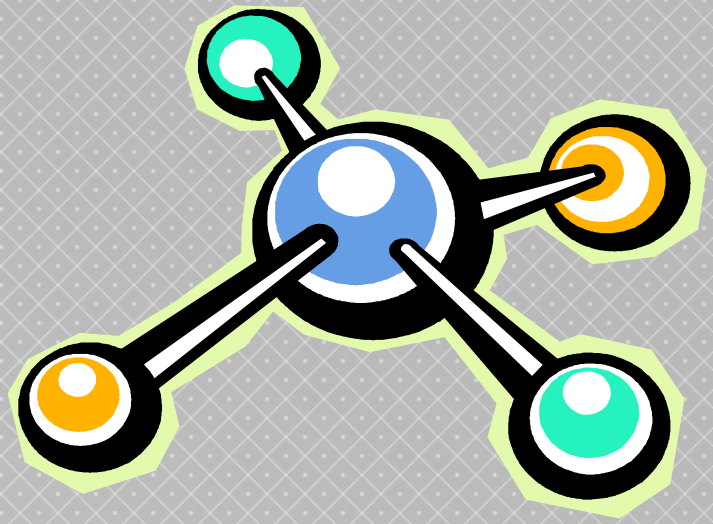
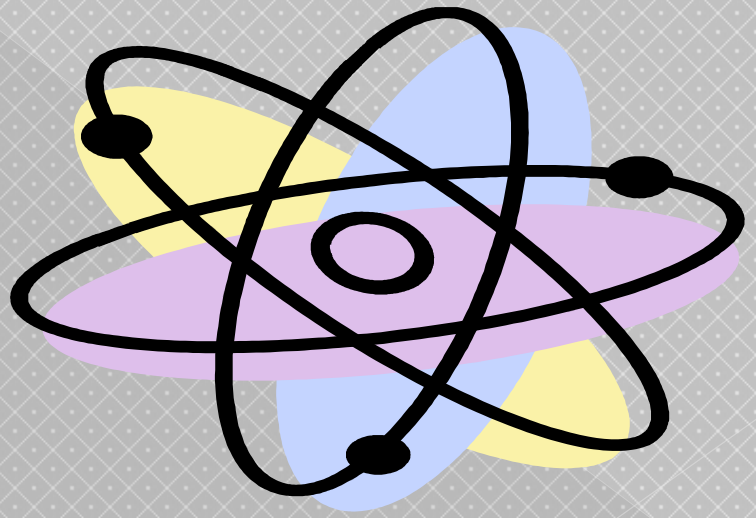
CHEMISTRY

Chapter 1 : MATTER

1.1 Atoms and Molecules





Learning outcomes

At the end of this topic, students should be able :

(a) Identify and describe proton, electron, and neutron as subatomic particle.

(b) Define proton number, Z, nucleon number, A and isotope. Write isotope notation.

(c) Sketch and explain the following main components of a simple mass spectrometer.

Introduction

- **Matter**

  Anything that occupies space and gas mass.

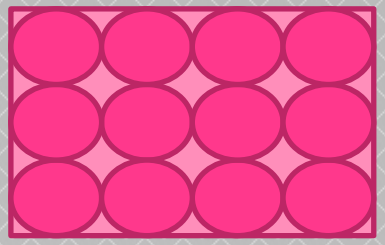
  e.g :

  air, water, animals, trees, atoms, …

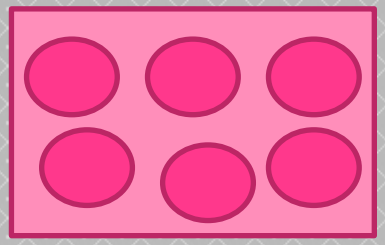
- Matter can consists of atoms, molecules or ions.

