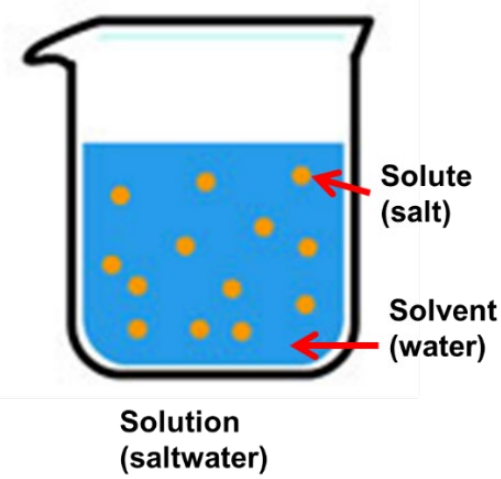
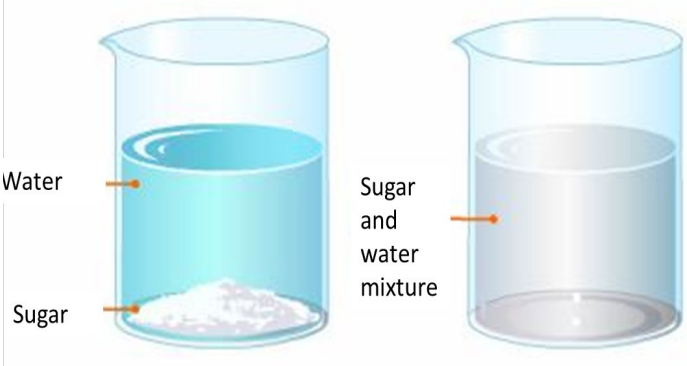
Solutions are made from a solute dissolved in a solvent

A **solution** is made up of a **solvent** and a **solute**. A solvent is a substance such as water that can dissolve a solute. The solvent 'pulls apart' the bonds that hold the solute particles together and the solute particles **diffuse** (spread randomly by hitting into each other) throughout the solvent to create a **solution**. The solution is a **mixture** with evenly spread solvent and solute particles. These particles can be physically separated by **evaporation**.



Where has the sugar gone?

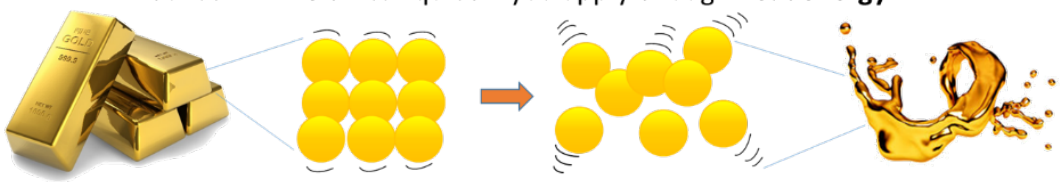


When solids mix into a liquid and can no longer be seen, they have **dissolved**. Often the particles of the solute seemed to have disappeared, but they are all still present. They are now just in very small particles, too small to be seen by eye.

Dissolving and melting.

Both dissolving and melting are physical changes, but they involve different processes

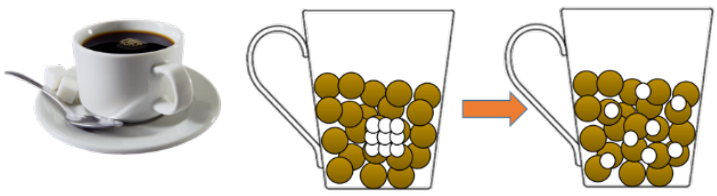
All Solids will **melt** into liquids if you apply enough **heat energy**



Heating adds more kinetic energy to particles

Particles will break free from each other to form a liquid

Some solids will **dissolve** into solvents to form a **solution**, which is a mixture



The solid sugar cubes are added to a cup of coffee (a mixture of water and coffee granules)

