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Gases

5.20

1 $P = 5.3 \text{ atm}$

$T = 96^\circ\text{C} \rightarrow 319.15 \text{ K}$

$$PV = nRT$$

$V = 1$

2 $P = ?$

$$P_1 V_1 = P_2 V_2$$

$V = 10.10 = 0.90$

$$\frac{P_1 V_1}{V_2} = P_2 \Rightarrow \frac{(5.3 \text{ atm})(1)}{0.90} = 5.89 \text{ atm}$$

$T = 319.15$

5.24

Proble

$$PV = nRT$$

O.

f.

$$P_1 = \frac{n}{V_1} = \frac{n}{V_2}$$

$V = 9.6 \text{ L}$

$V = 3.4 \text{ L}$

n

V_2

$T = 88^\circ\text{C} = 361.15$

$T = ?$

$$\frac{T_1 V_1}{V_2} = T_2 \Rightarrow \frac{361.15 (9.6)}{3.4} = 1022.91$$

$T_2 = 127.91 \text{ K}$

5.32

$$n_{\text{Co}} = 6.9$$

$$V = 30.4 \text{ L}$$

$$P = ?$$

$$T = 62^\circ\text{C} \Rightarrow 335.15$$

$$PV = nRT$$

$$P = \frac{nRT}{V} = \frac{(6.9)(0.0821)(335.15)}{30.4}$$

$$P = 6.14 \text{ atm}$$

$$\frac{\text{mol} \cdot \text{K}}{\text{mol} \cdot \text{K}}$$

L

5.3b

$$T_1 = 26^\circ\text{C} \rightarrow 298.15\text{ K}$$

$$P_1 = 1.2\text{ atm}$$

$$V_1 = 2.5\text{ L}$$

$$T_2 = -23^\circ\text{C} \rightarrow 250.15\text{ K}$$

$$P_2 = 3 \times 10^3\text{ atm}$$

$$V_2 = ?$$

$$PV = nRT$$

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \Rightarrow \frac{P_1 V_1 T_2}{T_1 P_2} = V_2 \Rightarrow V_2 = \frac{(1.2)(2.5)(250.15)}{(298.15)(3 \times 10^3)}$$

$$V_2 = 839\text{ L}$$

5.46

$V = ?$

$m = 88.4 \text{ g CO}_2$

$$PV = nRT$$

$$\frac{P}{RT} = \frac{n}{V} \Rightarrow \frac{MP}{RT} = \frac{m}{V}$$

TPE

$P = 1 \text{ atm}$

$T = 273.15 \text{ K}$

$$V = 88.4 / \frac{(44.01)(1)}{(0.0821)(273.15)}$$

$M_{\text{CO}_2} = 44.01$

$$(0.0821)(273.15)$$

$$\frac{2}{\frac{2}{2}} = \frac{2}{2} = 1$$

$$V = 45.06 \text{ L} \downarrow$$

$$\left(\frac{\frac{\text{g/mol} \cdot \text{atm}}{\text{mol} \cdot \text{K}}}{\frac{\text{g/mol} \cdot \text{L}}{\text{mol} \cdot \text{K}}} \right)$$

5.49

$P = 741 \text{ Torr} \rightarrow 0.976 \text{ atm}$

$T = 44^\circ\text{C} \rightarrow 317.15 \text{ K}$

$$\frac{MP}{RT} = \frac{m}{V}$$

$m = 7.10 \text{ g}$

$V = 5.40 \text{ L}$

$$M = \frac{mRT}{VP} \Rightarrow \frac{7.10(0.0821)(317.15)}{(5.4)(0.976)}$$

$$\frac{2 \left(\frac{\frac{\text{g/mol} \cdot \text{K}}{\text{mol} \cdot \text{K}}} \right) \text{K}}{\text{K} \cdot \text{atm}} = \frac{\text{g/mol}}{\text{K} \cdot \text{atm}}$$

$$M = 35.11 \text{ g/mol} \downarrow$$

5.48

$$f = \frac{m}{v}$$

$$\frac{MP}{RT} = \frac{m}{v}$$

$$\frac{\frac{g}{mol} \cdot \cancel{cm^3}}{\frac{cm^3}{mol} \cdot K} = \frac{g}{L}$$

