



Standard #: SC.912.P.10.5

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Relate temperature to the average molecular kinetic energy.

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
2002080:	M/J Comprehensive Science 2, Advanced (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)
2002420:	Integrated Science 2 (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)
2003310:	Physical Science (Specifically in versions: 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))
2002550:	Solar Energy 2 Honors (Specifically in versions: 2014 - 2015, 2015 - 2018 (course terminated))
2003020:	M/J Physical Science, Advanced (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))
2002085:	M/J Comprehensive Science 2 Accelerated Honors (Specifically in versions: 2014 - 2015, 2015 - 2022 (current), 2022 and beyond)
2002425:	Integrated Science 2 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)
2003385:	Physics 1 for Credit Recovery (Specifically in versions: 2014 - 2015, 2015 - 2020 (course terminated))
2003836:	Florida's Preinternational Baccalaureate Physics 1 (Specifically in versions: 2015 - 2022 (current), 2022 and beyond)
7920022:	Access Physical Science (Specifically in versions: 2016 - 2018, 2018 and beyond (current))
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.3:	Relate the transfer of heat to the states of matter, including gases result from heating, liquids result from cooling a gas, and solids result from further cooling a liquid.
SC.912.P.10.Su.3:	Observe and recognize ways that heat travels, such as through space (radiation), through solids (conduction), and through liquids and gases (convection).
SC.912.P.10.Pa.3:	Recognize the source and recipient of heat transfer.

Related Resources

Lesson Plans

Name	Description
Purple Haze:	In this lesson, students will analyze an informational text designed to support reading in the content area. An ancient coloring pigment is leading to new research in magnetic fields and superconductivity. Will this lead to new technologies involving quantum computers? The lesson plan includes a note-taking guide, text-dependent questions, a writing prompt, answer keys, and a writing rubric. Options to extend the lesson are also included.
Temperature, Volume, and Rate of Reaction:	This one-two day lab will allow students to collect data on temperature, volume, and rate for a reaction in a closed system. Heat speeds up the reaction, altering both volume and rate due to an increase in energy. Students will be able to graph their own lab group's data and compile class data if Google docs is available. They can then look at correlations between temperature, volume, and rate of reaction.
BIOSCOPE Summer Institute 2013 - States of Matter:	This lesson is designed to be part of a sequence of lessons. It follows CPALMS Resource #52957 "BIOSCOPE Summer Institute 2013 - Thermal Energy" and precedes CPALMS Resource #52961 "BIOSCOPE Summer Institute 2013 - Solutions." The lesson employs a predict, observe, explain approach along with inquiry-based activities to enhance student understanding of states of matter and phase changes in terms of the kinetic molecular theory.
Shake it up:	Students will model molecular motion with everyday materials (shaker bottles) then associate their model/actions to the phase transitions of water while graphing its heat curve from data collected during a structured inquiry lab.

Teaching Ideas

Name	Description
Melt Away - Exploring the Heat of Fusion of Water:	The heat of fusion of water is the energy required to melt one gram of ice. In this lab, your students will use experimental evidence to approximate the heat of fusion of water. They'll also compare the energy needed to cause a change of state to the energy needed to change temperature with no change of state. This lab can be used at the middle or high school level, depending on your learning objectives and how you introduce and debrief the activity.
Evaporation is Cool:	Differences in intermolecular forces are introduced using of rates of evaporation and measuring the resulting cooling effects of different liquids.

Text Resources

Name	Description
Text Resource - Purple Haze: Ancient Pigment Reveals Secrets about Unusual State of Matter:	This informational text resource is designed to support reading in the content area. The text explains how extreme cooling of an ancient pigment comprised of metallic compounds, as well as exposure to strong magnetic fields, converts the matter into a state called a Bose-Einstein condensate. In this state, the behavior of electrons within the pigment's atoms shifts and they form a single magnetic three-dimensional structure. When the condensate is cooled even further in this case, the magnetic structure loses a dimension.
Ultracold Atoms:	This informational text resource is intended to support reading in the content area. Most students are familiar with the four most common states of matter, but what about the 5th state of matter, the Bose-Einstein condensate (BEC for short)? This article explains what a BEC is and how researchers are exploring this unique state of matter.
Thermometers:	This informational text resource is intended to support reading in the content area. This text classifies the different types of thermometers, the history of each, and the advantages and disadvantages of each type.

Virtual Manipulative

Name	Description
States of Matter:	Watch different types of molecules form a solid, liquid, or gas. Add or remove heat and watch the phase change. Change the temperature or volume of a container and see a pressure-temperature diagram respond in real time.

Student Resources

Virtual Manipulative

Name	Description
States of Matter:	Watch different types of molecules form a solid, liquid, or gas. Add or remove heat and watch the phase change. Change the temperature or volume of a container and see a pressure-temperature diagram respond in real time.