

Atomic structure

The smallest particle that exhibit the properties of matter and may or may not have independent existence are termed as Atom.

The atomic structure of matter is made up of protons, electrons and neutron, called as fundamental particles.

Atomic structure is the structure of atom consist of a nucleus which is at center in which the protons (positively charged) and neutrons (neutral) are present. The negatively charged particles called electrons revolve around the center or present as electron cloud of the nucleus.

Neutral atoms have equal numbers of protons and electrons.

Atoms may gain or lose electrons in order to increase their stability, and after loss or gain of electrons the resulting charged entity is called an ion.

Dalton's Atomic Theory:

- Every matter is made up of atoms, which are very small particles.
- Atoms are indivisible, cannot be divided further.
- Specific elements have only one type of atoms in them means they are identical to all aspect.
- Each atom has its own constant mass that varies from element to element.
- Atoms undergo rearrangement during a chemical reaction and in simple ratio.
- Atoms can neither be created nor be destroyed but can be transformed from one form to another.

Fundamental Particles:

Protons

- Discovered by Goldstein.
- Protons are positively charged subatomic particles. The charge of a proton is $1e$, which corresponds to approximately 1.602×10^{-19}
- The mass of a proton is 1.672×10^{-24}
- The total number of protons in the atoms of an element is always equal to the atomic number of the element.

Neutrons

- Discovered by Chadwick
- These are neutral particles.
- Located inside the nucleus.
- The mass of a neutron is almost the same as that of a proton i.e. 1.674×10^{-24}
- Neutrons are electrically neutral particles and carry no charge.

Electrons

- Discovered by J.J. Thomson.
- They possess unit negative charge.
- Located in orbits or shell
- The charge of an electron is $-1e$, which approximates to -1.602×10^{-19}
- The mass of an electron is approximately 9.1×10^{-31} .

Atoms of each element contain a characteristic number of protons.

The number of protons is equal to the number of electrons.

The number of protons in an atom is called the **Atomic number**.

Atomic number = Number of proton + Number of electrons

$$(Z) = (p) + (e)$$

Molecules:

Atoms of the same element or different elements combine to form a molecule.

Example: hydrogen atom combines with chlorine atom giving rise to hydrogen chloride molecule.

A molecule is the smallest particle of pure substances.

- **Molecules of elements:**

Two or more atoms of same kind of element combine to form molecule of element.

Example: two atoms of nitrogen get combine to form one molecule of nitrogen

- **Molecule of compound:**

Two or more elements of different elements combine in fixed ratio in chemically to form molecule of compound.

Example: two oxygen atoms and one carbon atoms combine to form one whole carbon dioxide molecule.

Atomicity:

The number of atoms present in one molecule is called as atomicity of that molecule.

1. Monoatomic Molecule :
If there is only one atom present in molecule is called as monoatomic molecule
Eg. Metal- sodium(Na) , Metalloid- Antimony(Sb) , Nobel gas- Xenon (Xe)
2. Diatomic Molecule :
A molecules contains two atoms of elements are termed as diatomic molecule
Example: Oxygen (O₂) , Nitrogen (N₂)
3. Triatomic Molecule:
A molecule containing three atoms is called triatomic molecule.
Example : ozone (O₃)
4. Polyatomic Molecule:
A molecule containing more than three atoms is termed as polyatomic molecule.
Example: sulphur (S₈)

Radicle:

An atom of element or groupe of atoms of different elements behaving as a single unit with positive or negative charge Eg. Cl⁻ , NH₄⁺

- **Acid Radicle:**

The negatively charge radicals are called as radicle or anion Eg. (CO₃)²⁻ , Cl⁻

- **Basic radicle:**

The positively charged radicles termed as Basic radicles Eg. NH₄⁺ , sodium (Na⁺)

Valency:

It is the combining capacity of an atom of an element with another atom.

Defined as in two ways as per following :

(A) In terms of replaceable or combined hydrogen atoms:

It is calculated as, the number of hydrogen atoms which can combine with or displace one atom of element or radicle that is charged one forming a compound.

In case of water , two atoms of hydrogen combines with one oxygen atom the vacancy of oxygen is 2.

(B) In terms of loss and gain of electrons

Atom is positive when it losses the electron whereas it is negative when gain the electron.

On the basis how much electron gain or loss by an atom its valency is calculated.

Example: Na^{2+} , Zn^{2+} , Cl^{-1}

Writing the chemical formula of a chemical compound:**Aluminum oxide**

Valencies of elements: Al = 3 , O = 2

Lowest common multiple of valences = 6

Al = $2 \times 3 = 6$

O = $3 \times 2 = 6$

Therefore the chemical formula = Al_2O_3

Periodic table:

Mendeleev arranged the elements in tabular manner in order to their increasing order of atomic masses in particular rows and column.

Then Mosley arranged elements in order of their increasing order of atomic number called as (Modern periodic table)

Periodic means some properties arte repeated in elements after certain interval of time or period.

Relation between valency and group number :

The number of valence electrons increases from left to right in the periodic table.

If the number of valence electrons of an element is equal to 4 as that of carbon, the the element would also have same valency that is 4.

For Group 13 : The valence electron are given as (Group number - 10)= (13 – 10 = 3)

Therefore group 13 has valency 3.