10/17/05.

10/18/05 - Exam 2
No labs this week.

Exam covers ÷ gas law, thermodynamics, solution stoichiometry & titrations

kinetic theory of gases

Define root-mean squared speed (c) (different gas molecules have different velocity or speed so we define (c))

J/mol K

$$c = \left(\frac{3RT}{M}\right)^{\frac{1}{2}}$$

M - molar mass. kg/mol

When T↑, c high.
when M↑, c low.

So lighter molecules lower molar masses more faster.

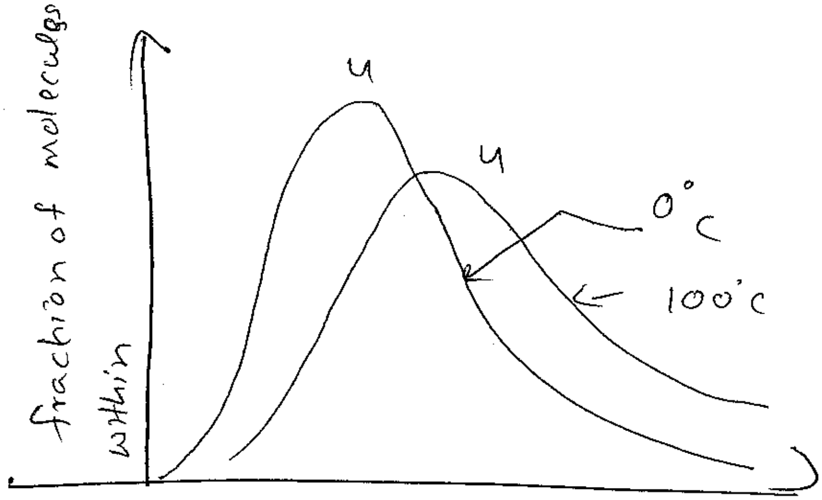
all term in SI units,

R = 8.3145 J/mol.K

1 atm = 101.325 J (exact)

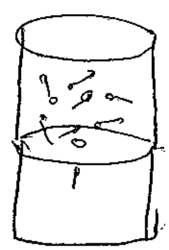
1J = $kg\,m^2/s^2$

Molecular Speed distribution



When increase temperature the speed of molecules go high.

Effusion of Gas



when a collection molecules of gas when seperated by a membrane, other side evacuated chamber. The gas molecules colloid each other, and when they get hold pin hole they will come down to the evacuated chamber.

@ const T rate of effusion $\propto \dfrac{1}{M^{\frac{1}{2}}}$

Graim's Law of Effusion.

$$\text{Rate of effusion } A = \sqrt{\frac{1}{M_A}}$$

$$\text{Rate of effusion } B = \sqrt{\frac{1}{M_B}}$$

$$\frac{\text{Rate of eff. } A}{\text{Rate of eff. } B} = \sqrt{\frac{M_B}{M_A}}$$

Ex - 12

CH_4 effuses @ rate $= 1.3 \times 10^{-8}$ mol/s. an unknown gas eff@ rate $= 542 \times 10^{-9}$ mol/s. These both are in same Temperature and presure.

$$\frac{\text{rate of effusion } CH_4}{\text{rate of eff. unknown}} = \sqrt{\frac{M_{unknown}}{M_{CH_4}}}$$

$$\frac{1.30 \times 10^{-8} \text{ mol/s}}{542 \times 10^{-9} \text{ mol/s}} = \sqrt{\frac{M_{unknown}}{16.042 \text{ g/mol}}}$$

$$M_{unknown} = 92.3 \text{ g/mol}$$

Van der Waals Equation at state.

$$PV = nRT.$$

$$\left(P + a\frac{n^2}{V^2}\right)(V - nb) = nRT.$$

a = compensate attractive forces couses by gas. (atm L² / mol²)

b = repulsive forces (L / mol)

a, b are tabulated numbers for each gases.

Examplo

O_2 cylinder $V = 28.0\ L.$

$m = 6.80\ kg\ O_2$

What is the presure. of this real gas @ 20°C.

$$\left(P + a\frac{n^2}{V^2}\right)(V - nb) = nRT.$$

$a = 1.378\ L^2\ atm\ / mol^2$

$b = 0.03183\ L/mol$

$$P = \left(\frac{nRT}{V - nb}\right) - \left(a\frac{n^2}{V^2}\right)$$