A close-up photograph of a variety of wrapped candies, including lollipops and wrapped chocolates, in various colors like red, green, yellow, and pink.

Separating mixtures

Separation techniques and flowcharts

ATAR Chemistry Unit 1, 2021



Outline

Outline

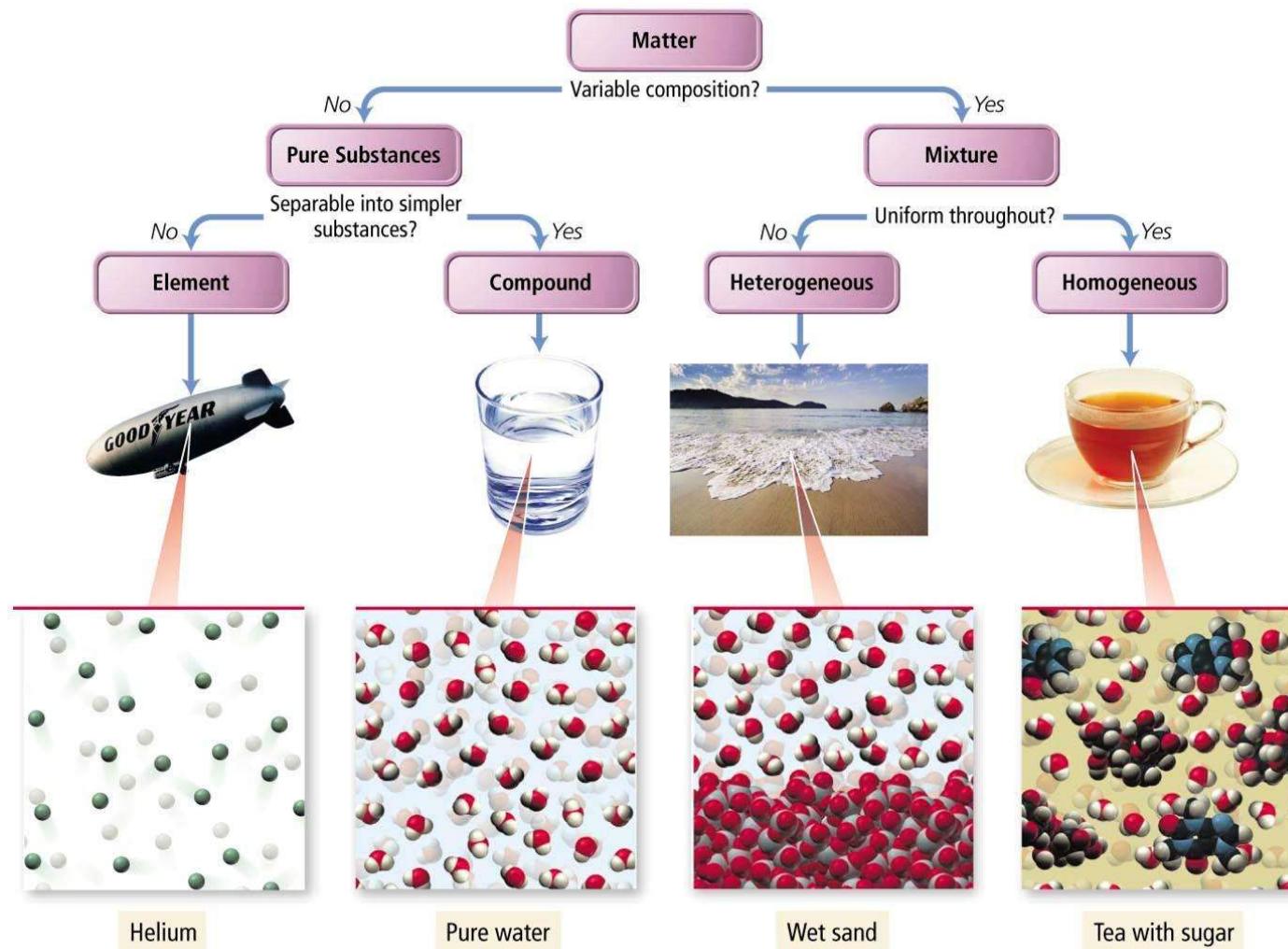
- Physical properties
- Separation techniques

Resources:

- Pearson ch 1.3 review Q 1.3
- STAWA



Review – classification of matter





Review – physical properties

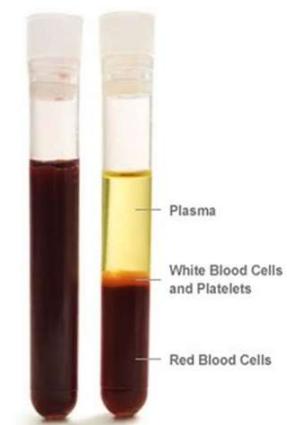
- Melting point – the temperature at which the solid changes state to a liquid
- ★ • Boiling point – the temperature at which the vapour pressure of the liquid equals the surrounding external pressure. The liquid changes into a vapour.
- Reactivity – the tendency of a substance to undergo chemical reactions, either with itself or with other materials.
- Hardness – the ability of a material to resist deformation from a force
- ★ • Density – a measure of a materials mass per volume
- ★ • Solubility – the ability for a one substance to dissolve in another substance
- ★ • Magnetism – the ability attract/repel other magnetic materials



Purifying materials

Separation and purification techniques play an important role in industry, research and at home, for example:

- Crude oil – can be separated into a large number of components using fractional distillation, the components being used in cars, to make plastics etc.
- Purifying silicon – 99.999 % silicon is used in solar panels, but you need 99.9999999 % silicon to make a microchip!
- In the kitchen – making cheese requires us to separate curds (solid, fatty bit) from the whey (the water like bit)
- Medicine – separate blood into plasma and blood cells





Purifying materials

What physical property can we use to separate this mixture?



