

# **N25 – Gases**

## **Review**

# Pressure Buildup in a Bottle of Champagne



# The Nature of Gases

- **Expand** to fill their containers
- Are fluid – they **flow**
- Have **low density**
  - 1/1000 the density of the equivalent liquid or solid
- Are **compressible**
- They **effuse** and **diffuse**

# Pressure

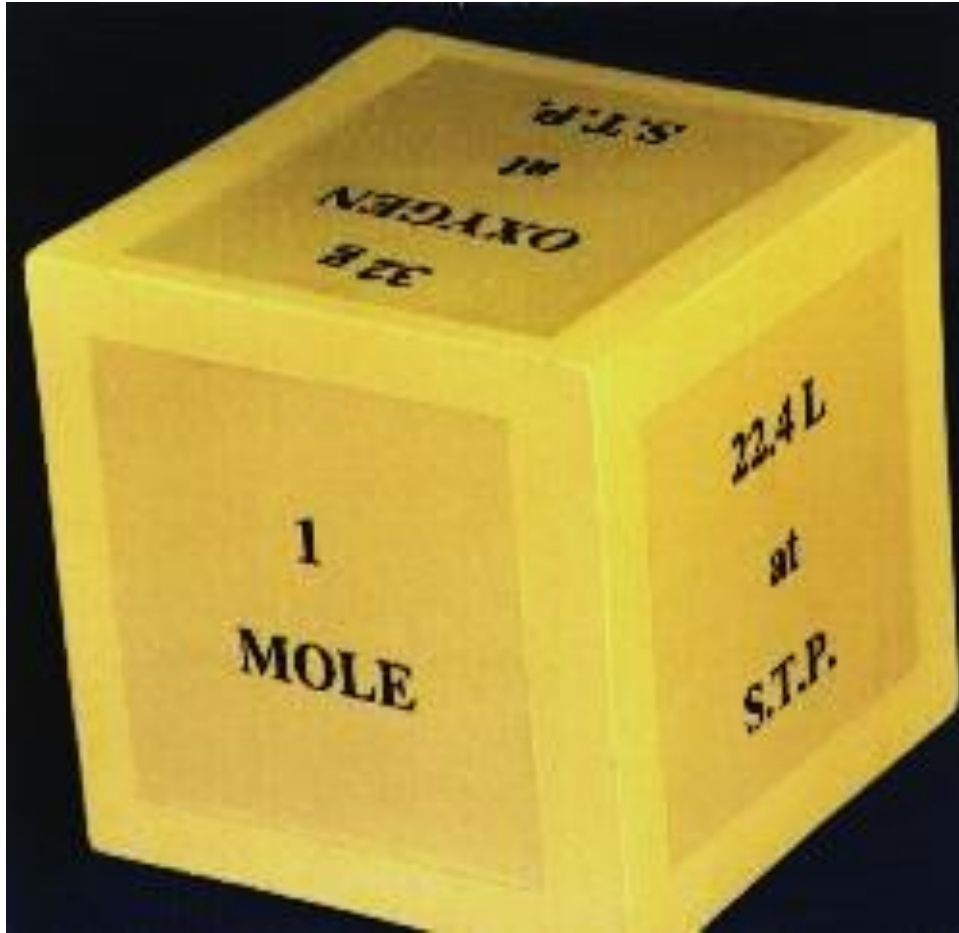
- **Caused by the collisions of molecules with the walls of a container**
- Equal to force/unit area
- SI units = Newton/meter<sup>2</sup> = 1 Pascal (Pa)
- 1 atmosphere = 101,325 Pa
- 1 atmosphere = 1 atm = 760 mm Hg = 760 torr

# 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  $P = 1 \text{ atm}$ ).

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

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

# 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** – *meaning 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 or repulsion** between gas particles
- The average kinetic energy of gas particles **depends on temperature**, not on the identity of the particle.