

$$\begin{aligned} (1) \quad P_1 &= .994 \text{ atm} & P_2 &= 1.28 \text{ atm} \\ V_1 &= 3.44 \text{ L} & V_2 &= ? \\ T_1 &= 18.2 + 273 = 291 & T_2 &= 65.0 + 273 = 338 \end{aligned}$$

$$\frac{.994(3.44)}{291} = \frac{1.28(V)}{338}$$

$$V = 3.10 \text{ L}$$

$$(2) \quad D = \frac{m}{V} \quad \left( \frac{n}{V} \right) \quad P = 1.0 \text{ atm}$$

$$V = ?$$

$$n =$$

$$R = .0821$$

$$T = 273$$

$$\text{CO}_2 \quad PV = nRT \quad \frac{P}{RT} = \frac{n}{V} = \frac{1.0}{(.0821)(273)} = .446 \frac{\text{mol}}{\text{L}}$$

$$\text{CO}_2: \frac{.446 \text{ mol} \mid 44.01 \text{ g} \mid 1 \text{ L}}{1 \text{ L} \mid 1 \text{ mol} \mid 1000 \text{ mL}} = 1.96 \times 10^{-3} \text{ g/mL CO}_2$$

$$\text{SF}_6: \frac{.446 \text{ mol} \mid 146.01 \text{ g} \mid 1 \text{ L}}{1 \text{ L} \mid 1 \text{ mol} \mid 1000} = 6.51 \times 10^{-3} \text{ g/mL SF}_6$$

CO<sub>2</sub> - diff faster

$$\frac{\text{CO}_2}{\text{SF}_6} = \sqrt{\frac{146.01}{44.01}} = 1.82$$

$$\textcircled{3} \quad \frac{n}{V} = \frac{P}{RT} = \frac{8.02 \text{ atm}}{0.0821 (299)} = \frac{.327 \text{ mol}}{1 \text{ L}}$$

$$P = 812.5 \text{ kPa} \left| \frac{1 \text{ atm}}{101.3 \text{ kPa}} \right| = 8.02 \text{ atm}$$

$$T = 26 + 273 = 299$$

$$\frac{.327 \text{ mol C}_4\text{H}_{10}}{1 \text{ L}} \left| \frac{58.12 \text{ g}}{1 \text{ mol}} \right| \left| \frac{1 \text{ L}}{1000 \text{ mL}} \right| = \boxed{1.90 \times 10^{-2} \text{ g/mL}}$$

$$\textcircled{4} \quad P = 1.55 \text{ atm}$$

$$V = ?$$

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

$$n = \frac{35.3 \text{ g NO}_2}{46.01 \text{ g}} \left| \frac{1 \text{ mol}}{46.01 \text{ g}} \right| = .7670 \quad V = \frac{.7670 (0.0821) (292)}{1.55}$$

$$R = 0.0821$$

$$T = 18.6 + 273 = 292$$

$$\boxed{V = 11.9 \text{ L}}$$

$$\textcircled{5} \quad P = 1.00 \text{ atm} \quad n = \frac{PV}{RT} = \frac{1}{(0.0821)(300)} = .0395$$

$$V = 1.00 \text{ L}$$

$$n = .0395$$

$$R = 0.0821$$

$$T = 35.0 + 273$$

$$\text{New} = P = .87$$

$$V = 1.35$$

$$n = .0395$$

$$R = 0.0821$$

$$T = ?$$

$$\frac{.87 (1.35)}{(.0395) (0.0821)} = T = 362 \text{ K}$$

$$- 273$$

$$\boxed{89^\circ \text{C}}$$

$$(6) \frac{CH_4}{C_8H_8} = \sqrt{\frac{44.09}{16.04}} = 1.658$$

$$(7) P_T = P_g + P_{H_2O}$$

$$1.04 \text{ atm} = 2.99 \text{ kPa}$$

$$\left. \begin{array}{l} P_g \\ V = 4.0 \text{ L} \\ n = \\ R = .0821 \\ T = 24.0 + 273 \end{array} \right\} \text{not needed}$$

$$\frac{2.99 \text{ kPa}}{101.3} = .0295 \text{ atm}$$

$$P_g = 1.04 - .0295 = \boxed{1.01 \text{ atm}}$$

$$(8) P_T = 100.0 \text{ kPa} = P_{He} + P_{H_2} + P_{O_2} + P_{CO_2} + P_{N_2}$$