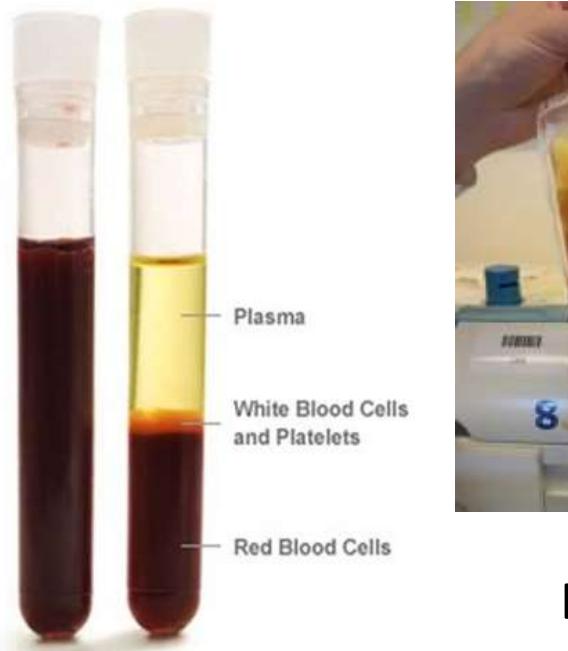
Crude oil

- Mixture of different hydrocarbons and organic compounds
- Can be separated based on the different boiling points of the substances
- Technique used: fractional distillation (we will cover in detail later)



Purifying materials

What physical property can we use to separate this mixture?



- Observation: See in the pictures that the darker red substance sinks to the bottom
- Inference: the mixture contains substances with different densities
- Technique used: centrifugation



Purifying materials

- Separating mixtures requires us to identify key physical properties then exploit the difference in properties to separate the components.
- In reality, the first step is to identify what are the components of the mixture. You will often be told.
- Determine the key physical properties of each component
- Pick a separation technique that exploits a difference in those properties



Separation by particle size

- Key property difference: Particle size
- Techniques: Sieving and filtration

sieving



Separating solids from solids

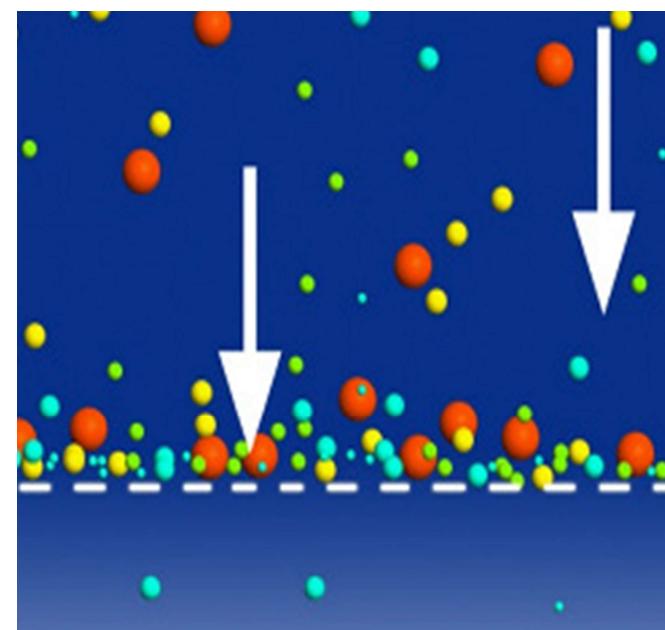
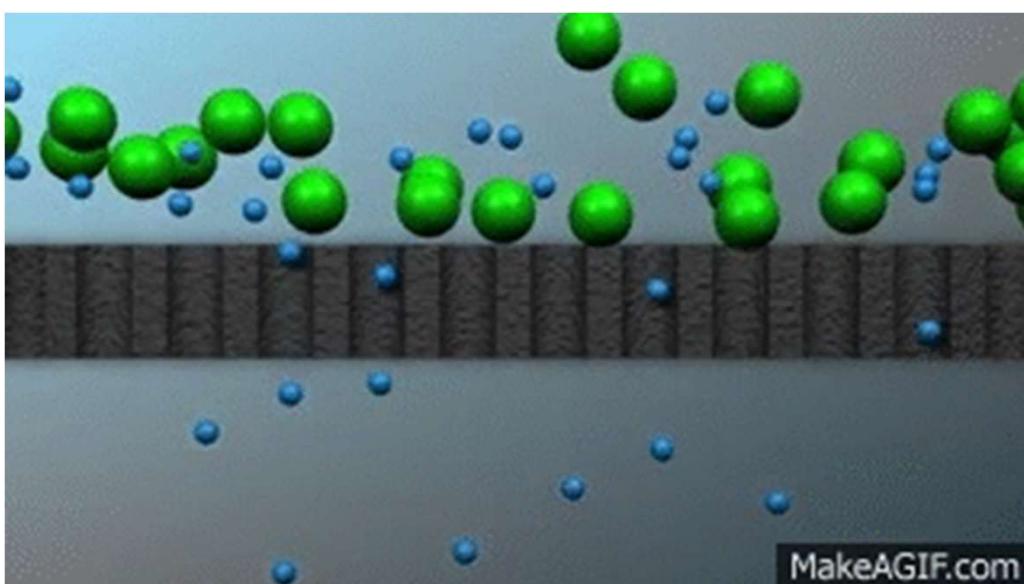
filtration



Separating solids from liquid or gases



Separation by particle size



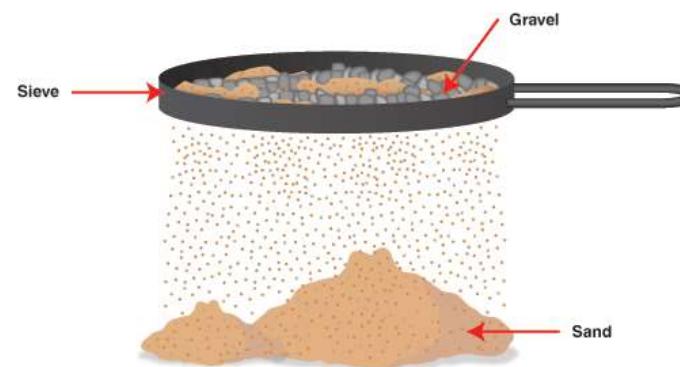
These particles are different sizes – only the small blue particles can pass through the barrier



Separation by particle size

Sieving – The process by which solid particles of various sizes can be physically separated using mesh of varying sizes.

