

Unit 4: Energy and Heat

8th Grade Science

12 Class Meetings

Revised June 2022

Essential Questions

- How does the flow and storage of energy affect the motion of objects in the world?

Enduring Understandings with Unit Goals

EU 1: Kinetic energy is related to the mass or speed of an object.

- Investigate the relationship between kinetic energy and mass as a linear proportional relationship.
- Infer that the kinetic energy doubles as the mass doubles and vice versa.

EU 2: The amount of potential energy in a system of objects changes of stationary objects in system.

- Demonstrate that a force has to be applied to move two attracting objects farther apart, transferring energy to the system.
- Demonstrate that a force has to be applied to move two repelling objects closer together, transferring energy to the system.

EU 3: Thermal energy is transferred from hotter objects to colder objects.

- Design a method to show heat transfer between objects.
- Describe different types of materials used in the design solution and their properties and how these materials will be used to minimize or maximize thermal energy transfer.

Standards

Next Generation Science Standards:

- **MS-PS3-1:** Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.
- **MS-PS3-2:** Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.
- **MS-PS3-3:** Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.
- **MS-PS3-4:** Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.
- **MS-PS3-5:** Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

Common Core State Standards:

- **RST.6-8.1:** Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- **RST.6-8.7:** Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or

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table).

- **SL.8.5:** Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
- **MP.2:** Reason abstractly and quantitatively.
- **6.RP.A.2:** Understand the concept of a unit rate a/b associated with a ratio $a:b$ with $b \neq 0$, and use rate language in the context of a ratio relationship.
- **7.RP.A.2:** Recognize and represent proportional relationships between quantities.

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. Kinetic versus Potential Energy

- Compare and contrast Kinetic versus Potential Energy
- Illustrate the difference between kinetic and potential energy

2. Thermal Energy

- Demonstrate how heat is transferred between objects

3. Common forms of Kinetic and Potential Energy

- Diagram the other nine types of energy
- Distinguish whether they are kinetic or potential energy

4. The Law of Conservation of Energy

- Examine the Law of Conservation of Energy

Interdisciplinary Connection:

- Language Arts– Cite textual evidence to support analysis of science and technical texts, attending to the precise details of explanation of description
- Math – Reason abstractly and quantitatively
- Art – Multimedia Art

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Daily Learning Objectives with *Do Now Activities*

Students will be able to...

- Compare and contrast kinetic and potential energy
 - What do the words kinetic and potential mean?
- Illustrate the difference between kinetic and potential energy
 - List three activities – be sure to include where the potential and kinetic energies are
- Analyze thermal energy and the law of thermodynamics
 - Explain what happens when you put a cold spoon into hot soup.
- Demonstrate how thermal energy is transferred between objects **
 - What is thermal energy? How is it different from sound energy?
- Outline and illustrate the nine other types of energy that can be observed in real-world scenarios
 - Match up the type of energy with the image that goes with it.
- Investigate and explain different ways in which energy can be observed every day
 - How do you use energy every day? Think of more than just your body.
- Examine and apply the Law of Conservation of Energy to real world situations
 - Define the Law of Conservation of Energy
- Design a model to show how energy is never created or destroyed but is transformed from one type to another.
 - Write down two examples of how energy is transferred between objects.
- Demonstrate content knowledge for success on the unit exam.
 - What topic of this unit would you like to discuss before the exam?

Instructional Strategies/Differentiated Instruction

- Whole group instruction
- Guided notes
- Student-led instruction
- Independent problem-solving
- Collaborative problem-solving
- Graphic Organizer
- Cross-curricular problem solving (independent and collaborative)
- Accountable Talk
- Homework
- Word walls with visuals
- Small group instruction
- Manipulatives

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Assessments

FORMATIVE ASSESSMENTS:

- Warm-ups
- Whiteboards
- Mid-class check-ins
- Exit Slips
- Accountable Talk Discussions
- Do Now
- Student-led instruction
- Homework
- NGSS Interim Assessments
- Performance Task- “Energizer Bunnies”
 - Problem-Solving Rubric

SUMMATIVE ASSESSMENTS:

- Quiz – EU 1 & EU 2
- Performance Task- “Energizer Bunnies”
- Unit 4 Test

Unit Task

Unit Task Name: “Energizer Bunnies”

Description: During this task, students will take on the role of the iconic Energizer Bunny. They begin by examining the law of conservation of energy and designing a model to show how energy is never created or destroyed, but is transformed from one type to another. The students will diagram and explain how their energizer bunny transforms between each type of energy. Along the way, they will write a summary as to how their example demonstrates each type of energy.

Evaluation: Summative Assessment and Problem-Solving Rubric

Unit Resources

- Flipped Google Classroom Videos
- Worksheets
- Laptops
- NGSS Interim Assessments
- Teach Engineering
- PALS