HBr \rightarrow 2/L $r = 733 \text{ mm Hg} \rightarrow 0.96$ $T = 46^\circ\text{C} \rightarrow 319.15$

$$\frac{MP}{RT} = f \Rightarrow f = \frac{(86.91)(0.96)}{(0.0821)(319.15)} = 2.962/L$$

HBr \Rightarrow 86.91

5.49

C = 64.9% $\rightarrow 64.92 / 12.01 = 5.40 \text{ mol C} / 1.35 = 4$ H = 13.6% $\rightarrow 13.65 / 1.01 = 13.52 \text{ mol H} / 1.35 = 10$ O = 21.5% $\rightarrow 21.62 / 16 = 1.35 \text{ mol O} / 1.35 = 1$ $T = 120^\circ\text{C} \rightarrow 393.15 \text{ K}$ F.E = $\text{C}_4\text{H}_{10}\text{O}$ $760 \text{ mm Hg} \rightarrow 0.987 \text{ atm}$

MR = 74.12 g/mol

 $v = 1 \text{ L}$

$$\frac{MP}{RT} = \frac{m}{v} \Rightarrow M = \frac{mRT}{PV} \Rightarrow M = \frac{2.30(0.0821)(393.15)}{0.987 \times 1}$$

$$M = 74.22 \text{ g/mol}$$

C = 4 \times 12.01 = 48.04H = 10 \times 1.01 = 10.1O = 1 \times 16 = 16
74.14 $n = \frac{74.22}{74.14} = 1 \Rightarrow \text{FM} = \text{C}_4\text{H}_{10}\text{O}$

5.50 SF4

 $T = 20 \rightarrow 293.15 \text{ K}$ $m = 0.1 \text{ g}$ $v = 0.0221 \text{ L}$
 $p = 1.02 \text{ atm}$

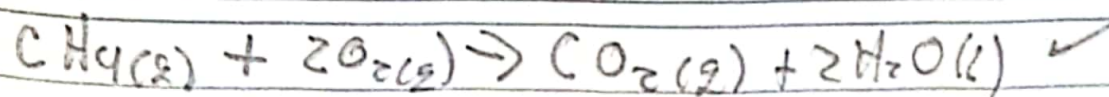
$$M = \frac{mRT}{PV} = \frac{(0.1)(0.0821)(293.15)}{(1.02)(0.0221)}$$

$$n = \frac{106.7}{208.02} = 1$$

$$M = 106.77$$

FM = SF4

5.84



$$n_{\text{CH}_4} = 15$$

$$15 \text{ CH}_4 \left(\frac{1 \text{ mol CO}_2}{1 \text{ mol CH}_4} \right) = 15 \text{ mol CO}_2$$

$$n_{\text{CO}_2} = ?$$

$$T = 296.15$$

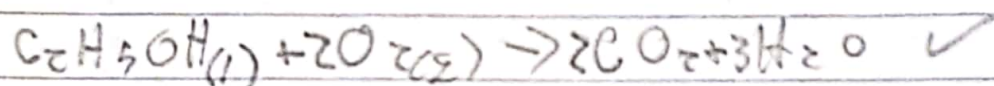
$$P = 0.985 \text{ atm}$$

$$PV = nRT$$

$$V_{\text{CO}_2} = \frac{15(0.0821)(296.15)}{0.985}$$

$$V_{\text{CO}_2} = 370.26 \text{ L} \quad \downarrow$$

5.85



$$V_{\text{O}_2} = ?$$

$$2272 \left(\frac{1 \text{ mol}}{51.06 \text{ g}} \right) \left(\frac{3 \text{ mol O}_2}{1 \text{ mol}} \right) = 8.39 \text{ mol O}_2$$

$$T = 308.15 \text{ K}$$

$$P = 1.04 \text{ atm}$$

$$\text{C}_2\text{H}_5\text{OH} = 227.2$$

$$PV = nRT$$

$$V_{\text{O}_2} = \frac{8.39(0.0821)(308.15)}{1.04} = 204.29 \text{ L O}_2 \quad \downarrow$$

