Aim: The Kinetic Model of a Gas Day 5 4/19/17

An ideal gas follows the equation: $PV = nRT$

n: Number of moles (molecules) of gas

R: 8.31 J/K mol (Universal gas Constant)

P: Pressure in Pa (Pascals) or we: KPa

V: Volume (m^3) L

T: Temp (K - Kelvin) K

What is Pressure? $\text{Pressure} = \frac{\text{Force}}{\text{Area}}$ Small Area generates a large pressure

Atmospheric Pressure = 101.3 KPa $\text{Pa} = \frac{\text{Newton}}{m^2}$

Ideal Gas Law Example:

Example: How many moles of H_2 is in a $3.1 m^3$ sample of H_2 measured @ 300. Pa @ 20.°C

$P = 300.\text{ Pa}$ $T = 20.^\circ C \rightarrow 293 K$ $PV = nRT$

$V = 3.1 m^3$ $R = 8.31$ J/mol K $(300)(3.1) = n(8.31)(293 K)$

Kelvin = Celcius + 273 $930 = 2434.83n$

$n = .38$ mol

Relationships between Variables of $PV = nRT$

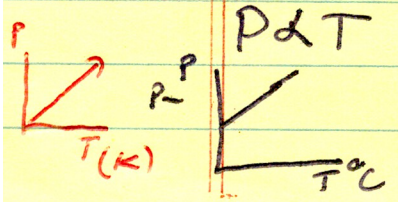
Constant Volume: $P = \left(\frac{nR}{V}\right)T$ $\frac{nR}{V}$ = const.

Constant Pressure: $V = \left(\frac{nR}{P}\right)T$ $\frac{nR}{P}$ = Const

Constant Temp: $P = (nRT)\frac{1}{V}$ nRT = Const

Not to 0 in relationship of Celsius vs. Kelvin

$P \propto T$ $V \propto T$ $P \propto \frac{1}{V}$



When using $Q = mc\Delta T$ ΔT is same in °C or K

Absolute 0 - Temp. @ which the molecules are still
- If no KE Pressure is 0 (no KE)
- Value of gas is 0

Assumptions that define an ideal gas

1) Molecules are small (Gas Value large compared to molecule Vol)
2) No Force between molecules (Move @ Const. speed in straight line
3) Molecules are elastic w/collisions until they collide)
4) Molecules are identical spheres
5) Large number of molecules

Result: No interactions between molecules
KE between molecules is conserved

Quest: Explain how if Value of a gas is fixed, inc. Temp leads to an inc. in Pressure

↑ Temp → ↑ KE of Molecules → Molecules hit wall faster (harder) and more frequently → ↑ Pressure

Quest: If Pressure of a gas is fixed, explain how inc. Temp will increase volume

↑ Temp → ↑ KE of Molecules → Molecules hit wall harder
To compensate the Value needs to increase → Molecules hit less frequently

Quest: If temp is fixed, th inc. th volu will dec. pressu

↑ Volu → Molecules hit less freq → ↓ Pressu