$$100.0 = 5(P)$$

- a) P of each gas = 20.0 kPa
- b) all the same
- c) all the same
- d)  $H_2$

$$(9) C$$

$$P_{H_2} = \frac{nRT}{V} = \frac{12.4 (.0821) (293)}{50.0} =$$

$$\boxed{P_{H_2} = 5.97 \text{ atm}}$$

$$(10) P_T$$

$$V = 50.0 \text{ L}$$

$$n_T = 13.2 \text{ mol}$$

$$R = .0821$$

$$T = 20.0 + 273$$

$$n_{H_2} = \frac{25.0 \text{ g } H_2}{2.016} = 12.4$$

$$n_{O_2} = \frac{25.0 \text{ g } O_2}{32.00} = .781$$

$$n_T = 13.2$$

$$P_T = \frac{nRT}{V} = \frac{13.2 (.0821) (293)}{50.0} = \boxed{6.35 \text{ atm total}}$$

$$P_{O_2} = \frac{6.35 - 5.97}{.781} = .38 \text{ atm}$$

(11.)  $P_T = 7.5 \text{ atm}$   
 $V_T =$   
 $n_T = 10.0$   
 $R = .0821$   
 $T =$

$P_{He} =$   
 $V =$   
 $n_{He} = 1.5$   
 $R =$   
 $T =$

$P_{Ne} =$   
 $V =$   
 $n_{Ne} = 2.5$   
 $R =$   
 $T =$

$P_{Ar} =$   
 $V =$   
 $n_{Ar} = 6.0$   
 $R =$   
 $T =$

$$\frac{P}{n} = \frac{RT}{V} = \text{constant}$$

$$P_T = n_T (\text{const})$$

$$7.5 = 1.5(x) + 2.5(x) + 6.0(x)$$

$$= x(10.0)$$

$$x = \frac{7.5}{10.0} = .75$$

$$\frac{P_T}{n_T} = \frac{P_{He}}{n_{He}}$$

$$\frac{1.5(7.5)}{10} = 1.1$$

a)

|                                                                                                     |
|-----------------------------------------------------------------------------------------------------|
| $P_{He} = .75(1.5) = 1.1$<br>$P_{Ne} = .75(2.5) = 1.9$<br>$P_{Ar} = .75(6.0) = 4.5$<br>$\hline 7.5$ |
|-----------------------------------------------------------------------------------------------------|

b) @ same T, same KE

c) He fastest

d) Ar densest

(12.) same P

(13.) 1.449g

$$P = 46.8 \text{ kPa} \div 101.3 = .462$$

$$V = .5000 \text{ L}$$

$$n = ?$$

$$R = .0821$$

$$T = 26.2 + 273$$

$$n = \frac{PV}{RT} = \frac{.462(.5000)}{(.0821)(299)} = 9.41 \times 10^{-3} \text{ mol}$$

$$MM = \frac{1.449g}{9.41 \times 10^{-3} \text{ mol}} = \boxed{154 \text{ g/mol}}$$

(14.)

Tank 1

$$P_{SO_2} = 250 \text{ kPa} \div 101.3 = 2.47$$

$$V = 10.0 \text{ L}$$

$$n_{SO_2}$$

$$R = .0821$$

$$T = 273 + 25 = 298$$

$$n_{SO_2} = \frac{PV}{RT}$$

$$= \frac{2.47 (10.0)}{.0821 (298)}$$

$$n_{SO_2} = 1.01 \text{ mol}$$

Tank 2

Initial

$$P_{Cl_2O} = 350 \text{ kPa} \div 101.3 = 3.46$$

$$V = 20.0 \text{ L}$$

$$n_{Cl_2O}$$

$$R = .0821$$

$$T = 298$$

$$n_{Cl_2O} = \frac{PV}{RT}$$

$$= \frac{3.46 (20.0)}{.0821 (298)}$$

$$n_{Cl_2O} = 2.83 \text{ mol}$$

mixed

$$P_T =$$

$$V = 20.0$$

$$n_T = 1.01 + 2.83 = 3.84$$

$$R = .0821$$

$$T = 298$$

$$P = \frac{nRT}{V} = \frac{3.84 (.0821) (298)}{20.0}$$

$$P_T = 4.70 \text{ atm}$$

$$P_{Cl_2O} = 3.46 \text{ atm}$$

$$P_{SO_2} = 1.24 \text{ atm}$$

(15.)

