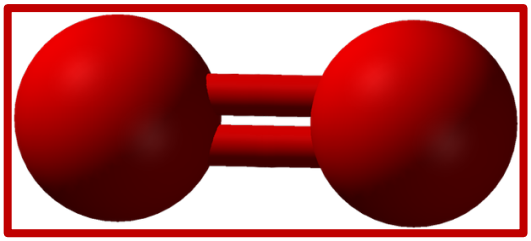
2 | Elements, Compounds & Mixtures

---------- Elements ----------

- Elements are substances that are made up of the same number of protons (or atomic number).
- It cannot be split simpler by chemical means.
- Example: Oxygen, Magnesium, Carbon



Critical Thinking

Why do you think the element above is denoted with one type of color and shape only?

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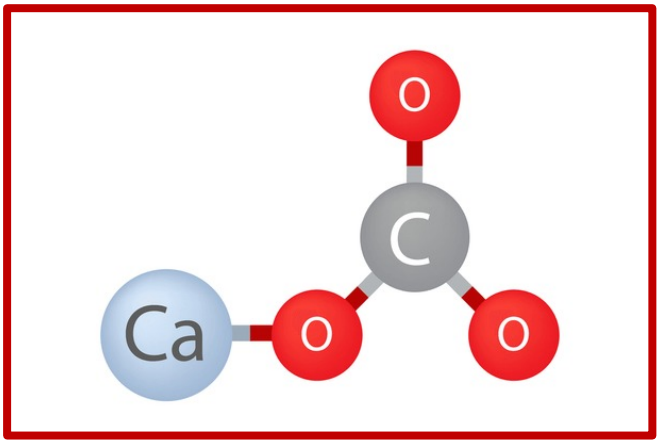
2 | Elements, Compounds & Mixtures

---------- Compounds ----------

- Compounds are made up of two or more elements that are chemically combined.
- They are combined in fixed proportions or ratios.
- Example: Calcium chloride, Zinc oxide, Copper carbonate.
- The below image displays a particle model of calcium carbonate.



Critical Thinking

What do you think is the ratio of calcium carbonate? Explain why.

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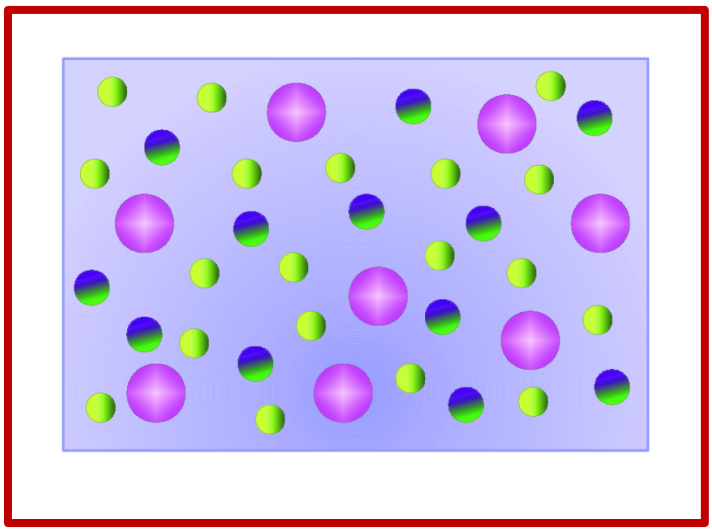
2 | Elements, Compounds & Mixtures

---------- Mixtures ----------

- Mixtures are a combination of two or more substances yet not chemically combined together.
- They are separated by physical means. E.g., filtration, sieving, distillation.
- At any proportion, mixtures can be made.



---------Simple Differences between Compounds and Mixtures -------

- Proportion:

A compound is made out of a fixed ratio. In other words, if that compound needs to be made, that fixed ratio needs to be present when forming that compound.

Remember: ratio means the number of each element.

For example: You always need 2 hydrogens and 1 oxygen to make water.

H_20

Meanwhile, mixtures can be made at any proportion of elements or compounds.

For example: to make a sample of air, you need carbon dioxide, oxygen, nitrogen and argon but it doesn't really matter on the number of each element that is needed to make them.

- Properties

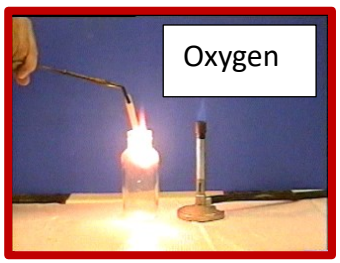
A mixture of elements will have its constituted elements keeping its own properties.

For example: a mixture of iron fillings and sand is present.