5.68

$$V = 2.5 \text{ L}$$

$$P_{\text{He}} = 1.2 \text{ atm} \quad \downarrow$$

$$X_{\text{He}} = \frac{0.5}{1.2} = 0.4$$

$$T = 288.15$$

$$T_{\text{He}} = 0.92 \text{ atm}$$

$$P_{\text{N}_2} = 0.37 \text{ atm}$$

$$X_{\text{Ne}} = \frac{0.12}{0.37} = 0.39$$

$$P_{\text{He}} = 0.5 \text{ atm}$$

$$\frac{P_{\text{O}_2} V_{\text{O}_2}}{T_{\text{O}_2}} = \frac{P_{\text{He}} V_{\text{He}}}{T_{\text{He}}}$$

$$P_{\text{Ne}} = 0.12 \text{ atm}$$

$$\frac{(0.92)(2.5)}{288.15} = \frac{V_{\text{He}}}{273.6} \Rightarrow V_{\text{He}} = 2.18 \text{ L} \quad \downarrow$$

5.70

$$T = 28^{\circ}\text{C}$$

$$P = 745 \text{ mm Hg}$$

$$P_{\text{He}} = 368 \text{ mm Hg}$$

Vapor aqu

$$28^{\circ}\text{C} = 28.3 \text{ mm Hg}$$

$$P_{\text{TOT}} = \sum P_i$$

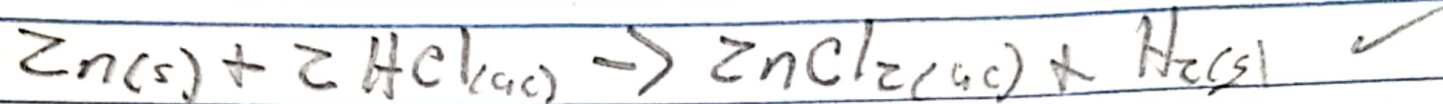
$$P_{\text{TOT}} = P_{\text{Ne}} + P_{\text{He}} + P_{\text{H}_2\text{O}}$$

$$745 = P_{\text{Ne}} + 368 + 28.3$$

$$P_{\text{Ne}} = 348.7 \text{ mm Hg}$$

Arimany.

5.72



$$T = 25^\circ\text{C} \rightarrow 298.15\text{K}$$

$$V = 7.8\text{L}$$

$$P = 0.98\text{atm}$$

vapor de agua

$$25^\circ\text{C} \rightarrow 23.8\text{ mm Hg} \rightarrow P_{\text{H}_2\text{O}}$$

$$\hookrightarrow 0.031\text{atm}$$

$$P_{\text{tot}} = P_{\text{H}_2} + P_{\text{H}_2\text{O}}$$

$$0.98\text{atm} = P_{\text{H}_2} + 23.8\text{ mm Hg}$$

$$P_{\text{H}_2} = 0.98 - 0.031\text{atm}$$

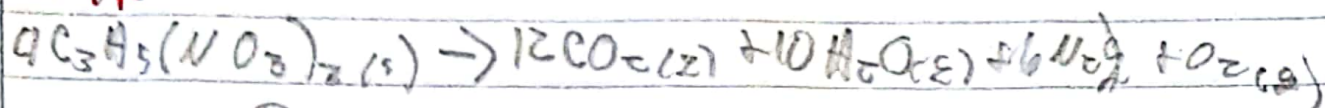
$$P_{\text{H}_2} = 0.949\text{atm}$$

$$P_{\text{H}_2} V = n_{\text{H}_2} RT \Rightarrow n_{\text{H}_2} = \frac{P_{\text{H}_2} V}{RT}$$

$$n_{\text{H}_2} = \frac{(0.949)(7.8)}{0.0821(298.15)} = 0.3\text{ mol H}_2$$

$$0.3\text{ mol H}_2 \left(\frac{1\text{ mol Zn}}{1\text{ mol H}_2} \right) \left(\frac{65.39\text{g Zn}}{1\text{ mol Zn}} \right) = 19.62\text{g Zn} \quad \checkmark$$

