

Chemical Reactions

Set 14

1.
 - a)

$$\begin{aligned} n(\text{CO}_2) &= \frac{8}{2} n(\text{C}_4\text{H}_{10}) \\ &= \frac{8}{2} \times 1.00 \\ &= 4.00 \text{ mol} \end{aligned}$$
 - b)

$$\begin{aligned} n(\text{H}_2\text{O}) &= \frac{10}{2} n(\text{C}_4\text{H}_{10}) \\ &= 5 \times 3.00 \\ &= 15.0 \text{ mol} \end{aligned}$$
 - c)

$$\begin{aligned} n(\text{O}_2) &= \frac{13}{2} n(\text{C}_4\text{H}_{10}) \\ &= 7.5 \times 0.600 \\ &= 4.50 \text{ mol} \end{aligned}$$

2.
 - a)

$$\begin{aligned} n(\text{HNO}_3) &= 2n(\text{MgO}) \\ &= 2 \times 0.0300 \\ &= 0.0600 \text{ mol} \\ m(\text{HNO}_3) &= 0.0600 \times 63.018 \\ &= 3.78 \text{ g} \end{aligned}$$
 - b)

$$\begin{aligned} n(\text{Mg}(\text{NO}_3)_2) &= n(\text{MgO}) \\ &= 0.0300 \text{ mol} \\ m(\text{Mg}(\text{NO}_3)_2) &= 0.0300 \times 148.33 \\ &= 4.45 \text{ g} \end{aligned}$$

3.
 - a)

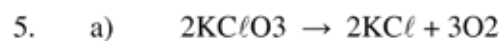
$$\begin{aligned} n(\text{AgNO}_3) &= n(\text{AgCl}) \\ &= 0.200 \text{ mol} \\ M(\text{AgNO}_3) &= 0.200 \times 169.91 \\ &= 34.0 \text{ g} \end{aligned}$$
 - b)

$$\begin{aligned} n(\text{CaCl}_2) &= \frac{1}{2} n(\text{AgNO}_3) \\ &= \frac{1}{2} \times 0.200 \\ &= 0.100 \text{ mol} \\ M(\text{CaCl}_2) &= 0.100 \times 110.98 \\ &= 11.1 \text{ g} \end{aligned}$$
 - c)

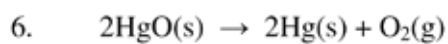
$$\begin{aligned} n(\text{Ca}(\text{NO}_3)_2) &= \frac{1}{2} n(\text{AgCl}) \\ &= \frac{1}{2} \times 0.200 \\ &= 0.100 \text{ mol} \\ M(\text{Ca}(\text{NO}_3)_2) &= 0.100 \times 164.1 \\ &= 16.4 \text{ g} \end{aligned}$$

$$\begin{aligned}
 4. \quad a) \quad n(\text{CuSO}_4 \cdot 5\text{H}_2\text{O}) &= \frac{3.14}{249.69} \\
 &= 0.01257 \text{ mol} \\
 n(\text{H}_2\text{SO}_4) &= n(\text{CuSO}_4 \cdot 5\text{H}_2\text{O}) \\
 &= 0.01257 \text{ mol} \\
 m(\text{H}_2\text{SO}_4) &= 0.01257 \times 98.076 \\
 &= 1.23 \text{ g}
 \end{aligned}$$

$$\begin{aligned}
 b) \quad n(\text{CuO}) &= n(\text{CuSO}_4 \cdot 5\text{H}_2\text{O}) \\
 &= 1.26 \times 10^{-2} \text{ mol}
 \end{aligned}$$



$$\begin{aligned}
 b) \quad n(\text{O}_2) &= \frac{3}{2} n(\text{KClO}_3) \\
 &= 1.5 \times 0.800 \\
 &= 1.20 \text{ mol}
 \end{aligned}$$



$$\begin{aligned}
 N(\text{O}_2) &= \frac{1}{2} n(\text{HgO}) \\
 &= \frac{1}{2} \times 0.240 \\
 &= 0.120 \text{ mol}
 \end{aligned}$$

$$\begin{aligned}
 M(\text{O}_2) &= 0.120 \times 32.00 \\
 &= 3.84 \text{ g}
 \end{aligned}$$

$$\begin{aligned}
 7. \quad a) \quad n(\text{CaCO}_3) &= \frac{3.00}{100.09} \\
 &= 2.997 \times 10^{-2} \text{ mol} \\
 N(\text{HNO}_3) &= 2 n(\text{CaCO}_3) \\
 &= 2 \times (2.997 \times 10^{-2}) \\
 &= 5.99 \times 10^{-2} \text{ mol} \\
 M(\text{HNO}_3) &= (5.99 \times 10^{-2}) \times 63.018 \\
 &= 3.78 \text{ g}
 \end{aligned}$$

