

# 1b - Elements, compounds and mixtures

## Edexcel IGCSE Chemistry Revision Notes

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### How to use these notes

These notes cover everything you need to know for this part of the specification. They have been written in question-answer format to make them easier for you to study from.

In order to study successfully, I recommend you do the following for each question and answer:

- Read it carefully and make sure you **understand** it.
- **Memorise** the answer.
- **Practice** applying your understanding to past exam questions.

A good way to memorise information is to use **retrieval practice**. This is when you practise retrieving information from your memory. You could do this by making a flashcard for each question with the question on one side and the answer on the other. Or you could use a flashcard app. Alternatively, use a sheet of paper to cover up the answer so you can only see the question. Try to answer the question and then check how you did.

You should practise retrieving each answer from your memory until you can do it perfectly. Even once you can retrieve the answer perfectly, your ability to retrieve it will probably fade as time passes without practising. Therefore you will need to keep going back to the questions that you have previously mastered and practising them again. However, each time you re-learn the answer, the memory will be stronger and will last longer than the time before.

### 1.8

#### What is a substance?

A substance is a solid, liquid or gas.

#### What is an element?

An element is a substance made up of only one type of atoms or ions.

**What is a compound?**

A compound is a substance made up of two or more types of atoms/ions chemically bonded together.

**What is a mixture?**

A mixture is a substance made up of two or more other substances that are mixed together but not chemically bonded.

## 1.9

**What is a pure substance?**

A pure substance is a substance that is not a mixture. In other words, it is a single element or compound.

**What is the difference between pure substances and mixtures in terms of their boiling points?**

A pure substance has a fixed melting point and a fixed boiling point. Whereas a mixture may melt or boil over a range of temperatures.

## 1.10

**What are some of the techniques used to separate mixtures into their components?**

Some techniques used to separate mixtures into their components are:

- Simple distillation
- Fractional distillation
- Filtration
- Crystallisation
- Paper chromatography

**What type of a mixture can be separated using simple distillation?**

A solute can be separated from a solvent by simple distillation.

**How is simple distillation carried out?**

Simple distillation is carried out as follows:

- Place the solution into a round bottomed flask with a side arm.
- Place a bung in the top of the flask, with a thermometer poking through the bung.
- Attach a condenser to the side arm of the flask.
- Place a beaker under the other end of the condenser.
- Heat the solution in the flask to at least the boiling point of the solvent.

The solvent will boil and rise up and out of the side arm, leaving the solute behind. Once the gaseous solvent reaches the condenser it will condense back to a liquid and flow out of the condenser into the beaker.

### **What type of mixture can be separated using fractional distillation?**

Fractional distillation can be used to separate any mixture in which the components have different boiling points.

### **How is fractional distillation carried out?**

Fractional distillation is carried out as follows:

- Place the mixture in a round bottomed flask with a side arm.
- Place a bung in the top of the flask, with a thermometer poking through the bung.
- Attach a condenser to the side arm of the flask.
- Place a beaker under the other end of the condenser.
- Heat the flask to the boiling point of whichever component of the mixture has the lowest boiling point.
- Wait until all of that component has boiled off and been collected in the beaker.
- Then remove the beaker and place a fresh beaker under the end of the condenser.
- Now heat the mixture to the boiling point of whichever component has the second lowest boiling point.
- Wait until all of that component has boiled off and been collected in the beaker. Then remove the beaker and place a fresh beaker under the end of the condenser.
- Continue in this way until all of the components of the mixture have been separated.

### **What types of mixtures can be separated using filtration?**

Filtration can be used:

- To separate a mixture of an insoluble solid and a liquid.
- To separate a mixture of a soluble solid and an insoluble solid.

### **How is filtration used to separate an insoluble solid from a liquid?**

Filtration is used to separate an insoluble solid from a liquid as follows:

- Fold a piece of filter paper into a cone and place it into a funnel.
- Place the funnel in a beaker.
- Pour the mixture into the filter paper in the funnel.

The liquid will pass through the filter paper and drain into the beaker.

The insoluble solid will remain in the filter paper.

### **How is filtration used to separate a mixture of a soluble solid and an insoluble solid?**

Filtration is used to separate a mixture of a soluble solid and an insoluble solid as follows:

- Pour water into the mixture and stir so that the soluble solid dissolves in the water. The insoluble solid will remain undissolved.
- Fold a piece of filter paper into a cone and place it into a funnel which is placed in a beaker.
- Pour the mixture into the filter paper.

The liquid with the soluble solid dissolved in it will pass through the filter paper and drain into the beaker.

The insoluble solid will remain in the filter paper.

### **What type of mixture can be separated using crystallisation?**

Crystallisation can be used to separate a soluble solid from the solvent it is dissolved in. However, only the solid is obtained since the solvent evaporates away.

### **How is crystallisation carried out?**

Crystallisation is carried out as follows:

- Place the solution in an evaporating basin.
- Heat the evaporating basin with a Bunsen burner until some of the solvent has evaporated off.
- Then turn the Bunsen burner off and wait until the rest of the solvent evaporates off.

As the solvent evaporates off, crystals of the solid will form in the evaporating dish.

### **What type of mixture can be separated using paper chromatography?**

Paper chromatography can be used to separate a mixture in which the components have different solubilities in water.

### **How is paper chromatography carried out?**

Paper chromatography is carried out as follows:

- Take a piece of paper and draw a pencil line across it a few centimetres from the bottom.
- Put a spot of the mixture on the pencil line.
- Stand the piece of paper up in a beaker containing a small amount of water. The bottom of the piece of paper should be in the water, but the level of the water should be below the pencil line.

The water will move up through the paper. Once the water reaches the spot of the mixture, the components of the mixture will dissolve in the water and be carried up the paper by the water. The components of the mixture will come out of the water and form new spots at different heights up the paper depending on their solubility.

**In paper chromatography, what is the stationary phase?**

In paper chromatography, the stationary phase is the paper (because it does not move).

**In paper chromatography, what is the mobile phase?**

In paper chromatography, the mobile phase is the water (because it moves up the paper).

## 1.11

**In paper chromatography, once the components of the mixture have separated into different spots, what is the piece of paper with the spots on it called?**

In paper chromatography, once the components of the mixture have separated into different spots, the piece of paper with the spots on it is called a chromatogram.

**What information does a chromatogram give about the components of a mixture?**

A chromatogram provides the following information:

- A chromatogram shows how many components a mixture contains. The number of components is equal to the number spots that the original spot separates into.
- This distance that each spot travels can be used to calculate something called an  $R_f$  value, which can be used to identify the component.

**How can paper chromatography be used to compare mixtures?**

Paper chromatography can be used to compare mixtures by putting multiple mixtures on the same piece of paper. A spot of each mixture is placed on the pencil line, with plenty of space between the spots. Then when the mixtures separate into their components, they can be compared to see whether they contain any of the same components.

## 1.12

**Once the components of a mixture have been separated by paper chromatography, how do you calculate an  $R_f$  value for one of the components?**

Once the components of a mixture have been separated by paper chromatography, you can calculate the  $R_f$  value for one of the components by doing the following:

- Measure the distance from the pencil line to the spot for that component. This is the distance travelled by the component.
- Measure the distance from the pencil to the furthest point on the paper that the water has reached. This is the distance travelled by the solvent.
- Divide the distance travelled by the substance by the distance travelled by the solvent, as shown below.

$$R_f = \frac{\text{Distance travelled by substance (cm)}}{\text{Distance travelled by solvent (cm)}}$$

**How can a component of a mixture be identified by its  $R_f$  value?**

A component's  $R_f$  value can be looked up in a database to find out what the component is.