Standard #: SC.912.P.12.10

This document was generated on CPALMS - www.cpalms.org

Interpret the behavior of ideal gases in terms of kinetic molecular theory.

General Information

Subject Area: Science

Grade: 912

Body of Knowledge: Physical Science

Idea: Level 3: Strategic Thinking & Complex Reasoning

Standard: Motion -
A. Motion can be measured and described qualitatively and quantitatively. Net forces create a change in motion. When objects travel at speeds comparable to the speed of light, Einstein's special theory of relativity applies.

B. Momentum is conserved under well-defined conditions. A change in momentum occurs when a net force is applied to an object over a time interval.

C. The Law of Universal Gravitation states that gravitational forces act on all objects irrespective of their size and position.

D. Gases consist of great numbers of molecules moving in all directions. The behavior of gases can be modeled by the kinetic molecular theory.

E. Chemical reaction rates change with conditions under which they occur. Chemical equilibrium is a dynamic state in which forward and reverse processes occur at the same rates.

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
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)
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)
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)
2003410:	Physics 2 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)
7920040:	Fundamental Integrated Science 3 (Specifically in versions: 2013 - 2015, 2015 - 2017 (course terminated))
2003838:	Florida's Preinternational Baccalaureate Physics 2 (Specifically in versions: 2015 and beyond (current))
7920022:	Access Physical Science (Specifically in versions: 2016 - 2018, 2018 and beyond (current))

Related Access Points

Access Points Number	Access Points Title
SC.912.P.12.In.6:	Identify that gases exert pressure in a closed surface, such as pressure inside a basketball or a hot air balloon.
SC.912.P.12.Su.6:	Recognize that a gas can exert pressure, such as in balloons, car tires, or pool floats.
SC.912.P.12.Pa.6:	Recognize that some objects contain air, such as balloons, tires, and balls.

Related Resources

Lesson Plans

Name	Description
Gas Laws:	Through this hands on activity, students will be able to identify the behavior of gases and the relationship between pressure and volume (Boyle's Law), volume and temperature (Charles' Law), and pressure and temperature (Gay-Lussac's Law)
Boyle's Law Bell Jar POEs:	This is a fun way to introduce Boyle's Law to students. Predict-Observe-Explain models are used to encourage students to think about what will happen to the volume of four different objects (balloon, marshmallow, cotton ball, and penny) when they are placed into a bell jar and the air is removed. They are then challenged to come up with an explanation for their observations. Students are surprised by the outcomes and excited by some of the results.
BIOSCOPES Summer Institute 2013 - States of Matter:	This lesson is designed to be part of a sequence of lessons. It follows CPALMS Resource #52957 "BIOSCOPES Summer Institute 2013 - Thermal Energy" and precedes CPALMS Resource #52961 "BIOSCOPES 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.
Gas Laws:	This is a "gold star" lesson plan that incorporates the virtual manipulative "Gas Properties" from PhET (University of Colorado). Students investigate properties of gases, represent predictions graphically, test predictions using the manipulative, and then extend the knowledge into real investigations (i.e. non virtual).

Perspectives Video: Professional/Enthusiasts

Name	Description
Coffee Physics: Siphon Method:	After you watch this video on coffee brewing and physics, let the information percolate. Download the CPALMS Perspectives video student note taking guide.
Coffee Physics: Raising the Bar with Espresso:	Under pressure to learn how physics and coffee go together? Watch this espresso video and find out. Download the CPALMS Perspectives video student note taking guide.

Video/Audio/Animation

Name	Description
Temperature, Pressure and American Football: Introduction to Gay-Lussac's Gas Law:	This lesson provides an introduction to Pressure, Temperature and Gay-Lussac's Gas Law, using as an example the Deflategate controversy that took place in the sport of American Football in January 2015. The main learning objectives are: (1) to define temperature and pressure; (2) to introduce the concepts of absolute pressure and absolute temperature, including the use of Kelvin measurement units; (3) to use Gay-Lussac's law to predict how the pressure of a fixed container of gas, such as a football, will change due to an increase or decrease in temperature; (4) to compare predictions from a physical law with experimental measurements of the same quantity; (5) to introduce the concept of measurement error and to discuss sources of uncertainty in pressure and temperature measurements; and (6) to use the Ideal Gas Law to compute the amount of gas that would need to be added or removed from a fixed volume of gas, held at constant temperature, to achieve a given increase or decrease in pressure.

