

Pure and Impure Substances

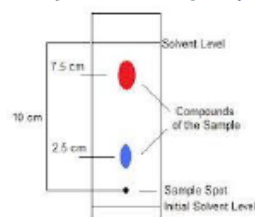
- A pure substance contains only one type of element or compound.
- An impure substance contains more than one type of element or compound in a mixture, for example salt water contains NaCl and H₂O. All mixtures are impure substances.
- Mixtures are much easier to separate than elements or compounds as they are not chemically bonded
- There are a variety of ways that mixtures can be separated and they are outlined below. Remember that these are all physical changes and chemical bonds are not broken during any of these processes.

Melting Point and Boiling point

- A chemically pure substance will melt or boil at a very specific temperature.
- If a substance is chemically impure it will melt or boil at a lower temperature and across a broader range.
- The closer the substance is to the melting point the purer the substance.

Chromatography and Rf values

- When carrying out chromatography we can calculate an Rf (retention factor) value/
- The retention factor is a ratio between the distance travelled by the solvent and the distance travelled by a compound.
- Chromatography has two phases- a stationary phase where particles can't move (the filter paper in most cases), a mobile phase where particles can move (a solvent for example water).
- Different compounds will have different Rf values in different solvents, this allow us to see whether a substance is pure or impure.
- To calculate Rf value you need to divide the distance moved by the solvent by the distance moved by the spot.
- For example to work out the Rf for the spot further up the paper:
- $Rf = \frac{B}{A} = \frac{7.5}{10} = 0.75$
- There are no units as the answer is a ratio
- The higher the Rf the further the spot has moved up the paper, compared to the solvent.



Gas Tests

During electrolysis the products made are often gases. Below are the tests for three common gases you need to know:

Gas	Test	Result
Hydrogen	Place a lit splint into the gas	If a squeaky pop is heard hydrogen is present
Oxygen	Place glowing splint into gas	If splint is relighted then oxygen is present
Chlorine	Damp litmus paper placed in gas	If paper bleaches, chlorine is present
Carbon Dioxide	Bubble the gas through limewater	If the limewater goes cloudy carbon dioxide is present

Formulations

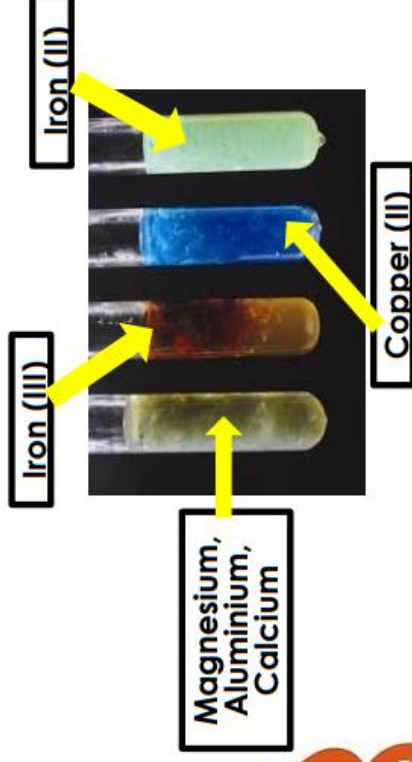
- Formulations are mixtures made using a precise amount of each substance, so they can serve a particular purpose.
- For example in paints or in pills.

Name	Diagram	Explanation
Chromatography		<ul style="list-style-type: none"> Different substances travel different distances up the paper depending on their solubility in the solvent used (it is often water but not always). The more soluble, the further it moves up the paper Line must be drawn with pencil because pencil will not run. Artificial colours in foods can be identified using chromatography. Additives do not necessarily have a colour and therefore are identified using chemical analysis.
Distillation		<ul style="list-style-type: none"> Distillation is when two liquids with <i>different boiling points</i> are separated For example ethanol (alcohol) boils at 78 °C and water boils at 100 °C If you heat a mixture of water and ethanol to 80°C the ethanol will evaporate but the water will not. You then condense the ethanol and collect the pure ethanol
Crystallisation		<ul style="list-style-type: none"> Crystallisation is when a solvent is evaporated from a solute.

Testing for CATIONS

Two types of test can be used:

- performing a flame test
- adding sodium hydroxide solution



Testing for ANIONS

Three types of test can be used to test for carbonates (CO_3^{2-}), halides (Br^- , Cl^- , I^-) and sulfates (SO_4^{2-})

• Halides = adding nitric acid and silver nitrate

• Sulfates = adding hydrochloric acid and barium chloride

• Carbonates = dilute acid and limewater



TEST FOR GASES

Oxygen – place glowing splint in test tube. Will relight if present.

Carbon dioxide – bubble through limewater. Will turn cloudy if present.

Hydrogen – hold a lit splint at the end of a test tube. Will produce a squeaky pop if present.

Chlorine – will bleach damp litmus paper, making it turn white.

Instrumental methods for analysing substances rely on the use of machines.

Advantages:

- Rapid
- Sensitive
- Accurate

Flame emission spectroscopy is used to analyse metal ions in solutions.

HOW IT WORKS?

The sample is put into a flame and the light given out is passed through a spectroscope. The output is a line spectrum that can be analysed to identify the metal ions in the solution

Each element emits light at a different wavelength so the line spectrum produced is individual for each element

