

03: Energy

Content Area: **Science**
Course(s):
Time Period: **Trimester**
Length: **Trimester**
Status: **Published**

General Overview, Course Description or Course Philosophy

In this unit, students explore energy! Students investigate how energy is stored, how it can make objects move, and how collisions transfer energy between objects. Students also construct devices that convert energy from one form into another, such as heat into motion and electricity into light.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

How does energy change based on position?

Where does energy come from?

CONTENT AREA STANDARDS

SCI.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.
SCI.4-PS3-1	Use evidence to construct an explanation relating the speed of an object to the energy of that object.
SCI.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.
SCI.4-PS3-2	Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
SCI.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.
SCI.4-PS3-3	Ask questions and predict outcomes about the changes in energy that occur when objects collide.
SCI.4-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

LA.W.4.1	Write opinion pieces on topics or texts, supporting a point of view with reasons and information.
MA.4.G.A.3	Recognize a line of symmetry for a two-dimensional figure as a line across the figure such

	that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.
LA.SL.4.5	Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes.
TECH.9.4.2.CI.1	Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2).
TECH.9.4.2.CI.2	Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
TECH.9.4.2.CT.1	Gather information about an issue, such as climate change, and collaboratively brainstorm ways to solve the problem (e.g., K-2-ETS1-1, 6.3.2.GeoGI.2).
TECH.9.4.2.CT.2	Identify possible approaches and resources to execute a plan (e.g., 1.2.2.CR1b, 8.2.2.ED.3).

STUDENT LEARNING TARGETS

Declarative Knowledge

Students will understand that:

- 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.
- 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).
- 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!
- 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 natural sources of energy such as solar, wind, and water. These natural sources don't require burning to release energy.
- 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 directly relate to the speed of the object.
- Giving something "height" (putting it up high) is another way to store energy. When the object falls or drops, that stored energy is released: this explains why roller coasters work, but also bicycling downhill or skiing. The higher up you place an object, the more energy you store in it, and the faster it goes when released or dropped. When an object collides with another object, some of its energy is transferred to the object and some is transferred to the air.
- Something that's falling only has as much energy as was stored in it in the first place. This is why you can notice a pattern with roller coasters - the first hill is always the highest. When an object collides with another object, some of its energy is transferred to the object and some is transferred to the air.

- We can invent devices that convert stored energy into movement, and transfer that energy to various other objects along a pathway.

Procedural Knowledge

Students will be able to:

- build a model to carry out an investigation to examine the relationship between energy and speed.
- analyze and interpret data from their models, comparing the speed of the ride using a thin versus thick rubber band.
- build a model of a roller coaster and carry out an investigation using marbles.
- analyze and interpret data from the model to explain the connection between height, energy, and speed.
- conduct an investigation using a model roller coaster to determine how energy can be stored in the hills of the coaster.
- analyze and interpret data from the model to understand that marbles must start at the tops of hills so that they will have enough energy to reach the goal at the end of the track.
- students begin to design a chain reaction machine.
- design a flashlights using batteries, lights and tin foil.
- experiment with different ways of constructing flashlights so that they turn on and off.
- conduct an investigation to explain how heat makes things move.
- evaluate the advantages and disadvantages of alternative energy sources to power a town.
- obtain and evaluate information about the needs of each source of energy and analyze and interpret data about the town's resources.

EVIDENCE OF LEARNING

Formative Assessments

- Lab Activities
- Student predictions, observations, and questions
- Teacher questions and discussion

- Observe students as they apply new concepts and skills
- Evidence of students changed thinking and behaviors
- Students answering questions using observations, evidence, and previous accepted explanations
- Students asking related questions that encourage future investigations
- Monitor students working in groups
- Listen to whole class conversations to check for understanding
- Completing tasks

Summative Assessments

Benchmark Assessments

- Multiple Choice Assessment administered at the end of each trimester (T1, T2, T3)

Alternative Assessments

- Oral Presentations
- Questions for Comprehension
- Performance Tasks
- Scientific Journals/Notebooks
- Self-Assessment
- WebQuests

RESOURCES (Instructional, Supplemental, Intervention Materials)

- Teacher Edition
- Student Lab Manual
- Student Science Notebook
- Graphic organizers
- Videos
- Environment and Living Things play cards
- How to make bread pdf
- How an aluminum can is made pdf
- Who am I? pdf

INTERDISCIPLINARY CONNECTIONS

- Integrate quantitative or technical information expressed in words in a text. Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
- Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
- Experimentation
- Social Emotional Learning
- Geoscience
- Sustainability

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

See link to Accommodations & Modifications document in course folder.

*In addition to IEP Accommodations & Modifications:

- Restate and review directions
- Student restates directions or information
- Oral responses
- Small group/ one to one
- Additional time
- Concrete examples
- Extra visuals
- Support auditory information with visuals
- Space for movement or breaks
- Extra verbal cues and prompts