Iron fillings will have its magnetic properties and sand will have its non-magnetic properties.

However, compounds have its own properties which are different from the elements it was made from. Usually because compounds are formed after a chemical reaction which means compounds are a new substance, which is totally different from reactant elements.

For example: Take H_2O (water) and O (oxygen) as an example.



2 | Elements, Compounds & Mixtures

Do you notice that water extinguishes fire but oxygen (its reactant element) combusts or burns?

This proves that the properties of a compound are different from the properties of the element it was constituted from.

- Ease of Separation

Mixtures can be separated by physical means. Separation through physical means is easy as we do such with separation techniques.

Yet for compounds, we have to separate it by using chemical reactions, such as electrolysis.

- Melting point and Boiling point

Pure substances or compounds have a fixed or a definite melting and boiling point.

While for mixtures, they have a range of temperatures to be its boiling point or melting point.

Critical Thinking

Sample B was recorded with a melting point of 87°C and a boiling point of 99°C. Explain why we can't regard it as a mixture.

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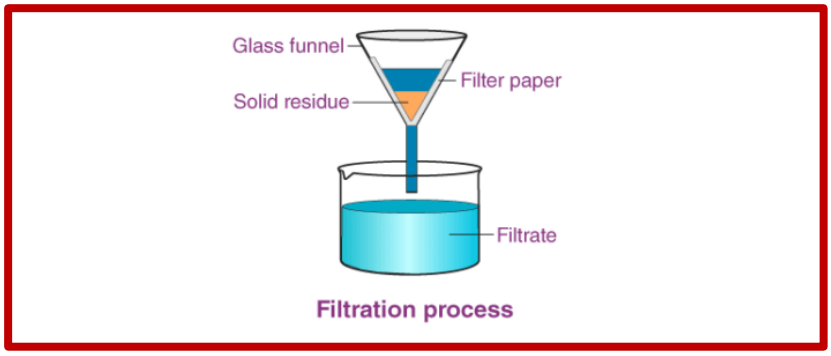
2 | Elements, Compounds & Mixtures

---------- Separation Techniques ----------

I) Filtration

- We use filtration to separate insoluble materials from a liquid.
- The property we are looking for when using filtration is insolubility.



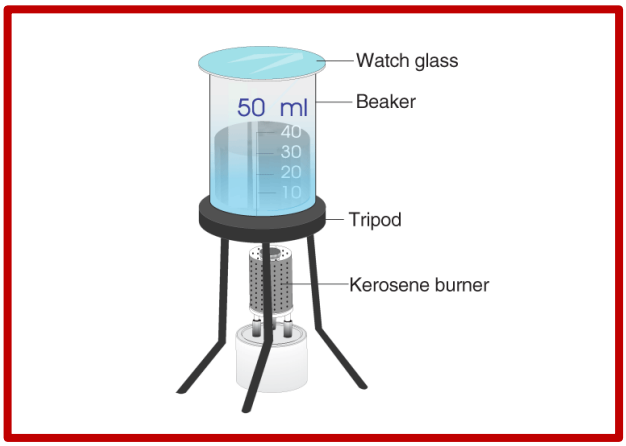
II) Crystallization

- Crystallization is used to separate a soluble solid from a solid.
- The property we are looking for when using crystallization is: solubility
- We use crystallization if we want:

  a) Solid crystals
  b) Removal of water

- The process of crystallization is noted below:

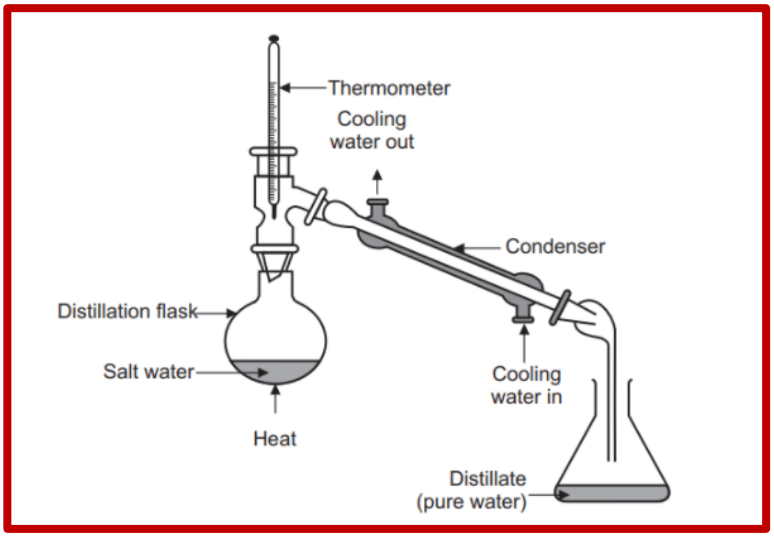
"The solution is heated in the basin to boil off some of the water, to remove it. this is to make the solution more concentrated. The solution will be cooled and crystals begin to grow as there is decreasing solubility. The crystals are collected from filtering the solution."



