History

Explore the discoverer's biography, including general facts about his life and anecdotes regarding how he made this particular discovery. Also see other significant scientific discoveries built largely on this concept and other real-world applications in history that may not still be relevant.

Discoverer/Developer

Avogadro's Law from 1811. Amedeo Avogadro (1776-1856) was an Italian physicist and lawyer. He taught physics in Turin, Italy. Avogadro published two memoirs, once in 1811, and the second in 1814. Both were published in French. Avogadro's Law was stated separately by Ampere in 1814, and the two are generally interchangeable, historically speaking.

Use/Application through History

Avogadro's Law is widely regarded as a significant contributor to the determination of atomic and molecular weights. Gaudin and Cannizzaro used Avogadro's law to determine atomic weights. Avogadro suggested the diatomic nature of many "elementary" gases, as did Dumas using Avogadro's Law. The Law also contributed to the determination of molecular formulae by demonstrating the ratios of combinations of gases, such as in the gases of water, hydrogen chloride, ammonia, and nitric oxide. Cannizzaro also used Avogadro's Law to "simplify the teaching of chemistry" and present a unified system consistent for chemical and physical observations. Avogadro's Law contributed to the development of the kinetic theory of matter. Avogadro's Law can also be applied to osmosis, which, in turn, allows the determination of molecular weights by osmotic pressure.

Concept Definition

Study the primary definition of this concept, broken into general, basic, and advanced English definitions. Also see the mathematical definition and any requisite background information, such as conditions or previous definitions.

General Science

Volume increases as the number of particles increases if temperature and pressure stay constant. Volume decreases as the number of particles decreases if temperature and pressure stay constant.

Basic

Volume and the number of particles of a gas are directly proportionate for a constant temperature and pressure.

Advanced

The ratio of volume (V) and the number of particles (n) of a gas is a constant. Volume and the number of particles of a gas are directly proportionate for a constant temperature and pressure.

Mathematical Definition

Background Information

Ideal Gas

An "ideal gas" is a gas in which:

- All collisions are totally elastic (particles always bounce off each other)
- There are no intermolecular attractions (a particle can only change direction when it collides with another particle)
- The molecule is infinitely small (particles will come all the way together before they collide)

What does this mean? An ideal gas is a collection of bouncy-balls.

Real World Application

Discover processes or disciplines in the natural or man-made worlds that employ the concept.

Avogadro's Law, along with other gas laws, explains why bread and other baked goods rise. Yeast or other leavening agents in the dough break down the long carbohydrates from the flour or sugar and convert them into carbon dioxide gas and ethanol. The carbon dioxide forms bubbles, and, as the yeast continues to leaven the dough, the increase in the number of particles of carbon dioxide increase the volume of the bubbles, thereby puffing up the dough.

Avogadro's Law explains projectiles, like cannons and guns; the rapid reaction of the gunpowder very suddenly creates a large amount of gas particles--mostly carbon dioxide and nitrogen gases--which increase the volume of the space behind the cannon or bullet until the projectile has enough speed to leave the barrel.

A balloon inflates because of Avogadro's Law; the person blowing into the balloon is inputing a lot of gas particles, so the balloon increases in volume.

We breathe because of Avogadro's Law, among others; the lungs expand, so more gas particles can enter the lungs from the outside air (inhaling). Then the lungs contract, so the waste gas particles are expelled (exhaling).

Vocabulary

Learn important vocabulary for this concept, including words that might appear in assessments (tests, quizzes, homework, etc.) that indicate the use of this concept.

Important Vocabulary **Term** **Context**

Evolves
- A gas evolves

Makes
- reaction makes a gas

Particles
- increase/decrease in the number of particles
- particles enter/leave

Produces

- reaction produces a gas

Yields

- reaction yields a gas

Computer Animations

Experience computer simulators or animations that illustrate the concept discussed here. Many simulators or animations come with worksheets for use in class.

http://www.grc.nasa.gov/WWW/K-12/airplane/Animation/frglab2.html
http://phet.colorado.edu/simulations/sims.php?sim=Gas_Properties
http://www.mhhe.com/physsci/chemistry/essentialchemistry/flash/gasesv6.swf
http://intro.chem.okstate.edu/1314F00/Laboratory/GLP.htm
http://preparatorychemistry.com/Bishop_animations.htm

Summary

Read a summary of the concept, indicating the enduring understanding students should retain after class.

Summary

If the pressure and temperature remain constant, increasing the number of particles of gas inside a container will increase the volume of the container. Likewise, decreasing the number of particles of gas inside a container will decrease the volume of the container.