Chemistry 4311

September 7, 2012

Quiz # 1 Name: KEY

R = 1.987 cal K^{-1} mol^{-1} = 8.314 J K^{-1} mol^{-1} = 0.08206 L atm K^{-1} mol^{-1}

K = °C + 273.15

+5 1. Matching

For $Y = -C1\ e^{-C2x}$ (where C1 and C2 constants), dY/dx = f

A g is tested by experiments and represents experiment

Force = i

An example of extensive property is a

Graham's Law states that rate of diffusion of a gas is e proportional to square root of molar mass

(a) Mass
(b) Mass X Velocity
(c) $-C1\ C2\ e^{-C2x}$
(d) Model
(e) Inversely
(f) $C1\ C2\ e^{-C2x}$
(g) Theory
(h) Directly
(i) Mass X Acceleration
(j) Temperature

+3 2. An adult human being exhales 4.7×10^2 mL of gas mixture with every breath. Calculate the number of molecules present in this volume at 37°C and 1.05 atm.

$PV = nRT$

$$n = \frac{PV}{RT} = \frac{(1.05\ atm)(4.7 \times 10^2\ mL)\left(\frac{1\ L}{1000\ mL}\right)}{(0.08206\ L\ atm\ K^{-1}\ mol^{-1})(273.15+37)\ K}$$

$$n = 0.01939027\ mol$$

$$N = n N_A = 0.01939027 \times 6.022 \times 10^{23} = 1.167 \times 10^{22}\ molecules$$

+2 3. Calculate the average translational kinetic energy for a N_2 molecule and for 1 mole of N_2 at 27°C.

For one N_2 molecule

$$\bar{E}_t = \frac{3}{2} k_B T$$

$$= \frac{3}{2} \times 1.381 \times 10^{-23}\ J\ K^{-1} \times (273.15+27)\ K$$

$$\bar{E}_t = 6.218 \times 10^{-21}\ J$$

For one mole,

$$\bar{E}_t = \frac{3}{2} RT = \frac{3}{2} \times 8.314\ J\ K^{-1}\ mol^{-1} \times (273.15+27)\ K$$

$$\bar{E}_t = 3.74 \times 10^3\ J\ mol^{-1}$$