The coffee dissolves the sugar and the particles are spread throughout the solution

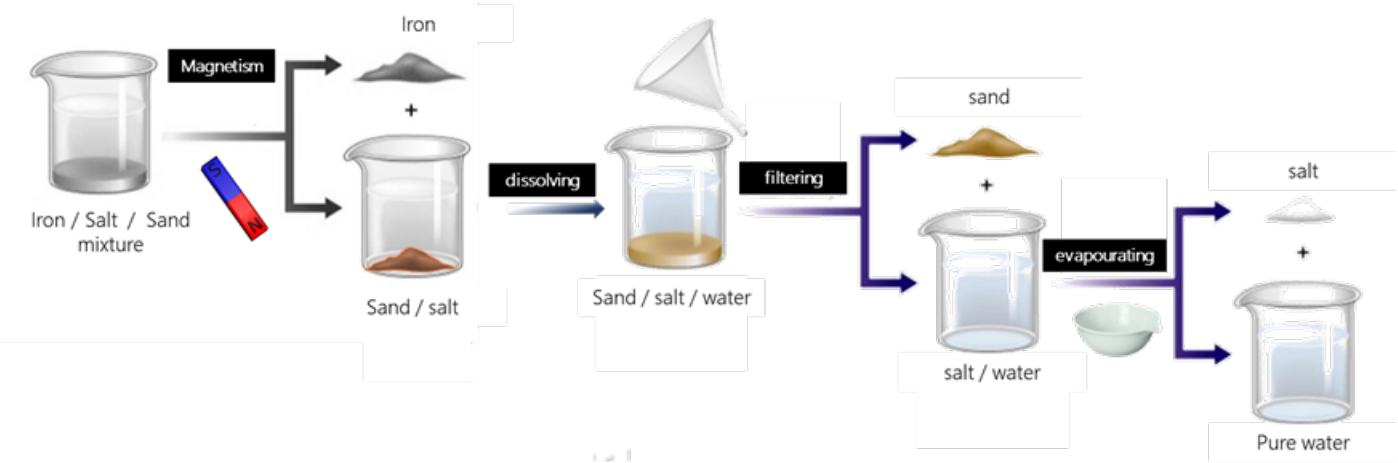
Everyday solutions

Many drinks we purchase are solutions. Most of them are solutions of mainly sugar (solute) and water (solvent) with a small amount of flavouring, colouring and some minerals mixed in. We do not "see" the sugar because it is dissolved into the water and becomes too small to see. This means a lot of sugar can be hidden in the liquid and we are unaware of the amount of sugar we take in, even in so-called healthy sports drinks.

Mixtures can be separated by physical processes

Mixtures of substances are not chemically bonded (joined) to each other so they can be separated by physical techniques.

The state of the various substances in the mixture, such as a liquid and solid or the physical properties of the substances, such as different boiling points will determine which method of separation will be used.



