

Chapter 25 – Separating Mixtures

A solution is formed when a solid dissolves in a liquid

The **solid** is referred to as the **solute**.

The **liquid** is referred to as the **solvent**.

A **dilute solution** is one where there is a lot of solvent and only a little solute

A **concentrated solution** is one where there is a lot of solute and only a little solvent

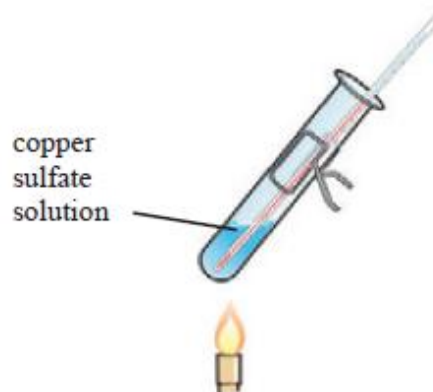
A solution can be made more concentrated by adding more of the solute.

A **saturated solution** is one where no more solute will dissolve in the solvent

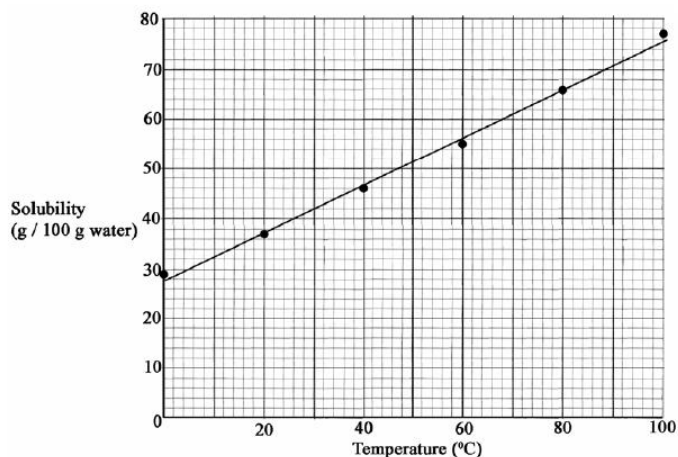
Experiment: To investigate the solubility of a variety of substances in water and the effect of temperature on solubility

Example; table salt
The mass of **salt** that will dissolve in **100g** of **water** at **20°C** is found using an **electronic balance**.

The water is **heated** to **30°C** and **more salt** is added to find the mass that can dissolve at this temperature. This is repeated for temperatures of **40°C**, **50°C** and **60°C**.

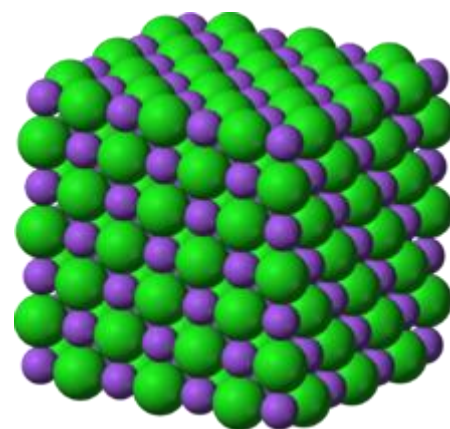


SAMPLE GRAPH



Crystals and crystallisation

Some solids are always found in the form of a crystal. Crystalline solids have definite shapes because the atoms in the crystal are in a regular pattern. Examples include sugar and salt diamonds and ice.



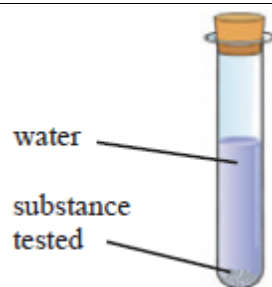
Salt is composed of two different types of atom, sodium (symbol Na) and chlorine (symbol Cl), arranged in an orderly pattern as shown.

Other solids are said to be non-crystalline.

Example: flour

To Investigate the Solubility of Different Substances in Water

A spatula full of each substance is added to water in a test tube. The test tube is stoppered and shaken to see which will dissolve.



Growing Copper Sulfate Crystals

A hot, concentrated solution of copper sulphate is poured on to a warm evaporating dish. The dish is left for 3 hours.

Crystals of copper sulphate form as the solution cools.



Filtration

Filtration is a way of separating an insoluble solid from a liquid

An insoluble solid is a solid which doesn't dissolve in a liquid, e.g. a soil/sand in water.

