

Unit 02: Energizing Everything

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **FY**
Status: **Published**

Standards Alignment

New Jersey Student Learning Standards

Practice 1. Asking questions (for science) and defining problems (for engineering)

Asking questions and defining problems in 3–5 builds on K–2 experiences and progresses to specifying qualitative relationships.

Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.

Practice 3. Planning and carrying out investigations

Planning and carrying out investigations to answer questions or test solutions to problems in 3–5 builds on K–2 experiences and progresses to include investigations that control variables and provide evidence to support explanations or design solutions.

Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.

Practice 6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 3–5 builds on K–2 experiences and progresses to the use of evidence in constructing explanations that specify variables that describe and predict phenomena and in designing multiple solutions to design problems.

Use evidence (e.g., measurements, observations, patterns) to construct or support an explanation or design a solution to a problem.

Apply scientific ideas to solve design problems.

Practice 8. Obtaining, evaluating, and communicating information

Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods.

Obtain and combine information from books and/or other reliable media to explain phenomena or solutions to a design problem.

Crosscutting Statements

2. Cause and Effect: Mechanism and Prediction – Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.

Cause and effect relationships are routinely identified, tested, and used to explain change.

5. Energy and Matter: Flows, Cycles, and Conservation – Tracking energy and matter flows, into, out of, and within systems helps one understand their system’s behavior.

Energy can be transferred in various ways and between objects.

Connections to Engineering, Technology and Applications of Science Interdependence of Science, Engineering, and Technology

Science and technology support each other.

Influence of Engineering, Technology, and Science and the Natural World

People's needs and wants change over time, as do their demands for new and improved technologies.

Engineers improve existing technologies or develop new ones to increase their benefits, decrease known risks, and meet societal demands.

Connections to the Nature of Science: Most Closely Associated with Crosscutting Concepts Science is a Human Endeavor

Most scientists and engineers work in teams.

Science affects everyday life.

ESS3: Earth and Human Activity

ESS3.A: Natural Resources

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)

PS3: Energy

PS3.A: Definitions of Energy

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

Energy can be moved from place to place by moving objects or through sound, light, or electric currents. (4-PS3-2),(4-PS3-3)

PS3.B: Conservation of Energy and Energy Transfer

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 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)

Light also transfers energy from place to place. (4-PS3-2)

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)

PS3.C: Relationship Between Energy and Forces

When objects collide, the contact forces transfer energy so as to change the objects' motions. (4-PS3-3)

ETS1: Engineering Design

ETS1.A: Defining and Delimiting an Engineering Problem

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. (3-5-ETS1-1) (secondary to 4-PS3-4)

ETS1.B: Developing Possible Solutions

Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2)

At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.(3-5-ETS1-2)

Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3)

Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary to 4-ESS3-2)

ETS1.C: Optimizing the Design Solution

Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. (3-5-ETS1-3) (secondary to 4-PS4-3)

SCI.4-PS3	Energy
SCI.4.PS3.A	Definitions of Energy
SCI.4.PS3.C	Relationship Between Energy and Forces
SCI.4.PS3.B	Conservation of Energy and Energy Transfer
SCI.4.ETS1.A	Defining Engineering Problems
SCI.2.ETS1.B	Developing Possible Solutions
SCI.2.ETS1.C	Optimizing the Design Solution
SCI.4-ESS3	Earth and Human Activity
SCI.4.ESS3.A	Natural Resources
3-5-ETS1	Engineering Design
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.
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-ETS1-1	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.
4-PS3-2	Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
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-PS3	Energy

Integration of Career Readiness, Life Literacies and Key Skills

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP3	Attend to personal health and financial well-being.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.

CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Technology / Integration of Computer Science and Design Thinking

TECH.8.2.5	Technology Education, Engineering, Design, and Computational Thinking - Programming: All students will develop an understanding of the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment.
TECH.8.2.5.C	Design: The design process is a systematic approach to solving problems.
TECH.8.2.5.C.1	Collaborate with peers to illustrate components of a designed system.
TECH.8.2.5.C.2	Explain how specifications and limitations can be used to direct a product's development.
TECH.8.2.5.C.4	Collaborate and brainstorm with peers to solve a problem evaluating all solutions to provide the best results with supporting sketches or models.
TECH.8.2.5.D	Abilities for a Technological World: The designed world is the product of a design process that provides the means to convert resources into products and systems.
TECH.8.2.5.D.1	Identify and collect information about a problem that can be solved by technology, generate ideas to solve the problem, and identify constraints and trade-offs to be considered.
TECH.8.2.5.D.2	Evaluate and test alternative solutions to a problem using the constraints and trade-offs identified in the design process to evaluate potential solutions.

