

States of matter

Everything is made of particles. Particles in solid are not free to move around. Liquids and gases can. As particles move they collide with each other and bounce off in all directions. This is called random motion.

In 2 substances, when mixed, particles bounce off in all directions when they collide. This mixing process is called diffusion. It's also the movement of particles without a force.

The smallest particle that cannot be broken down by chemical means is called an atom.

·In some substances, particles are just single atoms. For example the gas argon, found in air, is made up of single argon atoms.

·In many substances, particles consist of 2 atoms joined together. These are called molecules.

·In other substances, particles consist of atoms or groups of atoms that carry a charge. These particles are called ions.

Solids, liquids and gases

Solid Properties:

- Definite shape and volume
- Normally hard and rigid
- Large force required to change shape
- High Density
- Incompressible

Model:

- Closely packed
- Occupy minimum space
- Regular pattern
- Vibrate in fixed position

- Not free to move

Liquid Properties:

- Definite volume but no shape.
- High Density
- Not compressible

Model:

- Occur in clusters with molecules slightly further apart compared to solids
- Free to move about within a confined vessel

Gas Properties:

- No Fixed volume and no fixed shape
- Low density
- Compressible

Model:

- Very far apart
- Travel at high speed
- Independent and random motions
- Negligible forces of attraction between them

Diffusion in Gases

Gases diffuse in different rates. Those rates depend on their factors:

1. Mass of the particles

The lower the mass of its particles the faster a gas will diffuse.

Why?

Because the lighter the molecules, the faster it will travel

2. The temperature

The higher the temperature, the faster a gas will diffuse.

Why?

Because particles gain energy as they are heated

Mixtures, Solutions, and Solvents

Mixture: Contains more than one substance. They are just mixed together and not chemically combined.

Example: Sand and water.

Solution: It is when a solute and a solvent mix. The solute dissolves in the solvent making a solution.

Example: sugar (solute) dissolves in water (solvent) making a solution of sugar and water.

The solubility of every substance is different.

To help a solute dissolve you could:

- Stir it
- Rise the temperature

If you add excess amount of sugar in a small amount of water...it won't dissolve as there is no space for it. The solution becomes saturated.

Solvent: A substance that allows solutes to dissolve in

Example: Water, Ethanol

Pure substances and impurities

A pure substance is a substance that has no particles of any other substance mixed with it.

An unwanted substance, mixed with a wanted substance, is called an **impurity**. To check if a substance is pure, you have to check its melting and boiling points.

A pure substance has a definite, sharp, melting point. When a substance is impure, the melting point falls and its boiling point rises. So the more impurity present, the wider and bigger the change in melting and boiling point.

Separation methods:

Filter ----- Solid from liquid
Centrifuge ----- Solid from liquid
Evaporation ----- Solid from its solution
Crystallization ----- Solid from its solution
Distillation ----- Solvent from a solution
Fractional distillation ----- Liquid from each other
Chromatography ----- Different substances from a solution

Separation methods

1. Filtering

Example:

A mixture of chalk and water...

1. A filter paper is placed in a funnel, the funnel placed on a flask.
2. The mixture is poured on the filter paper.

The chalk (the residue) will remain in the filter paper and the water (the filtrate) will fall down in the flask.

2. Centrifuging

This method is used to separate small amounts of solid and liquid. Inside a centrifuge (it's a machine), test tubes are spun very fast so the solid gets flung to the bottom.

3. Evaporation

This method is used to separate a solution in which the solid is dissolved in the liquid.

1. The solution is heated so that the liquid evaporates and the solid remains in the bottom of the evaporating dish.

4. Crystallization

This method is similar to evaporation but here the solid forms crystals then the crystals are left to dry.

Separating a mixture of two solids

1. This can be done by dissolving one in an appropriate solvent.
2. Then filtering one and extracting the other from the solution by evaporation.

5. Simple distillation

1. The impure liquid is heated.
2. It boils, and steam rises into the condenser.
3. The impurities are left behind.
4. The condenser is cold so the steam condenses to the pure liquid and it drops out on the beaker.

6. Fractional distillation

1. The mixture is heated.
2. The wanted substance boils and evaporates (some of the unwanted liquid will evaporate too) and rises up the column.
3. The substance will condense on the beads in the column causing them to heat.
4. When the beads reach a certain temperature when the wanted liquid wont condense anymore (That's the boiling point) it will rise while the unwanted liquid will condense and drop. The wanted liquid will make its way through the condenser where it will condense and drop down in the beaker.

7. Chromatography

This method is used to separate a mixture of substances. For example you can use it to find how many coloured substances there are in black ink.

Steps:

1. Drop the black ink on to the center of a filter paper and allow it to dry.
2. Drop water on to the ink spot, one drop at a time.
3. Suppose there are three rings: yellow, red and blue. This shows the ink contains 3 coloured substances.

The substances travel across the paper at different rates. That's why they separate into rings. The filter paper showing the separate substances is called a **chromatogram**. This method works because different substances travel at different speeds because they have different levels of attraction to it.

Uses of chromatography:

- Separate mixtures of substances
- Purify a substance by separating the impurities from it
- Identify a substance