Edward Peake Church of England Middle School		
Topic: Particle model and Separating mixtures.	**Year: 7**	**Strand: Chemistry**

What should I already know?

States of matter

1. At room temperature, most materials can be grouped into being a solid, liquid or gas. The three main states of matter.
2. Heating or cooling a material may lead to a change of state.
3. Water freezes to become ice at 0 °C, and boils to becomes a gas at 100 °C.
4. In the water cycle, water evaporates to become a gas, condenses in clouds and forms water droplets. It falls back to Earth as precipitation.

Reversible changes

1. Water can be repeatedly frozen to make ice and melted to form liquid water. This is a physical change of state and is reversable.
2. Dissolving and mixing are also reversible changes – salt can be added to water, which can be evaporated to recover the solid salt.

Dissolving and solubility

1. Salt and sugar are examples of substances that dissolve in water. They are soluble and the mixture forms a solution.
2. Sand is an example of a substance that does not dissolve in water. It is insoluble.

What will I know by the end of the unit?

Using the particle model

1. To explain why solids, have a fixed shape and cannot flow. Liquids and gases do not have a fixed shape, and can flow.
2. To explain that particles in solids, liquids and gases have their own internal energy. The internal energy of the particles in gases is higher than that in liquids, solids have the least
3. To explain how changes of state are affected by temperature. This explains how solids, liquids and gases expand on heating.
4. To explain differences in density, concentration and pressure using the particle model.
5. To explain why perfume spreads in a room.

Separating mixtures

1. Solid material which have been mixed with water but not dissolved can be separated using a filter or a sieve.
2. Heat a liquid and it will evaporate turning it into a vapour (gas). Cool the vapour and it will turn back into a liquid. This process is called distillation. We can use information about different boiling points to separate mixtures of liquids. Distillation is used to make perfume and also fuels such as petrol.
3. Soluble substances will travel up filter paper in a suitable solvent, known as paper chromatography. We can show by testing coloured dyes or inks, that the different colours in the mixture move different distances. The same technique can be used to separate mixtures and identify chemicals.

Useful websites

https://www.bbc.co.uk/bitesize/guides/z2wmxnb/revision/1

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https://www.educationquizzes.com/ks3/science/solids-liquids-and-gases-01/
https://www.youtube.com/watch?v=PvHvx7k7UPU
https://www.youtube.com/watch?v=pDDWCfNuhj4
https://www.youtube.com/watch?v=q8Ent5CXhfY
https://keystagewiki.com/index.php/Separating_Mixtures

Vocabulary	
Alloy	A mixture of 2 or more metals. Gold is too soft to make wedding rings from. It is mixed with other metals to make it stronger.
Boil	To reach the temperature at which a liquid bubble and turns to vapour.
Boiling point	The fixed temperature at which pure substances boil. It is also the temperature where the reverse happens and a pure gaseous substance condenses. Pure water has a boiling point of 100 º C
Change of state	The change from one state (solid or liquid or gas) to another without a change in chemical composition eg solid ice turning into a liquid water.
Chromatography	The technique of separating out a mixture of chemicals, which are in gas or liquid form, by letting them creep slowly past another substance, which is typically a liquid or solid
Crystallisation	The process by which a solid form, where the atoms or molecules are highly organized into a structure known as a crystal.
Collide	Particles bump into other particles or the side of a container randomly when moving.
Compression	Squashing a material so that the particles are pushed closer together. **Gases can be compressed**
Concentration	The number of particles in a known volume
Condensation	the conversion of a vapour or gas to a liquid.
Conduction (Heat or electricity).	The transfer of heat or electrical charge by passing on energy to nearby particles. Metals are good at this and non-metals are not. The exception is graphite which also conducts
Brittle	Easily cracked or broken by hitting or bending
Diffusion	Movement of particles from a higher concentration to a lower concentration
Dissolve	When a solid is soluble and dissolves in a liquid so that it can no longer be seen. The solid is called the solute. The liquid is the solution
Distillation	Distillation is the process of separating components of a mixture based on different boiling points. Small scale distillation can be carried out in a **Liebig condenser**
Ductile	Layers of particles can slip past each other and the material can be stretched a lot. Metals are ductile
Equilibrium	A stable state in which no change is visible because the **diffusion** of particles is equal throughout a solution or gas. If there is a difference in concentration it is known as the **concentration gradient**