III) Simple Distillation

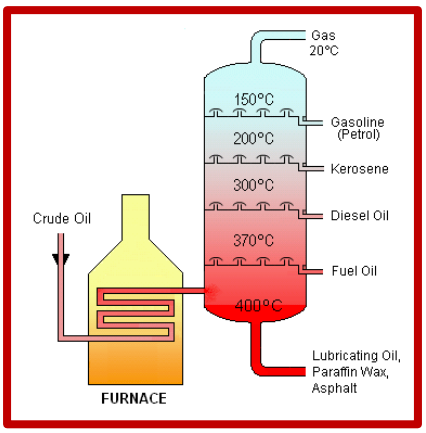
- Simple distillation can be used to separate the components of a solution.
- The property we are looking for when using distillation is: solubility.
- The only thing that differs from crystallization is that:

a) Water is separated and stored somewhere else within the set-up.
b) Crystals don't form.

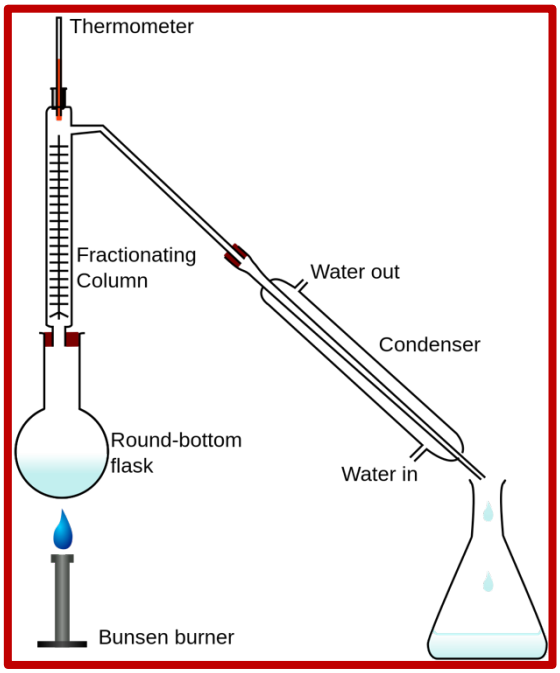


IV) Fractional Distillation

- Fractional distillation is used by separating a mixture of liquids.
- The property we are checking when using fractional distillation is: boiling point.
- The substance is able to boil first and vapors will pass through a condenser where they condense and gets stored as a liquid.



- We use fractional distillation when we are separating the contents of crude oil to get its relevant components.

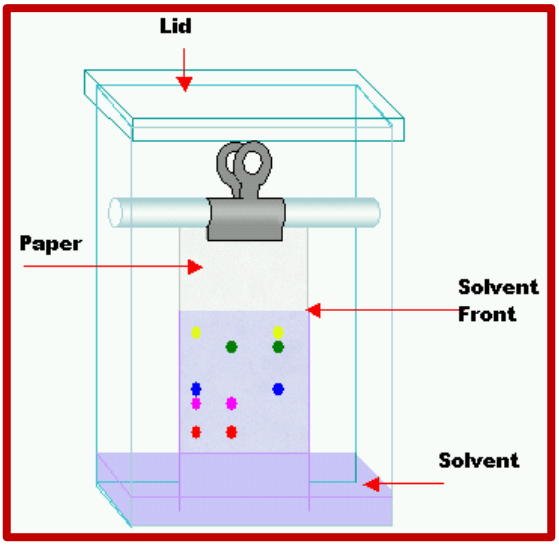


IV) Chromatography

- Paper chromatography is used to separate a variety of mixtures.
- We can use to check a mixture in one sample.
- Below is the general process for proceeding with chromatography.

"Draw a pencil line across the piece of chromatography paper. Next, put spots of mixtures on the pencil line. Then, suspend the chromatography paper on the beaker – which contains a small amount of water. Finally, place a lid on the beaker so the solvent won't get evaporated."

- If the dye does not move, it is not soluble.
- Further the dye moves, more soluble the dye is.
- If there is only spot, it is a pure compound.
- If the dye is separated into many spots, it is a mixture.



- We also can check for the R_f value – the retardation factor – to check for the components of a sample.
- R_f = distance moved by the spot / distance move by the solvent line