CHEMISTRY:
Concepts and Applications

Behavior of Gases

Gas Pressure : Boyle's Law

Mc Graw Hill Education

Gas Pressure

Essential Questions

- How can changes in the number of particles, the mass, temperature, pressure, and volume on a gas be explained by the kinetic theory?
- What is atmospheric pressure?

Review Vocabulary

diffusion: process by which particles of matter fill in a space because of random motion

Gas Pressure

New Vocabulary

barometer

standard atmosphere

pascal (Pa)

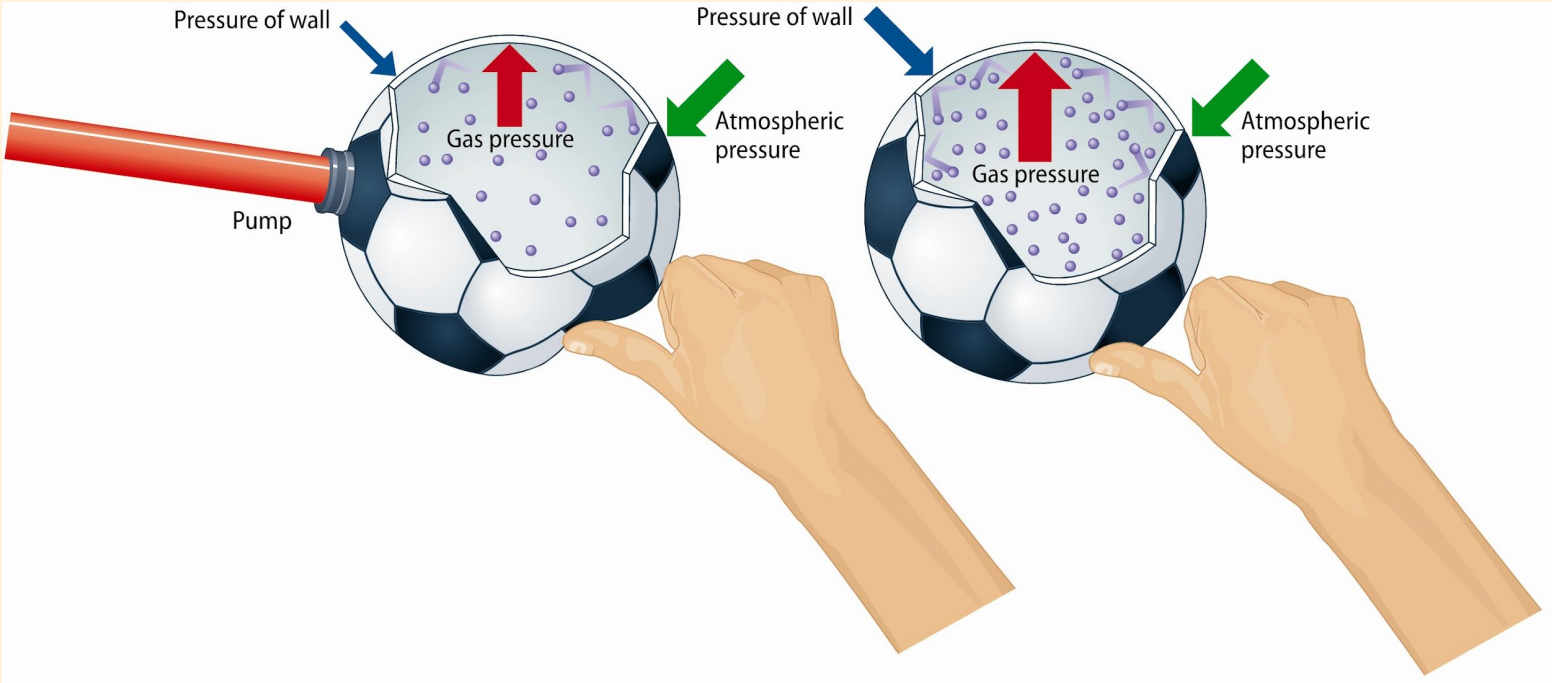
MAIN Idea

Gas pressure is related to the mass of the gas and to the motion of the gas particles.

Gas Pressure

Defining Gas Pressure

- Gas pressure is related to the mass of the gas and to the motion of the gas particles.



