Nov. Grade 4: Unit 2: Energy

Content Area: **Art**
Course(s):
Time Period: **November**
Length: **6-8 Weeks**
Status: **Published**

Unit Overview

In this unit students will learn how energy and motion are related, how energy transfers in a collision, how energy transfers through sound, light, heat and electric currents, and how energy is stored and used. They will explore how people choose their energy resources.

Enduring Understandings

Energy is related to motion and is transfered through collisions in physical objects, as well as sound, light, heat and electric currents.

Energy can be stored for later use.

People use different criteria in choosing an energy source.

Essential Questions

How is energy and motion related?

How is energy transfered through collisions, sound, light, heat and electric currents?

How is energy stored and used?

How do people choose thier energy resource?

Instructional Strategies & Learning Activities

TEACHERS: These units are linked directly to TCI Science Alive! NGSS teaching materials.

- 1
  How Are Energy and Motion Related?
  Students design a ramp that will roll a ball a certain distance.
  Reading Further: Coaster Energy

- 2
  How Is Energy Transferred by Colliding Objects?
  Students use straws hanging from a zipline to model collisions. They ask testable questions about the energy of the straws, and then answer them using information from this investigation.
  Reading Further: Dummies Keep Getting Smarter

- 3
  How Is Energy Transferred by Sound, Light, and Heat?
  Students make observations to identify how energy is transferred through heat, sound, or light. They use their knowledge of energy transfers to come up with solutions to various problems.
  Reading Further: Energy from Smartphones

- 4
  How Is Energy Transferred by Electric Currents?
  Students use circuits to investigate how electric current transfers energy. Then they build and solve a puzzle using electric currents.
  Reading Further: The Business of Creativity

- 5
  How Is Energy Stored and Used?
  Students act as engineers to design and build a lunchbox alarm.
  Reading Further: Blackout!

- 6
  How Do People Choose Energy Resources?
  Students act as advisors to research and report on different energy resources for a power plant.
  Reading Further: Your Energy Future

Integration of Career Exploration, Life Literacies and Key Skills

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
TECH.9.4.5.CT.4	Apply critical thinking and problem-solving strategies to different types of problems such as personal, academic, community and global (e.g., 6.1.5.CivicsCM.3).
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
TECH.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.
TECH.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).

CRP.K-12.CRP11	Use technology to enhance productivity.
TECH.9.4.5.CI.2	Investigate a persistent local or global issue, such as climate change, and collaborate with individuals with diverse perspectives to improve upon current actions designed to address the issue (e.g., 6.3.5.CivicsPD.3, W.5.7).
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.9.2.5.CAP.1	Evaluate personal likes and dislikes and identify careers that might be suited to personal likes.
TECH.9.4.5.CI.3	Participate in a brainstorming session with individuals with diverse perspectives to expand one's thinking about a topic of curiosity (e.g., 8.2.5.ED.2, 1.5.5.CR1a).
CRP.K-12.CRP7	Employ valid and reliable research strategies.
	Accurate and comprehensive information comes in a variety of platforms and formats and is the basis for effective decision-making.
TECH.9.4.5.IML.6	Use appropriate sources of information from diverse sources, contexts, disciplines, and cultures to answer questions (e.g., RI.5.7, 6.1.5.HistoryCC.7, 7.1.NM. IPRET.5).
WRK.9.2.5.CAP.2	Identify how you might like to earn an income.
	An individual's passions, aptitude and skills can affect his/her employment and earning potential.
TECH.9.4.5.CI.1	Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions (e.g., W.4.6, 3.MD.B.3,7.1.NM.IPERS.6).
WRK.9.2.5.CAP.3	Identify qualifications needed to pursue traditional and non-traditional careers and occupations.
TECH.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).
	Collaboration with individuals with diverse perspectives can result in new ways of thinking and/or innovative solutions.
CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Technology And Design Integration

