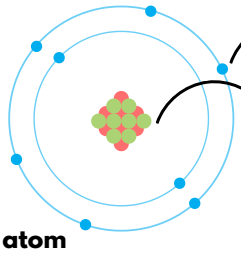
C1.1.1 Atoms, Elements and Compounds

An atom:

The smallest part of an _____ that can exist - the building blocks of all matter

Made up of **protons**, **neutrons** and **electrons**



e.g. An oxygen atom

Electrons in orbit around the nucleus in 'shells'

The nucleus contains _____ and _____

In the Periodic Table, elements are represented by a chemical _____

Consist of 1 or 2 letters
1st letter - uppercase
2nd letter - lowercase

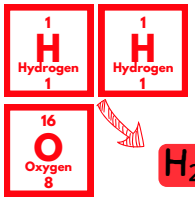
An element:

A substance made of one type of atom that all contain the same number of _____ - there are about 100 different elements!

Compounds

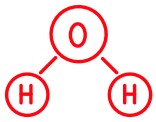
- A substance made up of ____ or more types of atoms in fixed proportions
- Formed from elements by chemical reactions, making them _____ combined together
- _____ be separated by physical means and often have different properties to the original elements
- Ionic compounds - _____ and non-metal joined as ions
  - The _____ is the first part of the name
  - The _____ is the second part of the name
    - Oxygen - suffix is most likely '-ate' e.g. sodium sulphate (Na_2SO_4)
    - Other non-metals - suffix is mostly likely '-ide' e.g. magnesium chloride ($MgCl_2$)
- Covalent compounds - _____ chemically bonded together through covalent bonds

Compounds are represented by _____, using the symbols from the atoms they were formed from



H_2O

Water contains 2 hydrogen and 1 oxygen atoms



H_2SO_4 - Sulfuric acid
CH_4 - Methane
C_2H_5OH - Ethanol
NH_3 - Ammonia
HCl - Hydrochloric acid
HNO_3 - Nitric acid

Exam Tip: Know the names and symbols of the first 20 elements, plus those in Group 1 and Group 7.

State symbols

State symbols represent what state each molecule is in during the reaction:

- Solid (__)
- Liquid (__)
- Gas (__)
- Aqueous (__)

Dissolved in water

Exam Tip: Include state symbols only when instructed.

Chemical Reactions

Formation of one or more new substances → Atoms combine in fixed _____ which give them full outer shells → Often involve a detectable _____ change

Can be represented by:

- Word equations: Magnesium + Hydrochloric Acid → Magnesium Chloride + Hydrogen

  Reactants → _____
- Formulae: $Mg + 2HCl \rightarrow MgCl_2 + H_2$
- Chemical structures

Exam Tip: If there is a catalyst, you can write this above the arrow

Balancing Chemical Equations

Formulae is used to represent a _____ symbol equation - telling us what is happening to each atom in a reaction. According to the Law of Conservation of Mass, the number of atoms for each element must remain _____ on both sides of the equation.

To balance a chemical reaction:

1. Count the atoms of each element in the reactants.
2. Count the atoms in the products.
3. Use trial and error to find what big numbers equalize the number of atoms for each element on both sides.

Exam Tip: You can change big numbers (e.g. $2Fe_2O_3$) but not small numbers (e.g. $2Fe_2O_3$)

C1.1.2 Mixtures

Filtration:

_____ solids

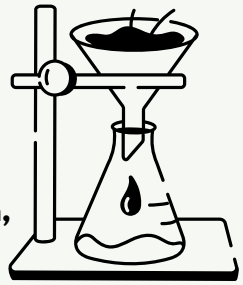
How it Works:

Used when a solid does ___ dissolve in a liquid.

- Example: Separating sand from water.

Method:

1. Place filter _____ in a funnel over a beaker.
2. _____ the mixture through the funnel.
3. Liquid (_____) passes through, solid (_____) stays behind



Filtration does not create a new substance because no chemical bonds are broken or formed.