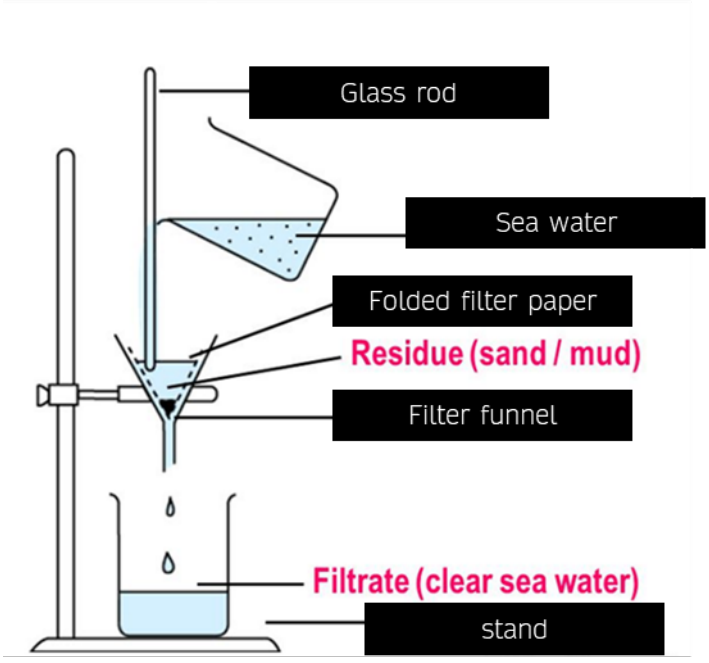
Filtering

Filtering separates an **insoluble solid** in a mixture from the **liquid** completely.

The solvent molecules (liquid) and any dissolved molecules present in the solution can pass through the filter paper, which has small holes, while the solid particles cannot because they are too large and stay in the filter paper.

The solvent or solution containing dissolved substances passes through the filter paper is called **filtrate**. The solid particles that remain on the filter paper are called the **residue**.

Filtering mud, sand and seawater

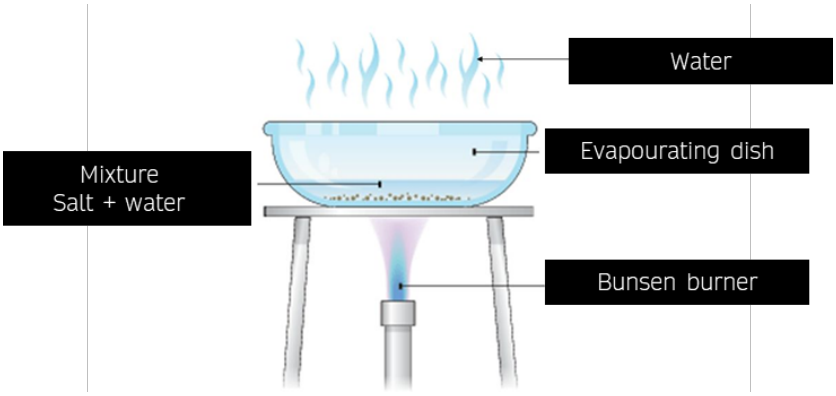


Evaporating (by boiling)

Evaporating separates a dissolved solid from a liquid. The solvent (liquid) is lost into the surroundings.

The liquid will evaporate but evaporation becomes faster at higher temperatures.

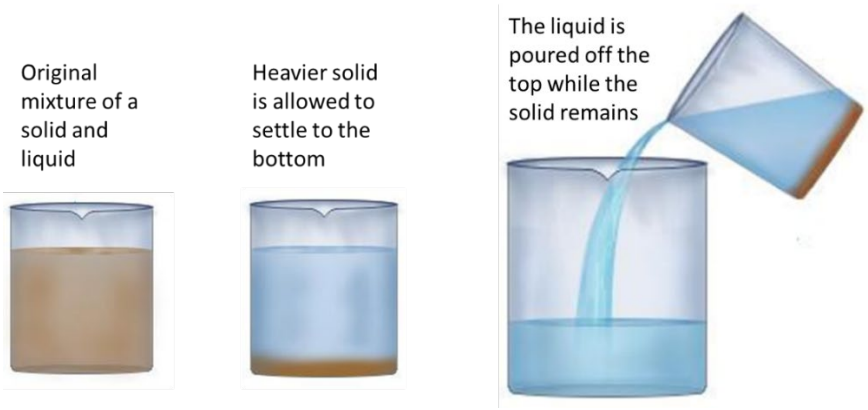
The solid remains because it has a higher (often very much higher) boiling point than the liquid.



