# Problem Set Chapter 3

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1. How many moles are in the following:

   (a) $Zn(NO_3)_2 \rightarrow 189[\text{g mol}^{-1}] \rightarrow \frac{38.7[\text{g}]}{189[\text{g mol}^{-1}]} = .205[\text{mol}]$

   (b) $HNO_3 \rightarrow 63[\text{g mol}^{-1}] \rightarrow \frac{40.2[\text{g}]}{63[\text{g mol}^{-1}]} = .638[\text{mol}]$

2. How many grams are in the following:

   (a) $CaCr_2O_7 \rightarrow 256[\text{g mol}^{-1}] \rightarrow 2.36[\text{mol}] \cdot 256[\text{g mol}^{-1}] \rightarrow 604[\text{g}]$

   (b) $Na_2CO_3 \rightarrow 106[\text{g mol}^{-1}] \rightarrow .058[\text{mol}] \cdot 106[\text{g mol}^{-1}] \rightarrow 6.148[\text{g}]$

3. How many molecules are in the following:

   (a) $H_2SO_4 \rightarrow 98[\text{g mol}^{-1}] \rightarrow \frac{23600[\text{g}]}{98[\text{g mol}^{-1}]} = 240.816[\text{mol}] \cdot 6.022 \cdot 10^{23} = 1.45 \cdot 10^{26}[\text{molecules}]$

   (b) $H_2O \rightarrow 18[\text{g mol}^{-1}] \rightarrow \frac{100[\text{g}]}{18[\text{g mol}^{-1}]} = 5.56[\text{mol}] \cdot 6.022 \cdot 10^{23} = 3.346 \cdot 10^{24}[\text{molecules}]$

4. How many grams of oxygen are in the following:

   (a) $Na_2S_2O_3 \rightarrow \frac{48[\text{g}]}{158[\text{g}]} = .304 \cdot 6.36[\text{g}] = 1.933[\text{g}]$

   (b) $Na_2Fe(CO)_4 \rightarrow \frac{64[\text{g}]}{214[\text{g}]} = .3 \cdot 855[\text{g}] = 256.5[\text{g}]$

5. Determine the mass percent of each element in the following:

   (a) Tin (II) Phosphate $\rightarrow Sn_3(PO_4)_2 \rightarrow m_{total} = 547[\text{g}] \rightarrow m_{Sn} = 357[\text{g}] \rightarrow m_P = 62[\text{g}] \rightarrow m_O = 128[\text{g}]$

$$m_{\%Sn} = \frac{357[\text{g}]}{547[\text{g}]} \cdot 100\% = 65.27\%$$

$$m_{\%P} = \frac{62[\text{g}]}{547[\text{g}]} \cdot 100\% = 11.33\%$$

$$m_{\%O} = \frac{128[\text{g}]}{547[\text{g}]} \cdot 100\% = 23.4\%$$

(b) Manganese (II) Carbonate $\rightarrow MnCO_3 \rightarrow m_{total} = 115[\text{g}] \rightarrow m_{Mn} = 55[\text{g}] \rightarrow m_P = 12[\text{g}] \rightarrow m_O = 48[\text{g}]$

$$m_{\%Mn} = \frac{55[\text{g}]}{115[\text{g}]} \cdot 100\% = 47.83\%$$

$$m_{\%P} = \frac{12[\text{g}]}{115[\text{g}]} \cdot 100\% = 10.43\%$$

$$m_{\%O} = \frac{48[\text{g}]}{115[\text{g}]} \cdot 100\% = 41.74\%$$

6. The insecticide DDD contains only C, H, and Cl. When 3.2[g] is combusted, 6.162[g] of $CO_2$ and 0.9008[g] of $H_2O$ are formed. What is the mass percent of all elements in DDD?

$$m_{CO_2} = 44[\text{g}] \rightarrow m_C = 12[\text{g}] \rightarrow \frac{12[\text{g}]}{44[\text{g}]} = .2727 \cdot 6.162[\text{g}] = \frac{1.68[\text{g}]}{3.2[\text{g}]} \cdot 100\% = 52.5\%$$

$$m_{H_2O} = 18[\text{g}] \rightarrow m_H = 2[\text{g}] \rightarrow \frac{2[\text{g}]}{18[\text{g}]} = .1111 \cdot .9008[\text{g}] = \frac{.1[\text{g}]}{3.2[\text{g}]} \cdot 100\% = 3.13\%$$

$$m_{\%Cl} = \frac{(3.2 - 1.68 - .1)[\text{g}]}{3.2[\text{g}]} \cdot 100\% = 44.38\%$$

7. A 4.7[g] sample of a copper oxide is heated in a stream of hydrogen gas and 0.592[g] of water is formed. What is the mass percent of all atoms in this oxide?

$$m_{H_2O} = 18[\text{g}] \rightarrow m_O = 16[\text{g}] \rightarrow \frac{16[\text{g}]}{18[\text{g}]} = .8888 \cdot .592[\text{g}] = \frac{.526[\text{g}]}{4.7[\text{g}]} \cdot 100\% = 11.19\%$$

$$m_{\%Cu} = \frac{(4.7 - .526)[\text{g}]}{4.7[\text{g}]} \cdot 100\% = 88.81\%$$