Honors Chemistry

Answers to More Chapter 5 Study Questions

1. $V_1 = 24.0$ L; $T_1 = 20°C = 293$ K; $P_1 = 1.50$ atm. $V_2 = 36.0$ L; $T_2 = 313°C = 586$ K; $P_2 = ?$

$$\frac{P_1 \times V_1}{T_1} = \frac{P_2 \times V_2}{T_2}; \quad P_2 = P_1 \times \frac{V_1}{V_2} \times \frac{T_2}{T_1} = 1.50\ atm \times \frac{24\ L}{36\ L} \times \frac{586\ K}{293\ K} = \mathbf{2.00\ atm}$$

2. $P_{N2} = 0.50$ atm; $P_{O2} = 0.20$ atm; $P_T = 0.80$ atm

a) $P_{CO2} = ?$; $P_{CO2} = P_T - (P_{N2} + P_{O2}) = 0.80 - (0.50 + 0.20) = \mathbf{0.10\ atm}$

b) $n_{N2} = 0.25$ moles; $n_{O2} = ?$ $\frac{n_{O_2}}{n_{N_2}} = \frac{P_{O_2}}{P_{N_2}}$; $n_{O_2} = \frac{P_{O_2}}{P_{N_2}} \times n_{N_2} = \frac{0.20\ atm}{0.50\ atm} \times 0.25\ mol = \mathbf{0.10\ mol}$

3. pentane = C_5H_{12}; mass = ?, V = 11.2 L, T = 273 K, P = 2.40 atm; so find *n* first.

$$n = \frac{PV}{RT} = \frac{2.40\ atm \times 11.2\ L}{0.08206 \times 273\ K} = 1.20\ mol; \quad 1.20\ mol \times \frac{72.0\ g}{1\ mol} = \mathbf{86.4\ g}$$

4. a) $N_2(g) + 3\ H_2(g) \rightarrow 2\ NH_3(g)$

b) $4.50\ L\ H_2 \times \frac{2\ L\ NH_3}{3\ L\ H_2} = \mathbf{3.00\ L\ NH_3}$

c) $5.60\ L\ N_2 \times \frac{1\ mol\ N_2}{22.4\ L\ N_2} \times \frac{2\ mol\ NH_3}{1\ mol\ N_2} \times \frac{17.0\ g\ NH_3}{1\ mol\ NH_3} = \mathbf{8.50\ g\ NH_3}$

d) first find molar volume @ 25°C, 1 atm: $V = \frac{nRT}{P} = \frac{(1\ mol)(0.08206)(298\ K)}{1\ atm} = 24.5$ L

$$12.1\ g\ H_2 \times \frac{1\ mol\ H_2}{2.016\ g\ H_2} \times \frac{2\ mol\ NH_3}{3\ mol\ H_2} \times \frac{24.5\ L\ NH_3}{1\ mol\ NH_3} = \mathbf{98.0\ L}$$

5. $d = \frac{mm}{mV}$; $T = 65^oC = 338\ K$; $P = 745\ mmHg \times \frac{1\ atm}{760\ mmHg} = 0.980\ atm$; $mm = 44.0\ g$

$$mV = \frac{nRT}{P} = \frac{(1\ mol)(0.08206)(338\ K)}{0.980\ atm} = 28.3\ L; \quad d = \frac{44.0\ g}{28.3\ L} = \mathbf{1.55\ g/L}$$

6. $d = \frac{mm}{mV}$; $mm = d \times mV$; $T = 34^oC = 307\ K$;

$$mV = \frac{nRT}{P} = \frac{(1\ mol)(0.08206)(307\ K)}{1.26\ atm} = 20.0\ L; \quad mm = 1.50\ g/L \times 20.0\ L = \mathbf{30.0\ g}$$

7. V_1 = 100 L; T_1 = 12°C = 293 K; P_1(dry gas) = 758 mmHg. V_2 = ?; T_2 = 20°C = 293 K;

P_2(wet gas) = 740. mmHg. From Table: P_{H2O}(20°C) = 17.5 mmHg

P_2(wet gas) = P_2(dry gas) + P_{H2O}; P_2(dry gas) = 740. mmHg – 17.5 mmHg = 723 mmHg

$$\frac{P_1 \times V_1}{T_1} = \frac{P_2 \times V_2}{T_2}; \quad V_2 = V_1 \times \frac{P_1}{P_2} \times \frac{T_2}{T_1} = 100\ L \times \frac{758}{723} \times \frac{293\ K}{285\ K} \quad = \quad \mathbf{108\ L}$$

8. Calculate the final partial pressure of each gas and add them.

O_2: V_1 = 0.20 L; T_1 = 0°C = 273 K; P_1 = 1.0 atm; V_2 = 0.40 L; T_2 = T_1 P_2 = ?

N_2: V_1 = 0.10 L; T_1 = 0°C = 273 K; P_1 = 2.0 atm; V_2 = 0.40 L; T_2 = T_1 P_2 = ?

P_1 x V_1 = P_2 x V_2; P_2 = P_1 x V_1/V_2

for O_2: $P_2 = 1.0\ atm \times \frac{0.20\ L}{0.40\ L}$ = 0.50 atm; for N_2: $P_2 = 2.0\ atm \times \frac{0.10\ L}{0.40\ L}$ = 0.50 atm

P_T = P_{O2} + P_{N2} = 0.50 atm + 0.50 atm = **1.00 atm**