

Unit 5: Energy Everywhere

4th Grade Science

25 Class Meetings

Written July 2025

Essential Questions

- How does the speed of an object help us understand how much energy it has?
- What happens to energy when objects crash into each other?
- How can a device change energy from one form to another to solve a problem?

Enduring Understandings with Unit Goals

EU 1: The faster an object moves, the more energy it has.

- Observe how changes in speed affect an object's energy.
- Investigate how the speed of an object is directly related to the amount of energy that it has

EU 2: Energy can change and move when objects collide.

- Investigate how energy is transferred during collisions
- Explain how the energy changes when an object impacts another object.

EU 3: Energy can be converted from one form to another to do work or solve problems.

- Understand energy conversion and transformation
- Design, test, and refine a simple device that demonstrates that understanding

Standards

NGSS Standards and Common Core Standards:

- **4-PS3-1.** Use evidence to construct an explanation relating the speed of an object to the energy of that object.
- **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.
- **3-5-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.
- **3-5-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.
- **3-5-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.
- **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.4.4:** 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.4.9:** 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.W.4.2:** Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
- **CCSS.ELA-Literacy.W.4.2.a:** 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.
- **CCSS.ELA-Literacy.W.4.2.b:** Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic.
- **CCSS.ELA-Literacy.W.4.2.c:** Link ideas within categories of information using words and phrases (e.g., *another, for example, also, because*).
- **CCSS.ELA-Literacy.W.4.2.d:** Use precise language and domain-specific vocabulary to inform about or explain the topic.
- **CCSS.ELA-Literacy.W.4.2.e:** Provide a concluding statement or section related to the information or explanation presented.
- **CCSS.ELA-Literacy.W.4.4:** Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience
- **CCSS.ELA-Literacy.W.4.5:** With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, and editing.
- **CCSS.ELA-Literacy.W.4.6:** With some guidance and support from adults, use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of one page in a single sitting.
- **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.SL.4.1:** Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 4 topics and texts*, building on others' ideas and expressing their own clearly.
- **CCSS.ELA-Literacy.SL.4.1.a:** Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
- **CCSS.ELA-Literacy.SL.4.1.b:** Follow agreed-upon rules for discussions and carry out assigned roles.
- **CCSS.ELA-Literacy.SL.4.1.c:** Pose and respond to specific questions to clarify or follow up on information and make comments that contribute to the discussion and link to the remarks of others.
- **CCSS.ELA-Literacy.SL.4.1.d:** Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.
- **CCSS.ELA-Literacy.SL.4.2:** Paraphrase portions of a text read aloud, or information presented in diverse media and formats, including visually, quantitatively, and orally.

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- **CCSS.ELA-Literacy.SL.4.3:** Identify the reasons and evidence a speaker provides to support particular points.
- **CCSS.ELA-Literacy.SL.4.4:** Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

ISAAC Vision of the Graduate Competencies

Competency 1: Write effectively for a variety of purposes.

Competency 2: Speak to diverse audiences in an accountable manner.

Competency 3: Develop the behaviors needed to interact and contribute with others on a team.

Competency 4: Analyze and solve problems independently and collaboratively.

Competency 5: Be responsible, creative, and empathetic members of the community.

Unit Content Overview

1. Speed vs. Energy

- Explore kinetic energy as energy of motion
- Make observations of fast- and slow-moving objects
- Compare and contrast the speed and energy of objects in motion
- Use simple tools to measure speed
- Record and analyze data on how speed affects how far or how hard an object pushes something
- Use visual models or graphs to show energy and speed relationships
- Construct explanations using evidence from experiments and observations

2. Changing Energy

- Define and explore collisions through real-world examples
- Investigate how energy moves from one object to another during collisions
- Ask questions and make predictions before conducting collision experiments
- Conduct hands-on investigations using balls, blocks, marbles, or cars to observe collisions
- Observe how speed, size, and material affect the result of a collision
- Use slow-motion videos or simulations to analyze energy changes in collisions
- Record and analyze what happens to objects before and after they collide
- Discuss cause-and-effects in collisions
- Explore safety engineering ideas based on energy transfer
- Reflect on how energy is conserved but changes form

3. Conversion of Energy

- Review common types of energy: motion, sound, heat, light, and electrical
- Identify examples of energy conversions in everyday life
- Explore simple devices that change energy
- Plan and carry out tests to observe how a device changes energy from one form to another
- Use design thinking: identify a problem, brainstorm solutions, and sketch a device
- Collect and use evidence to improve device designs

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Vocabulary and Key Terms: energy, motion, speed, force, collision, kinetic energy, potential energy, transfer, convert, transformation, heat, light, sound, mechanical energy, electrical energy, system, input, output, impact, evidence, data, model, design, test, refine, predict, observe, explanation, investigation, variable, energy source, energy receiver, engineer, problem, solution

Interdisciplinary Connection:

- ELA, math

Daily Learning Objectives with *TWPS*

Students will be able to...