- sieving flour to remove any lumps or foreign material.
- Earth to separate sand and rocks





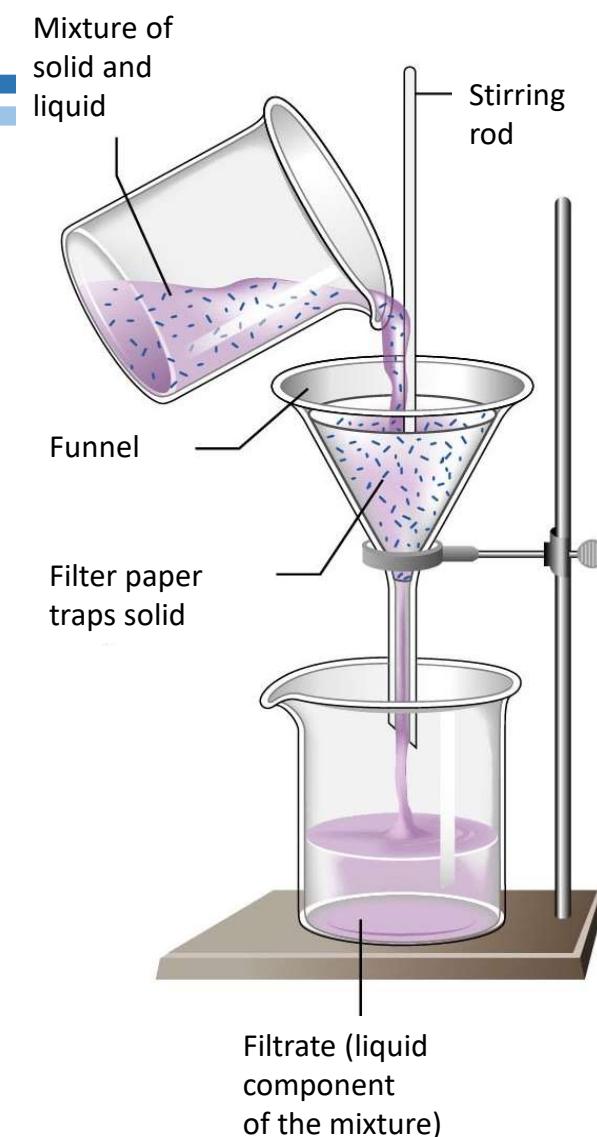
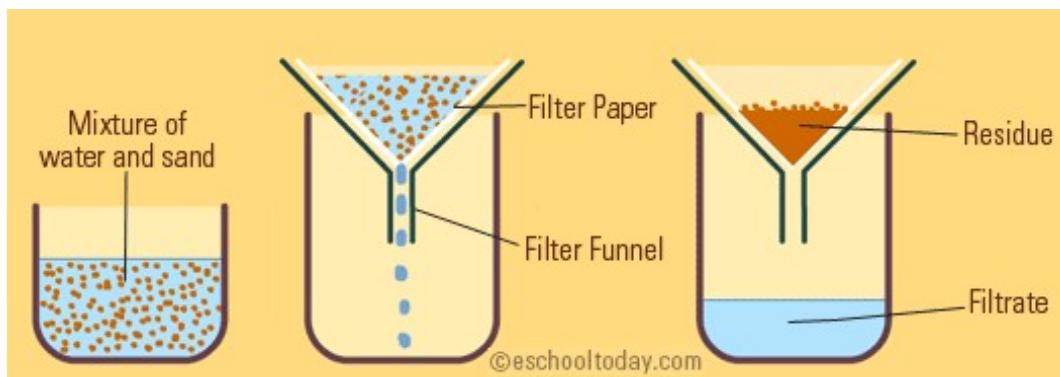
Separation by particle size

Filtration – Separation of solids or liquids

from a liquid or a gas by using a barrier

with holes smaller than the particles being

separated.