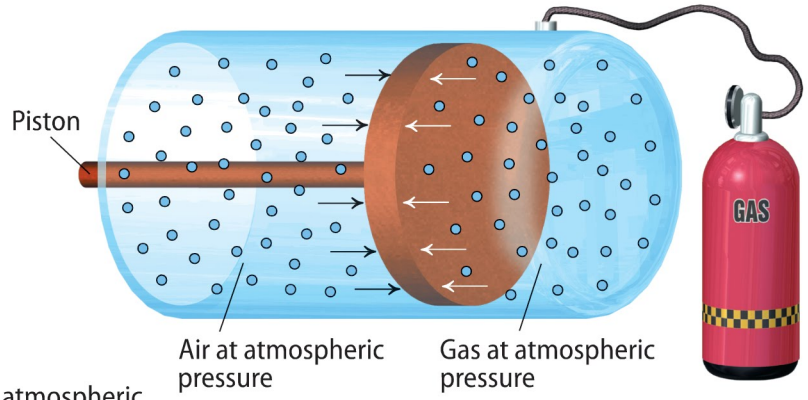
Gas Pressure

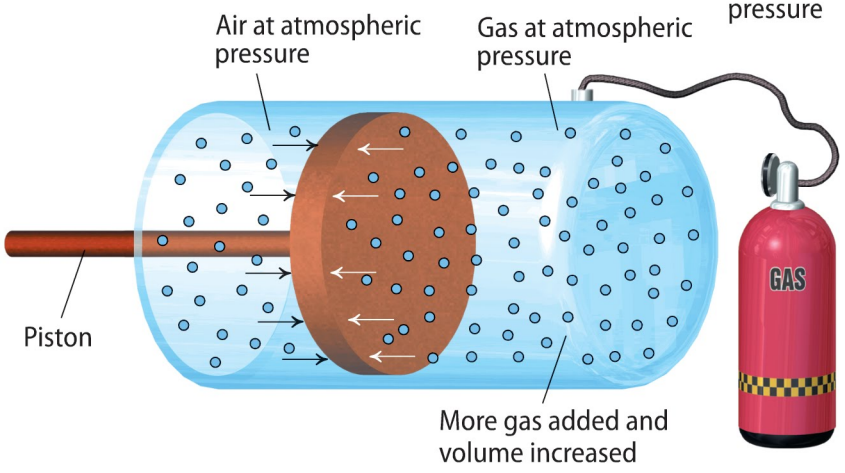
Defining Gas Pressure (cont.)

- The pressure of a gas is directly proportional to its mass.
- The more often the gas particles strike the walls of their container, the greater the pressure.

Defining Gas Pressure (cont.)

The constant bombardment of molecules and atoms in air exerts a pressure on the outside face of the piston. This pressure balances the pressure caused by the confined gas bombarding the inside face of the piston (right).





When gas is added to the cylinder, the piston is pushed out (left). When the pressure of the new volume inside the cylinder balances air pressure, the piston stops moving out.

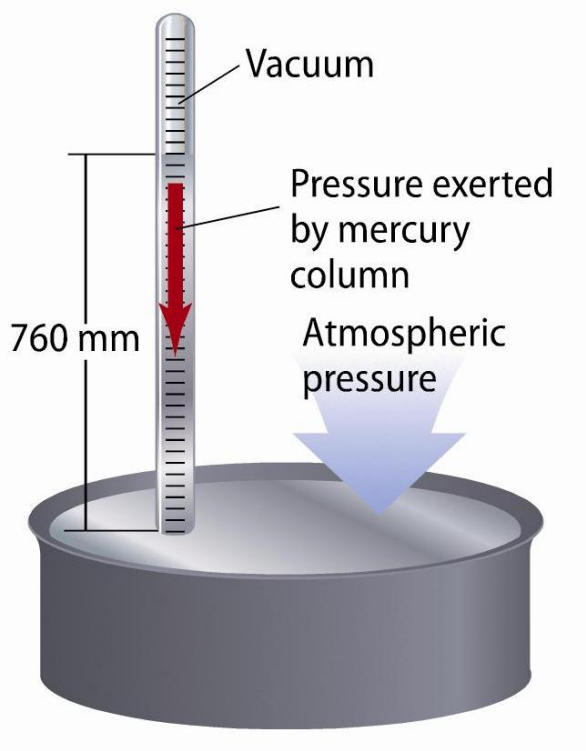
Gas Pressure

Defining Gas Pressure (cont.)

