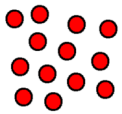
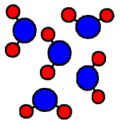
SCIENCE

Year 8: Solutions

1) Elements, Compounds and Mixtures

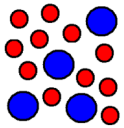
- Substances can be divided up into 3 groups: **elements**, **compounds** and **mixtures**
  - Everything is made up of simple particles called **atoms**
  - An **element** only has one **type of atom** and cannot be broken down into a simpler substance by chemical or physical means. eg. carbon (C), oxygen (O_2) and iron (Fe).
  - Elements are listed on the Periodic table





  - A **compound** has more than one type of **atom**
  - A **compound** can only be broken down in a **chemical reaction** because they contain **chemical bonds**
  - Some examples of **compounds** are: carbon dioxide(CO_2) , water (H_2O) and magnesium oxide (MgO).

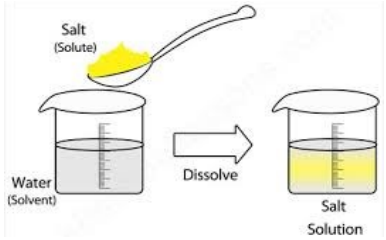
- A **mixture** can contain many different elements and compounds
- A **mixture** can be separated by **physical means** like evaporation, filtering or sieving.
- Some examples of **mixtures** are: sea water, air and steel.



Keyword	Meaning	Keyword	Meaning
Chromatography	A method for separating dissolved substances (solutes) from one another.	**Insoluble**	A substance that will not dissolve
Concentration	A measure of the number of particles of the solute in the solvent.	**Mixture**	Contains different substances that are not chemically joined to each other.
Distillation	A separation technique for separating the solvent from a *solution*.	**Saturated solution**	When no more solute will dissolve into the solution
Dissolve	The process of a solute spreading out into a solvent	**Soluble**	A substance that will dissolve
Evaporation	A separation technique used to separate a **soluble solid** from a **liquid**.	**Solute**	The solid that you dissolve in a solvent to make a solution
Filtration	A separation technique that is used to separate an **insoluble solid** from a **liquid**	**Solution**	A solute dissolved in a solvent
Filtrate	A liquid which has passed through a filter.	**Solvent**	The liquid you dissolve a solute in to make a solution

2) Making a solution

- A solution is made by adding a **solute** (solid) to a **solvent** (liquid). The solute dissolves into the solvent to form a solution. You can make one very easily by adding a solid to a liquid and stirring.
- The regular solid particles are separated from each other and the solid can no longer be seen.



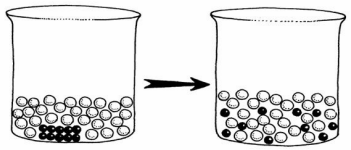
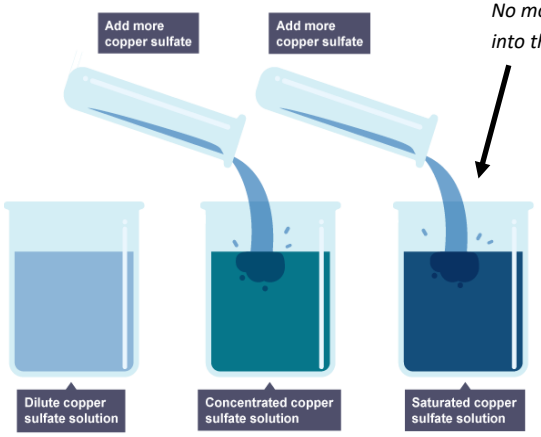


Diagram showing the particles in a solid during dissolving

- Not all solids will dissolve in a particular solvent.
  - A substance that does dissolve is called **soluble**.
  - A substance that will not dissolve is called **insoluble**.
- Common **solvents** include water and alcohol.
- Common **solutes** include salts and sugars.

3) Solubility and saturated solutions

- For each solute and solvent, there is a limit to the mass of solute that will dissolve in a particular volume of the solvent. When no more solute will dissolve, we say that the solution is a **saturated solution.**



- When a small mass of solute is dissolved into a solvent, we call our solution **dilute**. It has a low concentration.
- When a larger mass of solute is dissolved into a solvent, we call our solution **concentrated**.
- Different substances can have a different **solubility**—more or less of the solute can dissolve in the same volume solvent.
- Higher temperatures increase solubility.

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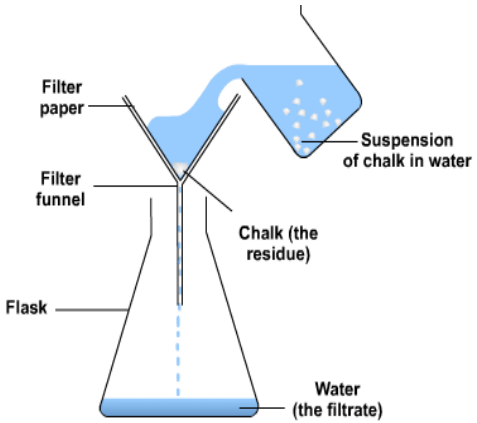
4) Separating mixtures: Filtration

Filtration is a separation technique that is used to separate an **insoluble solid** from a **liquid**.



