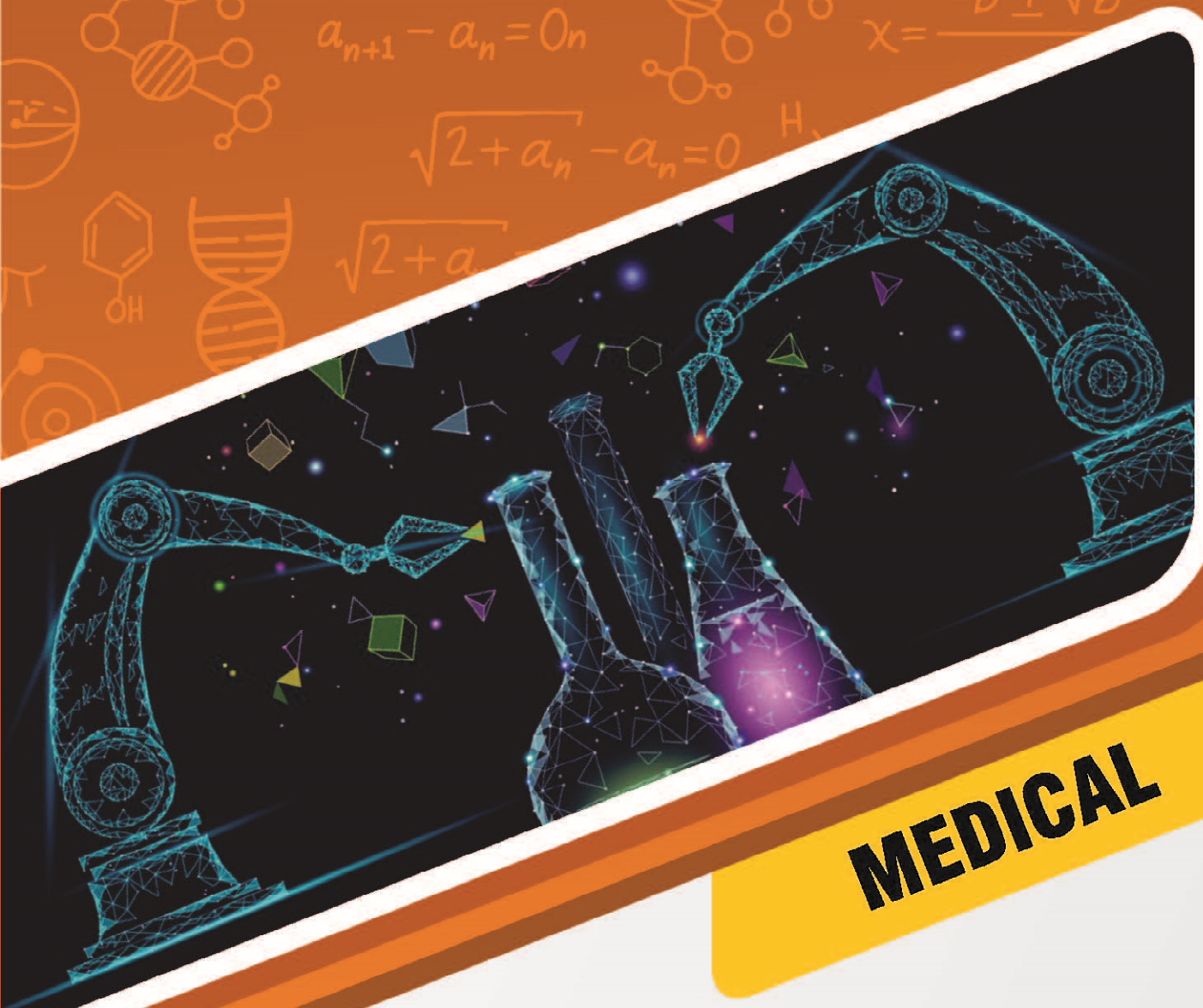
# CHEMISTRY



MEDICAL

## GENERAL CHEMISTRY

BANSAL CLASSES
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# CONTENT

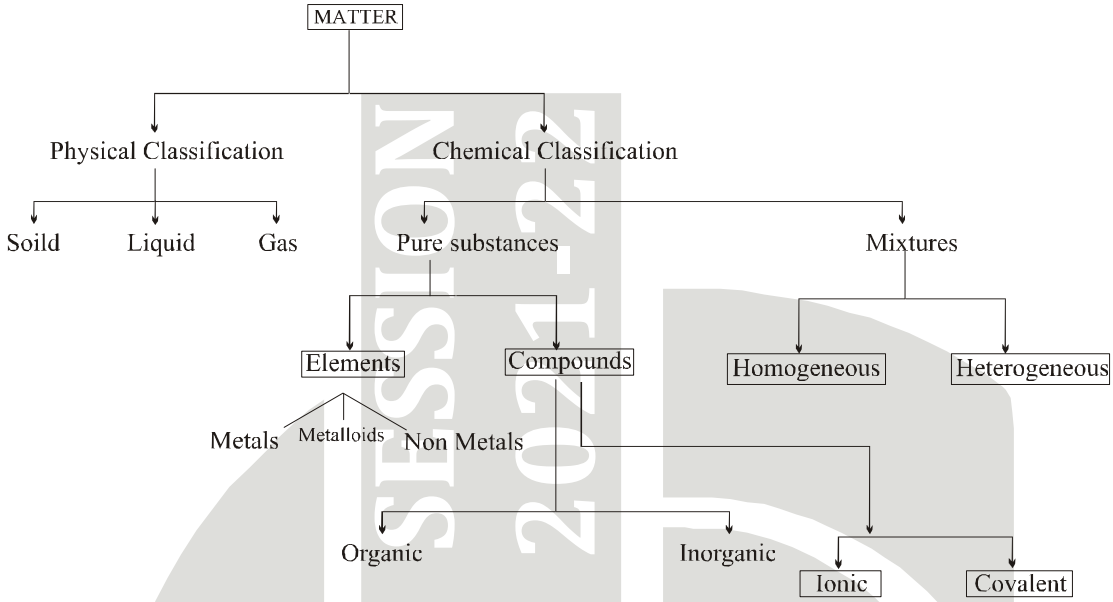


SESSION 2021-22

## GENERAL CHEMISTRY

# General Chemistry

Chemistry is the branch of science which deals with the study of matter, its physical & chemical properties, its chemical composition, the physical and chemical changes which it undergoes and the energy changes that accompany there process.




## BASIC DEFINITIONS (MOLE CONCEPT)

**Mole :** One mole is a collection of that many entities as there are number of atoms exactly in 12 gm of C-12 isotope.

**OR** 1 mole = collection of $6.02 \times 10^{23}$ species

$6.02 \times 10^{23} = N_A$ = Avogadro's No.

## BASIC DEFINITIONS (ATOMIC STRUCTURE)

**Atom :** An atom is the smallest particle of an element (made up of still smaller particles like electrons, protons, neutrons, etc.) which can take part in a chemical reaction. It may or may not exist free in nature. Discovery details of electron, proton and neturon should not discussed

| Name of particle | Mass | Nature of Charge | Amount of Charge | Presence in the atom |
|---|---|---|---|---|
| (i)Electron symbol – (e) Notation – $e^-$ Discoverer J.J.Thomson (1897) | $9.12 \times 10^{-28}$ g<br>$\frac{1}{1837}$ th of H-atom | Negatively charged | $-1.602 \times 10^{-19}$ Coulomb<br>or<br>$-4.8 \times 10^{-10}$ e.s.u | Outside the nucleus |
| (ii)Proton symbol (p) Notation ($_1H^1$) Discoverer E.Rutherford (1911) | $1.6725 \times 10^{-24}$ g | Positively charged | $+1.602 \times 10^{-19}$ Coulomb<br>or<br>$+4.8 \times 10^{-10}$ e.s.u | Inside the nucleus of an atom. |
| (iii)Neutron symbol – (n) Notation ($_0n^1$) Discoverer J.Chadwick (1932) | $1.675 \times 10^{-24}$ g | Neutral | 0 | Inside the nucleus of an atom. |