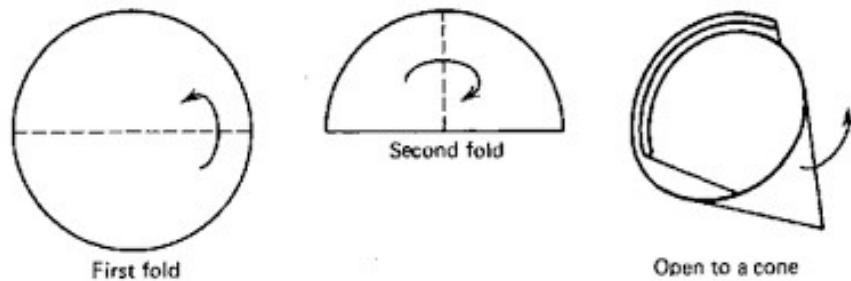




Separation by particle size

Folding filter paper – for lab-based filtrations

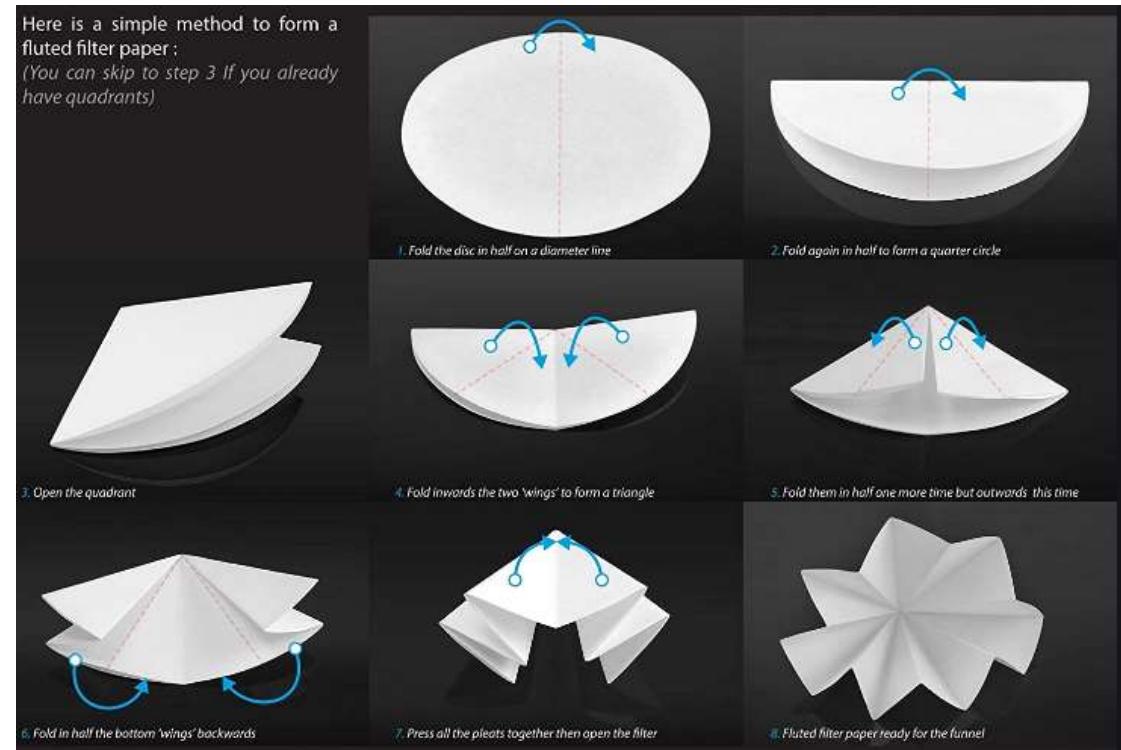
Cone-shaped filter



This video shows some of the ways to fold a filter paper (a skill you need for next week's experiment)

<https://www.youtube.com/watch?app=desktop&v=ctadASlwyT4>

Fluted filter

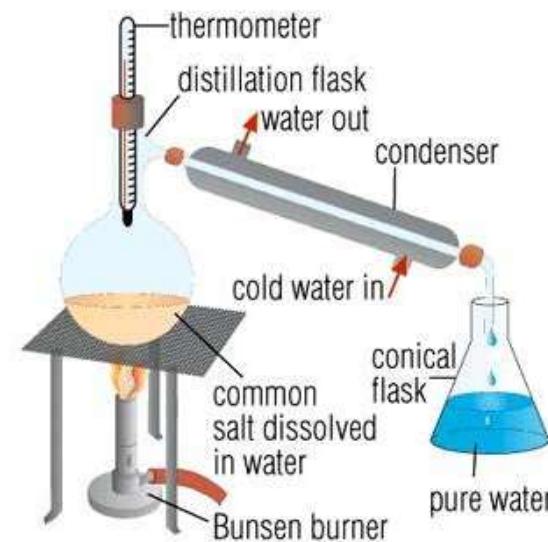
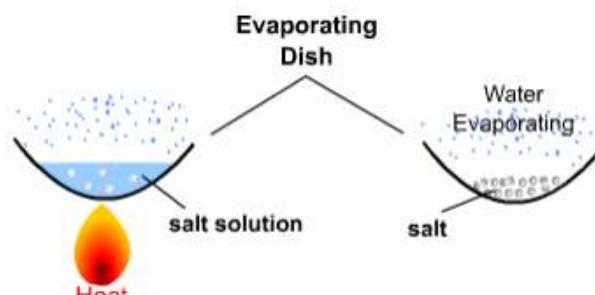




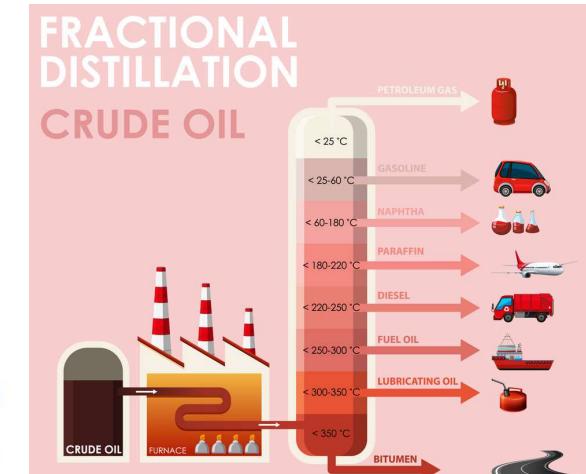
Separation based on boiling point

- Key property difference: Boiling point
- Techniques: evaporation and distillation