Virtual Manipulatives

Name	Description
Vapor Pressure:	This simulation activity will help you understand the concept of vapor pressure which is defined as the pressure of the vapor resulting from evaporation of a liquid (or solid) above a sample of the liquid (or solid) in a closed container. You will also recognize that the vapor pressure of a liquid varies with its temperature, which can be seen with the help of a graph in the simulation.
Balloons and Buoyancy:	This simulation will provide an insight into the properties of gases. You can explore the more advanced features which enables you to explore three physical situations: Hot Air Balloon (rigid open container with its own heat source), Rigid Sphere (rigid closed container), and Helium Balloon (elastic closed container). Through this activity you can: • Determine what causes the balloon, rigid sphere, and helium balloon to rise up or fall down in the box. • Predict how changing a variable among Pressure, Volume, Temperature and number influences the motion of the balloons.
PhET Gas Properties:	This virtual manipulative allows you to investigate various aspects of gases through virtual experimentation. From the site: Pump gas molecules to a box and see what happens as you change the volume, add or remove heat, change gravity, and more (open the box, change the molecular weight of the molecule). Measure the temperature and pressure, and discover how the properties of the gas vary in relation to each other.

Student Resources

Virtual Manipulatives

Name	Description
Vapor Pressure:	This simulation activity will help you understand the concept of vapor pressure which is defined as the pressure of the vapor resulting from evaporation of a liquid (or solid) above a sample of the liquid (or solid) in a closed container. You will also recognize that the vapor pressure of a liquid varies with its temperature, which can be seen with the help of a graph in the simulation.
	This simulation will provide an insight into the properties of gases. You can explore the more advanced features which enables you to explore three physical situations: Hot Air Balloon (rigid open container with its own heat source), Rigid Sphere (rigid closed container), and

Balloons and Buoyancy:	Helium Balloon (elastic closed container). Through this activity you can: • Determine what causes the balloon, rigid sphere, and helium balloon to rise up or fall down in the box. • Predict how changing a variable among Pressure, Volume, Temperature and number influences the motion of the balloons.
PhET Gas Properties:	This virtual manipulative allows you to investigate various aspects of gases through virtual experimentation. From the site: Pump gas molecules to a box and see what happens as you change the volume, add or remove heat, change gravity, and more (open the box, change the molecular weight of the molecule). Measure the temperature and pressure, and discover how the properties of the gas vary in relation to each other.

Parent Resources

Virtual Manipulatives

Name	Description
Vapor Pressure:	This simulation activity will help you understand the concept of vapor pressure which is defined as the pressure of the vapor resulting from evaporation of a liquid (or solid) above a sample of the liquid (or solid) in a closed container. You will also recognize that the vapor pressure of a liquid varies with its temperature, which can be seen with the help of a graph in the simulation.
Balloons and Buoyancy:	This simulation will provide an insight into the properties of gases. You can explore the more advanced features which enables you to explore three physical situations: Hot Air Balloon (rigid open container with its own heat source), Rigid Sphere (rigid closed container), and Helium Balloon (elastic closed container). Through this activity you can: • Determine what causes the balloon, rigid sphere, and helium balloon to rise up or fall down in the box. • Predict how changing a variable among Pressure, Volume, Temperature and number influences the motion of the balloons.
PhET Gas Properties:	This virtual manipulative allows you to investigate various aspects of gases through virtual experimentation. From the site: Pump gas molecules to a box and see what happens as you change the volume, add or remove heat, change gravity, and more (open the box, change the molecular weight of the molecule). Measure the temperature and pressure, and discover how the properties of the gas vary in relation to each other.