

Gases

Review

Pressure Buildup in a Bottle of Champagne



The Nature of Gases

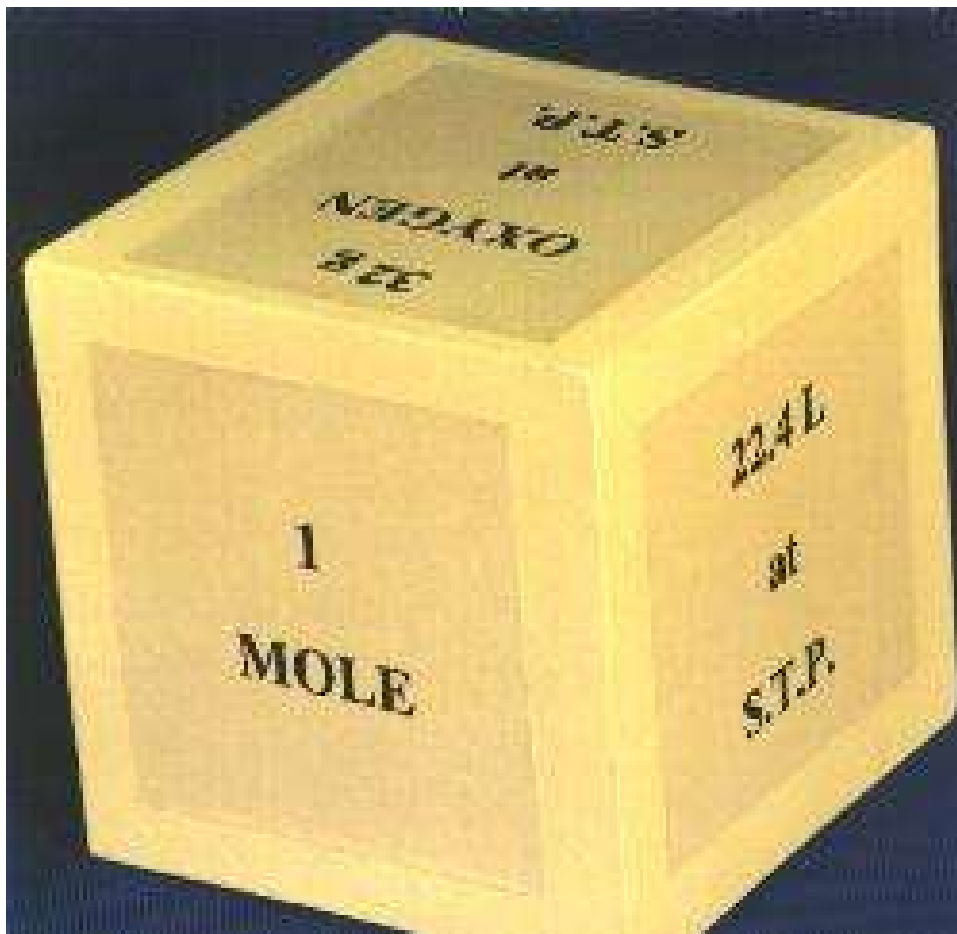
- ❑ Gases expand to fill their containers
- ❑ Gases are fluid - they flow
- ❑ Gases have low density
 - ❑ 1/1000 the density of the equivalent liquid or solid
- ❑ Gases are compressible
- ❑ Gases effuse and diffuse

Pressure

- Is caused by the collisions of molecules with the walls of a container
- is equal to force/unit area
- SI units = Newton/meter² = 1 Pascal (Pa)
- 1 atmosphere = 101,325 Pa
- 1 atmosphere = 1 atm = 760 mm Hg = 760 torr

Standard Temperature and Pressure "STP"

- $P = 1$ atmosphere, 760 torr
- $T = 0^{\circ}\text{C}$, 273 Kelvins
- The molar volume of an ideal gas is 22.42 liters at STP



Standard Molar Volume

Equal volumes of all gases at the same temperature and pressure contain the same number of molecules.

- Amedeo Avogadro

Molar Volume

- The volume occupied by one mole of a substance is its molar volume at STP ($T = 273 \text{ K}$ or $0 \text{ }^\circ\text{C}$ and $P = 1 \text{ atm}$).

$$V = \frac{nRT}{P}$$

$$\begin{aligned} & 1.00 \text{ mol} \times 0.08206 \frac{\text{L} \cdot \text{atm}}{\text{mol} \cdot \text{K}} \times 273 \text{ K} \\ = & \frac{\hspace{10em}}{1.00 \text{ atm}} \\ = & 22.4 \text{ L} \end{aligned}$$

Ideal Gases

Ideal gases are imaginary gases that perfectly fit all of the assumptions of the **KINETIC MOLECULAR THEORY**

- Gases consist of tiny particles that are far apart relative to their size.
- Collisions between gas particles and between particles and the walls of the container are elastic collisions
 - No kinetic energy is lost in elastic collisions

Ideal Gases (continued)

- ❑ Gas particles are in constant, rapid motion. They therefore possess kinetic energy, the energy of motion
- ❑ There are no forces of attraction between gas particles
- ❑ The average kinetic energy of gas particles depends on temperature, not on the identity of the particle.