evaporation



distillation



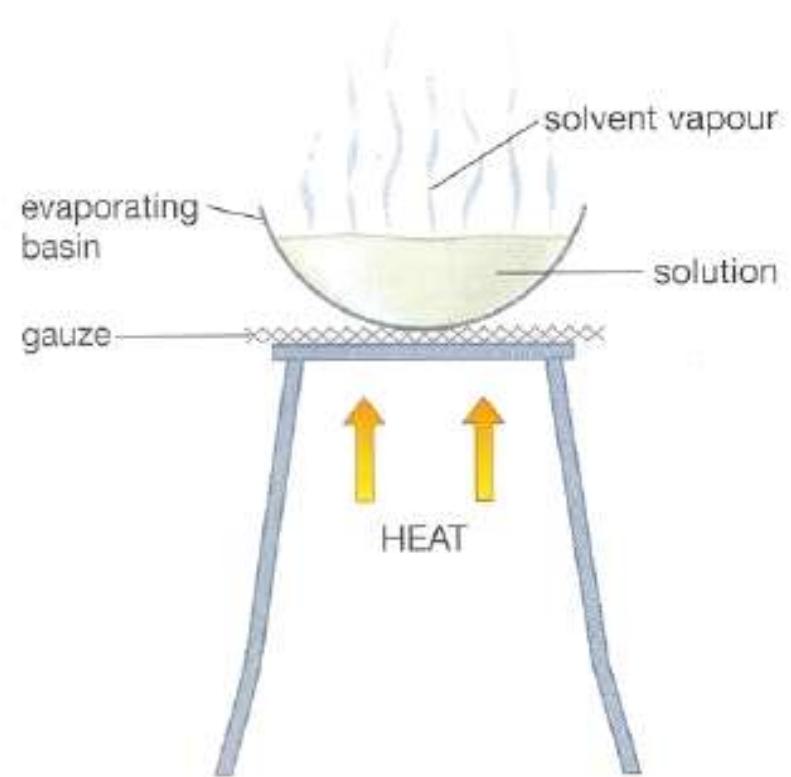
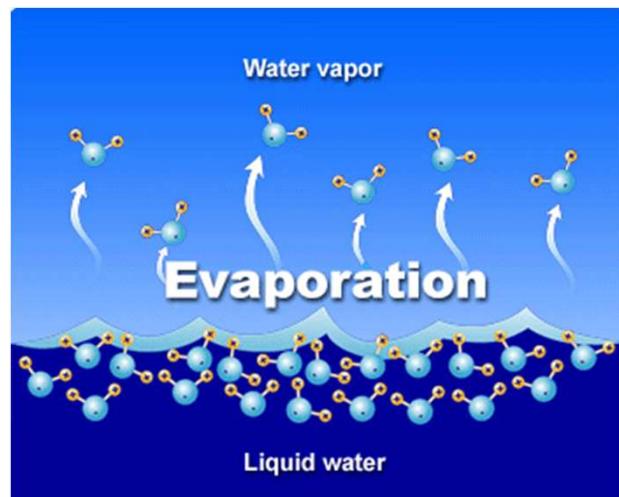
Want the low boiling substance or both

Only want the high boiling substance



Separation based on boiling point

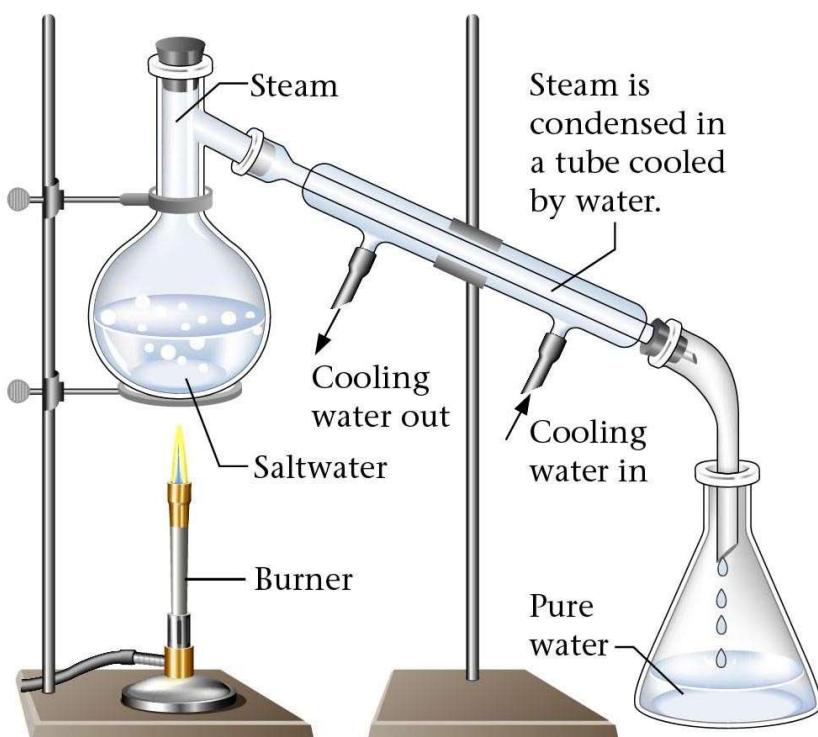
Evaporation – A process that uses heat to make a liquid solvent change state to a gas and leave behind the solute it had dissolved.





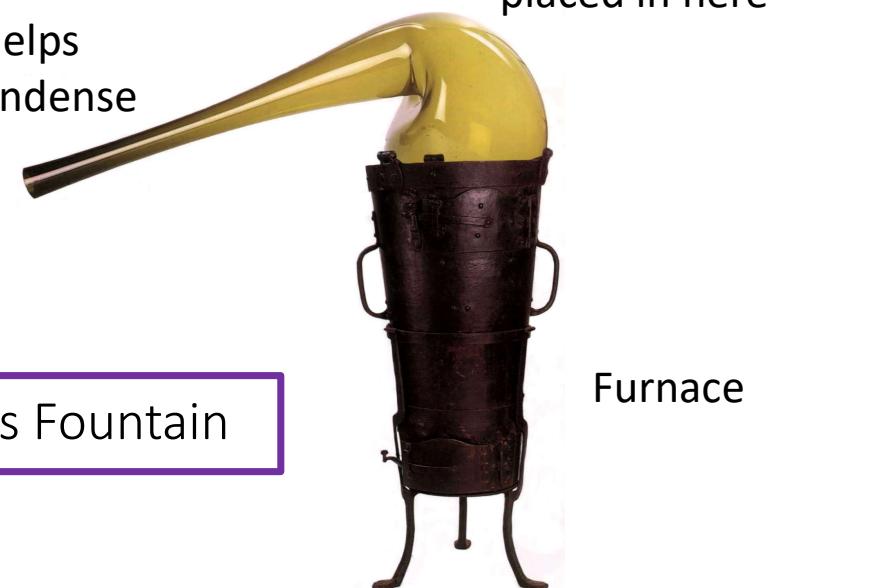
Separation based on boiling point

Distillation – A process that uses evaporation and condensation to separate solids from liquids or liquids from liquids, enabling the recovery of both.