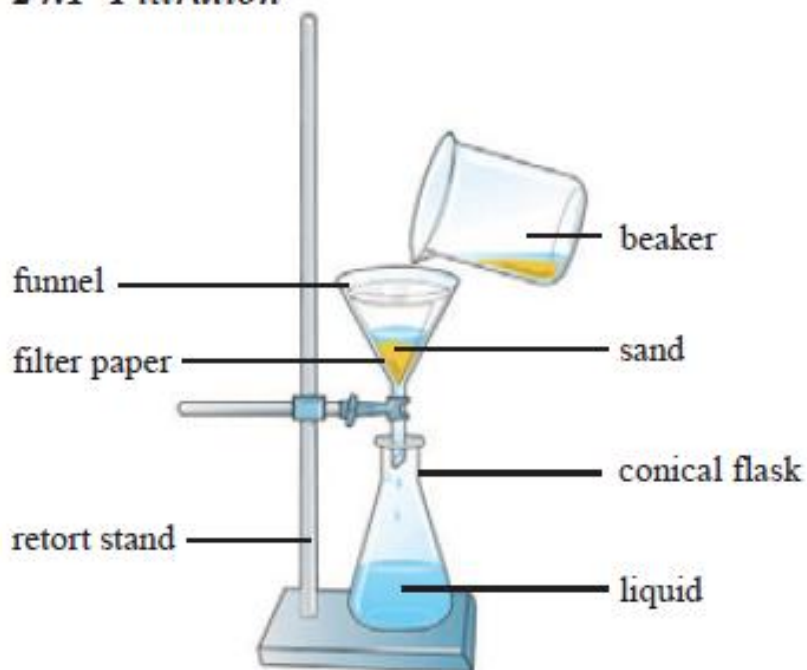
Equipment:

A solution of sand and water, filter paper, filter funnel, conical flask and beaker.

Procedure:

Carefully pour the solution into the conical flask – the water will flow through, leaving just the sand behind.

24.1 Filtration



Evaporation

A *soluble* solid is a solid which dissolves in a liquid, e.g. a sugar in water

Evaporation is used to separate a soluble solid and a liquid

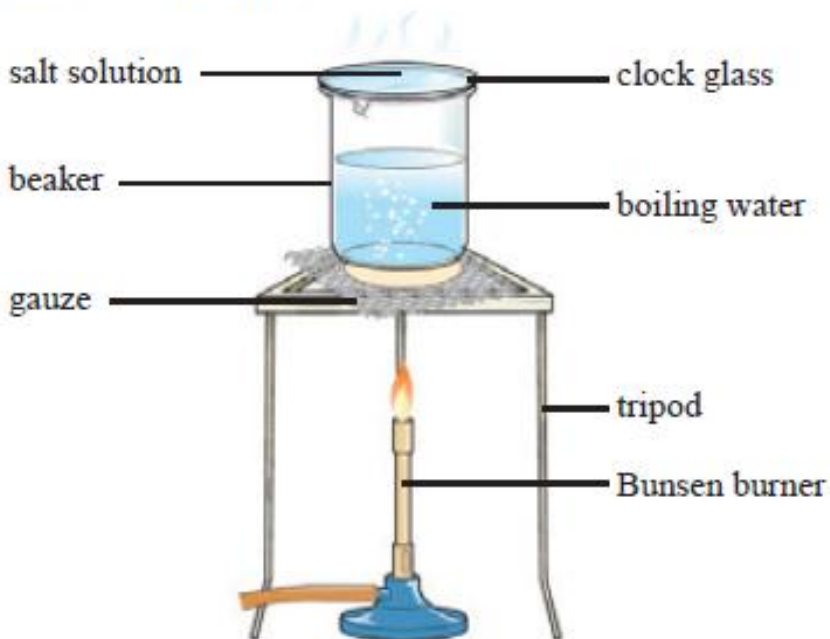
The problem is that you lose the liquid.

To separate salt and water by distillation:

Procedure:

Simply heat the mixture (e.g. water and salt) – the water will evaporate, leaving just the salt behind.

