

# Edexcel Chemistry GCSE

## Topic 2 - States of Matter and Mixtures

### Flashcards

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Describe the arrangement and movement of particles in solids



Describe the arrangement and movement of particles in solids

Tightly packed together in a regular arrangement.

Vibrate in fixed positions.



Describe the arrangement and movement of particles in liquids



Describe the arrangement and movement of particles in liquids

Close together but able to move past each other.

Vibrate and move around each other.



Describe the arrangement and movement of particles in gases



Describe the arrangement and movement of particles in gases

Well separated with no regular arrangement.

Vibrate and move freely at high speeds.



Compare the relative energies of particles in solids, liquids and gases





Compare the relative energies of particles in solids, liquids and gases

Particles in a solid have the least amount of energy and particles in a gas have the most energy.



What does 'interconversion of state'  
mean?



What does 'interconversion of state' mean?

When matter changes from one state to another due to changes in temperature or pressure.



What are the names for the state changes from solid to liquid and vice versa?



What are the names for the state changes from solid to liquid and vice versa?

Solid → liquid: Melting

Liquid → solid: Freezing



What are the names for the state changes from liquid to gas and vice versa?



What are the names for the state changes from liquid to gas and vice versa?

Liquid → gas: Evaporation

Gas → liquid: Condensation



Describe the forces between particles in solids, liquids and gases





# Describe the forces between particles in solids, liquids and gases

Solids - Strong forces of attraction between particles which keeps them in their fixed positions.

Liquids - Weaker attractive forces than in solids.

Gases - Weakest intermolecular forces so particles are in random movement.



How does a physical change differ from a chemical change?



# How does a physical change differ from a chemical change?

A physical change involves changes in the forces between particles. The particles themselves remain the same and the chemical properties remain the same.

A chemical change is different as it affects the chemical properties of the substance.



True or false?  
'Physical changes are relatively easy to reverse'



True or false?

‘Physical changes are relatively easy to reverse’

TRUE

Relatively easy to reverse since no new product is formed during the changes of state.



What is the term describing when a solid changes straight into a gas?



What is the term describing when a solid changes straight into a gas?

Sublimation



Describe what happens, in terms of particles, when a solid is heated and melts into a liquid





Describe what happens, in terms of particles, when a solid is heated and melts into a liquid

When heated the particles absorb thermal energy which is converted into kinetic energy. The particles in the solid vibrate more. This causes the solid to expand until the structure breaks, and becomes a liquid.



Describe what happens, in terms of particles, when a liquid is heated and evaporates into a gas



Describe what happens, in terms of particles, when a liquid is heated and evaporates into a gas

When heated, the particles in a liquid expand and some particles on the surface gain sufficient energy to overcome the intermolecular forces and evaporate. At the boiling point, all of the liquid particles gain enough energy to evaporate.



Substance A melts at  $-183^{\circ}\text{C}$  and boils at  $-50^{\circ}\text{C}$ . What state is A at  $-90^{\circ}\text{C}$ ?



Substance A melts at  $-183^{\circ}\text{C}$  and boils at  $-50^{\circ}\text{C}$ .  
What state is A at  $-90^{\circ}\text{C}$ ?

Liquid



# What is a mixture?



## What is a mixture?

Contains 2 or more elements or compounds that are not chemically combined together.

The chemical properties of each substance in the mixture are unchanged.



# What is a pure substance?





# What is a pure substance?

A single element or compound, not mixed with any other substance.



How can you use melting point data to distinguish between pure substances and mixtures?



How can you use melting point data to distinguish between pure substances and mixtures?

Pure substances have a sharp exact melting point whereas mixtures melt over a range of temperatures since they consist of several elements / compounds.



# When is simple distillation used?



# When is simple distillation used?

Used to separate a pure liquid from a mixture of liquids. Only works when the liquids have different boiling points.



# How can ethanol be separated from water?



# How can ethanol be separated from water?

Ethanol has a lower boiling point than water so can be separated from water by simple distillation:

- Distillation apparatus set up.
- Mixture boiled.
- Ethanol evaporates first.
- Ethanol vapour cools in the condenser, condensing back to a liquid before being collected.



When is fractional distillation used to separate mixtures?





When is fractional distillation used to separate mixtures?

Fractional distillation is used to separate all the elements/ compounds in a mixture. These chemicals must have different boiling points to be separated.



What is the difference between fractional and simple distillation?



# What is the difference between fractional and simple distillation?

Simple distillation is only able to separate the liquid with the lowest boiling point from the mixture.

Fractional distillation separates all the chemicals in a mixture, using their different boiling points.



# How does fractional distillation work?



## How does fractional distillation work?

- Oil is heated until it evaporates into the fractionating column.
- Vapours rise up the fractionating column and condense at the different fractions, depending on the relative boiling point of each substance.



What sort of mixtures can filtration be used to separate?



What sort of mixtures can filtration be used to separate?

Filtration is used to separate an insoluble substance from a solution.



