Individual practice problems – Answers

1. You want to help your little brother make an exploding volcano for his science class. The lava will be made from reacting baking soda (NaHCO₃) with vinegar (HC₂H₃O₂). After building the volcano, you know that you want to create about 100.0g of lava (or sodium acetate). Too little lava, and the volcano won’t overflow. Too much lava would be a giant mess! Using stoichiometry and the equation below, calculate the exact amount of baking soda needed to make 100.0g of lava. Assume you have excess vinegar.

\[ \text{NaHCO}_3 + \text{HC}_2\text{H}_3\text{O}_2 \rightarrow \text{NaC}_2\text{H}_3\text{O}_2 + \text{H}_2\text{O} + \text{CO}_2 \]

\[
\begin{array}{cccc}
100.0\text{gNaC}_2\text{H}_3\text{O}_2 & 1 \text{ mol NaC}_2\text{H}_3\text{O}_2 & 1 \text{ mol NaHCO}_3 & 84.01\text{g NaHCO}_3 \\
82.04\text{g NaC}_2\text{H}_3\text{O}_2 & 1 \text{ mol NaC}_2\text{H}_3\text{O}_2 & 1 \text{ mol NaHCO}_3 & \end{array} = 102.4\text{g NaHCO}_3
\]

2. Camels store the fat tristearin (C₅₇H₁₁₀O₆) in the hump. As well as being a source of energy, the fat is a source of water, because when it is used the reaction below takes place. What mass of water can be made from 1.0kg of fat?

\[ 2 \text{C}_5\text{H}_7\text{O}_6 + 163 \text{O}_2 \rightarrow 114 \text{CO}_2 + 110 \text{H}_2\text{O} \]

\[
\begin{array}{cccc}
1.0\text{kg C}_5\text{H}_7\text{O}_6 & 1000\text{g} & 1 \text{ mol C}_5\text{H}_7\text{O}_6 & 110 \text{ mol H}_2\text{O} & 18.02\text{g H}_2\text{O} \\
1 \text{ kg} & 891.67\text{g C}_5\text{H}_7\text{O}_6 & 2 \text{ mol C}_5\text{H}_7\text{O}_6 & 1 \text{ mol H}_2\text{O} & \end{array} = 1.1 \times 10^7 \text{g H}_2\text{O}
\]

3. You want to create 12.0g of copper to meld into a piece of jewelry. You know that when copper (II) chloride reacts with aluminum, copper is a product. Given excess copper (II) chloride, how much aluminum would you need to start your reaction with to get 12.0g of copper? (write and balance the reaction first)

\[ 2\text{Al} + 3\text{CuCl}_2 \rightarrow 2\text{AlCl}_3 + 3\text{Cu} \]

\[
\begin{array}{cccc}
12.0\text{g Cu} & 1 \text{ mol Cu} & 2 \text{ mol Al} & 26.98\text{g Al} \\
63.55\text{g Cu} & 3 \text{ mol Cu} & 1 \text{ mol Al} & \end{array} = 3.40\text{g Al}
\]