6.97



1.2 dm

$T = 298.15$

2.67 g

Molar mass = 227.08

$$2.67 \text{ g} \left(\frac{1 \text{ mol Nitro}}{227.08 \text{ g}} \right) \left(\frac{12 \text{ mol } CO_2}{4 \text{ mol Nitro}} \right) = 3.43 \text{ mol } CO_2$$

$$\left(\frac{10 \text{ mol } H_2O}{4 \text{ mol Nitro}} \right) = 2.86 \text{ mol } H_2O$$

$$\left(\frac{6 \text{ mol } N_2}{4 \text{ mol Nitro}} \right) = 1.72 \text{ mol } N_2$$

$$\left(\frac{1 \text{ mol } O_2}{4 \text{ mol Nitro}} \right) = 0.286 \text{ mol } O_2$$

$$n_T = 8.296$$

$$P_{CO_2} = \frac{3.43}{8.296} (1.2) = 0.496 \text{ atm}$$

$$P_{H_2O} = \frac{2.86}{8.296} (1.2) = 0.41 \text{ atm}$$

$$P_{N_2} = \frac{1.72}{8.296} (1.2) = 0.25 \text{ atm}$$

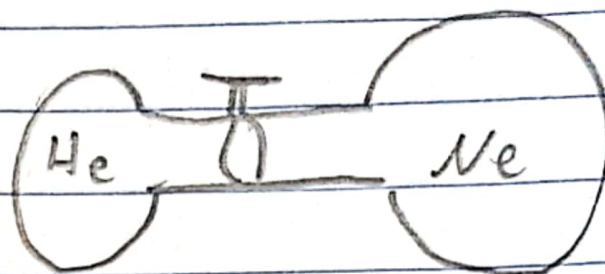
$$P_{O_2} = \frac{0.286}{8.296} (1.2) = 0.041 \text{ atm}$$

(1 mol He) / (1 mol Ne)

5.110

$P_{He} = ?$

$P_{Ne} = ?$



$$T = 16^\circ\text{C} \rightarrow 289.15\text{ K}$$

$$n_{He} \left\{ \begin{array}{l} 1.2\text{ L} \\ 0.63\text{ atm} \end{array} \right.$$

$$\left. \begin{array}{l} 3.4\text{ L} \\ 2.8\text{ atm} \end{array} \right\} n_{Ne}$$

a) abrir válvula

$$V = 4.6\text{ L}$$

$$T = 289.15\text{ K}$$

$$PV = nRT$$

$$n_{He} = \frac{(0.63)(1.2)}{0.0821 \cdot 289.15} = 0.032\text{ mol He}$$

$$n_{Ne} = \frac{(2.8)(3.4)}{0.0821 \cdot 289.15} = 0.410\text{ mol Ne}$$

$$P_{\text{tot}} = \frac{n_{\text{tot}} RT}{V}$$

$$n_{\text{tot}} = 0.43\text{ moles}$$

$$P_{\text{tot}} = \frac{(0.43)(0.0821)(289.15)}{4.6}$$

$$X_{He} = \frac{0.032}{0.43} = 0.074$$

$$X_{Ne} = \frac{0.40}{0.43} = 0.93$$

$$P_{\text{tot}} = 2.22\text{ atm}$$

$$P_{He} = 0.074(2.22) = 0.1643\text{ atm}; P_{Ne} = 0.93(2.22) = 2.065\text{ atm}$$