3 Energy

Content Area: **Science**
Course(s): **Applied Physical Science**
Time Period: **December**
Length: **25 days**
Status: **Published**

Unit Overview:

In this unit of study, students *develop and use models, plan and carry out investigations, use computational thinking and design solutions* as they make sense of the disciplinary core idea. The disciplinary core idea of *Energy* is broken down into subcore ideas: *definitions of energy*, *conservation of energy* and *energy transfer*, and *the relationship between energy and forces*. Energy is understood as a quantitative property of a system that depends on the motion and interactions of matter, and the total change of energy in any system is equal to the total energy transferred into and out of the system. Students also demonstrate their understanding of engineering principles when they design, build, and refine devices associated with the conversion of energy. The crosscutting concepts of *cause and effect, systems and systems models, energy and matter, and the influence of science, engineering, and technology on society and the natural world* are further developed in the performance expectations. Students are expected to demonstrate proficiency in *developing and using models, planning and carry out investigations, using computational thinking and designing solutions*, and they are expected to use these practices to demonstrate understanding of core ideas.

Enduring Understandings:

- Energy cannot be created nor destroyed. Energy can only transform from to another
- Heat is the “last stop” in the cycle of energy transformations in the universe
- Mechanical energy is conserved when there are only conservative, nondissipative forces doing work on a system.
- Most objects possess some form(s) of energy

Essential Questions:

- How is energy transferred and conserved?
- What are the advantages and disadvantages of different ways of meeting our energy needs? (For example, how do energy-capturing systems differ in their impact on the land and in their efficiency or inefficiency?)
- What is the relationship between patterns and natural phenomena?
- What kinds of energy exist in the universe and how do we convert one to another?
- Where does useful, mechanical energy go when the motion of an object stops?

Standards/Indicators/Student Learning Objectives (SLOs):

- SWBAT convert between KE and PE of moving objects

- SWBAT demonstrate their understanding of engineering principles when they design, build, and refine devices associated with the conversion of energy.
- SWBAT discuss how energy can be transferred and transformed but never lost or gained
- SWBAT explain how heat is transferred and create ways to make homes more efficiency
- SWBAT list and define the different types of energy

SCI.HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.
SCI.HS-PS3-5	Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.
SCI.HS-PS3-2	Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).
SCI.HS-PS3-4	Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).
SCI.HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.
9-12.HS-PS1-8	Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.
9-12.HS-PS2-3.2.1	Systems can be designed to cause a desired effect.
9-12.HS-PS1-8.5.1	In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.
9-12.HS-PS1-7.5.1	students learn that the total amount of energy and matter in closed systems is conserved. They can describe changes of energy and matter in a system in terms of energy and matter flows into, out of, and within that system. They also learn that energy cannot be created or destroyed. It only moves between one place and another place, between objects and/or fields, or between systems. Energy drives the cycling of matter within and between systems. In nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.
9-12.HS-PS2-4.5.1	Use mathematical representations of phenomena to describe explanations.
9-12.HS-PS2-3.ETS1.A.1	Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.
9-12.HS-PS2-3.ETS1.C.1	Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed.

Lesson Titles:

- Energy Transfer
- Heat
- Mechanical Energy transfer
- Types of Energy

Equity Considerations

LGBTQ and Disabilities Mandate

Lessons will include multiple perspectives from the LGBTQ and Disabilities population.

STEM	LGBTQ: Sir Francis Bacon (1561–1626) Florence NightingaleFrancis Bacon | Philosophy, Scientific Method, & Facts | Britannica(1820-1910) George Washington Carver (1861-1943) Sara Josephine Baker (1873-1945) Alan Turing (1912-1954) Allan Cox (1926-1987) Sally Ride (1951-2012) Ben Barres (1954-2017) Ruth Gates (1962-2018) Tim Cook (1960) Disabilities: Leonardo da Vinci (1452-1519)- Dyslexia Isaac Newton (1664-1727)- Epilepsy Thomas Edison (1847-1931)- Hearing Charles Darwin (1809-1882)- Stutter, Dyslexia Alexander Graham Bell (1847-1922)- Deaf Albert Einstein (1879-1955)- Aspergers Florence B. Seibert (1897-1991)- Mobility

