KS3 Big idea 5: Matter part 2

Glossary:

- **Atom**

The smallest part of an element that can exist.

- **Chromatography**

Used to separate different coloured substances.

- **Compound**

A pure substance made up of atoms of two or more elements, bonded together.

- **Dissolve**

When a solute mixes completely with a solvent.

- **Distillation**

Separating substances by boiling and condensing liquids.

- **Element**

A substance that cannot be broken down into other substances.

- **Evaporation**

A way to separate a solid dissolved in a liquid by the liquid turning into a gas.

- **Filtration**

Separating substances using a filter to produce a filtrate (solution) and residue.

- **Mixture**

Two or more pure substances mixed together, whose properties are different to the individual substances.

- **Molecule**

A pure substance made up of two or more atoms, bonded together.

- **Pure substance**

Single type of material with nothing mixed in.

- **Soluble (insoluble)**

Property of a substance that will (will not) dissolve in a liquid.

- **Solubility**

Maximum mass of solute that dissolves in a certain volume of solvent.

- **Solute**

A substance that can dissolve in a liquid.

- **Solution**

Mixture formed when a solvent dissolves a solute.

- **Solvent**

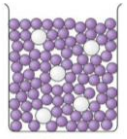
A substance, normally a liquid, that dissolves another substance.

Activities

1. Explain the difference between an **atom**, an **element**, a **compound** and a **mixture** using the gases found in air as examples. Substances you could use in your answer include: oxygen, carbon dioxide and argon.

2. A pupil heats a sample of water. It does **not** boil at exactly 100°C. Decide whether it is a pure or an impure sample and give a reason for your answer.

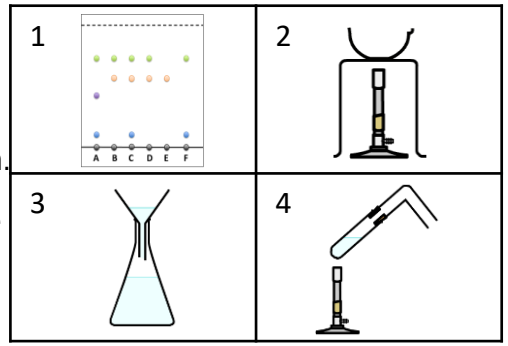
3. This particle diagram shows a solution of sugar and water which has been made at 20°C and not stirred. Draw a similar particle diagram to show a solution of sugar and water which has been made at 50°C and stirred, and explain the difference.



4. Look at the diagrams. For <u>each one</u>, name the separating technique.

5. Look at the diagrams. For <u>each one</u>, name the pieces of equipment included in the diagram.

6. Look at the diagrams. For <u>each one</u>, describe how the equipment is used to separate mixtures. Make sure you include key scientific terms, including changes in state if appropriate.



7. Rock salt contains sand and salt. A student mixed rock salt in warm water. Describe how the student would separate out the sand, salt <u>and</u> water from the mixture formed. You will need to consider the question carefully as the water needs to be collected too.

QUICK QUESTIONS:

1. What is a solute?
2. Elements, molecules and compounds are all made up of ____?
3. Which separation methods require heating?
4. Give an example of a mixture.

KS3 Science

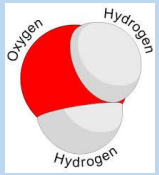
Big idea 5: Matter part 1b

1. Inside particles

A substance is made of one kind of material only. All of its particles are the same. Different substances have different particles to each other.
Every element has its own type of atom.

- Molecules are atoms strongly bonded together
- Compounds are atoms of two or more elements strongly bonded together.

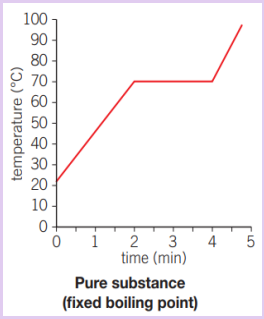
Water particles are molecules, made of atoms of the elements hydrogen and oxygen. Water has different properties to either hydrogen or oxygen.



2. Pure substances

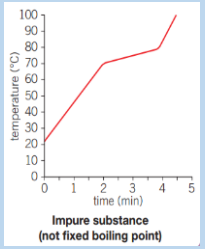
A pure substance is a **single** type of material with nothing mixed in.
All the particles are **the same**.
A pure substance can be identified because it has:

- A **fixed melting point**
- A **fixed boiling point**



3. Mixtures

When two or more pure substances are mixed together, a mixture is formed. Each pure substance still keeps its own **properties**. It is for this reason that we can **separate** the pure substances from a mixture. Examples of mixtures are milk, the air, seawater and most rocks.
Each pure substance has its own fixed melting and boiling point, so a mixture will melt over **a range of temperatures**.

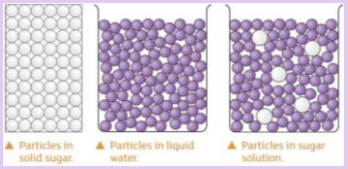


4. Solutions and solubility

A **solution** is type of mixture made of two parts, made when a **solute dissolves** in a **solvent**. Each solute will have a fixed **solubility** in a solvent. Sugar is more soluble in water than sodium chloride (salt).
Most substances become more soluble if you:

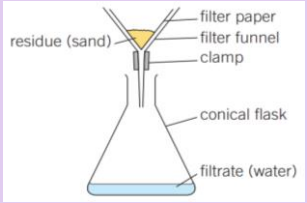
- Increase the **temperature**
- **Stir** the mixture

An example of a solution is sugary water, where the sugar is the solute and water is the solvent.



5. Separating mixtures - filtration

Some solid substances are **insoluble**. This means they do not dissolve in a mixture with a solvent or a solution, and they can be **separated** out using **filtration**. This works because particles of different substances are **different sizes**. Any which are small enough pass through **tiny holes** in the filter paper, but those which are too big remain in the paper.

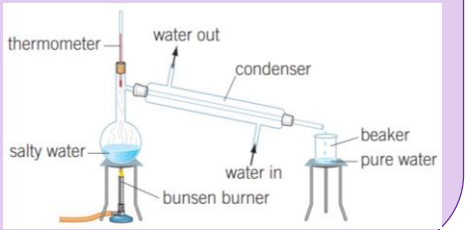


6. Separating mixtures - evaporation

To **separate** a solution and collect a solid **solute**, **evaporation** can be used. This works because the solvent and solute have different **boiling points**.
When the mixture is heated, the solvent will **evaporate** as its particles change state from liquid to gas, leaving the solid solute behind.

7. Separating mixtures - distillation

To **separate** and collect the solvent from a solution, **distillation** can be used. This works because the different substances have different **boiling points**. It works like evaporation, except the evaporated solvent travels down the **condenser**, causing it to cool and return to a liquid state.



8. Separating mixtures - chromatography

To **separate dyes** from a mixture, **chromatography** can be used. A spot of the mixture is placed on special paper and the bottom of the paper lowered into a solvent e.g. water. The mixture of dyes and water **travels up the paper**.
If the dye is more strongly **attracted** to the paper than the water, it won't move as far up the paper. Dyes more strongly attracted to the water than the paper will travel further up the paper.