Dissolving

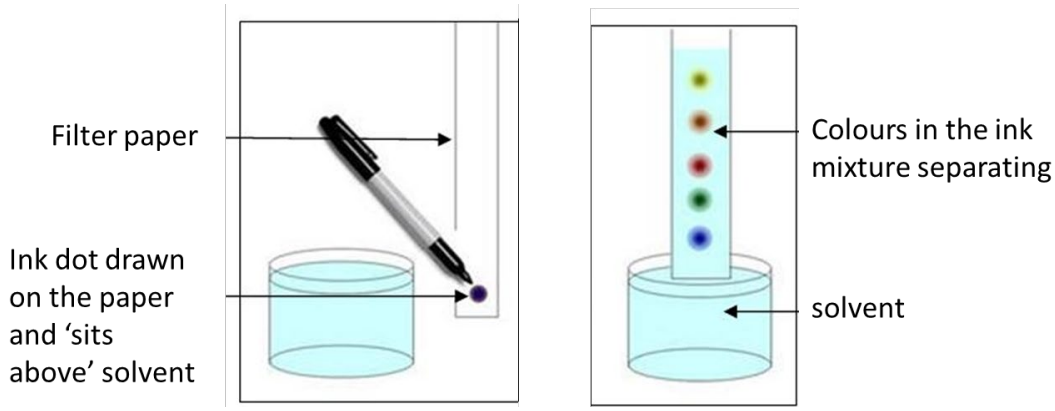
When two solid substances are mixed together, they can be separated by dissolving. A solvent such as water can be added if only one of the substances is soluble. For example; if salt is mixed with dirt then adding water will dissolve the salt (which can later be separated by evaporation) and the remaining dirt can be removed from the solution by filtering. The salt becomes the solute and will go through the filter as it is in solution.

Decanting



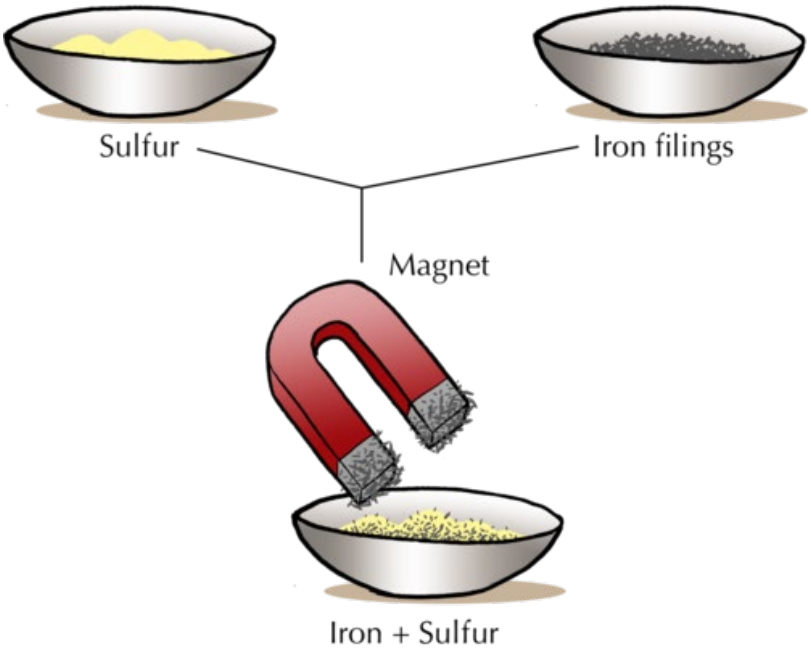
Decanting is simply pouring off a liquid without losing any of the denser substance (usually an insoluble solid) in the bottom of the container. Decanting separates a heavier substance from a lighter one. Chemists are most often after the substance at the BOTTOM of the container.

Chromatography



Chromatography is a method used to separate the various substances in a mixture of dye or ink. Substances of the mixture will differ in how much they "stick" to things: to each other, and to other substances. Some of the substances of the ink will stick more tightly to the paper fibres. They will spend less time in the water as it moves along the paper fibres, and they will not travel very far. Other components of the ink will stick less tightly to the paper fibres. They will spend more time in the water as it moves along the paper fibres, and they will travel further through the paper.