- If the volume of the container and the number of particles of gas are not changed, the pressure of gas increases in direct proportion to the Kelvin temperature increase.

Devices to Measure Pressure

- A **barometer** is an instrument that measures absolute pressure; that is, the total pressures exerted by all gases, including the atmosphere.



Gas Pressure

Devices to Measure Pressure (cont.)

- The **standard atmosphere (atm)** is defined as the pressure that supports a 760-mm column of mercury (1.00 atm = 760 mm Hg).
- Pressure gauges are used to measure the pressure within a contained unit of gas, such as an inflated tire.

Pressure Units

- The SI unit for measuring pressure is the **pascal (Pa)**.

Pressure Units (cont.)

- One standard atmosphere is equal to 101.3 kilopascals.
- To find absolute pressure, add the atmospheric pressure to the gauge pressure.

Table 1 Equivalent Pressures
1.00 atm
760 mm Hg
14.7 psi
101.3 kPa

Section Check

The SI unit for measuring pressure is the ___.

A. barometer

B. pascal

C. standard atmosphere

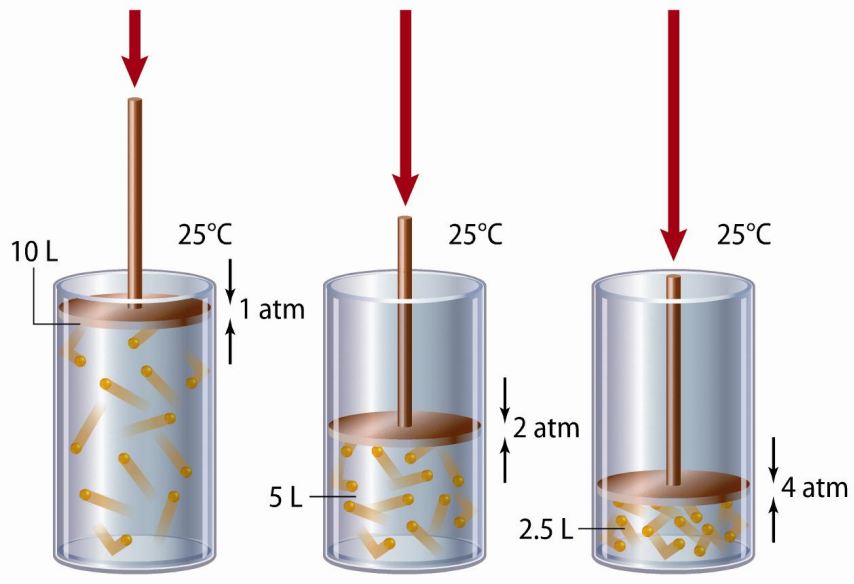
D. pressure gauge

Review Vocabulary

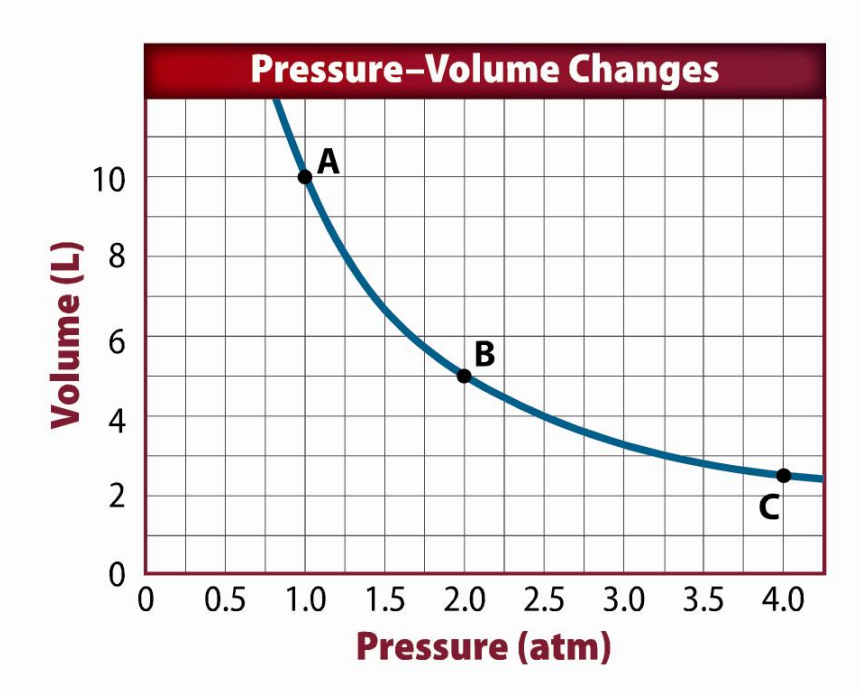
pascal: SI unit for measuring pressure

Boyle's Law: Pressure and Volume

- **Boyle's law** states that the pressure and volume of a gas at constant temperature are inversely proportional.



Boyle's Law: Pressure and Volume (Cont.)



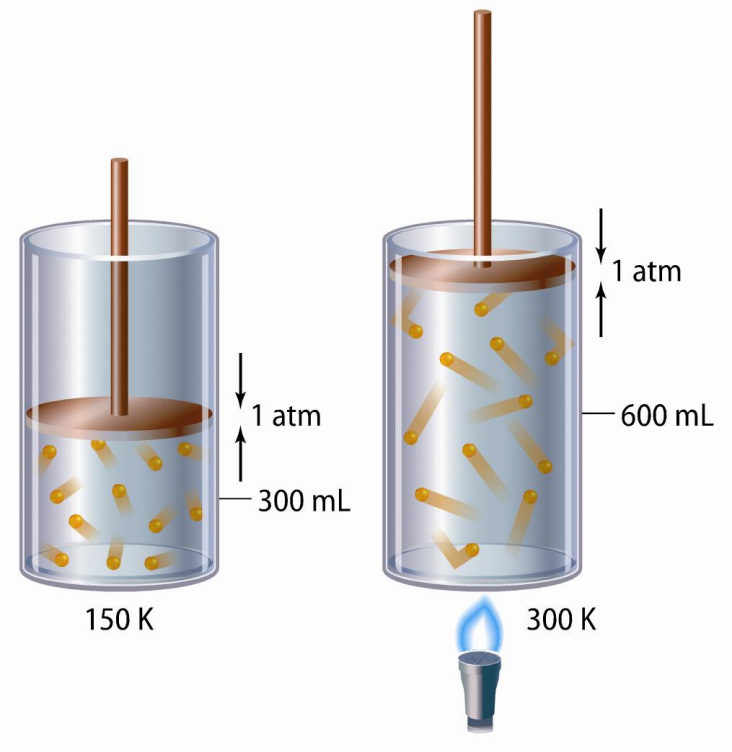
Concepts In Motion

Boyle's Law: Pressure and Volume (Cont.)

- A balloon full of helium will continue to rise until the pressure inside and outside are equal.