- Define kinetic energy as the energy of motion and identify examples in the classroom and outdoors.
 - How can we tell if something has kinetic energy without touching it?
- Make and record observations of fast- and slow-moving objects in different settings.
 - *Why might two objects moving at different speeds feel different if they hit you?*
- Compare the speed and energy of objects of the same size moving at different speeds.
 - *Does speed or size matter more for how much energy something has? Why?*
- Use stopwatches and rulers to measure the speed of rolling objects.
 - *How do we know our measurements of speed are accurate?*
- Analyze how changes in speed affect how far an object pushes another object.
 - *If we double the speed of an object, do we double its energy? Why or why not?*
- Create simple graphs to show the relationship between speed and distance traveled after impact.
 - *What does our graph tell us that our observations alone might not?*
- Use evidence from experiments to construct an explanation relating speed to energy.
 - *How can we use our evidence to convince someone who disagrees with us?*
- Summarize how the speed of an object changes the amount of energy it has and can transfer.
 - *If two objects start at the same speed, how could one have more energy than the other?*
- Define and give examples of collisions in sports, transportation, and nature.
 - *What's the difference between a collision and just touching something?*
- Predict what will happen when objects of different speeds collide.
 - *How can our predictions help us design safer experiments?*
- Conduct hands-on collision tests using balls, blocks, or marbles to observe energy transfer.
 - *What changes do we see in each object after the collision?*
- Investigate how speed affects the result of a collision between objects of the same size.
 - *Does a faster object always win in a collision?*
- Investigate how size (mass) affects the result of a collision at the same speed.
 - *Why might a heavier object move a lighter one more easily?*
- Investigate how material (rubber, metal, wood) affects energy transfer during a collision.
 - *How does the material of an object change the way energy moves during a collision?*
- Use slow-motion videos or simulations to observe energy changes in collisions.
 - *What can we see in slow motion that we miss with our eyes alone?*
- Record and analyze changes in speed, direction, and shape before and after collisions.
 - *Why do some collisions cause permanent changes in objects while others don't?*
- Explain how energy is conserved but changes form during collisions.
 - *If energy doesn't disappear in a collision, where does it go?*

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- Identify and describe common forms of energy (motion, sound, heat, light, electrical).
 - *How can we tell which type of energy something has?*
- Identify examples of energy conversions in everyday life.
 - *Can one action change energy into more than one form at the same time?*
- Explore simple devices that convert one type of energy to another.
 - *What makes a device effective at changing energy from one form to another?*
- Plan an investigation to test a device that changes energy from one form to another.
 - *How do we decide what to change and what to keep the same in our test?*
- Carry out an investigation to observe how a device changes energy forms.
 - *How do we know for sure that energy changes from one type to another?*
- Use data from the investigation to explain how energy was converted in the device.
 - *Why is data more convincing than just saying what happened?*
- Brainstorm multiple designs for a device that converts energy, considering criteria and constraints.
 - *How do we decide which design is the best without building all of them?*
- Design and refine a device that converts energy from one form to another.
 - *How did testing help us improve our design?*

Instructional Strategies/Differentiated Instruction

- Whole group instruction
- Paragraph frames and sentence starters
- Teacher modeling
- Think-write-pair-share and small-group discussions
- Graphic organizers
- Accountable talk
- Homework
- Word walls with visuals (Venn Diagrams)
- Small group instruction
- Visual exemplars with teacher and student critiques
- Text and video chunking
- Spiraling back to guiding questions
- Close reading with text-dependent questions

EL Differentiation Strategies

- Key vocabulary, Word Banks and Word Walls with visuals
- TWPS (Think, write, pair, share)
- Pre-reading strategies
- Culturally responsive teaching
- Explicit teacher modeling
- Graphic organizers
- Strategic Grouping
- Non-verbal assessments

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Assessments

FORMATIVE ASSESSMENTS:

- Do Now
- Academic Discourse
- Exit Slips
- Accountable Talk Discussions
- Completed notes
- Completed graphic organizers
- Homework
- Performance Task – Playground Safety
 - Teacher’s rubric/scoring guide

SUMMATIVE ASSESSMENTS:

- Quiz: Speed and Energy, Changing Energy, Conversion of Energy (EU1, EU2, EU3, and EU4)
- Unit Task: Playground Safety (EU1, EU2 and EU3)

Unit Task

Unit Task Name: Playground Safety

Description: Upon completing the unit, students will act as members of a Student Design Team and use their science knowledge to develop a playground equipment design that demonstrates how speed affects energy, how energy changes form, and how collisions can be managed to reduce injury. Students will choose a piece of playground equipment to design thinking about potential collisions that happen with that equipment (e.g., slide, swing, seesaw, zip line, spinning ride). Students will draw and label their design, showing parts where energy changes form or where collisions may happen. Finally, students will write a persuasive proposal to the city council that explains: how their design works, using correct science terms, how speed affects energy in their design and why that matters for safety and fun, how energy changes form in your equipment, and what safety features they included to control speed, reduce harmful collisions, and keep energy transfer safe.

Evaluation: Teacher’s Scoring Guide

Unit Resources

- NewsEla
- Google Slides (Teacher’s)
- Student Journals
- Chromebooks
- ReadWorks
- Google Classroom
- Mystery Science