

STUDY CARDS

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MODULE 1: STRUCTURE & PROPERTIES OF MATTER

C H E M I S T R Y

• 3 main subatomic particles



Electrons

- negative in charge
- located in shells that surround the nucleus.
- 1840 X less mass than a proton
- $1/1840$ amu



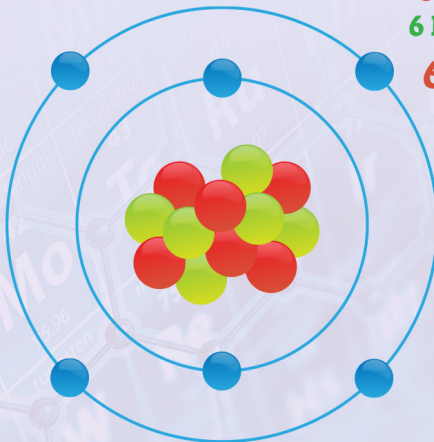
Protons

- positive charge
- located in nucleus
- 1 amu



Neutrons

- neutral charge
- located in nucleus
- 1 amu



6 Protons
6 Neutrons
 $6+6=12$



Syllabus statement:

- * investigate the basic structure of stable and unstable isotopes by examining:
 - the distribution of electrons, protons and neutrons in the atom

Video in course
2.2

- On the PT, elements are represented as follows

Atomic Number →

- atomic #** = the number of **protons** in the nucleus.

Name →

Electrons per shell →

79
Au
Gold
196.97
2-8-18-32-18-1

← Symbol

← Atomic Weight

- atomic mass** = the number of **protons + neutrons** in the nucleus.
- For **NEUTRAL atoms**, the **# protons = # electrons**

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Video in course
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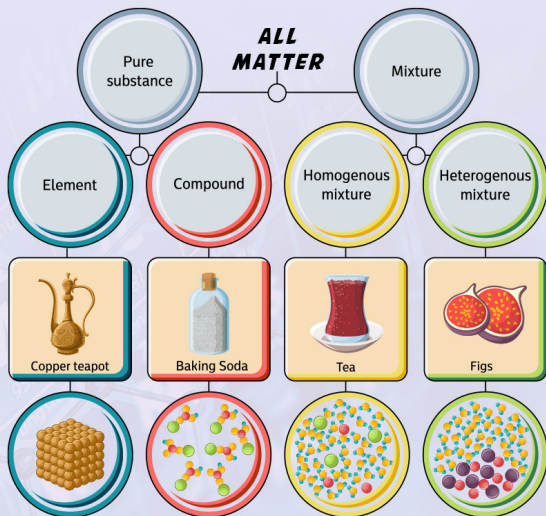
STRUCTURE OF MATTER PURE VS IMPURE

● Pure substances:

- have only **ONE type** of atom, compound present.
- have fixed, well defined M.P & B.P

● Impure substances:

- have **two or more types** of atoms, compounds present.
- variable M.P & B.P
- can be physically separated



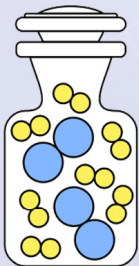
Syllabus statement:

- * explore homogeneous mixtures and heterogeneous mixtures through practical investigations:
 - using separation techniques based on physical properties

Video in course
2.3

● Mixtures:

- contain two or more different components (elements or compounds)
- have variable physical properties
- can be homogeneous or heterogeneous in nature



Mixture
(H_2 and O_2)

Heterogeneous mixture that has:

- water
- orange pulp
- vitamins
- sugars

Colour of juice and concentration of components vary throughout a sample.



Glass of O.J

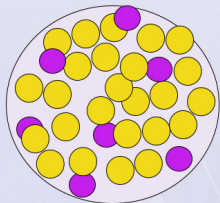
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Video in course
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Homogeneous Mixtures:

- have uniform properties throughout
- composition, texture, density, colour, concentrations, are the same from one location to the next.



Mixture that has:

- water
- food colouring

The distribution of food colour molecules are evenly spread throughout the liquid.