$$\begin{aligned}
 b) \quad n(\text{CaCO}_3) &= n(\text{CO}_2) \\
 &= 2.997 \times 10^{-2} \text{ mol} \\
 M(\text{CO}_2) &= (2.997 \times 10^{-2}) \times 44.01 \\
 &= 1.32 \text{ g}
 \end{aligned}$$

$$\begin{aligned}
 c) \quad n(\text{Ca}(\text{NO}_3)_2) &= n(\text{CaCO}_3) \\
 &= 2.997 \times 10^{-2} \text{ mol} \\
 M(\text{Ca}(\text{NO}_3)_2) &= (2.997 \times 10^{-2}) \times 164.1 \\
 &= 4.92 \text{ g}
 \end{aligned}$$

$$\begin{aligned}
 8. \quad a) \quad n(\text{UO}_2) &= \frac{7.5 \times 1000}{270.0} \\
 &= 27.8 \text{ mol}
 \end{aligned}$$

$$\begin{aligned}
 N(\text{HF}) &= \frac{1}{4} n(\text{UO}_2) \\
 &= \frac{1}{4} \times 27.8 \\
 &= 6.94 \text{ mol} \\
 M(\text{HF}) &= 6.94 \times 20.008 \\
 &= 139 \text{ g}
 \end{aligned}$$

$$\begin{aligned}
 \text{b) } n(\text{F}_2) &= n(\text{UO}_2) \\
 &= 27.8 \text{ mol} \\
 M(\text{F}_2) &= 27.8 \times (2 \times 19.00) \\
 &= 1.06 \times 10^3 \text{ g}
 \end{aligned}$$

$$\begin{aligned}
 \text{c) } n(\text{UF}_6) &= n(\text{UO}_2) \\
 &= 27.8 \\
 M(\text{UF}_6) &= 27.8 \times 352.0 \\
 &= 9.79 \times 10^3 \text{ g}
 \end{aligned}$$

$$\begin{aligned}
 9. \quad \text{a) } m(\text{Al}_2\text{O}_3) &= \frac{23.4}{100} \times (2.50 \times 10^6) \\
 &= 5.85 \times 10^5 \text{ g}
 \end{aligned}$$

$$\begin{aligned}
 \text{b) } n(\text{Al}_2\text{O}_3) &= \frac{5.85 \times 10^5}{101.96} \\
 &= 5.74 \times 10^3 \text{ mol}
 \end{aligned}$$

$$\begin{aligned}
 n(\text{Al}) &= 2 n(\text{Al}_2\text{O}_3) \\
 &= 2 \times (5.74 \times 10^3) \\
 &= 1.15 \times 10^4 \text{ mol} \\
 m(\text{Al}) &= (1.15 \times 10^4) \times 26.98 \\
 &= 3.10 \times 10^5 \text{ g}
 \end{aligned}$$

$$\begin{aligned}
 \text{c) } n(\text{O}_2) &= \frac{3}{2} \times n(\text{Al}_2\text{O}_3) \\
 &= 1.5 \times (5.74 \times 10^3) \\
 &= 8.61 \times 10^3 \text{ mol} \\
 m(\text{O}_2) &= (8.61 \times 10^3) \times 32.00 \\
 &= 2.75 \times 10^5 \text{ g}
 \end{aligned}$$

$$\begin{aligned}
 10. \quad \text{a) } m(\text{CaCO}_3) &= \frac{92.0}{100.0} \times (500 \times 10^3) \\
 &= 4.60 \times 10^5 \text{ g} \\
 N(\text{CaCO}_3) &= \frac{4.60 \times 10^5}{100.09} \\
 &= 4.596 \times 10^3 \text{ mol}
 \end{aligned}$$

$$\begin{aligned}
 N(\text{CaO}) &= n(\text{CaCO}_3) \\
 &= 4.596 \times 10^3 \text{ mol} \\
 M(\text{CaO}) &= (4.596 \times 10^3) \times 72.08 \\
 &= 3.31 \times 10^5 \text{ g}
 \end{aligned}$$

$$\begin{aligned}
 \text{b) } n(\text{CO}_2) &= n(\text{CaCO}_3) \\
 &= 4.596 \times 10^3 \text{ mol} \\
 M(\text{CO}_2) &= (4.596 \times 10^3) \times 44.01 \\
 &= 2.02 \times 10^5 \text{ g}
 \end{aligned}$$