long spout helps
vapors to condense

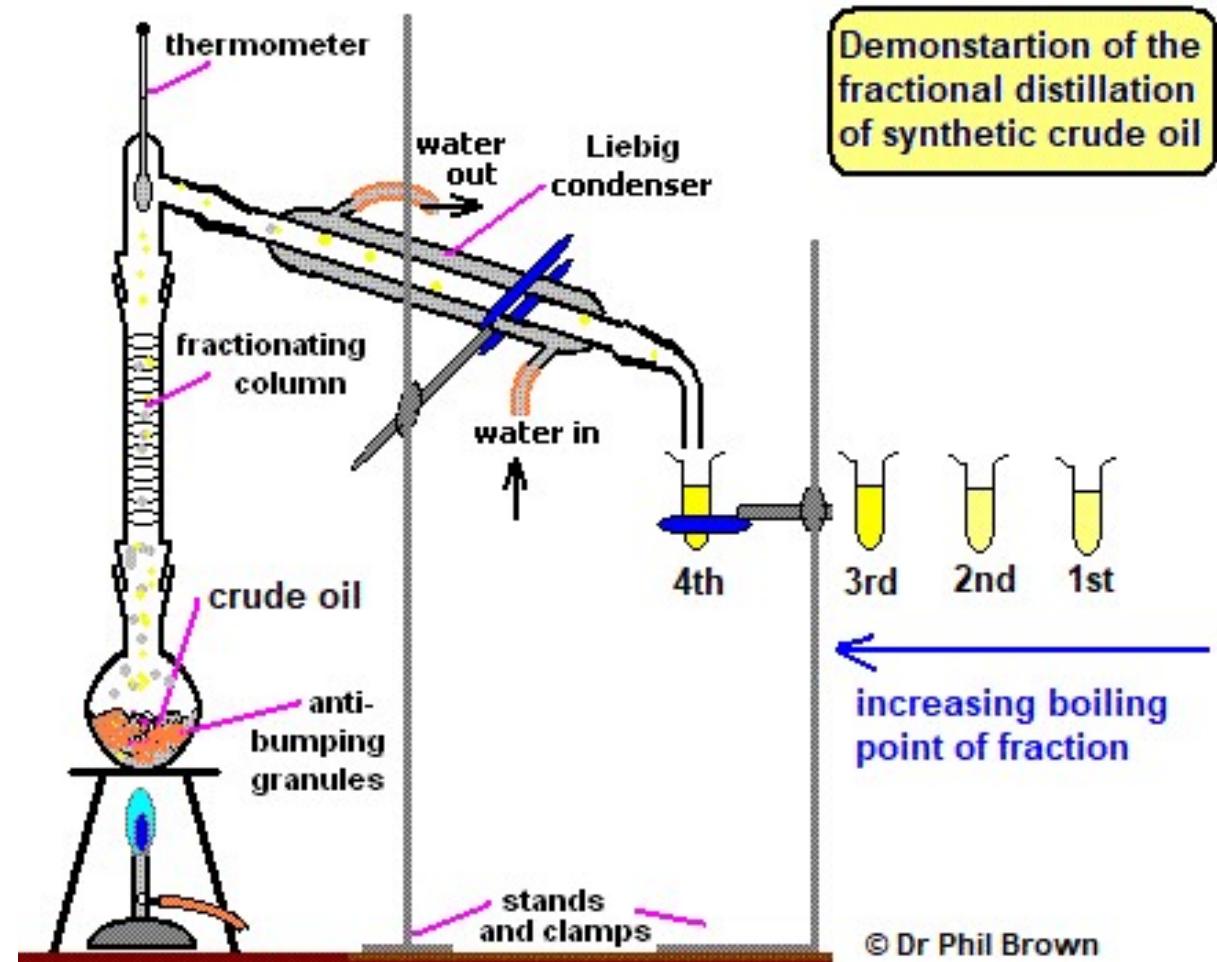
A Hero's Fountain





Separation based on boiling point

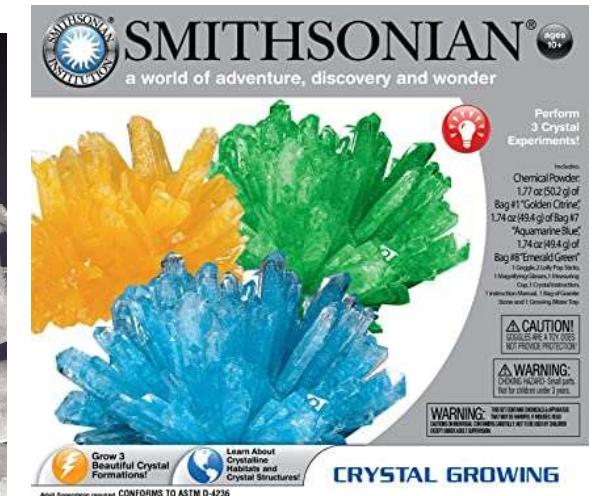
Fractional Distillation – use a long fractionating column to allow you to separate multiple fluids with different boiling points





