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Chapter 10 Practice Problems

10.1

1. $M_{C_{12}H_{22}O_{11}} = (12 \times 12.01) + (22 \times 1.01) + (11 \times 16.00)$
 $= 342.34 \text{ g/mol}$

2. $M_{PCl_5} = (1 \times 30.97) + (5 \times 35.45)$
 $= 208.22 \text{ g/mol}$

$M_{UF_6} = (1 \times 238.03) + (6 \times 19.00)$
 $= 352.03 \text{ g/mol}$

3. a) $KMnO_4 = (1 \times 39.10) + (1 \times 54.94) + (4 \times 16.00)$
 $= 158.04 \text{ g/mol}$

b) $Ca_3(PO_4)_2 = (3 \times 40.08) + (2 \times 30.97) + (8 \times 16.00)$
 $= 310.18 \text{ g/mol}$

4. $n_{H_2O} = 3.52 \times 10^{24} \text{ molecules} \times \frac{1 \text{ mol}}{6.02 \times 10^{23} \text{ molecules}} = 5.85 \text{ mol}$

5. $\text{atoms}_{Zn} = 0.60 \text{ mol} \times \frac{6.02 \times 10^{23} \text{ atoms}}{1 \text{ mol}} = 3.6 \times 10^{23} \text{ atoms}$

6. $m_{O_2} = 1.00 \text{ mol} \times \frac{32.00 \text{ g}}{1 \text{ mol}} = 32.0 \text{ g}$

10.2

1. a) $M_{C_6H_{12}O_6} = (6 \times 12.01) + (12 \times 1.01) + (6 \times 16.00)$
 $= 180.18 \text{ g/mol}$

b) $M_{NaHCO_3} = (1 \times 22.99) + (1 \times 1.01) + (1 \times 12.01) + (3 \times 16.00)$
 $= 84.01 \text{ g/mol}$

$$\begin{aligned} \text{c) } M_{\text{C}_7\text{H}_{12}} &= (7 \times 12.01) + (12 \times 1.01) \\ &= 96.19 \text{ g/mol} \end{aligned}$$

$$\begin{aligned} \text{d) } M_{\text{K}_2\text{NH}_4\text{SO}_4} &= (1 \times 39.10) + (1 \times 14.01) + (4 \times 1.01) + (1 \times 32.06) + (4 \times 16.00) \\ &= 153.21 \text{ g/mol} \end{aligned}$$

$$2. \text{ a) } m_{\text{PbO}} = 8.0 \text{ mol} \times \frac{223.20 \text{ g}}{1 \text{ mol}} = 1.8 \times 10^3 \text{ g}$$

$$\text{b) } m_{\text{H}_2\text{S}} = 0.75 \text{ mol} \times \frac{34.08 \text{ g}}{1 \text{ mol}} = 26 \text{ g}$$

$$\text{c) } m_{\text{SiH}_4} = 0.00100 \text{ mol} \times \frac{32.13 \text{ g}}{1 \text{ mol}} = 3.21 \times 10^{-2} \text{ g}$$

$$\text{d) } m_{\text{O}_2} = 1.50 \times 10^{-2} \text{ mol} \times \frac{32.00 \text{ g}}{1 \text{ mol}} = 0.480 \text{ g}$$

$$\text{e) } m_{\text{C}_2\text{H}_6\text{O}_2} = 2.30 \text{ mol} \times \frac{62.08 \text{ g}}{1 \text{ mol}} = 143 \text{ g}$$

$$3. \text{ } m_{\text{N}_2\text{O}_5} = 1.73 \text{ mol} \times \frac{108.02 \text{ g}}{1 \text{ mol}} = 187 \text{ g}$$

$$4. \text{ } m_{\text{Ca}_3(\text{PO}_4)_2} = 0.658 \text{ mol} \times \frac{310.18 \text{ g}}{1 \text{ mol}} = 204 \text{ g}$$

$$5. \text{ a) } n_{\text{NaBr}} = 0.50 \text{ g} \times \frac{1 \text{ mol}}{102.89 \text{ g}} = 4.9 \times 10^{-3} \text{ mol}$$

$$\text{b) } n_{\text{Mg}(\text{NO}_3)_2} = 13.5 \text{ g} \times \frac{1 \text{ mol}}{148.33 \text{ g}} = 9.1 \times 10^{-2} \text{ mol}$$

