CHE-110 GASES

1. $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ $\quad V_2 = \frac{P_1V_1T_2}{P_2T_1} = \frac{(760\ mm\ Hg)(250\ mL)(313\ K)}{(3.65 \times 760\ mm\ Hg)(310\ K)}$

$= 67.3\ mL$

2. $PV = nRT = \frac{gRT}{mm}$

$mm = \frac{gRT}{PV} = \frac{(2.94\ g) \times (0.0821\ L.atm) \times 423\ K}{1\ K \quad mol\ K \quad (720/760)\ atm}$

$= 108\ g/mol$

3. (a) $d = \frac{44.0\ g/mol}{22.4\ L/mol} = 1.96\ g/L$

(b) $\frac{g}{V} = d = \frac{P(mm)}{RT} = \frac{(748/760)\ atm \quad 44.0\ g/mol}{(0.0821\ L.atm/mol.K)(300\ K)}$

$= 1.76\ g/L$

4. $\%\ C = 0.2706 \times \frac{12}{44} \times \frac{100}{0.1023} = 73.74$

$\%\ H = 0.0991 \times \frac{2}{18} \times \frac{100}{0.1023} = 10.76$

$\%\ N_2 = 0.0276\ L \times \frac{1\ mol\ N_2}{22.4\ L} \times \frac{28.0\ g\ N_2}{1\ mol\ N_2} \times \frac{28.0\ g\ N}{28.0\ g\ N_2} \times \frac{100}{0.4831}$

$= 7.14$

$\%\ O = 100 - \{73.74 + 10.76 + 7.14\} = 8.36$

	MASS %	MOL	MOL RATIO
C	73.74	6.15	12
H	10.76	10.76	21
N	7.14	0.510	1
O	8.36	0.523	1

EF IS $C_{12}H_{21}N_1O_1$

$PV = nRT = gRT/MM$

$MM = \frac{gRT}{PV} = \frac{(4.02\,g)(0.0821\,L\cdot atm)(400\,K)}{1\,L\,(mol\,K)(256/760)\,atm}$

$= 392\ g/mol$

$MF = (EF)_n \qquad n = \frac{MM}{EM} = \frac{392}{196} = 2$

$\therefore$ MF IS $C_{24}H_{42}N_2O_2$

$n = \frac{PV}{RT} = \frac{(10^{-6}/760)\,atm \times 1\times10^{-3}\,L}{(0.0821\,\frac{L\cdot atm}{mol\cdot K})(273\,K)}$

$= 5.87\times10^{-14}\ mol$

MOLECULES $= 5.87\times10^{-14}\,\frac{mol}{mL} \times 6.02\times10^{23}\,\frac{molecules}{mol}$

$= 3.53\times10^{10}\ molecules/mL$

$n_{O_2} = \frac{PV}{RT} = \frac{(89.8\times10^{-3}\,L)\{(727-19.8)/760\}\,atm}{(295\,K)(0.0821\,L\cdot atm/mol\cdot K)}$

$= 3.45\times10^{-3}\ mol$

mol $KClO_3 = 3.45\times10^{-3} \times \frac{2}{3} = 2.30\times10^{-3}$ mol $KClO_3$

g $KClO_3 = 0.282$ g

% $KClO_3 = (0.282/\ )100 = 9.66$ % $KCl = 90.3$

(a) $5.00\ \text{g AtG} \times \frac{1\ \text{mol AtG}}{227\ \text{g AtG}} \times \frac{29\ \text{mol gases}}{4\ \text{mol AtG}} = 1.60\times10^{-1}\ \text{mol}$

$$P = \frac{nRT}{V} = \frac{(1.60\times10^{-1}\ \text{mol})(0.0821\ \text{L·atm})(2773\ \text{K})}{(\text{mol K})(1.000\ \text{L})}$$

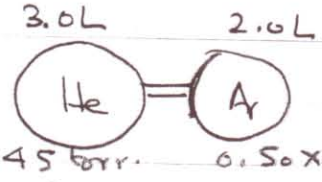
$$= 36.4\ \text{atm}$$

(b) $p = X \cdot P_T$.

$\therefore p_{CO_2} = \frac{12}{29} \times 36.4\ \text{atm} = 15.1\ \text{atm}$

$p_{H_2O} = 12.6$ $\quad p_{N_2} = 7.53\ \text{atm}$

$p_{O_2} = 1.26\ \text{atm}$



$P_1V_1 = P_2V_2$

$$P_2 = \frac{(145\ \text{torr})(3.0\text{L})}{(5.0\ \text{L})} = 87.0\ \text{torr}\ (\text{He})$$

$$P_2\ (\text{Ar}) = \frac{380 \times 2}{5} = 152\ \text{torr}\ (\text{Ar})$$

$P_T = p_{He} + p_{Ar} = 87 + 152 = 239\ \text{mmHg}$

$$\frac{R_B}{R_A} = \frac{t_A}{t_B} = \sqrt{\frac{M_A}{M_B}}$$

Let $A = O_2$ $\quad B = \text{unk.}$

$$\therefore M_B = M_A \Big/ \left(\frac{R_B}{R_A}\right)^2 = (32.0\ \text{g/mol}) \Big/ \left(\frac{1 \times 0.468}{1}\right)^2$$

$$= 146\ \text{g/mol}$$

10. $\frac{t_A}{t_B} = \sqrt{\frac{M_A}{M_B}}$

$$M_A = \left(\frac{t_A}{t_B}\right)^2 \times M_B = \left(\frac{300\ s}{219\ s}\right)^2 (16.0\ g/mol) = 30.0\ g/mol$$

11. $P_B = X_B \cdot P_T$, $X_B = 1 - \left[(0.30) + \left(\frac{792.2/44}{60}\right)\right]$

$= 0.40$

$= 0.40 \times 4\ atm$

$= 1.60\ atm$

12. $NH_4NO_3(s) \xrightarrow{\Delta} N_2O(g) + 2\,H_2O(g)$

$$n_{N_2O} = \frac{(1.00\ atm)(3.50\ L)}{(0.0821\ L \cdot atm/mol \cdot K)(528\ K)} = 0.0807\ mol$$

$$0.0807\ mol\ N_2O \times \frac{1\ mol\ NH_4NO_3}{1\ mol\ N_2O} \times \frac{80.0\ g\ NH_4NO_3}{1\ mol\ NH_4NO_3}$$

$= 6.46\ g\ NH_4NO_3$