Separation based on solubility

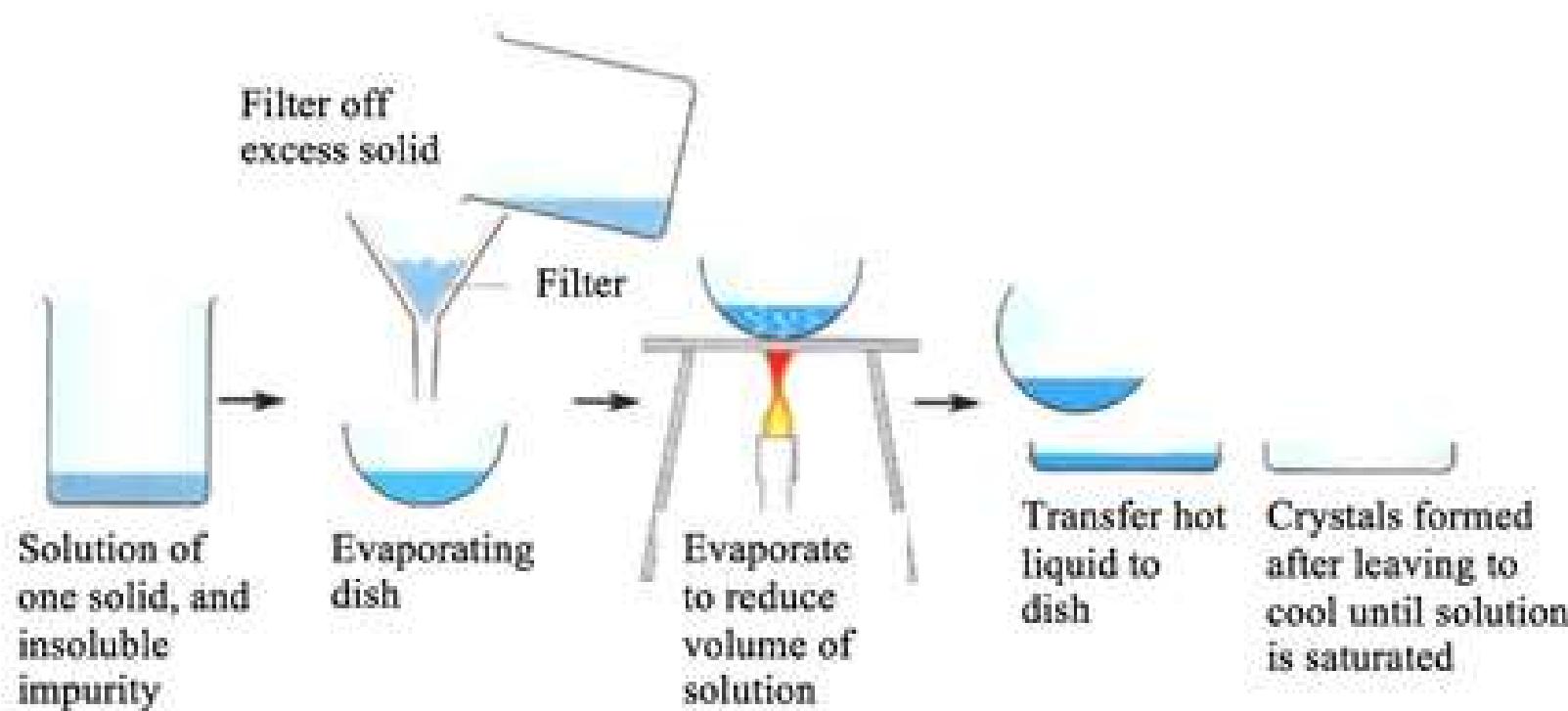
- Key property difference: solubility
- Techniques: crystallisation





Separation based on solubility

Crystallisation – Formation of crystals as a dissolved substance solidifies as the solvent is slowly evaporated.





Separation based on density

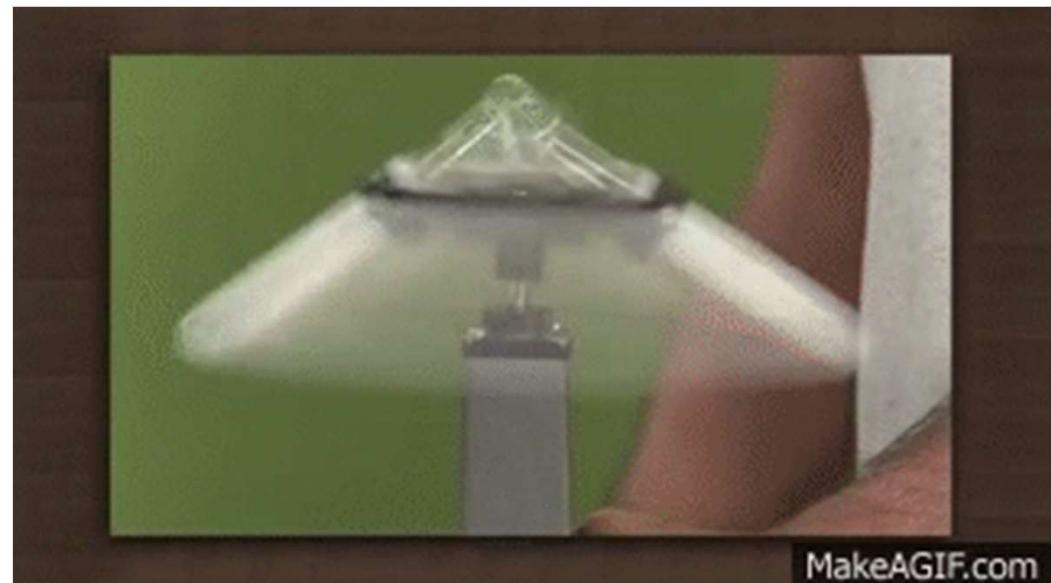
- Key property difference: Density
- Techniques: decantation, centrifugation, panning (all types of gravity separation)



