4 Science Unit 1: Energy & Energy Transfer (Energizing Everything)

Content Area: **Science**
Course(s):
Time Period: **Marking Period 4**
Length: **9 Weeks**
Status: **Published**

Unit Overview

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.

Standards

Scientific & Engineering Practices

- Students build a model of an 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 speed. Students also start to build an understanding of energy transfer as they observe what happens when additional marbles (additional collisions) are added to the model.
- Students conduct an investigation using a model roller coaster to determine how energy can be stored in the hills of the coaster. Students 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. 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 Lesson 5.
- Students design a chain reaction machine that displays a message at the end. The chain reaction machines use multiple components that transfer energy from one part to the next.
- Students design a flashlights using batteries, lights 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.

Crosscutting Concepts

- 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 of the model spinning around.
- Students consider how energy is stored, released, and transferred in a system as they experiment with their marble roller coasters.

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- Students consider the ways in which energy can be stored, released, and transferred as they trace the path of energy through a chain reaction.
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- 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).

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.
4-PS3-1	Use evidence to construct an explanation relating the speed of an object to the energy of that object.
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.
4-PS3-2	Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
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.
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.
4-ESS3-1	Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

Materials

Core Materials:

- Mystery Science
  - How is your body similar to a car?
  - What makes roller coasters go so fast?
  - Why is the first hill of a roller coaster always the highest?
  - Could you knock down a building using only dominoes?
  - Can you build a chain reaction machine?
  - What if there were no electricity?
  - How long did it take to travel across the country before cars and planes?
  - Where does energy come from?
- Teacher Created Labs

Supplemental Materials:

- BrainPop resources
- NewsELA
- GRC Lessons
- TBSAID
- Nearpod Activities

Technology

Technology Literacy

• 9.4.5.TL.1: Compare the common uses of at least two different digital tools and identify the advantages and disadvantages of using each.

• 9.4.5.TL.2: Sort and filter data in a spreadsheet to analyze findings.

• 9.4.5.TL.3: Format a document using a word processing application to enhance text, change page formatting, and include appropriate images graphics, or symbols.

Technology - Engineering Design

• 8.2.5.ED.1: Explain the functions of a system and its subsystems.

• 8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.

• 8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.

Technology - Data & Analysis

• 8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.

• 8.1.5.DA.2: Compare the amount of storage space required for different types of data.

• 8.1.5.DA.3: Organize and present collected data visually to communicate insights gained from different views of the data.

• 8.1.5.DA.4: Organize and present climate change data visually to highlight relationships or support a claim.

• 8.1.5.DA.5: Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

Technology - Effects on the Natural World

• 8.2.5.ETW.2: Describe ways that various technologies are used to reduce improper use of resources.

• 8.2.5.ETW.3: Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.

• 8.2.5.ETW.4: Explain the impact that resources, such as energy and materials used to develop technology, have on the environment.

• 8.2.5.ETW.5: Identify the impact of a specific technology on the environment and determine what can be done to increase positive effects and to reduce any negative effects, such as climate change.

Evidence of Learning/Assessment

Formative Assessment

- Teacher Observation
- Quizzes
- Exit Tickets
- Labs

Summative Assessment

- Benchmark Tests
- Alternative Assessments: Performance Tasks & Projects

Accommodations & Modifications

Special Education

Follow IEP Plan which may contain some of the following examples…

- In class/pull out support with special ed teacher
- Additional time during intervention time
- Preferred seating
- Questions read aloud
- Extended time for completing tasks
- Graphic organizers
- Vocabulary support
- Mnemonic devices
- Songs/videos to reinforce concepts
- Study Guides
- Limit number of questions
- Scribe
- Newsela leveled reading passages

504

Follow 504 Plan which may contain some of the following examples…

- In class/pull out support with special ed teacher
- Additional time during intervention time
- Preferred seating
- Questions read aloud
- Extended time for completing tasks
- Graphic organizers
- Vocabulary support
- Mnemonic devices
- Songs/videos to reinforce concepts
- Study Guides

- Limit number of questions
- Scribe
- Newsela leveled reading passages

ELL

- Translation device/dictionary
- In class/pull out support with ESL teacher
- In class/pull out support with special ed teacher
- Additional time during intervention time
- Preferred seating
- Questions read aloud
- Extended time for completing tasks
- Graphic organizers
- Vocabulary support
- Mnemonic devices
- Songs/videos to reinforce concepts
- Study Guides
- Limit number of questions
- Scribe
- Newsela leveled reading passages

At-risk of Failure

- Extra time during intervention
- In class/pull out support with special ed teacher
- Additional time during intervention time
- Preferred seating
- Questions read aloud
- Extended time for completing tasks
- Graphic organizers
- Vocabulary support
- Mnemonic devices
- Songs/videos to reinforce concepts
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- Newsela leveled reading passage

Gifted & Talented

- Independent projects
- STEM Projects
- Leveled Reading with Newsela

Interdisciplinary Connections

Connections to NJSLS - English Language Arts

• RI.3.2 Determine the main idea of a text; recount the key details and explain how they support the main idea. (3-LS3-1), (3-LS3-2)

• RI.3.3 Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect. (3-LS3- 1), (3-LS3-2)

• W.3.2 Write informative/explanatory texts to examine a topic and convey ideas and information clearly. (3-LS3-1), (3-LS3-2) • SL.3.4 Report on a topic or text, tell a story, or recount an experience with appropriate facts and relevant, descriptive details, speaking clearly at an understandable pace. (3-LS3-1), (3-LS3-2)

• RI.3.7 Use information gained from illustrations (e.g., maps, photographs) and the words in a text to demonstrate understanding of the text (e.g., where, when, why, and how key events occur). (3-LS1-1)

• SL.3.5 Create engaging audio recordings of stories or poems that demonstrate fluid reading at an understandable pace; add visual displays when appropriate to emphasize or enhance certain facts or details. (3-LS1-1)

Connections to NJSLS - Mathematics

• MP.2 Reason abstractly and quantitatively. (3-LS3-1), (3-LS3-2)

• MP.4 Model with mathematics. (3-LS3-1), (3-LS3-2)

• 3.MD.B.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters. (3-LS3-1), (3-LS3-2)

• 3.NBT Number and Operations in Base Ten (3-LS1-1)

• 3.NF Number and Operations—Fractions (3-LS1-1)

Career Readiness, Life Literacies, and Key Skills

Critical Thinking and Problem Solving:

• 9.4.5.CT.1: Identify and gather relevant data that will aid in the problem-solving process (e.g., 2.1.5.EH.4, 4-ESS3-1, 6.3.5.CivicsPD.2).

• 9.4.5.CT.2: Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem (e.g., 2.1.5.CHSS.1, 4-ESS3-1).

• 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems. • 9.4.5.CT.4: Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global

Career Ready Practices

- CRP6. Demonstrate creativity and innovation.
- CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.