$$c) n_{\text{MgCl}_2} = 1.02 \text{ g} \times \frac{1 \text{ mol}}{95.21 \text{ g}} = 1.07 \times 10^{-2} \text{ mol}$$

$$d) n_{\text{CH}_3\text{Cl}} = 0.00100 \text{ g} \times \frac{1 \text{ mol}}{50.49 \text{ g}} = 1.98 \times 10^{-5} \text{ mol}$$

$$e) n_{\text{C}_3\text{H}_6(\text{OH})_2} = 1.50 \times 10^{-3} \text{ g} \times \frac{1 \text{ mol}}{76.11 \text{ g}} = 1.97 \times 10^{-5} \text{ mol}$$

$$6. n_{\text{NH}_4\text{NO}_3} = 435.0 \text{ g} \times \frac{1 \text{ mol}}{80.06 \text{ g}} = 5.433 \text{ mol}$$

$$7. m_{\text{C}_{20}\text{H}_{24}\text{N}_2\text{O}_2} = 0.0465 \text{ mol} \times \frac{324.46 \text{ g}}{1 \text{ mol}} = 15.1 \text{ g}$$

$$8. V_{\text{CH}_4} = 2.66 \text{ mol} \times \frac{22.4 \text{ L}}{1 \text{ mol}} = 59.6 \text{ L}$$

$$9. n_{\text{NH}_3} = 135 \text{ L} \times \frac{1 \text{ mol}}{22.4 \text{ L}} = 6.03 \text{ mol}$$

10.3

$$1. \% \text{C} = 5.34 \text{ g} / 52.84 \text{ g} \times 100\% = 10.1\%$$

$$\% \text{H} = 0.42 \text{ g} / 52.84 \text{ g} \times 100\% = 0.79\%$$

$$\% \text{Cl} = 47.08 \text{ g} / 52.84 \text{ g} \times 100\% = 89.1\%$$

$$2. \% \text{Sn} = 5.74 \text{ g} / 18.35 \text{ g} \times 100\% = 31.3\%$$

$$\% \text{Cl} = 12.61 \text{ g} / 18.35 \text{ g} \times 100\% = 68.7\%$$

$$3. \% \text{C} = 3.907 \text{ g} / 4.781 \text{ g} \times 100\% = 81.7\%$$

$$\% \text{H} = 0.874 \text{ g} / 4.781 \text{ g} \times 100\% = 18.3\%$$

$$4. m_{\text{C}} = \frac{4 \times 12.01 \text{ g} \cdot \text{mol}^{-1}}{\text{g} \cdot \text{mol}^{-1}} \times 100\% \times 65.3 \text{ g}$$

$$5. m_{\text{Al}} = 25.0 \text{ g} \times \frac{2.2698 \text{ g} \cdot \text{mol}^{-1}}{101.96 \text{ g} \cdot \text{mol}^{-1}} \times 100\% = 13.2 \text{ g}$$

$$6. m_{\text{Fe}} = 21.6 \text{ g} \times \frac{2.5585 \text{ g} \cdot \text{mol}^{-1}}{159.70 \text{ g} \cdot \text{mol}^{-1}} \times 100\% = 15.1 \text{ g}$$

$$7. a) n_{\text{C}} = 7.8 \text{ g} / 12.01 \text{ g} = 0.65 \text{ mol} \\ n_{\text{Cl}} = 92.2 \text{ g} / 35.45 \text{ g} = 2.60 \text{ mol} \\ = \frac{\text{C}_{0.65} \text{Cl}_{2.60}}{0.65 \quad 0.65} = \text{CCl}_4$$

$$b) n_{\text{C}} = 10.0 \text{ g} / 12.01 \text{ g} = 0.833 \text{ mol} \\ n_{\text{H}} = 0.80 \text{ g} / 1.01 \text{ g} = 0.792 \text{ mol} \\ n_{\text{Cl}} = 89.1 \text{ g} / 35.45 \text{ g} = 2.51 \text{ mol} \\ = \frac{\text{C}_{0.833} \text{H}_{0.792} \text{Cl}_{2.51}}{0.792 \quad 0.792 \quad 0.792} = \text{CHCl}_3$$