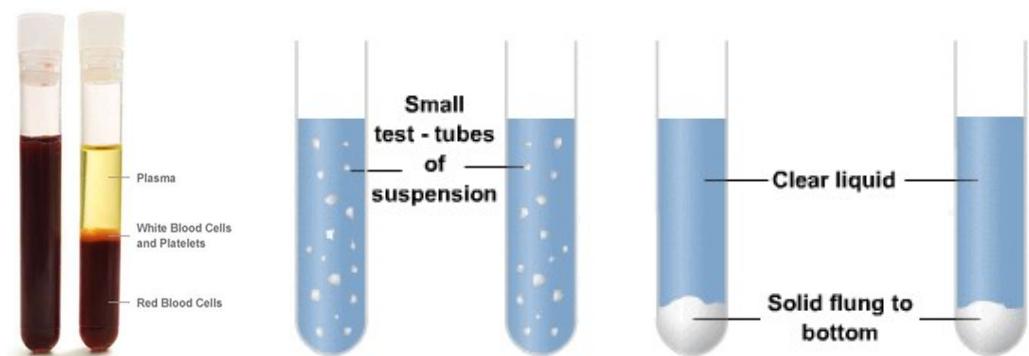


Separation based on density

Centrifugation – Separation of solids from liquids, or separates liquids that have different weights, by using a device called a centrifuge. Spins very fast generating centrifugal force — the force from spinning that moves things away from the centre — For example, a centrifuge is used to separate blood cells from plasma cells.



MakeAGIF.com





Separation based on magnetism

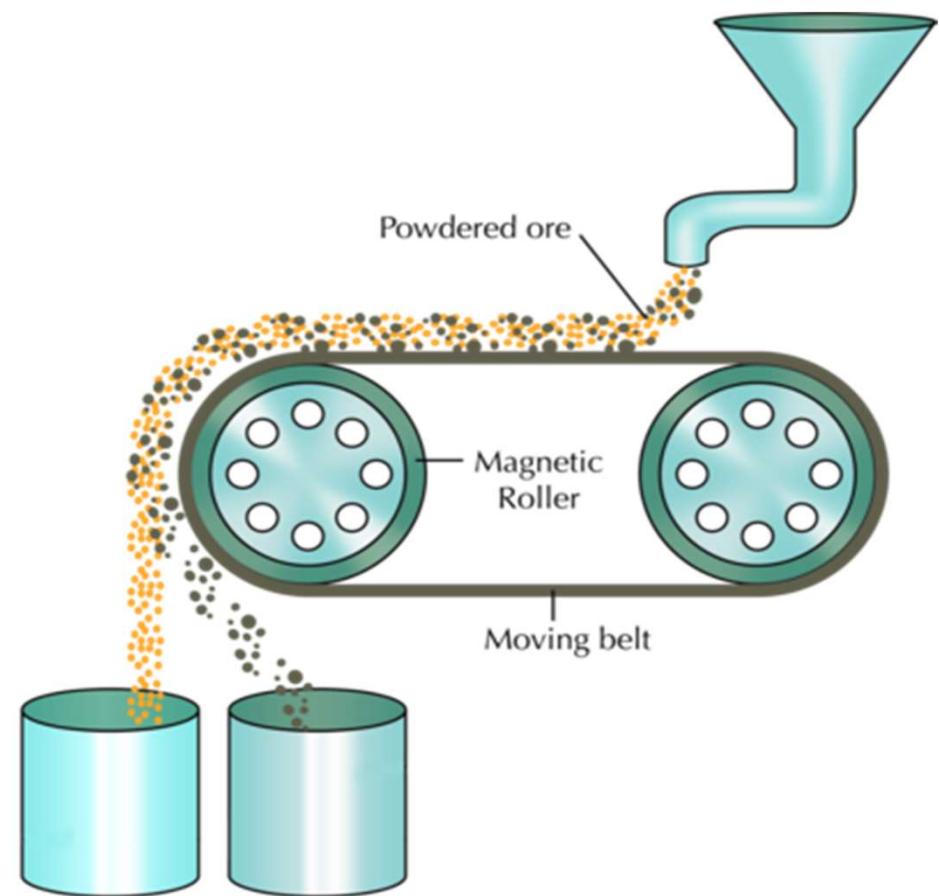
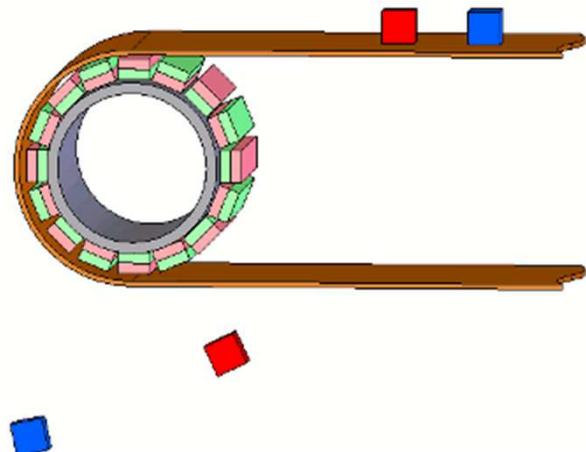
- Key property difference: Magnetic moment
- Techniques: magnetic separation





Separation based on magnetism

Magnetic separation – Magnetic separation is a process in which magnetically susceptible (e.g. some metals) material is extracted from a mixture using a magnetic force.





Separation flowcharts

Manual

You manually pick out the different materials



Chromatographic

Do this in detail in unit 2.