-Online games for each unit

-Generation Genius

-Bill Nye

-Brainpop

-TCI website

TECH.8.1.5.A.CS1	Understand and use technology systems
CS.3-5.8.2.5.ITH.1	Explain how societal needs and wants influence the development and function of a product and a system.
	Engineering design is a systematic and creative process of communicating and

	collaborating to meet a design challenge. Often, several design solutions exist, each better in some way than the others.
CS.3-5.8.1.5.DA.1	Collect, organize, and display data in order to highlight relationships or support a claim.
CS.3-5.8.2.5.ETW.4	Explain the impact that resources, such as energy and materials used to develop technology, have on the environment.
CS.3-5.8.2.5.ED.3	Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
CS.3-5.8.2.5.ED.4	Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).
CS.3-5.8.2.5.ETW.3	Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.
CS.3-5.8.2.5.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.
	Societal needs and wants determine which new tools are developed to address real-world problems.
CS.3-5.8.2.5.ITH.2	Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.
CS.3-5.8.2.5.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.
CS.3-5.8.2.5.ED.5	Describe how specifications and limitations impact the engineering design process.
CS.3-5.8.2.5.ED.6	Evaluate and test alternative solutions to a problem using the constraints and trade-offs identified in the design process.
CS.3-5.8.1.5.DA.5	Propose cause and effect relationships, predict outcomes, or communicate ideas using data.
CS.3-5.8.1.5.DA.3	Organize and present collected data visually to communicate insights gained from different views of the data.
CS.3-5.8.2.5.ETW.1	Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.
CS.3-5.8.2.5.ETW.2	Describe ways that various technologies are used to reduce improper use of resources.
TECH.8.1.5.A.1	Select and use the appropriate digital tools and resources to accomplish a variety of tasks including solving problems.
TECH.8.1.5.A.CS2	Select and use applications effectively and productively.

Interdisciplinary Connections

LA.W.4.7	Conduct short research projects that build knowledge through investigation of different aspects of a topic.
LA.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.
LA.RF.4.3	Know and apply grade-level phonics and word analysis skills in decoding and encoding words.
LA.W.4.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
LA.RF.4.4	Read with sufficient accuracy and fluency to support comprehension.

LA.L.4.2	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
LA.W.4.10	Write routinely over extended time frames (time for research, reflection, metacognition/self-correction and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.
LA.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.
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.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.
LA.L.4.3	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
LA.W.4.2	Write informative/explanatory texts to examine a topic and convey ideas and information clearly.
LA.L.4.4	Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies.
LA.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.
LA.L.4.1	Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
LA.RI.4.2	Determine the main idea of a text and explain how it is supported by key details; summarize the text.
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.RI.4.6	Compare and contrast a firsthand and secondhand account of the same event or topic; describe the differences in focus and the information provided.
LA.RI.4.7	Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.
LA.RI.4.8	Explain how an author uses reasons and evidence to support particular points in a text.
LA.W.4.4	Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience. (Grade-specific expectations for writing types are defined in standards 1–3 above.)
LA.RI.4.9	Integrate and reflect on (e.g., practical knowledge, historical/cultural context, and background knowledge) information from two texts on the same topic in order to write or speak about the subject knowledgeably.
LA.W.4.5	With guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, and editing.
LA.L.4.6	Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal precise actions, emotions, or states of being (e.g., quizzed, whined, stammered) and that are basic to a particular topic (e.g., wildlife, conservation, and endangered when discussing animal preservation).
LA.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.

LA.RI.4.10	By the end of year, read and comprehend literary nonfiction at grade level text-complexity or above, with scaffolding as needed.

Differentiation

- Understand that gifted students, just like all students, come to school to learn and be challenged.
- Pre-assess your students. Find out their areas of strength as well as those areas you may need to address before students move on.
- Consider grouping gifted students together for at least part of the school day.
- Plan for differentiation. Consider pre-assessments, extension activities, and compacting the curriculum.
- Use phrases like "You've shown you don't need more practice" or "You need more practice" instead of words like "qualify" or "eligible" when referring to extension work.
- Encourage high-ability students to take on challenges. Because they're often used to getting good grades, gifted students may be risk averse.

- **Definitions of Differentiation Components**:

    - Content – the specific information that is to be taught in the lesson/unit/course of instruction.
    - Process – how the student will acquire the content information.
    - Product – how the student will demonstrate understanding of the content.
    - Learning Environment – the environment where learning is taking place including physical location and/or student grouping

Differentiation occurring in this unit:

Utilize differentiation suggestions in the TCI Science Alive! program for enrichment and support.