Colour, concentration are the **SAME** in all locations.

Red food colouring in water



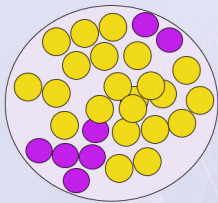
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Video in course
2.3

• Heterogeneous Mixtures:

- don't have uniform properties throughout
- composition, texture, density, colour, concentrations, may vary significantly from one location to the next.



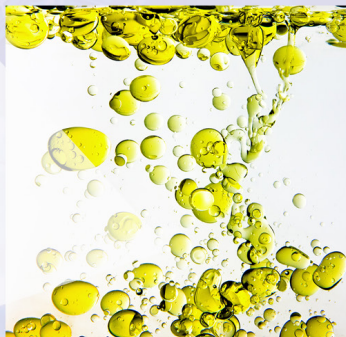
Mixture has:

- water
- oil

The distribution of oil is not \ uniform. It clumps.

Two distinct layers can be seen.

Oil and water



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Video in course
2.3

- **Sieving:** a technique in which two or more components of a mixture can be separated **based on their size** difference.
- **Sieving:** only works if components have different sizes. eg will NOT work to separate a mixture of flour and chalk powder



Sieving a mixture of nuts



Geological Soil Profile

Soil mixture is placed in top, agitator turned on. The soil grains fall through each sieve grate until each sieve holds soil particles for its diameter size.



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- **Decantation:** a technique of separation for liquid-liquid immiscible liquids (oil/water) OR an insoluble solid that has settled from a liquid (muddy water).
- **Physical Property:** density

Immiscible-liquids



Sediment in rivers



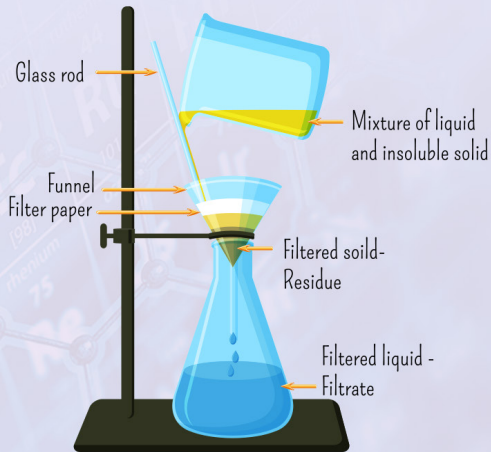
Decanting a solid-liquid mixture



Syllabus statement:

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 - using separation techniques based on physical properties

- **Filtration:** a technique of separation used to separate insoluble materials from soluble materials.
- **Physical Property:**
 - (a) **solubility**
- soluble component in filtrate
 - (b) **particle size**
- filter paper separates insoluble material which remains in the residue.

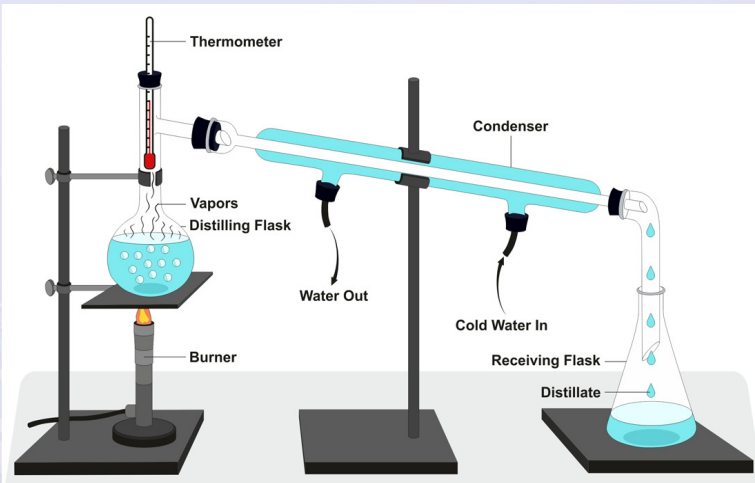


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- **Distillation:**
a technique of separation used to separate mixtures containing miscible liquids who have relatively large gaps between their B.P ($> 30^{\circ}\text{C}$)
- **Physical Property:**
B.P



