TITRATIONS !!!!!

A TITRATION is a process in which a measured amount of a solution is reacted with a KNOWN volume and concentration of another solution until the equivalence point is reached.

The EQUIVALENCE POINT is when moles of KNOWN (A) EQUALS moles of unknown (B). usually coincides with a colour change.

IN CHEMISTRY 11 we will only deal with titrations of NEUTRALIZATION REACTIONS!!!

COLOUR Change → provided by the added INDICATOR

Example 2. When a 25.0 mL sample of unknown concentration of Sodium hydroxide is titrated with 23.5 mL of 0.100 M Sulfuric Acid, the equivalence point is reached. What is the *concentration of NaOH*? (end point)

Step 1. Write out the balanced equation:

$$1\,H_2SO_4(aq) + 2\,NaOH(aq) \longrightarrow Na_2SO_4(aq) + 2\,H_2O(\ell)$$

Step 2. Use the known concentration + volume to solve for moles

$$L \cdot \frac{mol}{L} = \text{moles A}$$

Step 3. Use the MOLE BRIDGE to calculate the moles of the unknown

$$\text{moles A} \cdot \frac{2\ mol\ B}{1\ mol\ A} = \text{moles B} \div L = M$$

Step 4. Divide the moles of unknown by volume of unknown to solve for concentration

$$23.5\,mL\left(\frac{1\cdot10^{-3}\,L}{1\,mL}\right)\left(\frac{0.100\ mol\ H_2SO_4}{1\,L}\right)\left(\frac{2\ mol\ NaOH}{1\ mol\ H_2SO_4}\right)\left(\frac{1}{25.0\,mL}\right)\left(\frac{1\,mL}{1\cdot10^{-3}\,L}\right)$$

$$= 0.188\ M\ NaOH$$

Example 3. What *volume of 0.200 M KOH* is required to react with 125 mL of 0.250 M H_3PO_4 in order to produce K_2HPO_4 according to this balanced equation: $H_3PO_4(aq) + 2\,KOH(aq) \rightarrow K_2HPO_4(aq) + 2\,H_2O(l)$

Step 1. Identify the balanced equation:

$$1\,H_3PO_4(aq) + 2\,KOH(aq) \longrightarrow K_2HPO_4(aq) + 2\,H_2O(\ell)$$

Step 2. Use the known concentration + volume to solve for moles

$$L \cdot \frac{mol\ A}{L} = \text{moles A}$$

Step 3. Use the MOLE BRIDGE to calculate the moles of the unknown

$$\text{moles A}\left(\frac{2\ mol\ B}{1\ mol\ A}\right) = \text{moles B} \div M = L$$

Step 4. Divide the moles of unknown by molarity of unknown to solve for volume

$$125\,mL\left(\frac{1\cdot10^{-3}\,L}{1\,mL}\right)\left(\frac{0.250\ mol\ H_3PO_4}{1\,L}\right)\left(\frac{2\ mol\ KOH}{1\ mol\ H_3PO_4}\right)\left(\frac{1\,L}{0.200\ mol\ KOH}\right)$$

$$= 0.313\ L\ KOH$$

Ex: 19 - 24