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Energy	Something has energy if it has the ability to make something happen when that energy is transferred
Evaporation/ evaporate	The process of a substance in a liquid state changing to a gaseous state due to an increase in temperature
Filtration	Filtration, the process in which solid particles, which were **insoluble** in a liquid or gaseous fluid are removed by the use of a **filter** medium that permits the fluid to pass through but retains the solid particles. E.g sand is **insoluble** in water and can be separated using **filter paper**
Freezing	When a substance changes from a liquid to a solid
Gas pressure	The measure of the average force of gas particle **collisions** over the area of the container's sides. The units of pressure are **kilopascals (kPa)**
Hard (hardness)	A measure of how easy it is to scratch a solid
Immiscible	Liquids that do not mix are immiscible. Oil and water are examples. You may see oil floating to the top of vinaigrette.
Malleable	How easy it is to bend or hammer a solid without it breaking
Melting point	The temperature at which a pure substance **melts** or **freezes**
Mixtures	A mixture is a combination of two or more elements or compounds mixed together, but not chemically joined.
Rate	How fast something is happening e.g. **diffusion.**
Particles	All matter is made up of tiny particles
Particle model	Is used to show how particles are arranged. We can draw particle models for three states of matter. **Solid, liquid and gas**.
Pure substance	**A substance that has a fixed chemical composition throughout** is called a pure substance such as water, air, and nitrogen. A pure substance does not have to be of a single element or compound
Purify	**Distillation** is a process we can use to **purifying** substances
States of matter	State of matter is one of the distinct forms in which matter can exist eg solid, liquid, gas.
Strength	The ability of a solid to withstand a force. **Metals** are generally strong
sublimation	When anything solid turns into a gas without first becoming liquid.
Solute	A solute is the substance that is dissolved in a solution. It is **soluble**
Solvent	A solvent is the component of a solution that is present in the greatest amount. It is the substance in which the solute is dissolved. Examples: The solvent for seawater is water.
Solution	A solution consists of a **solute** and a **solvent**. The solute is the substance that is dissolved in the solvent. ... For example, in a saline solution, salt is the **solute** dissolved in water as the **solvent.**

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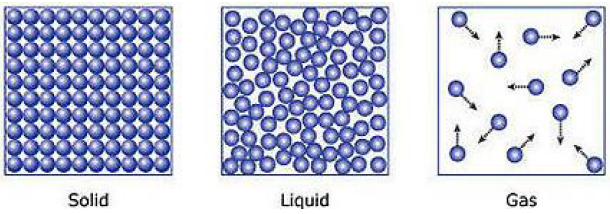
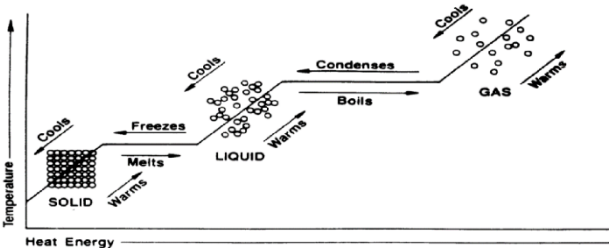
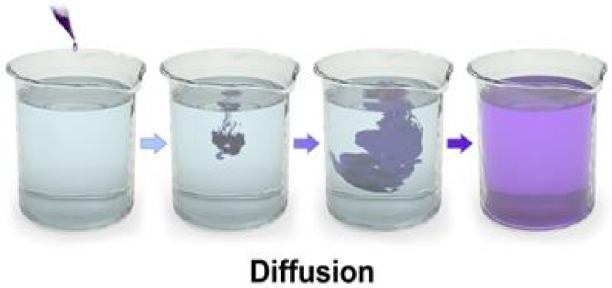
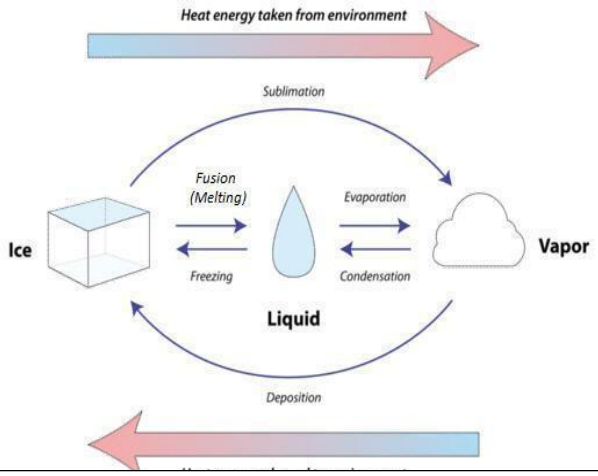
Vapour	Liquid that has evaporated and is a gas. You can see water vapour coming out of a kettle of boiling water.
Viscosity	Resistance to flow in a liquid. A viscus liquid is slow moving, e.g. golden syrup

Diagram	
Particle diagrams   **Interpreting the Energy Temperature Graph**  Diffusion  	**Particle Theory** All matter is made up of particles. Particles are found in all three states of matter. Particles in the three states have different movement and arrangement. -In solids, particles are arranged in a regular pattern and they can only vibrate in a fixed position. Particles are held together by strong bonds. -In liquids, particles are arranged randomly but are still touching each other. Particles can slide past each other and move around. -In gases, p articles are far apart and are arranged randomly. Particles carry a lot of energy and they move in all directions in a high speed. **Properties of Solids, Liquids and Gases** Due to their arrangement and movement, the three states each have different properties. Solids are rigid, have a fixed shape and fixed volume because particles are held together by strong bonds and arranged regularly. Liquids are not rigid and have no fixed shape, meaning they can flow to fill their container. This is because the bonds are weaker, so the particles can move. However, there is a fixed volume because the particles are still close together. Gases are not rigid, have no fixed shape or fixed volume because there is so much space between particles and the bonds holding them together are broken. **Changes of State** Changes of state take place when the particles gain or lose energy. -When energy is applied, particles gain energy, move faster and move further apart. -When energy is lost, particles become closer to each other, move slower and arrange themselves more regularly. **Diffusion and Factors Affecting Diffusion** Diffusion is the movement of particles from a higher concentration to a lower concentration. Diffusion will stop when particles spread themselves evenly. Diffusion occurs in liquids and gases but not in solids, because particles in a solid are not free to move. There are 2 factors affecting the rate of diffusion: 1.Temperature: When temperature increases, particles gain more energy. They can then move and spread out at a higher rate. 2. Concentration : When concentration increases, the rate of diffusion increases because there are more particles. DISSOLVING During dissolving, particles of solvent (water) collide with particles of solute (sugar). They surround the particles of solute, gradually moving them away until the particles are evenly spread