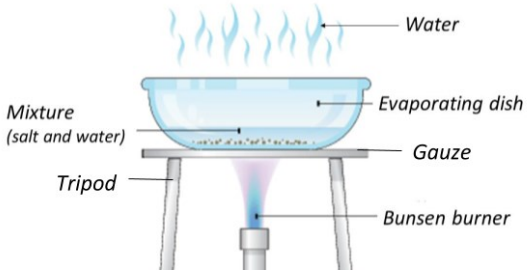
- In this example, chalk is the **insoluble solid** and water is the **liquid**. The mixture of chalk and water are poured through the **filter funnel** that is lined with **filter paper**.
- The filter paper stops the solid chalk particles going though but allows the liquid particles through.
- This means the water (**filtrate**) can be collected in the conical flask and the chalk (**residue**) is collected in the filter paper.

Remember: If a substance does not dissolve in a solvent, we say that it is insoluble. For example, sand does not dissolve in water – it is insoluble. This means we can separate sand from water using filtration

5) Separating mixtures: Evaporation

Evaporation is used to separate a **soluble solid** from a **liquid**.

- For example, salt (sodium chloride) is **soluble** in water – its crystals **dissolve** in water to form a salt solution.
- During evaporation, the water **evaporates** away leaving solid sodium chloride (salt) crystals behind.



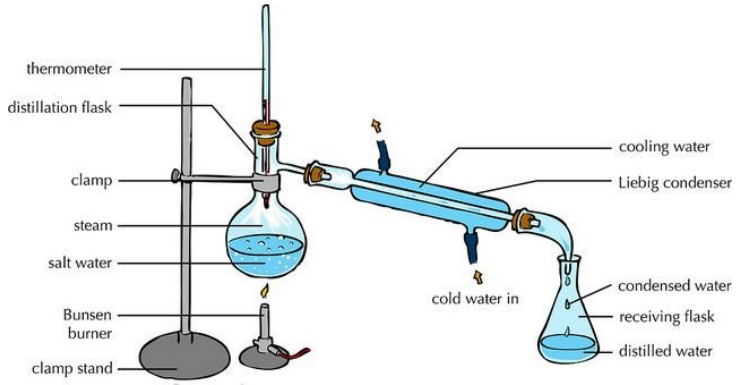
Steps

1) A solution is placed in an evaporating basin and heated with a Bunsen burner.
2) The volume of the solution has decreased because some of the water has evaporated. Solid particles begin to form in the basin.
3) All the water has **evaporated**, leaving solid crystals behind.

6) Separating mixtures: Distillation

Simple **distillation** is a method for separating the **solvent** from a **solution**.

- For example, water can be separated from salt solution by using the simple distillation equipment shown below:



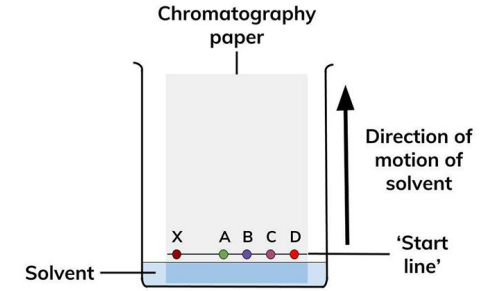
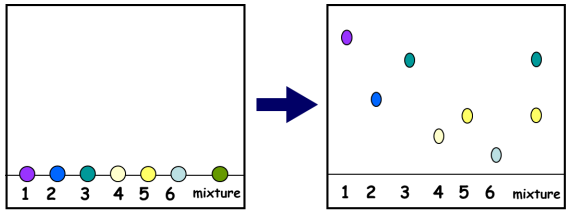
- This method works because water has a much lower **boiling point** than salt.

Steps

1) The salt solution is heated.
2) Water **evaporates** and its vapours rise. The water vapour passes into the **condenser**, where it cools and **condenses**. Liquid water drips into a beaker.
3) All the water has evaporated from the salt solution, leaving the salt behind

7) Separating mixture: Chromatography

Paper **chromatography** is a method for separating dissolved substances (**solutes**) from one another.



- It is often used when the dissolved substances are coloured, such as inks, food colourings and plant dyes.
- It works because some of the coloured substances **dissolve** in the **solvent** used better than others, so they travel further up the paper.
- Chromatography produces a **chromatogram** which can be used to identify unknown substances or compare mixtures.
- A **pure substance** will only produce one spot on the chromatogram during paper chromatography.
- A **mixture** will produce more than one spot.
- Two substances will be the same if they produce the same colour of spot, and their spots travel the same distance up the paper.