Three states of matter

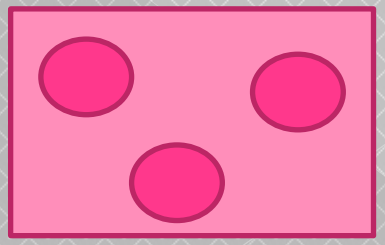
solid



liquid



air



Atoms

Atoms

- An atom is the smallest unit of chemical element/compound

- In an atom. There are three subatomic particles :

  - Proton (p)
  - Neutron (n)

  } Packed in a small nucleus

  - Electron (e)

  } Move rapidly around the nucleus of an atom

Elements

- A substance that cannot be separated into simpler substances by chemical reactions.
- An element is composed of atoms of only one kind
- Compounds : A substance composed of atoms of two or more elements chemically united in fix proportions.

Isotopes

- Isotopes are two or more atoms that having the same number of protons in their nucleus but different number of neutrons.

- Isotopes sometime used in daily life.

Ion

- Ion is an atom or group of atoms that has a net positive or negative charge.
- Ionic compound: any neutral compound containing cations and anions.
- Monoatomic ion: an ion that contains only one atom.
- Polyatomic ion: an ion that contains more than one atom.

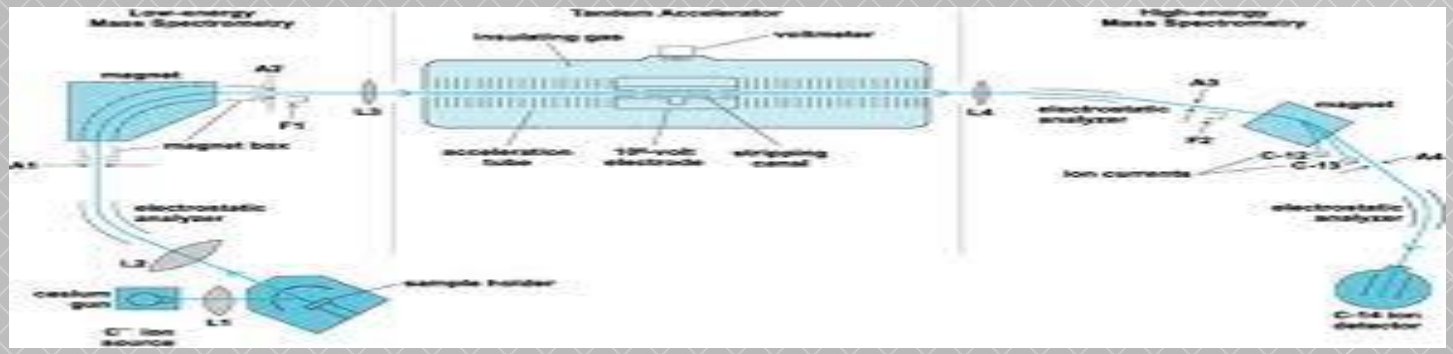
Two types of ion: (a) Cation (b) Anions

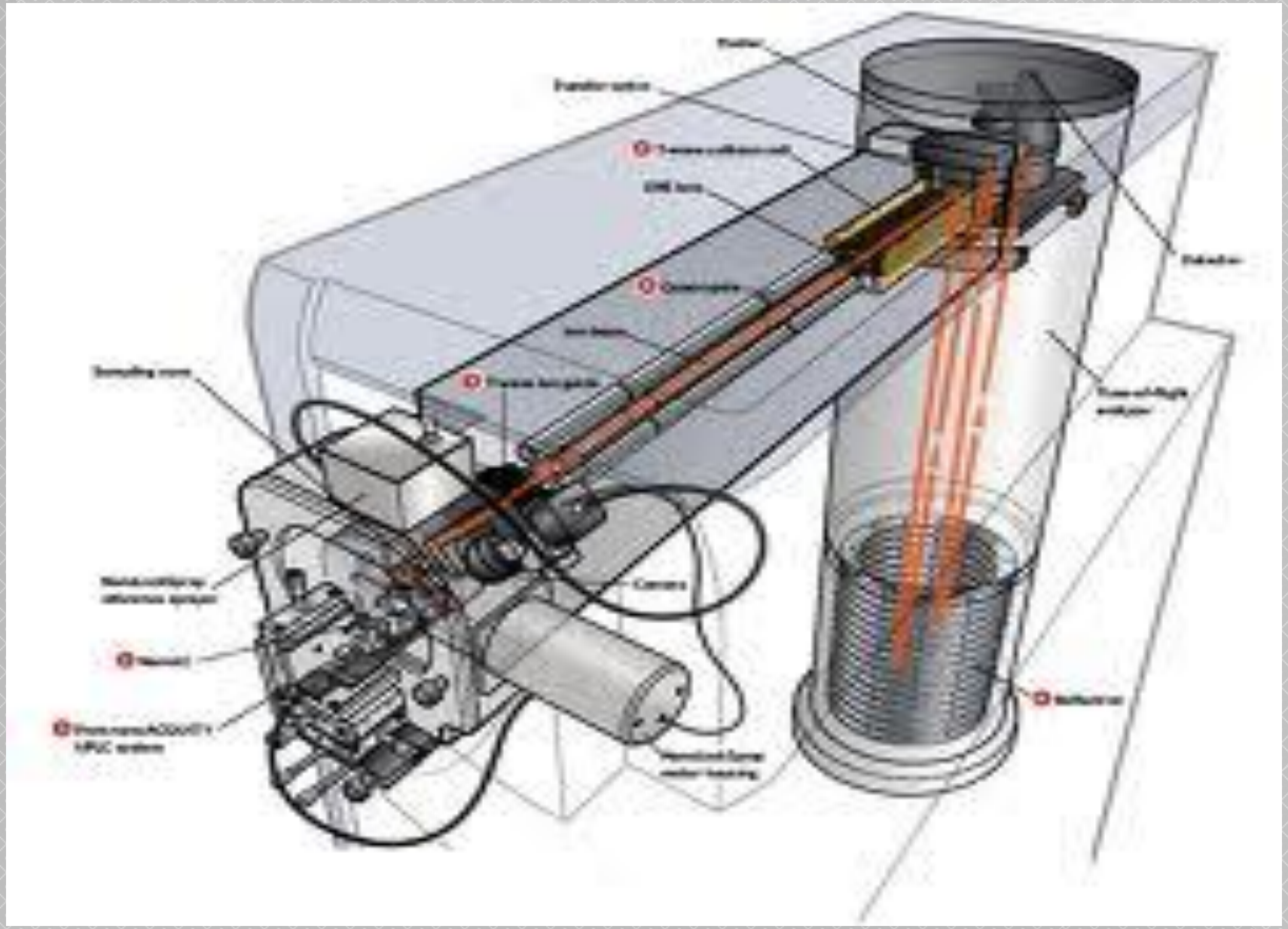
Cation:
A positive charge ion formed when a neutral atom loses an electron
Example:
Na^+

Anion:
A negative charge ion formed when a neutral atom gains an electron
Example:
Cl^-

Mass Spectrometry

- An experiment technique that allows determination of atomic or molecular masses by the separation of electrically charged particles in a magnetic field.





Mass Spectrometer

- A spectrometer is used to determine :