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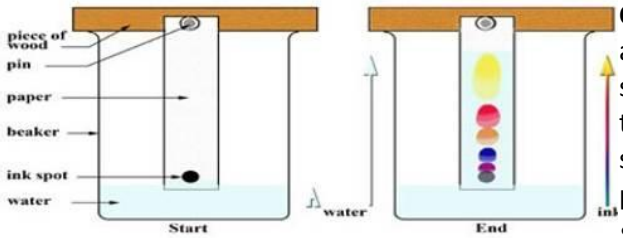
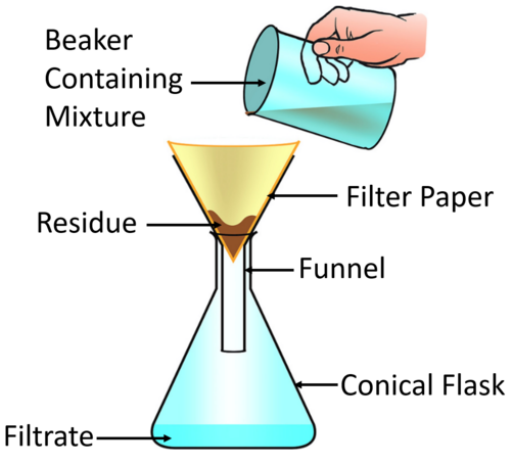
Changing state

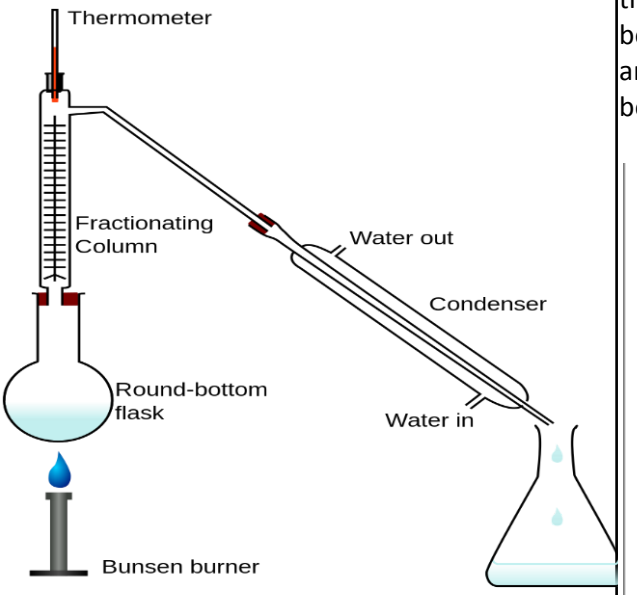
Chromatography



Filtration



Distillation in a Liebig condenser



through the solvent. 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.

CHROMATOGRAPHY; It is often used when the dissolved substances are coloured (inks, food colourings and plant dyes). It works because some of the coloured substances dissolve in the solvent used better than others (it is attracted more strongly to the water than the paper), so they travel further up the paper. • A pure substance will only produce one spot on the chromatogram during paper chromatography. • Two substances will be the same if they produce the same colour of spot, and their spots travel the same distance up the paper. How is it useful? • Identifying food nutrients; compare the amounts of vitamins in different food types. • Testing the purity of a sample. • Forensic science; finger printing and DNA analysis. • Checking the level of pesticides, herbicides and contamination. More recently used in COVID testing

FILTRATION; You can separate sand and water by pouring the mixture into filter paper. Water passes through the filter paper (filtrate) as water particles are smaller than the tiny holes in the filter paper. The grains of sand (residue) stay in the filter paper as they are bigger than the tiny holes. How is it useful? • Separates coffee solution from ground-up coffee. • Oil filters in cars. • Sand filters to make water safe to drink. • LifeStraw; fibres filter the water removing bacteria and parasites.

Distillation

How can we get drinking water from seawater? • On heating, water in the salt solution boils, forming steam. Salt does not boil, because its boiling point it much higher. • Steam travels through the condenser and cools down to form liquid water. • Liquid water drips into the beaker

PURE SUBSTANCES AND MIXTURES

- Chemists make mixtures suitable to specific purposes (e.g. toothpaste and paint); they work out the best amounts of each substance to add to the mixture.
- A pure substance has a fixed melting and boiling point.
- An impure substance (mixture) will melt/boil over a range of temperatures.

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