Stephen Hawking (1942-2019)- ALS

John Forbes Nash (1928-2015)-
Schizophrenia

Temple Grandin (1947)- Autism

Asian American and Pacific Islander Mandate

Lessons will include multiple perspectives from the Asian American and Pacific Islander population.

https://ideas.ted.com/8-asian-americans-and-pacific-islanders-whose-innovations-have-changed-your-life-really/

Climate Change

Students will engage in conversation and discussion focused around climate change and energy transfer. In this lesson, students will practice distinguishing between correlation and causation within the context of global climate change. Students will think critically and analyze different claims and datasets related to what might be causing increasing temperatures in a fictitious town called Solutionville, as well as around the globe.

https://www.calacademy.org/educators/lesson-plans/the-heat-is-on-cause-and-effect-and-climate

SCI.HS-ESS3-1	Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and climate change have influenced human activity.

Inter-Disciplinary Connections:

LA.RH.11-12.1	Accurately cite strong and thorough textual evidence, (e.g., via discussion, written response, etc.), to support analysis of primary and secondary sources, connecting insights gained from specific details to develop an understanding of the text as a whole.
LA.RH.11-12.2	Determine the theme, central ideas, information and/or perspective(s) presented in a primary or secondary source; provide an accurate summary of how key events, ideas and/or author's perspective(s) develop over the course of the text.
LA.RH.11-12.3	Evaluate various perspectives for actions or events; determine which explanation best accords with textual evidence, acknowledging where the text leaves matters uncertain.
LA.RH.11-12.4	Determine the meaning of words and phrases as they are used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text (e.g., how Madison defines faction in Federalist No. 10).
LA.RH.11-12.6	Evaluate authors' differing perspectives on the same historical event or issue by assessing

	the authors' claims, reasoning, and evidence.
LA.RH.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, qualitatively, as well as in words) in order to address a question or solve a problem.
LA.RH.11-12.8	Evaluate an author's claims, reasoning, and evidence by corroborating or challenging them with other sources.
LA.RH.11-12.9	Integrate information from diverse sources, both primary and secondary, into a coherent understanding of an idea or event, noting discrepancies among sources.
LA.RST.11-12.1	Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
LA.RST.11-12.2	Determine the central ideas, themes, or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
LA.WHST.11-12.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LA.WHST.11-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
LA.WHST.11-12.6	Use technology, including the Internet, to produce, share, and update writing products in response to ongoing feedback, including new arguments or information.
	The same solution techniques used to solve equations can be used to rearrange formulas. For example, the formula for the area of a trapezoid, ð˜^ = ((ð˜£â,+ð˜£â,,)/2)ð˜©, can be solved for ð˜© using the same deductive process.
	The solutions of an equation in one variable form a set of numbers; the solutions of an equation in two variables form a set of ordered pairs of numbers, which can be plotted in the coordinate plane. Two or more equations and/or inequalities form a system. A solution for such a system must satisfy every equation and inequality in the system.
	Algebraic manipulations are governed by the properties of operations and exponents, and the conventions of algebraic notation. At times, an expression is the result of applying operations to simpler expressions. For example, p + 0.05p is the sum of the simpler expressions p and 0.05p. Viewing an expression as the result of operation on simpler expressions can sometimes clarify its underlying structure.
	An expression is a record of a computation with numbers, symbols that represent numbers, arithmetic operations, exponentiation, and, at more advanced levels, the operation of evaluating a function. Conventions about the use of parentheses and the order of operations assure that each expression is unambiguous. Creating an expression that describes a computation involving a general quantity requires the ability to express the computation in general terms, abstracting from specific instances.
	An equation is a statement of equality between two expressions, often viewed as a question asking for which values of the variables the expressions on either side are in fact equal. These values are the solutions to the equation. An identity, in contrast, is true for all values of the variables; identities are often developed by rewriting an expression in an equivalent form.