$$P = 3.2 \times 10^2$$

$$V = 3.0 \times 10^4 \text{ L}$$

$$n =$$

$$R = .0821$$

$$T = 273 - 28.2 = 244.8$$

$$n = \frac{PV}{RT} = \frac{3.2 \times 10^2 (3.0 \times 10^4)}{.0821 (244.8)}$$

$$= 4.78 \times 10^5 \text{ mol } Cl_2O$$

$$\frac{4.78 \times 10^5 \text{ mol } Cl_2O}{1 \text{ mol } Cl_2O} \times \frac{86.9 \text{ g}}{1 \text{ mol } Cl_2O} = 4.15 \times 10^7 \text{ g } Cl_2O$$

$$\frac{P}{RT} = \frac{n}{V}$$

$$(16) \quad D = \frac{m}{V}$$

$$N_2O = 44.02 \text{ g/mol}$$

$$\frac{n}{V} = \frac{P}{RT} = \frac{4.60}{(0.0821)(373)} = .150 \frac{\text{mol}}{\text{L}} \left| \frac{44.02 \text{ g}}{\text{mol}} \right| = \boxed{\frac{6.61 \text{ g}}{\text{L}}}$$

(17)

$$P = .65$$

$$V = .0100 \text{ L}$$

$$n = 2.5 \times 10^{-3}$$

$$R = .0821$$

$$T$$

$$T = \frac{PV}{Rn} = \frac{.65(.0100)}{(0.0821)(2.5 \times 10^{-3})} = 32 \text{ K}$$

$$\boxed{T = -241^\circ \text{C}}$$

(18)

$$\text{vol, } T, P \text{ const}$$

$$\therefore n \text{ const.}$$

$$\frac{50.0 \text{ g UFe}}{352 \text{ g}} = .142 \text{ mol UFe}$$

$$\frac{.142 \text{ mol H}_2}{1 \text{ mol}} \left| \frac{2.016 \text{ g}}{1 \text{ mol}} \right| = \boxed{2.86 \times 10^{-1} \text{ g H}_2}$$

(19)

$$P = 1.25$$

$$V = ?$$

$$n = 2.50$$

$$R = .0821$$

$$T = 273 + 24.5 = 298$$

$$V = \frac{nRT}{P} = \frac{2.50(.0821)(298)}{1.25}$$

$$\boxed{V = 48.9 \text{ L for all}}$$

(20)

$$P = 104.7 \text{ kPa} \div 101.3 = 1.03$$

$$V = .0300$$

$$n =$$

$$R = .0821$$

$$T = 28 + 273 = 301$$

$$n = \frac{PV}{RT}$$

$$= \frac{1.03(.0300)}{(0.0821)(301)}$$

$$= \frac{1.25 \times 10^{-3} \text{ mol Cl}_2}{70.9} = \boxed{8.66 \times 10^{-6}}$$

$$(21) P = 65.0$$

$$V =$$

$$n = .010$$

$$R = .0821$$

$$T = 273 - 25 = 248$$

$$V = \frac{nRT}{P} = \frac{.010(.0821)(248)}{65.0}$$

$$\boxed{V = 3.1 \times 10^{-3} \text{ L} \text{ OR } 3.1 \text{ mL}}$$

$$(22) P = .969$$

$$V = .800$$

$$n =$$

$$R = .0821$$

$$T = 298$$

$$n = \frac{PV}{RT} = \frac{(.969)(.800)}{(.0821)(298)}$$

$$n = .0317 \text{ mol}$$

$$\frac{2.54 \text{ g}}{.0317 \text{ mol}} = \boxed{80.1 \text{ g/mol}}$$

$$(23) P = 105.2 \text{ kPa} \div 101.3 = 1.04$$

$$V =$$

$$n =$$

$$R = .0821$$

$$T = 28 + 273 = 301$$

$$\frac{n}{V} = \frac{P}{RT} = \frac{1.04}{(.0821)(301)}$$

$$\frac{.0421 \text{ mol}}{\text{L}} \left| \frac{32 \text{ g}}{1 \text{ mol}} \right| = \boxed{1.35 \text{ g/L}}$$

$$(24) P_T = P_A + P_B$$

$$P_A = .25(25.0) = \boxed{6.3 \text{ atm}}$$

$$25.0 = n_A \left( \frac{RT}{V} \right) + n_B \left( \frac{RT}{V} \right)$$

$$25.0 = .25 \left( \frac{RT}{V} \right) + .75 \left( \frac{RT}{V} \right)$$

$$25.0 = 1.00 \left( \frac{RT}{V} \right)$$

$$25.0 = \frac{RT}{V}$$

$$P_B = .75(25.0) = \boxed{19 \text{ atm}}$$

$$(25.) \quad \frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\frac{(0.850)(1.1)}{297} = \frac{P(0.910)}{371}$$

$$\boxed{P = 1.3 \text{ atm}}$$