Grade 4 Science - Unit 2 - Energy Transfer by Collision & Electricity

Unit Focus

This Grade 4 science unit introduces students to the foundational concept of energy and how it causes change in the world around us. Students begin by observing everyday phenomena to identify and describe different types and forms of energy, such as kinetic, potential, light, sound, heat, electrical, and chemical. Through engaging demonstrations, multimedia resources, hands-on activities, and read-alouds, students develop a concrete understanding of how energy can be seen and felt in their daily lives. Select lessons from Mystery Science are incorporated to help students explore energy-related phenomena in accessible, real-world contexts. Activities like energy scavenger hunts, flashlight and sound demonstrations, and connections to music and literature help students explore cause and effect relationships— reinforcing the core idea that energy is the ability to cause change.

Building on this knowledge, students investigate how energy and motion are related. They explore how speed and mass affect kinetic energy through ramps, marbles, and real-world applications like roller coasters. The unit then progresses to energy transfer, where students discover how energy moves from one object or place to another. Through circuit building with Snap Circuits, heat spinner experiments, and "Power Stations" labs, students observe energy moving through light, heat, sound, and electricity. Aligned with NGSS performance expectations, this unit is designed to cultivate curiosity and scientific thinking through observation, experimentation, and collaborative inquiry—laying the groundwork for deeper understanding of physical science concepts in the grades ahead.

Stage 1: Desired Results - Key Understandings

Standard(s)

Next Generation Science Standards

Cross Cutting Concepts: 4

- Cause and effect relationships are routinely identified and used to explain change. (4- ESS3-1) (4.E.CC.1.1)
- Energy can be transferred in various ways and between objects. (4-PS3-1), (4- PS3-2), (4-PS3-3),(4-PS3-4) (4.E.CC.2.1)
- Knowledge of relevant scientific concepts and research findings is important in engineering. (4-ESS3-1) (4.E.CC.3.1)
- Over time, people's needs and wants change, as do their demands for new and improved technologies. (4-ESS3-1) (4.E.CC. 4.1)
- Engineers improve existing technologies or develop new ones. (4-PS3-4) (4.E.CC.4.2)
- Most scientists and engineers work in teams. (4-PS3-4) (4.E.CC.5.1)
- Science affects everyday life. (4-PS3-4) (4.E.CC.5.2)

Disciplinary Core Ideas: 4

- The faster a given object is moving, the more energy it possesses. (4-PS3-1) (4.PS3.A.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) (4.PS3.A.2)
- 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

Transfer

Students will be able to independently use their learning to...

T1 Use the scientific process to generate evidence that addresses the original questions.

T2 Create models to explore complex systems, show mastery of key science concepts, and/or develop solutions through creation of a product open to testing and redesign.

Meaning

Understanding(s)

Students will understand that...

U1 Energy exists in different forms and can be transferred between objects and systems.

U2 The speed of an object is related to the energy it possesses.

U3 Energy can move from one place to another through sound, light, heat, and electricity.

U4 Energy and fuels come from natural resources, and their use affects the environment in various ways.

U5 Engineers and scientists design solutions to convert energy from one form to another in useful ways.

Essential Question(s)

Students will keep considering...

Q1 What are different sources of energy, and how does their use impact the environment?

Q2 In what ways can energy move from place to place or from one object to another?

Q3 How can we tell how much energy something has by how it moves?

Q4 What can collisions teach us about energy and motion?

Q5 How can we design a device that converts energy from one form to another?

Stage 1: Desired Results - Key Understandings

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) (4.PS3.B.1)

- Light also transfers energy from place to place. (4-PS3-2) (4.PS3.B.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) (4.PS3.B.3)
- When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3-3) (4.PS3.C.1)
- The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use. (4- PS3-4) (4.PS3.D.1)
- Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1) (4.ESS3.A.1)
- Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (secondary to 4-PS3-4) (4.ETS1.A.1)

Performance Expectations: 4

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

Science and Engineering Practices: 4

- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships. (4-PS3-3) (4.E.SEP.1.1)
- Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (4-PS3-2 (4.E.SEP.2.1)
- Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4-PS3-1) (4.E.SEP.3.1)
- Apply scientific ideas to solve design problems. (4- PS3-4) (4.E.SEP.3.2)

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
Students will know... **K1** The difference between renewable and nonrenewable energy resources. **K2** How energy transfer occurs through sound, light, heat, and electric currents. **K3** That energy can be stored and released in different ways. **K4** The environmental impacts of energy use and extraction. **K5** That collisions can result in changes in an object's speed and energy. **K6** That energy conversion devices help us harness energy for practical use. **K7** Vocabulary: Change, Energy, Potential Energy, Kinetic Energy, Light Energy, Heat Energy, Sound Energy, Electric Charge, Electric Energy, Chemical Energy, Motion, Speed, Variable, Collision, Energy Transfer, Experiment, Gravitational Energy, Gravity, Model, Trials, Circuit, Electrons, Conductor, Insulator, Switch, Power Source, Force, Mass, Transfer, Renewable Energy, Non-Renewable Energy, Fossil Fuels.	*Students will be skilled at...* **S1** Gather and analyze information about different types of energy sources. **S2** Explain the relationship between an object's speed and its energy. **S3** Conduct investigations to observe energy transfer through sound, light, heat, and electricity. **S4** Ask questions and make predictions about energy changes in collisions. **S5** Design and test a device that converts energy from one form to another.

Stage 1: Desired Results - Key Understandings		
• Obtain and combine information from books and other reliable media to explain phenomena. (4-ESS3-1) (4.E.SEP.4.1) **Madison Public Schools Profile of a Graduate** • Design: Engaging in a process to refine a product for an intended audience and purpose. (POG.2.2) • Self-Awareness: Examining current performance critically to identify steps/ strategies to persist. (POG.4.1)		