Instructional Strategies, Learning Activities, and Levels of Blooms/DOK:

- Build a Machine that converts energy
- Energy conversions practice
- Energy Math Practice

- Energy notes
- online skate park lab
- Potential and Kinetic Energy Notes
- Thermal Lab
- Thermal math practice
- Thermal Notes
- Work, Energy math

Modifications

ELL Modifications:

- Focus on domain specific vocabulary and keywords
- Front load information
- Group students
- Provide ELL students with multiple literacy strategies
- Sheltered English Instruction
- Use real objects when possible

IEP & 504 Modifications:

- less none of the above, all of the above, which of the following apply, or which do not apply type questions (again it is testing for understanding of the question not the content)
- providing students with content vocabulary prior to teaching a lesson including that vocabulary (pre-teaching)
- providing study guides that don't lead the student to study too much extraneous information (less unnecessary details)/scaffolded study guides
- scaffolded notes
- teaching the main ideas/concepts (limiting not needed details)to be taught and repeating them in several different ways over several different days (goal is 7 different ways same concept for students with learning disabilities)

G&T Modifications:

- Determine where students' interests lie and capitalize on their inquisitiveness. (Is there a specific career they are interested in? How would this apply to their interest?)
- Employ differentiated curriculum to keep interest high.
- Encourage students to explore concepts in depth and encourage independent studies or investigations.

- Invite students to explore different points of view on a topic of study and compare the two.
- Provide additional rigorous challenge problems for advanced students
- Student led/directed discussions

At Risk Modifications

- guided notes
- hands-on Instruction
- modeling and showing lots of examples
- non-verbal redirection of behaviors
- outlines & graphic organizers
- scaffolded notes
- slower pacing of materials
- study guides

Career Readiness, Life Literacies & Key Skills

WRK.K-12.P.4	Demonstrate creativity and innovation.
WRK.K-12.P.5	Utilize critical thinking to make sense of problems and persevere in solving them.
WRK.K-12.P.8	Use technology to enhance productivity increase collaboration and communicate effectively.
WRK.K-12.P.9	Work productively in teams while using cultural/global competence.

Alternative assessments:

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Performance tasks

Project-based assignments

Problem-based assignments

Presentations

Reflective pieces

Concept maps

Case-based scenarios

Portfolios

Benchmark Assessments:

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Skills-based assessment

Reading response

Writing prompt

Lab practical

Formative Assessment:

- Anticipatory Set
- Closure
- Heat quiz
- Mechanical energy quiz
- Transfer quiz
- Types quiz
- Warm-Up

Summative Assessment:

- Alternate Assessment
- Energy unit test
- Marking Period Assessment
- Personalized learning project

Resources & Materials:

- Lab equipment
- Notes
- practice
- study guides

Technology:

- Analyze the capabilities and limitations of current and emerging technology resources and assess their potential to address personal, social, lifelong learning, and career needs. 8.1.12.D.5

- Apply previous content knowledge by creating and piloting a digital learning game or tutorial. 8.1.12.B.2
- chromebook
- Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community. 8.1.12.C.1
- https://phet.colorado.edu/en/simulation/energy-skate-park
- https://sites.google.com/site/mantonphysicalscience/
- https://www.teachengineering.org/lessons/view/uoh_magic_lesson01
- internet
- Research and evaluate the impact on society of the unethical use of digital tools and present your research to peers. 8.1.12.E.2

TECH.8.1.12.A.2	Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
TECH.8.1.12.A.5	Create a report from a relational database consisting of at least two tables and describe the process, and explain the report results.
TECH.8.1.12.A.CS2	Select and use applications effectively and productively.
TECH.8.1.12.B.CS1	Apply existing knowledge to generate new ideas, products, or processes.
TECH.8.1.12.B.CS2	Create original works as a means of personal or group expression.
TECH.8.1.12.C.CS1	Interact, collaborate, and publish with peers, experts, or others by employing a variety of digital environments and media.
TECH.8.1.12.C.CS2	Communicate information and ideas to multiple audiences using a variety of media and formats.
TECH.8.1.12.C.CS4	Contribute to project teams to produce original works or solve problems.
TECH.8.1.12.D.1	Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.
TECH.8.1.12.D.CS1	Advocate and practice safe, legal, and responsible use of information and technology.
TECH.8.1.12.D.CS2	Demonstrate personal responsibility for lifelong learning.
TECH.8.1.12.F.CS1	Identify and define authentic problems and significant questions for investigation.
TECH.8.1.12.F.CS3	Collect and analyze data to identify solutions and/or make informed decisions.