Standard #: SC.912.P.10.2

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Explore the Law of Conservation of Energy by differentiating among open, closed, and isolated systems and explain that the total energy in an isolated system is a conserved quantity.

General Information

Subject Area: Science

Grade: 912

Body of Knowledge: Physical Science

Idea: Level 3: Strategic Thinking & Complex Reasoning

Standard: Energy -
A. Energy is involved in all physical and chemical processes. It is conserved, and can be transformed from one form to another and into work. At the atomic and nuclear levels energy is not continuous but exists in discrete amounts. Energy and mass are related through Einstein's equation $E=mc^2$.

B. The properties of atomic nuclei are responsible for energy-related phenomena such as radioactivity, fission and fusion.

C. Changes in entropy and energy that accompany chemical reactions influence reaction paths. Chemical reactions result in the release or absorption of energy.

D. The theory of electromagnetism explains that electricity and magnetism are closely related. Electric charges are the source of electric fields. Moving charges generate magnetic fields.

E. Waves are the propagation of a disturbance. They transport energy and momentum but do not transport matter.

Date Adopted or Revised: 02/08

Content Complexity Rating: Level 3: Strategic Thinking & Complex Reasoning - More Information

Date of Last Rating: 05/08

Status: State Board Approved

Related Courses

Course Number	Course Title
2003350:	Chemistry 1 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2000380:	Ecology (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2001340:	Environmental Science (Specifically in versions: 2015 - 2022 (current), 2022 and beyond)
2002440:	Integrated Science 3 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2002450:	Integrated Science 3 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2000390:	Limnology (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
2002500:	Marine Science 1 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2002510:	Marine Science 1 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2002520:	Marine Science 2 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2002530:	Marine Science 2 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2003400:	Nuclear Radiation (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
2020710:	Nuclear Radiation Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2003320:	Physical Science Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2003380:	Physics 1 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2003390:	Physics 1 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2003600:	Principles of Technology 1 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2003610:	Principles of Technology 2 (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
2002540:	Solar Energy Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2002550:	Solar Energy 2 Honors (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
2002330:	Space Technology and Engineering (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
2002445:	Integrated Science 3 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 - 2020 (course terminated))
2003385:	Physics 1 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 - 2020 (course terminated))
2003500:	Renewable Energy 1 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2003836:	Florida's Preinternational Baccalaureate Physics 1 (Specifically in versions: 2015 - 2022 (current), 2022 and beyond)

2001341:	Environmental Science Honors (Specifically in versions: 2016 - 2022 (current), 2022 and beyond)
2001330:	Meteorology Honors (Specifically in versions: 2016 - 2019, 2019 - 2022 (current), 2022 and beyond)

Related Access Points

Access Points Number	Access Points Title
SC.912.P.10.In.1:	Identify examples of energy being transformed from one form to another (conserved quantity).
SC.912.P.10.Su.1:	Recognize energy transformations that occur in everyday life, such as solar energy to electricity.
SC.912.P.10.Pa.1:	Observe and recognize examples of the transformation of electrical energy to light and heat.

Related Resources

Lesson Plans

Name	Description
Keep a Lid on It!:	An introduction to the Law of Conservation of Energy within the confines of open, closed, and isolated systems.
Make Your Own Thermos:	In this lab, students will use the law of conservation of energy to design and test insulators made with various materials.
BIOSCOPES Summer Institute 2013 - Mechanical Energy:	This lesson is designed to be part of a sequence of lessons. It follows resource 52648 "BIOSCOPES Summer Institute 2013 - Forces" and precedes resource 52957 "BIOSCOPES Summer Institute 2013 - Thermal Energy." This lesson uses a predict, observe, and explain approach along with inquiry based activities to enhance student understanding of the conservation of energy.
Ramp It Up:	Using inquiry techniques, students, working in groups, are asked to design and conduct experiments to test the Law of Conservation of Energy and the Law of Conservation of Momentum. Upon being provided with textbooks, rulers, measuring tapes, stopwatches, mini-storage containers, golf balls, marbles, rubber balls, steel balls, and pennies, they work cooperatively to implement and revise their hypotheses. With limited guidance from the teacher, students are able to visualize the relationships between mass, velocity, height, gravitational potential energy, kinetic energy, and total energy as well as the relationships between mass, velocity, and momentum.
Riding the Roller Coaster of Success:	Students compete with one another to design and build a roller coaster from insulation tubing and tape that will allow a marble to travel from start to finish with the lowest average velocity. In so doing, students learn about differences between distance and displacement, speed and velocity, and potential and kinetic energy. They also examine the Law of Conservation of Energy and concepts related to force and motion.
Amusement Park Physics:	Students will research various types of amusement park rides and use their findings to design a feasible ride of their own. They will summarize their findings and present their ride design to the class. Each student will then write a persuasive letter to a local amusement park describing the reasons their ride design is the best.
SMALL: Shape Memory Alloy Lab:	Shape Memory Alloys are metals that can return to or 'remember' their original shape. They are a cutting edge application for Chemistry, Physics, and Integrated Science. The activities in this lesson work well for the study of forces, Newton's Laws, and electricity in physics. They also lend themselves well to crystalline structures, heat of reaction, and bonding in chemistry. In addition, students could study applications for the materials in the medical and space industries.

Resource Collection

Name	Description
Conceptual Physics Conservation of Energy Units:	This topic is broken into units to help in formulating cohesive, effective lessons. Clicking on each unit title will display appropriate activities, lesson plans, or labs. Units are intended to help students understand the interconnectedness of the concepts of conservation of energy, momentum and angular momentum underpinning the basis for much of physics. Units are not listed in a prescribed order.

Teaching Idea

Name	Description
Metal Mania:	Students will determine the specific heat of a metal using the law of conservation of energy.

Text Resources

Name	Description
A Fuel Cell for Home: Tested in Private Households:	This informational text resource is intended to support reading in the content area. Scientists at the Fraunhofer Institute in Dresden have developed an energy-efficient fuel cell superior to combustion engines and other traditional ways of heating homes. The stacked fuel cells convert natural gas directly into electrical energy without resulting in energy loss. The fuel cell prototypes are being tried in homes and signal promise for the future.
The Surprisingly Scientific Flash Behind the Fireworks:	This resource is intended to support reading in the content area. Chemists create pyrotechnics to give viewers the most spectacular fireworks show that they can by using basic chemistry concepts and physics. Readers of this article might be surprised to learn that conserving energy, preventing explosions, and cooling-down reactions are part of this process.
How Phase Change Materials Can Keep Your Coffee Hot:	This informational text resource is intended to support reading in the content area. The article discusses the concept of phase change materials (PCM) and how they can be used to maintain constant temperatures through application of the Law of Conservation of Energy and energy transfer.

Virtual Manipulative

Name	Description
PhysClips:	Vast collection of multimedia resources in mechanics, waves and relativity.