N25 – Gases

Review

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A Review

Target: I can make sure that I remember the *concepts* behind Gas Laws, and don't just focus on the mathematical equations!

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

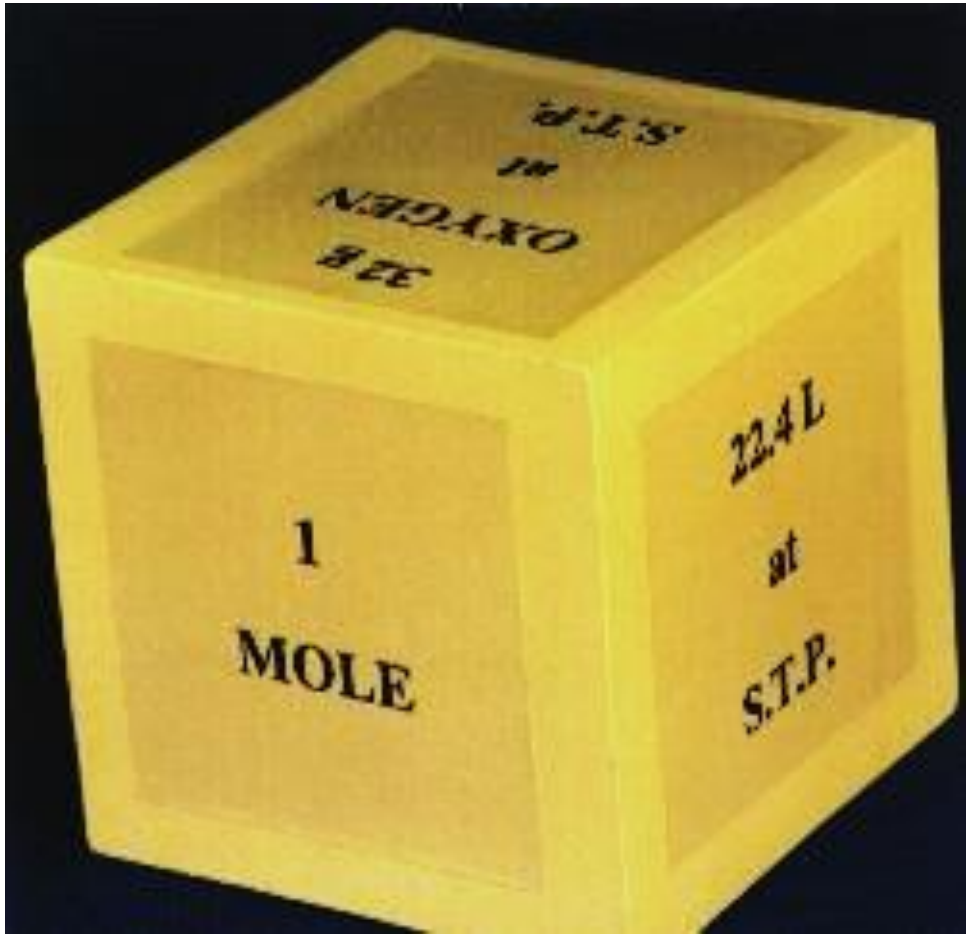
- **Caused by the collisions of molecules with the walls of a container**
- Equal to force/unit area
- SI units = Newton/meter^2 = 1 Pascal (Pa)
- 1 atmosphere = 101,325 Pa
- 1 atmosphere = 1 atm = 760 mm Hg = 760 torr

Standard Temperature and Pressure

“STP”

- ***P*** **= 1 atmosphere, 760 torr**
- ***T*** **= 0°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 K or 0 °C and P = 1atm).*

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

$$= \frac{1.00 \cancel{\text{mol}} \times 0.08206 \dfrac{\text{L} \cdot \cancel{\text{atm}}}{\text{mol} \cdot \cancel{\text{K}}} \times 273 \cancel{\text{K}}}{1.00 \cancel{\text{atm}}}$$

$$= 22.4 \text{ L}$$

Ideal Gases

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

1. Gases consist of tiny point particles that are **far apart** relative to their size.

2. 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)

3. Gas particles are in **constant, rapid, straight line motion**. They therefore **possess kinetic energy**, the energy of motion. (Sometimes described as “chaotic” because the particles all travel individually, not as a group, so it looks like they are bouncing around all crazy, but they are each individually traveling in a straight line.)

4. There are **no forces of attraction or repulsion** between gas particles

Ideal Gases (continued)

5. The average kinetic energy of gas particles **depends on temperature**, not on the identity of the particle. (proportional to KELVIN temperature not Celsius!)

   (There is a **distribution of speeds** at a given temperature. Therefore, there is an **average kinetic energy** of the sample.)

Ideal Gases (continued)

$$PV = nRT \longrightarrow \left(P + \frac{an^2}{V^2} \right) (V - nb) = nRT$$

Correction for molecular attraction

Correction for volume of molecules

YouTube Link to Presentation:

https://youtu.be/2mMIMRP0ACY