Purity

In chemistry a pure substance contains only an **element** or a **compound**. It's not mixed with anything else. But in everyday language, a pure substance can mean a substance that has had nothing added to it, so it is in its natural state, e.g. pure milk.

The melting point (MP) or boiling point (BP) tells you how pure a substance is

- Pure elements and compounds **melt** and **boil** at **specific** temperatures
- You can test the purity of a sample by measuring its BP and MP, and then compare it to the BP and MP of pure substances (find from a data book)
- The closer your measured value is to the actual BP or MP, the **purer** your sample is. i.e. the purer the compound the narrower the range.

Impurities in your sample;

- **Lower** the MP and **increase** the melting range of your substance
- **Increase** the boiling point and may result in your sample boiling at a **range** of temperatures

Formulations

Is a mixture that has been designed to produce a useful product with a precise purpose, that are made by following a 'formula' (a recipe).

E.g. of formulations: paint, medicinal drugs, fragrance additives, fuels, fertilisers, pesticides, alloys, cosmetics & food products.

Paints are formulations, they contain:

- A **pigment**, to provide colour
- A **binder (resin)**, to help the paint attach itself to an object and to form a protective film when dry
- A **solvent**, to help the pigment and binder spread well (dissolve) during painting by thinning them out (alter the viscosity)
- An **additive**, to further change the physical and chemical properties of the paint.

Washing up liquids are formulations, they contain:

- A **surfactant**, the actual detergent that removes the grease.

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- **Water**, to thin out the mixture so it can squirt more easily from the bottle.
- **Colouring and fragrance additives**, to improve the appeal of the product to customers.
- **Rinse agent**, to help water drain off crockery

Formulations in the industry

Are very important. E.g. pharmaceutical industry

Medicines are formulations:

Alter formulations of a pill, to ensure it delivers the drug to the correct part of the body; At the right concentration; To make sure it can be consumed; It has a long enough shelf life etc.

E.g. products have info about composition on the packaging;

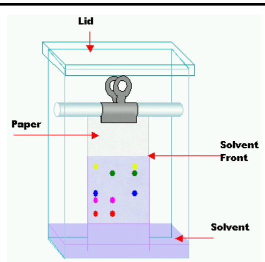
Ratio/percentage of each component

Choose the right composition for your particular use

Chromatography

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

Chromatography always involves a **mobile phase** and a **stationary phase**.



- The mobile phase, where the molecules **can** move. Always liquid or gas.
- The stationary phase, where the molecules **cannot** move. Solid or really thick liquid.
- During chromatography, the substance constantly move between mobile (M) and a stationary (S) phase = Equilibrium formed
- The mobile phase, moves through the stationary phase, and anything dissolved in the mobile phase moves with it.
- How quick a chemical moves depends on 'distribution' between phases, i.e. how much more time it spends in M or S phase.
- More time in M phase = move further
- Components in a mixture normally separate through S phase

- **Pure substance** = **one spot only**, one substance, in any solvent
- If the unknown sample is a mixture of compounds, there is usually more than one spot formed on the chromatogram.
- A substance with a stronger force of attraction between itself and the mobile phase is carried further
- than a substance with a stronger force of attraction between itself and the stationary phase.
- In paper chromatography the **mobile** phase is the **solvent** (e.g. water or ethanol)
- The **stationary** phase is the **paper**.

How long molecules spend in each phase depend:

1) how soluble they are in the solvent
2) how attached they are to paper

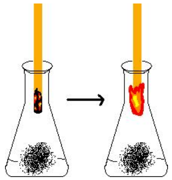
- Molecules with **higher solubility** and **less attracted** to paper = spend more time in M phase

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

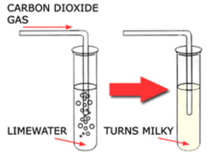
Test for gases

Hydrogen: Use a burning splint held at the open end of a test tube of the gas. Hydrogen burns rapidly with a pop sound.

Oxygen: Use a glowing splint inserted into a test tube of the gas. The splint relights in oxygen.



Carbon dioxide: Use an aqueous solution of calcium hydroxide (lime water). When carbon dioxide is shaken with or bubbled through limewater, the limewater turns milky (cloudy).



Chlorine: Use litmus paper. When damp litmus paper is put into chlorine gas the litmus paper is bleached and turns white.