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Video in course
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SEPARATING MIXTURES FRACTIONAL DISTILLATION

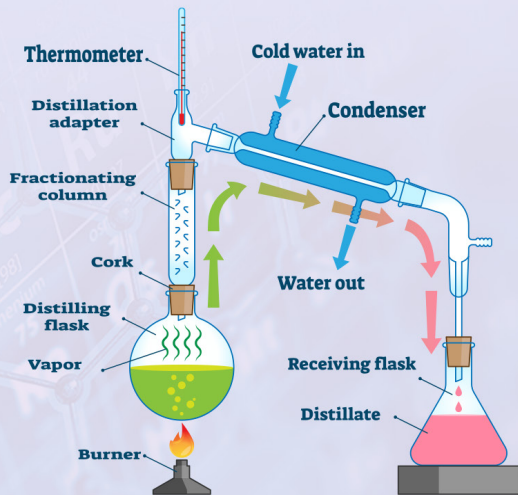
● Fractional Distillation:

- is used when the B.P of the components are close together.
- this allows continual evaporation and condensation cycles to occur producing a more pure distillate.
- the most volatile components vapourise first.

● Physical Property:

B.P

- Fractionating column is designed to have a large SA with glass beads, glass spirals often in the column.



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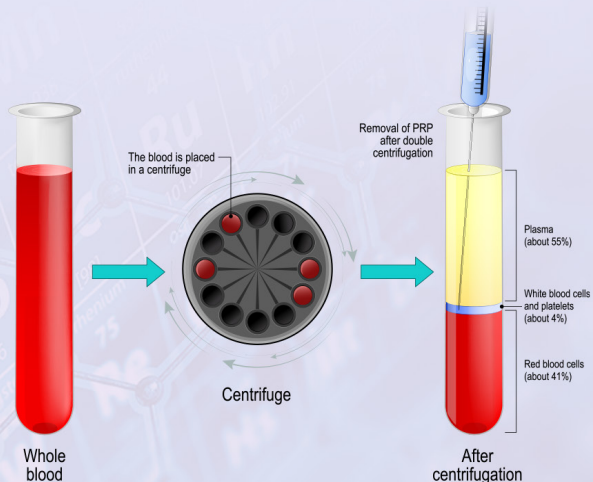
Video in course
2.10

Centrifugation:

- is used to separate suspended particles in a solution due to differences in size, mass, density or viscosity.
- high speed is used to provide the force used to separate particles.

Physical Property:

size, mass, density, viscosity



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SEPARATING MIXTURES MAGNETIC SEPARATION

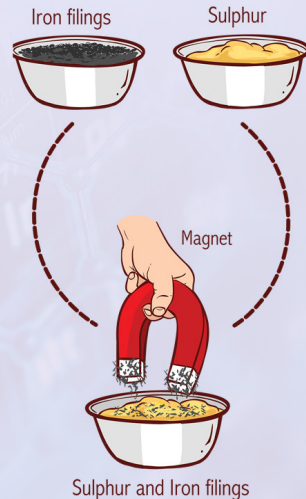
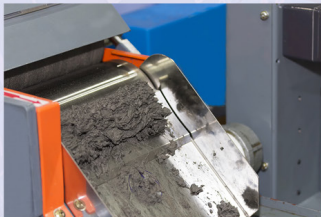
● Magnetic Separation:

- is used to separate magnetic materials from non-magnetic materials.
often used in Industry to remove iron ore from waste or metal from recycling in factory processing.

- Magnetic materials have Fe, Ni or Co in them.

● Physical Property:

magnetic attraction (material must be ferromagnetic)



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Video in course
2.6

● Evaporative crystallisation:

- is used to separate a mixture of soluble solutes.
- when solubility decreases, pure crystals form as they push out impurities when forming a crystal.
- differences in solubility are used to separate components.

● Physical Property:

solubility in fixed volume of water



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Video in course
2.7