



Standard #: SC.912.P.10.9

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Describe the quantization of energy at the atomic level.

General Information

Subject Area: Science

Grade: 912

Body of Knowledge: Physical Science

Idea: Level 2: Basic Application of Skills & Concepts

Standard: [Energy](#) -

Date Adopted or Revised: 02/08

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.

Content Complexity Rating: [Level 2: Basic Application of Skills & Concepts](#) - [More Information](#)

Date of Last Rating: 05/08

Status: State Board Approved

Related Courses

Course Number	Course Title
2001350:	Astronomy Solar/Galactic (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2020910:	Astronomy Solar/Galactic Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2003340:	Chemistry 1 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2003350:	Chemistry 1 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2002430:	Integrated Science 2 Honors (Specifically in versions: 2014 - 2015, 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)
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)
2003410:	Physics 2 Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2002540:	Solar Energy Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2003800:	Florida's Preinternational Baccalaureate Chemistry 1 (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
7920011:	Access Chemistry 1 (Specifically in versions: 2014 - 2015, 2015 - 2018, 2018 and beyond (current))
2002445:	Integrated Science 3 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 - 2020 (course terminated))
2003345:	Chemistry 1 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2003838:	Florida's Preinternational Baccalaureate Physics 2 (Specifically in versions: 2015 and beyond (current))

Related Access Points

Access Points Number	Access Points Title
SC.912.P.10.In.6:	Identify that atoms can be changed to release energy, such as in nuclear power plants, and recognize one related safety issue.
SC.912.P.10.Su.5:	Recognize that nuclear power plants generate electricity and can be dangerous.
SC.912.P.10.Pa.5:	Recognize the universal symbols for radioactive and other hazardous materials.

Related Resources

Text Resources

Name	Description
Fireworks!	This informational text is intended to support reading in the content area. The article describes the composition and workings of fireworks. Details are also given as to how the colors, lights, sounds and propulsion are produced by fireworks' components.
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.

Tutorial

Name	Description
Sparks Fly: Discovering Central Ideas:	Click "View Site" to open a full-screen version. This tutorial is designed to help secondary science teachers learn how to integrate literacy skills within their science curriculum. The focus on literacy across content areas is designed to help students independently build knowledge in different disciplines through reading and writing. This tutorial will demonstrate a series of steps that teachers can use with students to help them determine the central ideas of a science text. It will also demonstrate how students can trace a text's explanation or depiction of a complex process. Finally, it will explain what an effective summary contains.

Virtual Manipulatives

Name	Description
Atomic Orbital Energies:	This simulation explores the trends observed in orbital energies for the main group elements. The energies of the highest energy atomic orbitals in a series of atoms increase with increasing principal quantum number. The energies of orbital subshells also change when moving across the periodic table from element to element.
Photoelectric Effect:	This virtual manipulative will help the students to understand how the light shines on a metal surface. Students will recognize a process called as photoelectric effect wherein light can be used to push electrons from the surface of a solid. Some of the sample learning goals can be: <ul style="list-style-type: none">• Visualize and describe the photoelectric effect experiment.• Predict the results of the experiment, when the intensity of light is changed and its effects on the current and energy of the electrons.• Predict the results of the experiment, when the wavelength of the light is changed and its effects on the current and the energy of the electrons.• Predict the results of the experiment, when the voltage of the light is changed and its effects on the current and energy of electrons.
Neon Lights and Other Discharge Lamps:	This virtual manipulative will allow you to produce light by bombarding atoms with electrons. You can also visualize how the characteristic spectra of different elements are produced, and configure your own element's energy states to produce light of different colors. Other areas to investigate: <ul style="list-style-type: none">• Provide a basic design for a discharge lamp and explain the function of the different components.• Explain the basic structure of an atom and relate it to the color of light produced by discharge lamps.• Explain why discharge lamps emit only certain colors.• Design a discharge lamp to emit any desired spectrum of colors.

Student Resources

Virtual Manipulatives

Name	Description
Photoelectric Effect:	This virtual manipulative will help the students to understand how the light shines on a metal surface. Students will recognize a process called as photoelectric effect wherein light can be used to push electrons from the surface of a solid. Some of the sample learning goals can be: <ul style="list-style-type: none">• Visualize and describe the photoelectric effect experiment.• Predict the results of the experiment, when the intensity of light is changed and its effects on the current and energy of the electrons.• Predict the results of the experiment, when the wavelength of the light is changed and its effects on the current and the energy of the electrons.• Predict the results of the experiment, when the voltage of the light is changed and its effects on the current and energy of electrons.
	This virtual manipulative will allow you to produce light by bombarding atoms with electrons. You can also visualize how the

characteristic spectra of different elements are produced, and configure your own element's energy states to produce light of different colors.

[Neon Lights and Other Discharge Lamps:](#)

Other areas to investigate:

- Provide a basic design for a discharge lamp and explain the function of the different components.
- Explain the basic structure of an atom and relate it to the color of light produced by discharge lamps.
- Explain why discharge lamps emit only certain colors.
- Design a discharge lamp to emit any desired spectrum of colors.

Parent Resources

Virtual Manipulatives

Name	Description
Photoelectric Effect:	<p>This virtual manipulative will help the students to understand how the light shines on a metal surface. Students will recognize a process called as photoelectric effect wherein light can be used to push electrons from the surface of a solid. Some of the sample learning goals can be:</p> <ul style="list-style-type: none">• Visualize and describe the photoelectric effect experiment.• Predict the results of the experiment, when the intensity of light is changed and its effects on the current and energy of the electrons.• Predict the results of the experiment, when the wavelength of the light is changed and its effects on the current and the energy of the electrons.• Predict the results of the experiment, when the voltage of the light is changed and its effects on the current and energy of electrons.
Neon Lights and Other Discharge Lamps:	<p>This virtual manipulative will allow you to produce light by bombarding atoms with electrons. You can also visualize how the characteristic spectra of different elements are produced, and configure your own element's energy states to produce light of different colors.</p> <p>Other areas to investigate:</p> <ul style="list-style-type: none">• Provide a basic design for a discharge lamp and explain the function of the different components.• Explain the basic structure of an atom and relate it to the color of light produced by discharge lamps.• Explain why discharge lamps emit only certain colors.• Design a discharge lamp to emit any desired spectrum of colors.