Magnetism



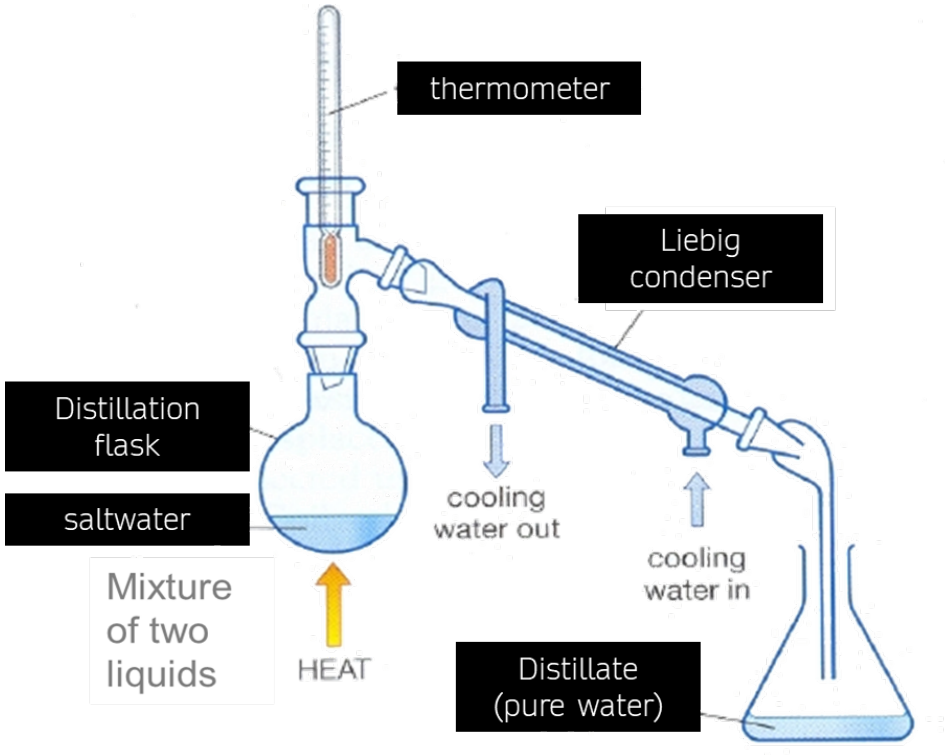
Magnetism can be used to separate a magnetic substance (such as iron) from a mixture containing non-magnetic substances (such as sulfur or sand).

The magnetic substance of the mixture is separated with the help of the magnetic attraction.

A magnet is moved over the mixture containing the magnetic substance e.g., iron filings. These get attracted to the magnet. The process is repeated until the magnetic material is completely separated from the mixture. The non-magnetic substance is left behind.