24.2 Evaporation



Distillation

Distillation can be used to separate a soluble solid and a liquid (and you get to keep both)

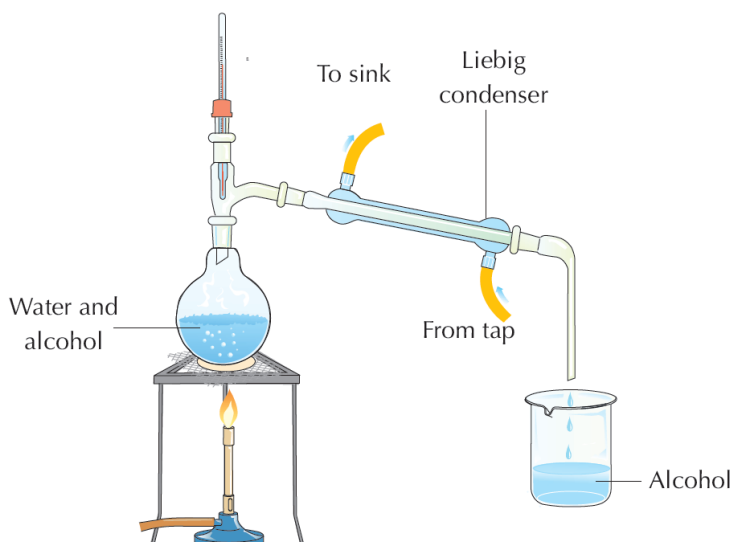
Distillation can be used to separate two miscible liquids with different boiling points (and you get to keep both)

Two miscible liquids are liquids which mix together, e.g. alcohol and water.

To separate two miscible liquids by distillation.

Set up equipment as shown in the diagram.

The Liebig Condenser: it has an outer tube which carries cold water which causes the water vapour passing through the inner tube to condense back into a liquid.



Cold water goes in through the bottom of the condenser and out through the top

The round-bottom flask above the Bunsen burner contains water and alcohol.

Alcohol evaporates at 78 °C, and water does not evaporate until 100 °C.

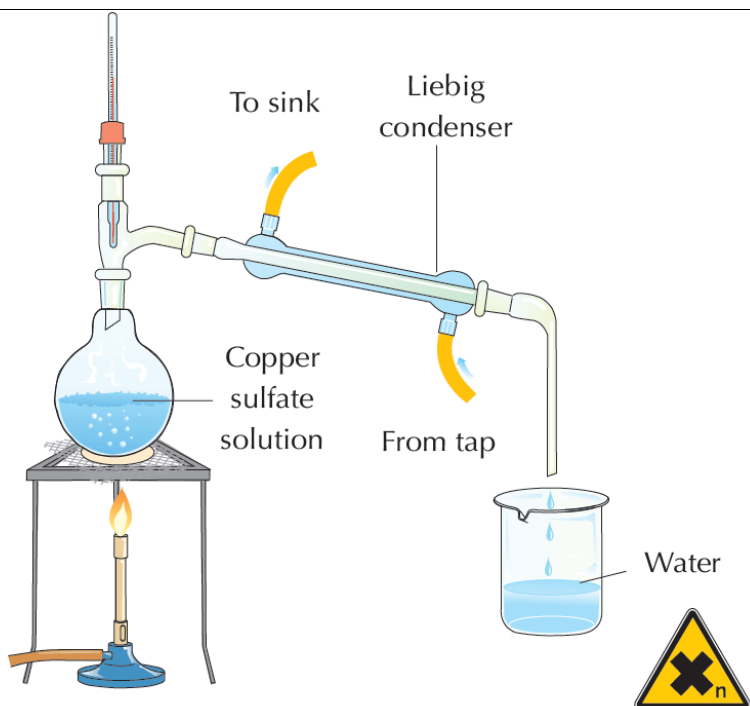
Using the thermometer ensure the temperature remains around 80 °C, the alcohol vapour will travel through the condenser into the beaker and the water will be left behind in the round – bottomed flask.

To separate a liquid and a dissolved solid (copper sulfate) by distillation.

Set up equipment as shown in the diagram.

Allow the liquid to boil (water @ 100 °C), it will travel through the Liebig condenser and condense into the beaker.

The copper sulfate will be left behind in the round-bottomed flask.



Chromatography

Chromatography is used to separate a mixture of dyes in an ink

To separate the dyes in black ink by liquid chromatography.

Set up the equipment as indicated in the diagram.

Put an ink spot just above the water line as shown.

Water rises up through the chromatography paper and takes the various colours which were in the ink spot to different heights.