Describe how to separate an insoluble substance from a solution





## Describe how to separate an insoluble substance from a solution

- Place filter paper in a funnel.
- Pour the solution containing an insoluble substance through the funnel into a conical flask.
- The insoluble substance will collect on the filter paper and the solution will collect in the conical flask.



When is the process of crystallisation used to separate a mixture?



When is the process of crystallisation used to separate a mixture?

To separate a soluble solid from a solution if the solid decomposes when heated.



How could you separate a soluble solid from a solution, if the solid decomposes when heated?



# How could you separate a soluble solid from a solution, if the solid decomposes when heated?

## Crystallisation:

- Pour the solution into an evaporating dish and heat gently.
- When the crystals start to form, remove the dish from the heat and leave to cool.
- Once cold, filter the crystals out of the solution and leave them in a warm place to dry.



What process can be used to identify substances in a mixture?



What process can be used to identify soluble substances in a mixture?

Chromatography



# How does paper chromatography work to separate a mixture?





# How does paper chromatography work to separate a mixture?

- The mobile phase (solvent) moves through the stationary phase (paper) so anything dissolved in the mobile phase will move with up the paper.
- Compounds interact differently with each phase so will move different distances through the stationary phase meaning they will be separated.



How can chromatography show the composition of a mixture?



How can chromatography show the composition of a mixture?

Different coloured substances in the mixture will separate as they have different solubilities in the solvent and will travel at different rates.



Why should pencil be used to draw the line along the bottom of the chromatography paper?



Why should pencil be used to draw the line along the bottom of the chromatography paper?

It will not affect the experiment as it is insoluble in the solvent.



Why should the water (solvent) in the beaker for paper chromatography be no deeper than 1 cm deep?



Why should the water (solvent) in the beaker for paper chromatography be no deeper than 1 cm deep?

If it is deeper it will wash away the substances placed on the line on the chromatography paper.



Why should you use a lid when carrying out paper chromatography?





Why should you use a lid when carrying out paper chromatography?

To prevent the solvent evaporating.



How many spots will a pure substance produce on a chromatogram? How would this be different for an impure substance?



How many spots will a pure substance produce on a chromatogram? How would this be different for an impure substance?

Pure substances produce one spot.

An impure substance contains more than one compound so will produce more spots (one spot for each chemical).



# What is an R<sub>f</sub> value?



# What is an Rf value?

The Rf value is the ratio between the distance travelled by the dissolved substance (the solute) and the distance travelled by the solvent.



# How do you calculate Rf values?



How do you calculate Rf values?

Rf =

Distance travelled by substance

Distance travelled by solvent



When measuring the distance moved by a substance on the chromatography paper, where should you measure between?





When measuring the distance moved by a substance on the chromatography paper, where should you measure between?

Measure from the pencil baseline to the middle of the spot of the substance.



How can you use chromatography to see if a certain substance is present in a mixture?



How can you use chromatography to see if a certain substance is present in a mixture?

Run a pure sample of this substance alongside the unknown mixture.

If the  $R_f$  value of the pure substance matches the value of one of the spots from the mixture, it is likely to be present.



True or false?

‘Substances with a higher solubility in the solvent will travel further up the chromatography paper’



True or false?

‘Substances with a higher solubility in the solvent will travel further up the chromatography paper’

TRUE

They will stay dissolved in the solvent (mobile phase) for longer.



How could you separate salt from a mixture of salt and sand?



How could you separate salt from a mixture of salt and sand?

- Salt is soluble in water, sand isn't.
- Add water to the mixture.
- Filter the solution to remove the insoluble sand.
- Evaporate the water to collect the salt crystals.



How can liquids be separated if they have different densities?





How can liquids be separated if they have different densities?

If liquids have different densities they will naturally separate into two layers.

To separate these layers, use a flask with a tap on the bottom. Open the tap to collect the bottom liquid (has the highest density).



# What does potable mean?



What does potable mean?

Safe to drink.



# How can waste and groundwater be made potable?



# How can waste and groundwater be made potable?

1. Sedimentation: Large insoluble particles sink to the bottom after the water is left still for a while.
2. Filtration: Removes small insoluble particles by passing the water through layers of sand and filters.
3. Chlorination: Kills bacteria and microorganisms which are too small to be removed by filtration.



# How can seawater be made potable?



# How can seawater be made potable?

## Distillation

1. Filter to remove insoluble particles.
2. Boil.
3. Cool and condense the water vapour.



What issues surround the process of making seawater potable?





What issues surround the process of making seawater potable?

- Extremely expensive as it requires a lot of energy to boil large volumes of water.
- Wastewater is toxic due to the high concentration of salt so must be disposed of carefully.



# What is deionised water?



# What is deionised water?

Water that has had metallic ions (such as copper or calcium ions) removed.



# Why is deionised water used in experimental analysis?



Why is deionised water used in experimental analysis?

Deionised water is used to prevent ions in the water interacting with the substances under analysis. If water wasn't deionised, false positive results may be produced.