Distillation

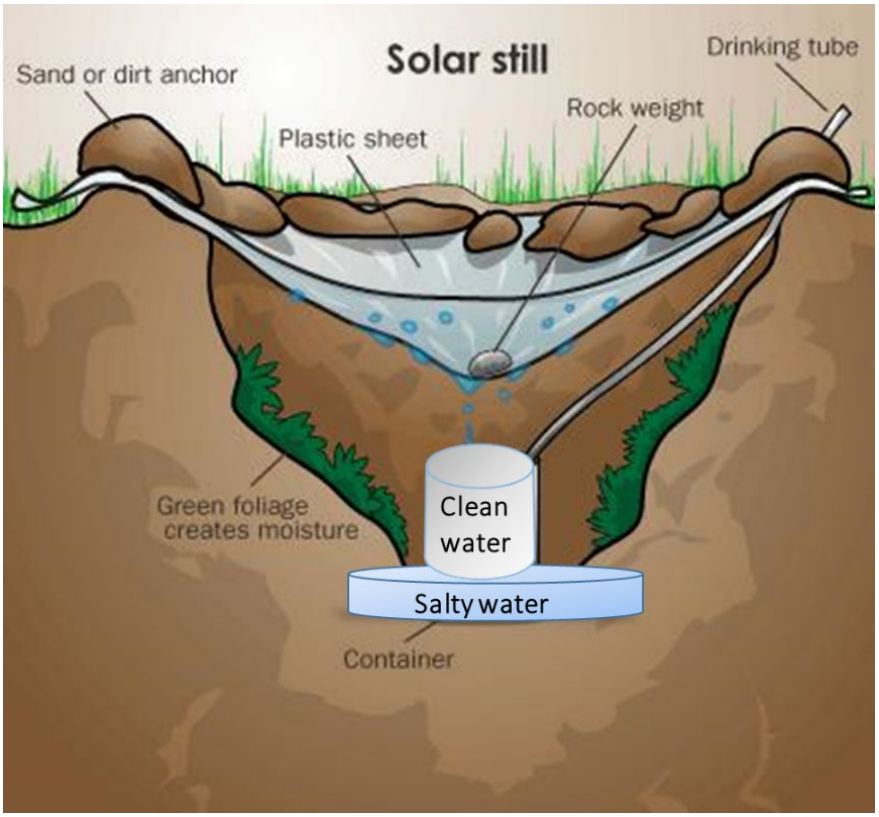
Distillation is a process of boiling a liquid until it forms a vapour and condensing, then collecting the liquid. The liquid collected is the distillate. The Liebig Condenser cools the vapour back into liquid. The purpose of distillation is separation of a mixture of two liquids. This is possible if the two substances have different boiling points. The substance with the lower boiling point turns to gas and is collected while the other substance with a higher boiling point remains as a liquid in the flask.



Mixtures can be easily separated physically - Summary

Separation technique	Property used for separation	example
Magnetic Attraction	magnetism	magnetic iron can be separated from non-magnetic sulfur using a magnet
Decanting	density or solubility	liquid water can be poured off (decanted) insoluble sand sediment less dense oil can be poured off (decanted) more dense water
Filtration	solubility, size of particles	sand can be separated from a solution of sodium chloride in water by filtration
Evaporation	solubility and boiling point	soluble sodium chloride can be separated from water by evaporation
dissolving	solubility	soluble salt can be separated from sand by dissolving into a solvent
Distillation	boiling point	ethanol can be separated from water by distillation because ethanol has a lower boiling point than water

Survival with a solar sill – making pure water from salty water



With a few pieces of equipment, a **solar sill** can be made to produce clean drinking water.

A **hole** must be dug with a container of the salty water placed at the bottom.

Another **collecting container** sits on top with a straw leading out of it for drinking.

A **plastic sheet** covers the hole and is secured with rocks. A rock weight is placed on the sheet.

Water is **evapourated** from the salty water, **condenses** on the plastic sheet and drips into the collecting container.

1. Look at the list of mixtures and identify the type of substances (solid, liquid or gas) that are mixed in each of the examples on the list. Write the name of each example in the appropriate block on the diagram.

Mixtures:

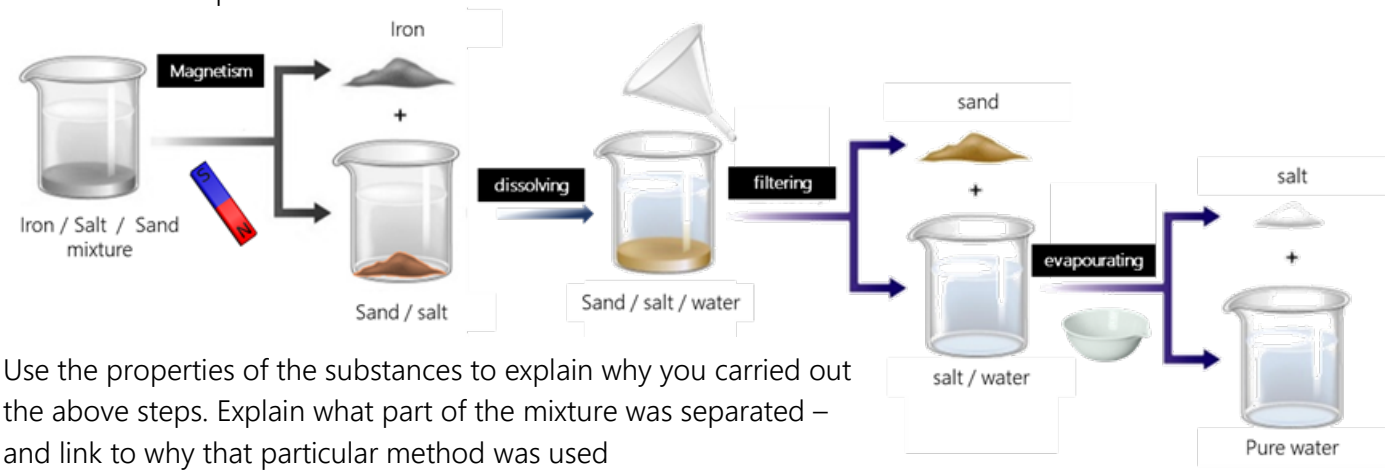
air	Italian salad dressing (vinegar and oil)	Pure orange juice
Iron sand	cordial	Bubbly coca cola
water and ice	Muesli	Fly spray
Chocolate chip cookies	Stainless steel (Metal alloy)	Weetbix and milk
milk	Ocean water	pizza

For instance, air would go in the top block of the top row, to show that it is mostly a gas (oxygen) mixed with a gas (nitrogen)

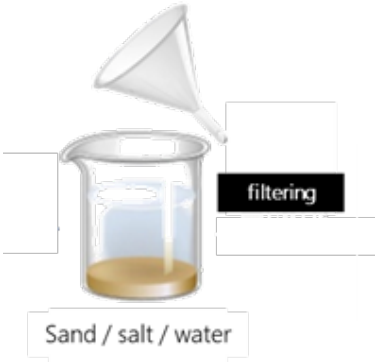
	gas		
gas	Air	liquid	
liquid			solid
solid			

2. Research to add at least one of your own examples to each box above

3. Sand on a beach is a mixture of **iron sand**, **normal sand** and **salt**. To separate the mixture into its parts you should follow the process below