Interdisciplinary Connections: NJSLA for ELA, Social Studies, Science and/or Math Section

LA.K-12.NJSLA.R1	Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
LA.K-12.NJSLA.R2	Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
LA.K-12.NJSLA.R3	Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
LA.RI.4	Reading Informational Text Key Ideas and Details
LA.RI.4.1	Refer to details and examples in a text and make relevant connections when explaining what the text says explicitly and when drawing inferences from the text.
LA.RI.4.2	Determine the main idea of a text and explain how it is supported by key details; summarize the text.

LA.K-12.NJSLSA.W	Writing Text Types and Purposes
LA.RI.4.3	Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text.
LA.K-12.NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
LA.K-12.NJSLSA.W2	Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
LA.K-12.NJSLSA.SL	Speaking and Listening Comprehension and Collaboration
LA.K-12.NJSLSA.SL1	Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
LA.W.4.1	Write opinion pieces on topics or texts, supporting a point of view with reasons and information.
LA.W.4.2	Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
LA.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.

Integration of Diversity, Equity and Inclusion; Climate Change; Informational and Media LiteracyNew Section

see Crosswalks

21st Century Life and Careers

Stage I: Desired Results

Transfer/Overview/Rationale

Transfer / Overview / Rationale

Unit Rationale

The purpose of this unit...

...is for students to be able to use evidence to construct an explanation of the relationship between the speed of an

object and the energy of that object; develop an understanding that energy can be transferred from place to place by sound, light, heat, and electric currents or from object to object through collisions; apply their understanding of energy to design, test, and refine a device that converts energy from one form to another.

(4th Grade NGSS Storyline)

Meaning

Essential Questions

Essential Questions

- Where do we get the energy we need for modern life?
- What is the relationship between the speed of an object and the energy of that object?
- How can scientific ideas be applied to design, test, and refine a device that converts energy from one form to another?

Enduring Understanding/Indicators of Understanding

Enduring Understanding/Indicators of Understanding

(Crosscutting Concepts)

- Energy can be transferred in various ways and between objects.
- Cause and effect relationships are routinely identified and used to explain change.
- Engineers improve existing technologies or develop new ones.
- Most scientists and engineers work in teams.
- Science affects everyday life.
- Knowledge of relevant scientific concepts and research findings is important in engineering.
- Over time, people's needs and wants change, as do their demands for new and improved technologies.

Acquisition (Student Learning Objectives)

Knowledge

Knowledge

Students will know...

(Disciplinary Core Ideas)

- The faster a given object is moving, the more energy it possesses.
- Energy can be moved from place to place by moving objects or through sound, light, or electric currents.
- 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 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.
- Light also transfers energy from place to place.
- 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.
- When objects collide, the contact forces transfer energy so as to change the objects' motions.
- 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 takes the constraints into account.
- Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions.
- At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs.
- Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.
- Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.
- Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiples ways. Some resources are renewable over time, and others are not.

Skills

Skills

Student will be skilled at ...

(Science and Engineering Practices)

- Use evidence (e.g., measurements, observations, patterns) to construct an explanation.
- Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
- Apply scientific ideas to solve design problems.
- Obtain and combine information from books and other reliable media to explain phenomena.

Stage 3: Learning Plan

Resource and Mentor Texts

Resources and Mentor Texts

Texts

- *Science Notebooks: Writing about Inquiry* by Lori Fulton & Brian Campbell
- *Perfect Pairs: Using Fiction and Nonfiction Picture Books to Teach Life Science, Grade 3-5* by Melissa Steward and Nancy Chesley

E-Texts (link below)

- *Next Generation Science Standards: A Framework for K-12 Science Education*
- *Next Generation Science Standards: Developing Assessments*
- *Next Generation Science Standards: Guide to Implementing the Standards*
- *Next Generation Science Standards: Science Teacher's Learning: Enhancing Opportunities, Creating Supportive Contexts*
- *Next Generation Science Standards: Surrounded by Science*

Websites (links available in Unit Overview)

- Next Generation Science Standards
- Mystery Science
- New Jersey Center for Teaching and Learning
- Better Lessons
- New Jersey Model Curriculum

[E-Texts](#)

Formative Assessment Strategies

Formative Assessment Strategies

Daily Formative Assessments:

- Teacher Observation
- Notebook or Journal (see link below for ideas)

Mystery Science-Specific Formative Assessments:

- End of Mystery Assessments
- End of Unit Assessment

[Science Notebooks](#)

Learning Activities/Unit of Study

Learning Activities/Unit of Study

Lesson Components (See Lesson Guides to assist with planning.)

1. Watch Exploration video.

2. Engage in Activity.

3. Refine, extend, and/or assess student understanding with "Optional Extras".

The Unit Overview, Lesson Guides, and associated resources are available in the 4th Grade Science Folder for Unit 2 on Google Drive (link below).

[Unit 2: Energizing Everything](#)

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, Gifted, At-risk of Failure)

English Language Learners

Native language support: The teacher provides auditory or written content to students in their native language.

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for

students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

Students with 504 Plans

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Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the

instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.