

Topic 4 - Calculations and titrations

Relative atomic mass (A_r)	The average mass of an atom of an element compared to Carbon-12.
Relative formula mass (M_r)	The sum of all the atomic masses of the atoms in a formula of a substance (e.g. CO_2).

How to calculate formula mass M_r

Add up all the atomic masses in a formula.	e.g. CO_2 Mass of C = 12. Mass of oxygen = 16. $12 + (2 \times 16) = 44$
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Chemical calculations Key Terms

Yield of a chemical reaction	Describes how much product is made
Percentage yield	Tells you how much product is made compared with the maximum amount that could be made.
Atom Economy	A measure of the amount of starting materials that end up as useful products
Titration	Used to measure accurately what volumes of acid and alkali react together completely.
Standard solution	A solution of known concentration.

$$\text{Percentage yield} = \frac{\text{actual yield of product produced}}{\text{theoretical yield of product}} \times 100$$

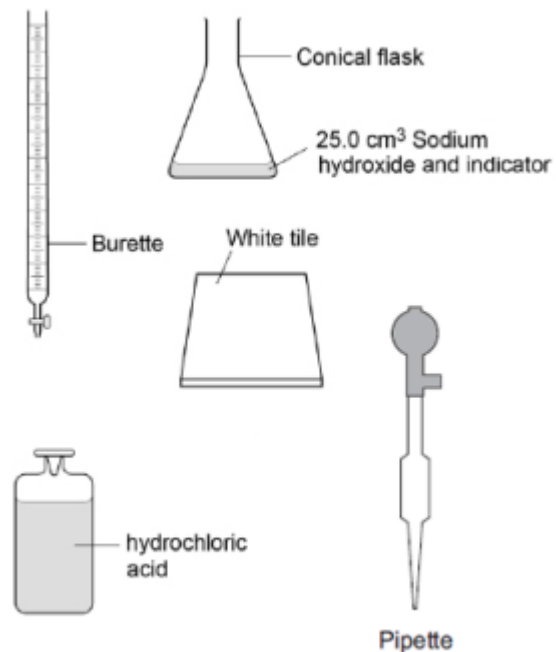
Factors affecting percentage yield

- Reaction may be reversible
- Some unwanted products may be formed
- Some of the desired product lost in handling/left on apparatus
- Reactants may be impure

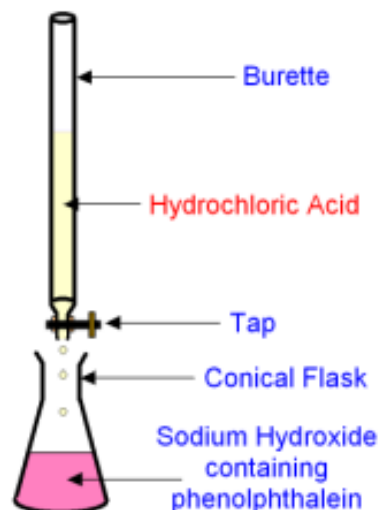
Titration

Method - The method is the same for sulfuric acid, hydrochloric acid and nitric acid.

- Use the pipette and pipette filler to add a measured volume of sodium hydroxide solution to a clean conical flask.
- Add a few drops of indicator and put the conical flask on a white tile.
- Fill the burette with hydrochloric acid and note the starting volume.
- Slowly add the acid from the burette to the alkali in the conical flask, swirling to mix.
- Stop adding the acid when the end-point is reached (when the indicator first permanently changes colour). Note the final volume reading.
- Repeat steps 1 to 5 until titres are obtained.



Key Terms	Definitions
Concentration	A measure of the number of moles or mass in a given volume.
Titration	An experimental techniques where unknown concentrations of solutions can be found.
Burette	A piece of apparatus used to accurately measure volumes of solution.



	In acid	In alkali
Litmus	Red	Blue
Methyl Orange	Red	Yellow
Phenolphthalein	Colourless	Pink