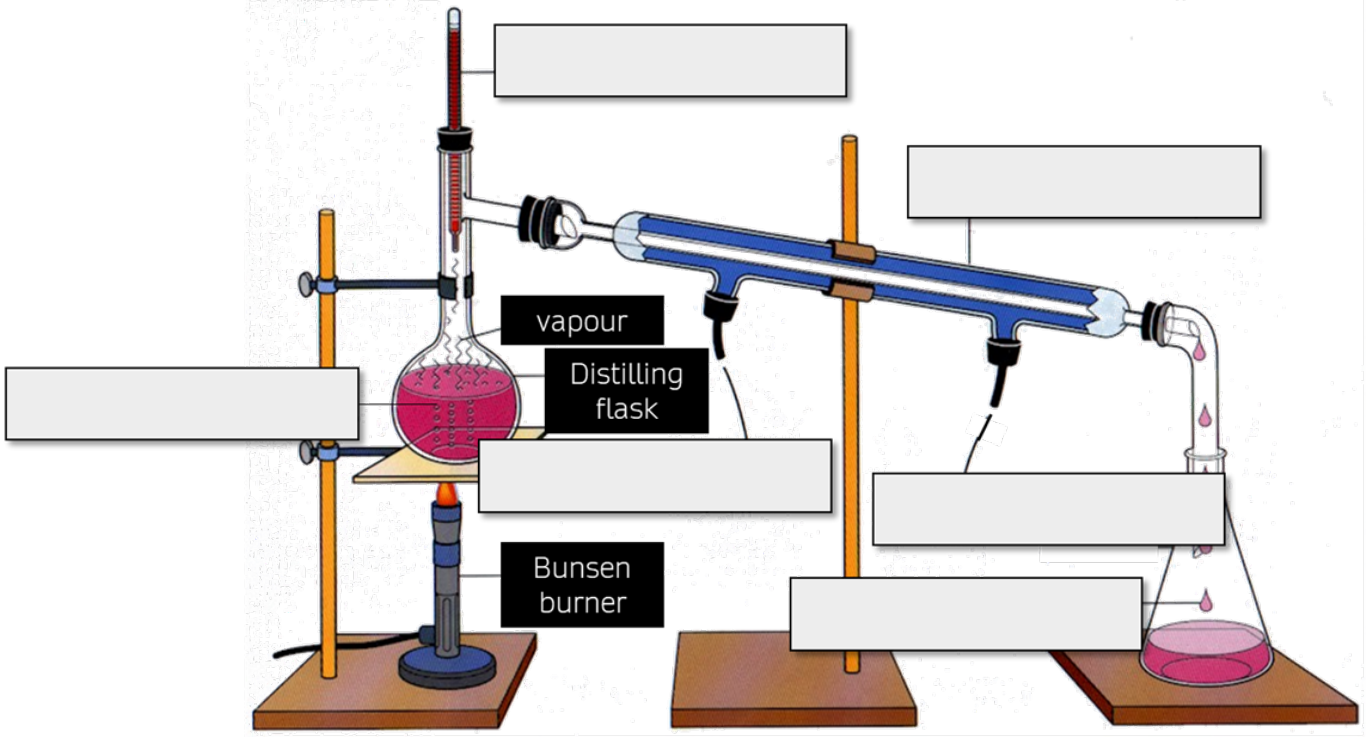


Use the properties of the substances to explain why you carried out the above steps. Explain what part of the mixture was separated – and link to why that particular method was used

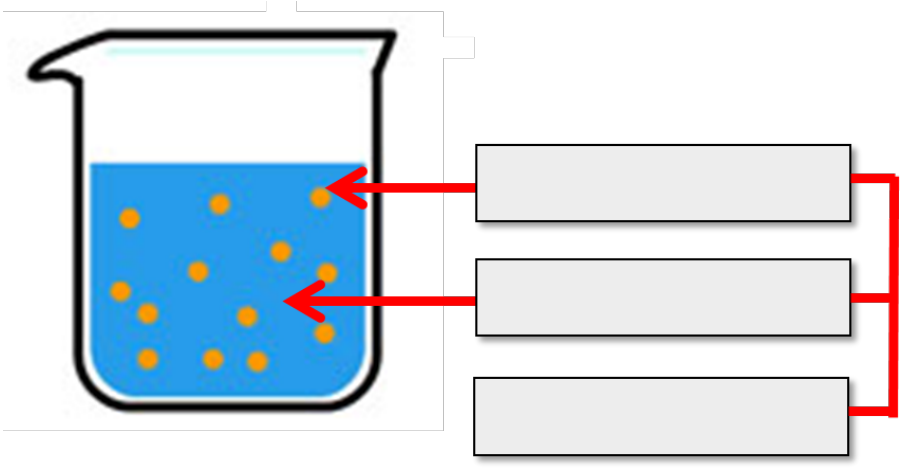
Step	Explanation
	
	
	
	

4. a. Complete labelled diagram of the distillation process for a water and methylated spirits mixture

condenser	*water and meths mixture*	*thermometer*	*water in*	*water out*	*methylated spirits*



4b. What physical property is used to separate the water and Methylated spirits mix above? Explain the process occurring to separate the two liquids.



5. Label the mixture of salt water beside THEN identify the substances

component	substance
solution	
solvent	
solute	