

Part 4

Mixing and separating solids and liquids



Soluble and Insoluble

When solids and liquids meet the liquids flow around the solids any may float, sink or dissolve. Solids that dissolve are called soluble solids, solids that do not are called insoluble solids.

Soluble

When a solid dissolves, it breaks up into very tiny pieces, called particles, which are so small that they cannot be seen. The particles of some solids, such as instant coffee granules, give the liquid a colour, but the particles of others, such as salt and sugar, do not. Some dissolved particles, such as those of salt and sugar, give the liquid a particular taste, but the particles of rocks found in mineral waters do not. A liquid with a solid dissolved in it is called a solution.

Speeding up the process the dissolving process.

Breaking up

When a solid dissolves, tiny particles of it escape at its surface and enter the liquid. A big lump of a solid looks as if it has a large surface, but if it is broken down into smaller bits, their surfaces are even greater. This allows more particles to escape into the liquid and speeds up dissolving.

Stirring up

If the water around the bits of solid is still the particles move into it quickly at first. As they start to fill up the water, they move more slowly. When the water is stirred, it flows over the bits, picks up particles, and moves on. Every second a new portion of water sweeps by the bits and takes away the particles.

Heating up

When solids warm, the tiny particles in them shake very slightly. If the solid is in a liquid, the particles at its surface shoot off quickly into the liquid and dissolve. The hotter the solid and liquid the faster the solid dissolves

3 Types of insoluble solids:

Floating Solids, Sinking Solids and Sediments

All solids have **weight**, which is a force that pushed downward. All liquids push upward on solids with a force called **buoyancy**. If the weight of a solid pushing down on the liquid is less than the buoyancy, the solids floats on the liquid. If the weight of the solids is more than the buoyancy, the solid sinks.

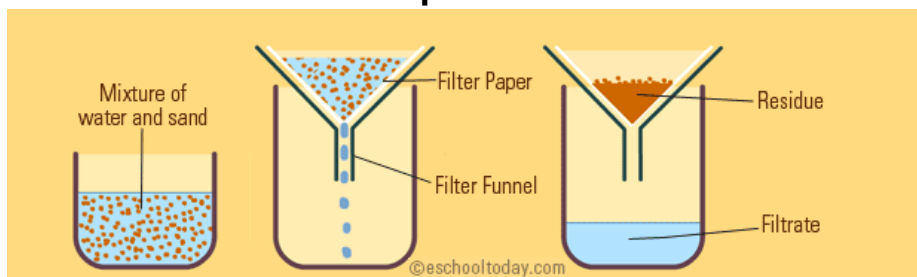
Large solids sink to the bottom of the liquid immediately. They form a layer called **sediments**.

Filtration separation method

Filtration is a more common method of separating an insoluble solid from a liquid.

An example of such a mixture is sand and water. Filtration is used in water treatment plants, where water from the river is filtered to remove solid particles.

Here is a basic lab setup for filtration:

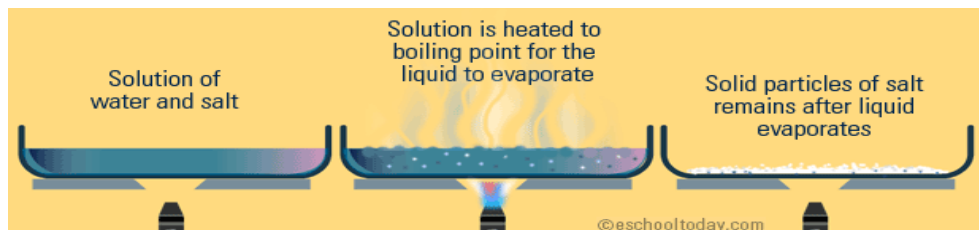


This process involves the use of a **filter paper** placed in a filter funnel. The funnel is placed in a beaker and the mixture of water and sand is poured into the funnel. The liquid part drains through the filter paper into the beaker, leaving the solid sand particles trapped on the filter. In filtration, the liquid part collected is called the **filtrate** and the solid bit that remained on the filter paper is called the **residue**.

Evaporation separation method

Evaporation is the process by which water (and other liquids) changes from a liquid state to a gas state. Evaporation is great for separating a mixture (solution) of a soluble solid and a solvent. The process involves heating the solution until the solvent evaporates (turns into gas) leaving behind the solid residue.

Here is a simple example involving a mixture of salt and water.

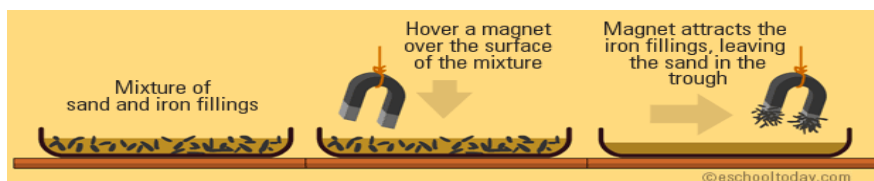


To get the salt back from the salt water, the solution is heated to boiling point. As it boils, the water escapes as vapor (gas). After some time, all the water evaporates, leaving a layer of salt at the bottom of the beaker.

Magnetism

Magnetism is ideal for separating mixtures of two solids with one part having **magnetic** properties. Some metals like iron, nickel and cobalt have magnetic properties whiles gold, silver and aluminum do not. Magnetic elements are attracted to a magnet.

It works like this: Let us take a mixture of sand and iron filing for example.



To separate this, spread out the mixture on a flat surface. Run a magnet bar over the surface.

You will notice that the magnetic elements (iron filings) will be attracted to the magnet over it. After a number of runs, all the sand will be free from any iron filing.