Unfortunately, burnable sources of energy release smoke and cause air pollution. Many scientists are exploring alternative	**machines use multiple components that transfer energy from one part to the next.** • **Students design a flashlights using batteries, flights and tin foil. Students experiment with different ways of constructing their flashlights so that they turn on and off.** • **Students build a paper spinner and conduct an investigation to explain how heat makes things move.** • **Students evaluate the advantages and disadvantages of alternative energy sources to power a town. They obtain and evaluate information about the needs of each source of energy and analyze and interpret data about the town's resources.** **Inquiry Questions:** **1. How is your body similar to a car?** **2. What makes roller coasters go so fast?** **3. Why is the first hill of a roller coaster always the highest?** **4. Could you knock down a building using only dominoes?** **5. Can you build a chain reaction machine?** **6. What if there were no electricity?** **7. How long did it take to travel across the country before cars and planes?** **8. Where does energy come from?**

	natural sources of energy such as solar, wind, and water. These natural sources don't require burning to release energy. DCIs: PS3.D, ESS3.A •	

Evidence

Evaluation Criteria	Assessment Evidence
	PERFORMANCE TASK(S):
	OTHER EVIDENCE: **Unit assessment**

Learning Plan

Summary of Key Learning Events and Instruction