Modifications & Accommodations

Refer to QSAC EXCEL SMALL SPED ACCOMMOCATIONS spreadsheet in this discipline.

Modifications and Accommodations used in this unit:

Utilize 504 and IEP accommodations where required.

Benchmark Assessments

Benchmark Assessments are given periodically (e.g., at the end of every quarter or as frequently as once per month) throughout a school year to establish baseline achievement data and measure progress toward a

standard or set of academic standards and goals.

Schoolwide Benchmark assessments:

Aimsweb benchmarks 3X a year

Linkit Benchmarks 3X a year

DRA

Additional Benchmarks used in this unit:

-End of unit assessments

-Online quizzes

-TCI packet responses

Formative Assessments

Assessment allows both instructor and student to monitor progress towards achieving learning objectives, and can be approached in a variety of ways. **Formative assessment** refers to tools that identify misconceptions, struggles, and learning gaps along the way and assess how to close those gaps. It includes effective tools for helping to shape learning, and can even bolster students' abilities to take ownership of their learning when they understand that the goal is to improve learning, not apply final marks (Trumbull and Lash, 2013). It can include students assessing themselves, peers, or even the instructor, through writing, quizzes, conversation, and more. In short, formative assessment occurs throughout a class or course, and seeks to improve student achievement of learning objectives through approaches that can support specific student needs (Theal and Franklin, 2010, p. 151).

Formative Assessments used in this unit:

TCI worksheets, quizzes

Discussion

Teacher observation

Labs and Hands on activities

Summative Assessments

Summative assessments evaluate student learning, knowledge, proficiency, or success at the conclusion of an instructional period, like a unit, course, or program. Summative assessments are almost always formally graded and often heavily weighted (though they do not need to be). Summative assessment can be used to great effect in conjunction and alignment with formative assessment, and instructors can consider a variety of ways to combine these approaches.

Summative assessments for this unit:

Unit assessments in the TCI program

Instructional Materials

Materials for labs indicated in TCI program

Standards

	Assessment does not include quantitative measures of changes in the speed of an object or on any precise or quantitative definition of energy.
	When objects collide, the contact forces transfer energy so as to change the objects' motions.
SCI.4.PS3.B	Conservation of Energy and Energy Transfer
SCI.4.PS3.D	Energy in Chemical Processes and Everyday Life
	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.
	Devices should be limited to those that convert motion energy to electric energy or use stored energy to cause motion or produce light or sound.
SCI.4.PS3.A	Definitions of Energy
SCI.4.PS3.A	Definitions of Energy
	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.
	Energy can be moved from place to place by moving objects or through sound, light, or electric currents.
	Light also transfers energy from place to place.
	Planning and Carrying Out Investigations
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.ETS1.A	Defining Engineering Problems
	Energy and Matter
	Assessment does not include quantitative measurements of energy.
	Energy can be moved from place to place by moving objects or through sound, light, or electric currents.
	Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause and effect relationships.
	Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution.
SCI.4.PS3.C	Relationship Between Energy and Forces
SCI.4-PS3	Energy
	Asking Questions and Defining Problems
SCI.4-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
	Constructing Explanations and Designing Solutions
	Energy can be transferred in various ways and between objects.
SCI.4.PS3.B	Conservation of Energy and Energy Transfer
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.
	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.
	Asking questions and defining problems in grades 3–5 builds on K–2 experiences and progresses to specifying qualitative relationships.
SCI.4-PS3-3	Ask questions and predict outcomes about the changes in energy that occur when objects collide.
	Examples of devices could include electric circuits that convert electrical energy into motion energy of a vehicle, light, or sound; and, a passive solar heater that converts light into heat. Examples of constraints could include the materials, cost, or time to design the device.
SCI.4.PS3.B	Conservation of Energy and Energy Transfer
	The expression “produce energy” typically refers to the conversion of stored energy into a desired form for practical use.
	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.
	Energy and Matter
	Assessment does not include quantitative measurements of energy.
	Energy can be transferred in various ways and between objects.
	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.

SCI.4-PS3-1	Use evidence to construct an explanation relating the speed of an object to the energy of that object. 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. 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.
SCI.4-PS3-3	Ask questions and predict outcomes about the changes in energy that occur when objects collide. Energy can be transferred in various ways and between objects.