

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.

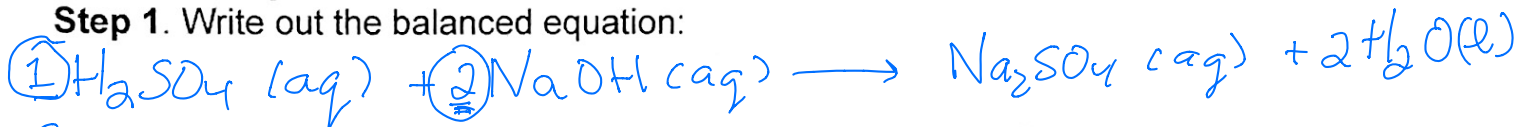
The EQUIVALENCE POINT is when moles of known (A) EQUALS moles of unknown (B). usually coincides with a colour change.

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:



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

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

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

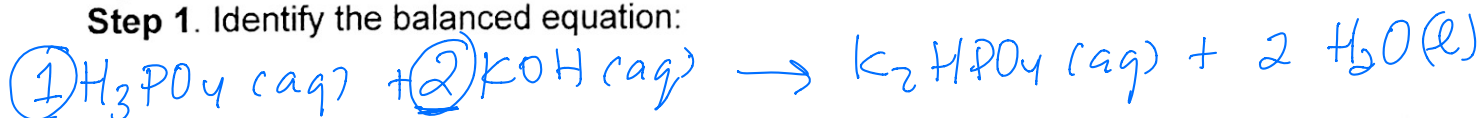
$$\text{moles A} \cdot \frac{2 \text{ mol B}}{1 \text{ mol A}} = \text{moles B} \div M = M$$

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

$$23.5 \text{ mL} \left(\frac{1 \cdot 10^{-3} \text{ L}}{1 \text{ mL}} \right) \left(\frac{0.100 \text{ mol H}_2\text{SO}_4}{1 \text{ L}} \right) \left(\frac{2 \text{ mol NaOH}}{1 \text{ mol H}_2\text{SO}_4} \right) \left(\frac{1}{25.0 \text{ mL}} \right) \left(\frac{1 \text{ mL}}{1 \cdot 10^{-3} \text{ L}} \right) = 0.188 \text{ M NaOH}$$

Example 3. What volume of 0.200 M KOH is required to react with 125 mL of 0.250 M H₃PO₄ in order to produce K₂HPO₄ according to this balanced equation: H₃PO₄ (aq) + 2 KOH (aq) → K₂HPO₄ (aq) + 2 H₂O (l)

Step 1. Identify the balanced equation:



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

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

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

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

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

$$125 \text{ mL} \left(\frac{1 \cdot 10^{-3} \text{ L}}{1 \text{ mL}} \right) \left(\frac{0.250 \text{ mol H}_3\text{PO}_4}{1 \text{ L}} \right) \left(\frac{2 \text{ mol KOH}}{1 \text{ mol H}_3\text{PO}_4} \right) \left(\frac{1 \text{ L}}{0.200 \text{ mol KOH}} \right) = 0.313 \text{ L KOH}$$

Ex: 19 - 24