Crystallisation:

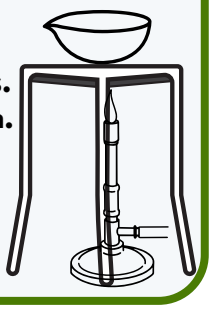
How it Works:

Used when a solid dissolves in a liquid and forms _____ upon _____.

- Example: Copper sulfate crystals from a solution.

Method:

1. _____ the solution to evaporate some of the solvent.
2. Allow the solution to _____ slowly.
3. Crystals form as _____ decreases.
4. Filter out the crystals and _____ them.



Use filter paper or a drying oven to dry crystals properly.

Mixtures are a combination of ____ or more substances that are ____ chemically bonded together.

Mixtures can consist of elements, compounds, or both, but they do not form new _____.

The chemical properties of each substance in the mixture are _____.

Mixtures can be _____ through physical processes.

Mixtures differ from pure substances, which consist of only one element or compound with identical particles that cannot be physically separated.

Simple Distillation

Liquid separation

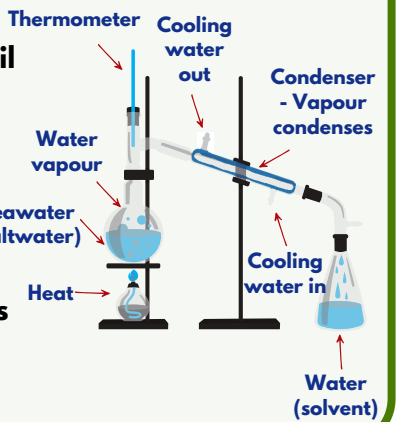
How it Works:

Used to separate a _____ from a dissolved solid.

Example: Separating water from seawater.

Method:

1. Heat the solution until the solvent evaporates.
2. The vapour is cooled in a _____, turning back into liquid.
3. The solvent (_____) is collected, and the solute (_____) remains behind.



Fractional Distillation

Liquid separation

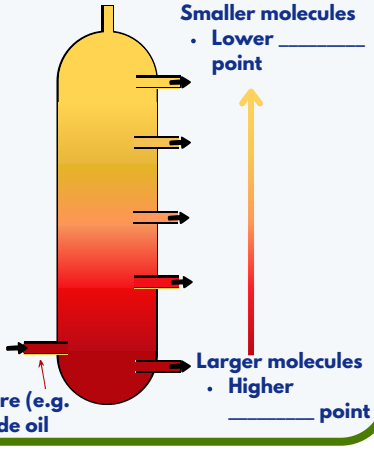
How it Works:

Used to separate two or more miscible liquids and works due to different _____ points.

Example: Crude oil

Method:

1. Heat the mixture; the liquid with the _____ _____ point evaporates first.
2. Vapour is _____ in a _____ and collected.
3. _____ heating to separate other components.

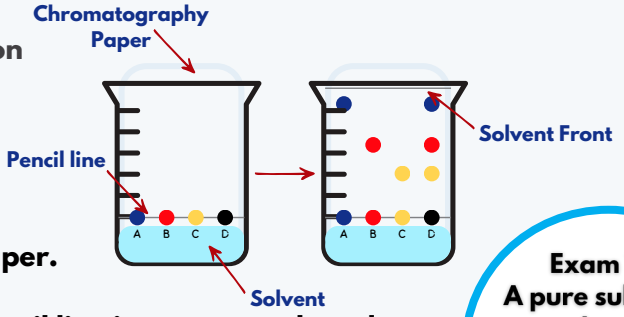


Chromatography

Soluble separation

How it Works:

Used to separate different _____ in ink based on _____.



Method:

1. Draw a _____ line on chromatography paper.
2. Place spots of the samples on the line.
3. _____ the paper in a solvent, ensuring the pencil line is _____ the solvent.
4. The solvent carries the substances up the paper at different _____.

Stationary phase: The paper.
Mobile phase: The solvent moving through the paper.

Exam Tip: Use a pencil for you start line - ink would affect results!

Exam Tip: A pure substance produces one spot, while a mixture produces multiple spots