4.8 Revision Checklist for Analysis

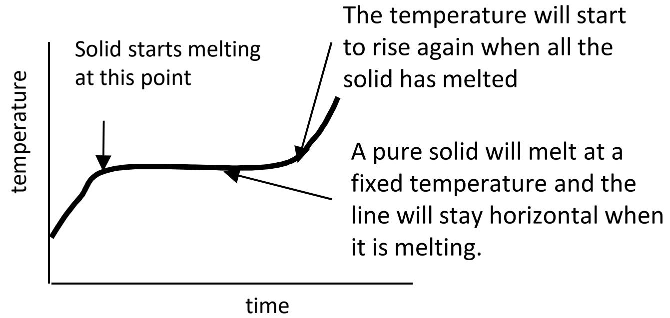
Pure Substances

In chemistry, a pure substance is a single element or compound, not mixed with any other substance.

In everyday language, a pure substance can mean a substance that has had nothing added to it, so it is unadulterated and in its natural state, eg pure milk.

Pure elements and compounds melt and boil at specific temperatures.
Melting point and boiling point data can be used to distinguish pure substances from mixtures.
A **pure substance** will melt or boil at a **fixed temperature.**
A **mixture** or impure substance will melt over a **range of temperatures** and not a sharp melting point

Melting point curve



The temperature does not rise when the solid is melting because the heat is absorbed to break the bonds between the solid particles

Formulations

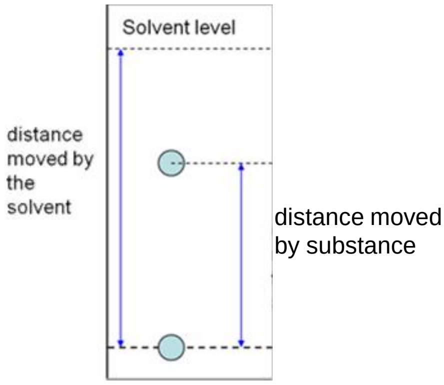
- A formulation is a **mixture** that has been **designed as a useful product**. Many products are complex mixtures in which each chemical has a particular purpose.
- Formulations are made by mixing the components in carefully measured quantities to ensure that the product has the required properties.
- Formulations include fuels, cleaning agents, paints, medicines, alloys, fertilisers and foods

Chromatography

Chromatography can be used to separate mixtures and can give information to help identify substances.

In paper chromatography a solvent moves through the paper carrying different compounds different distances. The distance the substance moves depends on their attraction for the paper and their solubility in the solvent.
If a compound is more soluble in the solvent it will move further up the paper.
If a compound is not soluble in the solvent it will not move up the paper

Chromatography involves a **stationary phase** (paper) and a **mobile phase** (solvent). Separation depends on the distribution of substances between the phases.



Required Practical Method: **chromatography**
a) draw a **pencil line** 1 cm above the bottom of the paper and mark spots for each sample, equally spaced along line.
b) Add a **tiny drop** of each substance to a different spot
c) Add solvent to beaker with a lid so that is no more than **1cm in depth**
d) Place the paper into the beaker, **making sure that the level of the solvent is below the pencil line**. Replace the **lid to get a tight** seal.
e) When the level of the solvent reaches about 1 cm from the top of the paper, remove the paper and mark the solvent level with a pencil.
f) Calculate the Rf values of the observed spots.

pencil line –will not dissolve in the solvent
tiny drop – too big a drop will cause different spots to merge
Depth of solvent– if the solvent is too deep it will dissolve the sample spots from the plate
lid– to prevent evaporation of solvent

The ratio of the distance moved by a compound (centre of spot from origin) to the distance moved by the solvent can be expressed as its R_f value:

$$R_f = \frac{\text{distance moved by substance}}{\text{distance moved by solvent}}$$

The compounds in a mixture may separate into different spots depending on the solvent. A pure compound will produce a single spot in all solvents.

Different compounds have different R_f values in different solvents, which can be used to help identify the compounds.

Gas Tests

Gas	Test	Result
Hydrogen	**burning splint** held at the open end of a test tube of the gas.	Hydrogen burns rapidly with a **pop sound**.
Oxygen	a **glowing splint** inserted into a test tube of the gas.	The **splint relights** in oxygen.
Carbon dioxide	uses an aqueous **solution of calcium hydroxide** (lime water).	When carbon dioxide is shaken with or bubbled through limewater the **limewater turns milky (**cloudy).
Chlorine	**damp litmus** paper	litmus paper is **bleached** and **turns white.**