i. Relative atomic mass of an element.
ii. Relative molecular mass of a compound.
iii. Types of isotopes, the abundance and its relative isotopic mass.
iv. Recognize the structure of the compound in an unknown sample.

There are the function of the component in the mass spectrometer :

Vaporisation Chamber

- Sample of the element is vaporised into gaseous atom.

Ionisation Chamber

- A gaseous sample is bombarded by a stream of high-energy electrons that are emitted from a hot filament.
- Collisions between the electrons and the gaseous sample produce positive ions by dislodging an electron from each atom or molecule.

Vacuum Pump

- A pump maintains a vacuum inside the mass spectrometer to avoid any small particle that would block the movement of the ions and to avoid the contamination of the sample.

- It's important that the ions produced in the ionization chamber have a free run through the machine without hitting air molecules.

Acceleration Chamber

- The positive ions are accelerated by an electric field towards the two oppositely charge plates.
- The electric field is produced by a high voltage between the two plates.
- The emerging ions are of high voltage and constant velocity.

Magnetic Field

- The positive ions are separated and deflected into a circular path by a magnet according to its mass / charge (m/e) ratio.

- Positive ions with a small m/e ratio are deflected most ions with large m/e ratio are deflected least.

Ion Detecter

- The numbers of ions and types of isotopes are recorded as a mass spectrum.

Lesson end..

GUDLUCK!