Solution Stoichiometry

Remember – change to moles before you do anything else

Consider the following reaction:

$$KOH(aq) + H_2SO_4(aq) \rightarrow K_2SO_4(aq) + 2H_2O(aq)$$

a) How many moles of KOH are there in 23.0mL of a 0.20M solution?

b) If the solution in (a) reacts completely with sulphuric acid, how many moles of sulphuric acid will be used up?

c) If the volume of the sulphuric acid is 10.0mL, what is its concentration?

Practice Questions:

1. Consider the following reaction:

$$CuCl_2(aq) + Na_2CO_3(aq) \rightarrow CuCO_3(s) + 2\ NaCl(aq)$$

a) Predict the mass of copper (II) carbonate that will form when 250mL of a 0.50M solution of $CuCl_2$ reacts completely.

b) What volume of 0.10M Na_2CO_3 will be required to produce 3.0g of $CuCO_3$?

c) What volume of 0.25M sodium sulphate will be needed to react with 120mL of 0.15M copper (II) chloride?

Solution Stoichiometry

Remember – change to moles before you do anything else

conc. $c = \frac{n}{V}$ # of moles / volume

Consider the following reaction:

$$2\,KOH(aq) + H_2SO_4(aq) \rightarrow K_2SO_4(aq) + 2H_2O(aq)$$

a) How many moles of KOH are there in 23.0mL of a 0.20M solution?

$n = c \cdot V = (0.20\,M)(0.0230\,dm^3) = 0.0046\,mol\ KOH$

b) If the solution in (a) reacts completely with sulphuric acid, how many moles of sulphuric acid will be used up?

$0.0046\,mol\ KOH \times \frac{1\,mol\ H_2SO_4}{2\,mol\ KOH} = 0.0023\,mol\ H_2SO_4$

c) If the volume of the sulphuric acid is 10.0mL, what is its concentration?

$c = \frac{n}{V} = \frac{0.0023\ mol}{0.010\ dm^3} = 0.23\ mol/dm^3$

Practice Questions:

1. Consider the following reaction:

$$CuCl_2(aq) + Na_2CO_3(aq) \rightarrow CuCO_3(s) + 2\ NaCl(aq)$$

a) Predict the mass of copper (II) carbonate that will form when 250mL of a 0.50M solution of $CuCl_2$ reacts completely.

$(0.250\ L)(0.50\ M) = 0.125\ mol\ CuCl_2$

$$0.125\ mol\ CuCl_2 \times \frac{1\ mol\ CuCO_3}{1\ mol\ CuCl_2} \times \frac{123.56\ g\ CuCO_3}{1\ mol\ CuCO_3} = 15\ g$$

b) What volume of 0.10M Na_2CO_3 will be required to produce 3.0g of $CuCO_3$?

$$3.0\ g\ CuCO_3 \times \frac{1\ mol\ CuCO_3}{123.56\ g\ CuCO_3} \times \frac{1\ mol\ Na_2CO_3}{1\ mol\ CuCO_3} = 0.02428\ mol\ Na_2CO_3$$

$$V = \frac{n}{c} = \frac{0.02428\ mol}{0.10\ M} = 0.24\ dm^3 = 240\ cm^3$$

c) What volume of 0.25M sodium ~~sulphate~~ carbonate will be needed to react with 120mL of 0.15M copper (II) chloride?

$(0.120\ dm^3)(0.15\ M) = 0.018\ mol\ CuCl_2$

$$0.018\ mol\ CuCl_2 \times \frac{1\ mol\ Na_2CO_3}{1\ mol\ CuCl_2} = 0.018\ mol\ Na_2CO_3$$

$$\frac{0.018\ mol\ Na_2CO_3}{0.25\ M} = 0.072\ dm^3 = 72\ cm^3$$