# Stoichiometry Review WS

1. In the metallurgy of Iron, the iron ore, $Fe_2O_3$, is converted to iron and carbon monoxide by reacting the ore with coke, C.

   How many moles of carbon monoxide would form if 0.500 mol of $Fe_2O_3$ was reacted with sufficient coke?

   $$Fe_2O_3 + 3C \longrightarrow 2Fe + 3CO$$

   $$0.500 \text{ mol } Fe_2O_3 \times \frac{3 CO}{1 Fe_2O_3} = 1.50 \text{ mol } CO$$

2. Butane, $C_4H_{10}$, the principal ingredient of one kind of bottled gas is commonly used as a fuel in campers and mobile homes.

   What mass of $CO_2(g)$ would be produced if 4.00 mol of butane were to react with sufficient oxygen?

   $$2 C_4H_{10} + 13 O_2 \longrightarrow 8 CO_2 + 10 H_2O$$

   $$4.00 \text{ mol } C_4H_{10} \times \frac{8 CO_2}{2 C_4H_{10}} \times \frac{44.0 \text{ g } CO_2}{1 \text{ mol } CO_2} = 704 \text{ g } CO_2$$

3. Yellow (white) phosphorus, $P_4$, combines directly with iodine to form dark-red phosphorus tiiodide. If 77.5 g of phosphorus is combined with iodine, how many moles of phosphorus triiodide is formed?

   $$P_4 + 6 I_2 \longrightarrow 4 PI_3$$

   $$77.5 \text{ g } P_4 \times \frac{1 \text{ mol } P_4}{124.0 \text{ g } P_4} \times \frac{4 PI_3}{1 P_4} = 2.5 \text{ moles } PI_3$$

4. Liquified hydrogen and oxygen are common fuels used to produce the thrust for rockets that carry satellites into orbit.

   What volume of oxygen gas will combine with 1.01L of hydrogen gas?

   $$2H_2 + O_2 \longrightarrow 2H_2O$$

   $$1.01L\,H_2 \times \frac{1\,mol}{22.4L} \times \frac{1\,O_2}{2\,H_2} \times \frac{22.4L}{1\,mol} = 0.505\,L\,O_2$$
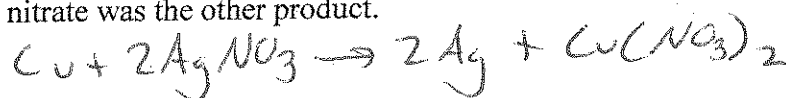
5. A student made the following observations in an experiment where a strip of copper metal was placed in an aqueous solution of silver nitrate.

   Initial mass of copper metal = 2.97 g
   Final mass of copper metal = 1.54 g

   1.43 g reacted

   Calculate the mass of silver that was formed in this experiment. Assume copper (II) nitrate was the other product.

   $$Cu + 2AgNO_3 \longrightarrow 2Ag + Cu(NO_3)_2$$

   $$1.43g\,Cu \times \frac{1\,mol\,Cu}{63.5g\,Cu} \times \frac{2\,Ag}{1\,Cu} \times \frac{107.9\,g\,Ag}{1\,mol\,Ag} = 4.86\,g\,Ag$$

6. Hydrochloric acid can be used for cleaning rust off iron and steel surfaces. The reaction involved can be represented by the following equation:

   $$Fe(OH)_3\,(s) + 3HCl\,(aq) \text{-----------------}\rightarrow FeCl_3(aq) + 3\,H_2O(l)$$

   What mass of rust {$Fe(OH)_3$} will react with $2.35\times10^{27}$ molecules of hydrochloric acid?

   $$2.35\times10^{27}\,molecules\,HCl \times \frac{1\,mol}{6.02\times10^{23}\,molecules} \times \frac{1\,Fe(OH)_3}{3\,HCl} \times \frac{106.8\,g\,Fe(OH)_3}{1\,mol\,Fe(OH)_3}$$

   $$= 1.39\times10^{5}\,g\,Fe(OH)_3$$

   mm Fe(OH)₃
   $$\frac{55.8}{3\times16.0}\quad \frac{55.8}{48.0}$$
   $$3\times1.0 \quad \frac{3.0}{106.8}$$