- If you compress the volume of a gas while keeping the temperature constant, the pressure increases to twice its initial value.
- Boyle's law quantified the kinetic theory.

Charles's Law: Temperature and Volume

- **Charles's law** states that at constant pressure, the volume of a gas is directly proportional to its Kelvin temperature.



Gas Pressure

Study Guide

Key Concepts

- The pressure of a gas at constant temperature and volume is directly proportional to the number of gas particles.
- At sea level, the pressure exerted by gases of the atmosphere equals one standard atmosphere (1 atm).
- Boyle's law states that the pressure and volume of a confined gas are inversely proportional.

Chapter Assessment

A ___ is an instrument that measures absolute pressure.

A. pascal

B. barometer

C. standard atmosphere

D. pressure gauge

Chapter Assessment

One standard atmosphere is equal to:

A. 101.3 kPa

B. 101.3 Pa

C. 101.3 atm

D. 101.3 psi

Behavior of Gases

Chapter Assessment

Which law states that the pressure and volume of a gas at constant temperature are inversely proportional?

A. Boyle's law

B. Charles's law

C. combined gas law

D. law of combining gas volumes

What conditions represent standard temperature and pressure?

A. 0.00°C and 0.00 atm

B. 1.00°C and 1.00 atm

C. 0.00°F and 1.00 atm

D. 0.00°C and 1.00 atm

Standardized Test Practice

Boyle's law explains which relationship of properties in gases?

A. temperature and volume

B. amount and pressure

C. pressure and volume

D. volume and mass

The End