***Proton's have positive charge but they remain inside the nucleus together. why?***

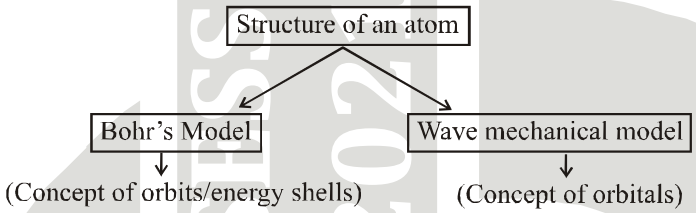
**Representation of atom :** ${}_{Z}X^{A}$

A ⟶ Mass number
Z ⟶ Atomic number
} give details

**Isotope:** Atoms of a given element which have same atomic number but different mass number are called isotopes. e.g. ${}_{1}H^{1}$, ${}_{1}H^{2}$, ${}_{1}H^{3}$ etc.

**Isobar:** Atoms of different element with the same mass number but different atomic number. e.g. ${}_{18}Ar^{40}$, ${}_{19}K^{40}$ and ${}_{20}Ca^{40}$.

**Iso-electronic species :** Species (atoms, molecules or ions) having same number of electrons are called iso-electronic.e.g. $H^{-}$,He, $Li^{+}$ and $Be^{2+}$ have 2 electron each.




**Orbital :** An orbital is defined as that zone in space where electron is most likely to be found. The orbitals are characterized by a set of 3 quantum numbers (n,*l*,m).

## QUNATUM NUMBER

### Principal Quantum number (n) :

(i) Permissible value of $n \rightarrow 1 - \infty$.
(ii) It represents shell number / energy level.
(iii) The energy states corresponding to different principal quantum numbers are denoted by letters K,L, M, N etc.

| **n** | : | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| **Designation of shell** | : | K | L | M | N | O | P |

(iv) It indicates the distance of an electron from the nucleus.
(v) It also determines the energy of the electron. In general higher the value of 'n', higher is the energy of an electron.

***In H & hydrogen like species energy of electron increases with increases in 'n' but energy difference between successive energy level decreases.***

(vi) It give an idea of total number of orbitals & electrons (which may) present in a shell & that equals to $n^2$ & $2n^2$ respectively.

### Azimuthal Quantum number (*l*) :

(i) The values of *l* depends upon the value of 'n' and possible values are '0' to (n–1).
(ii) It gives the name of subshells associated with the energy level and number of subshells within an energy level.
(iii) The different value of '*l*' indicates the shape of orbitals and designated as follows:

| **Value** | **Notation** | **Name** | **Shape** |
|---|---|---|---|
| $l = 0$ | s | Sharp | Spherical |
| $l = 1$ | p | Principal | Dumbell |
| $l = 2$ | d | Diffused | Double Dumbell |
| $l = 3$ | f | Fundamental | Complex |

***Shape of $d_{z^2}$ orbital is different from other d-orbitals in a d-subshell.***

(iv) It also determines the energy of orbital along with n.
For a particular energy level/ shell, energy of subshell is in the following:
Order ⟶ s < p < d < f

(v) It gives the total number of orbitals in a subshell & that equals to $2l + 1$ and number of electron in a subshell = $2(2l + 1)$.

***How many electrons are there in a orbital of f-subshell?***

***Maximum number of orbitals in a shell = $n^2$ or*** $\sum_{l=0}^{l=n-1}(2l+1)$.

**Magnetic Quantum number (m):**

(i) The value of m depends upon the value of $l$ and it may have integral value $-l$ to $+l$ including zero

(ii) Its gives the number of orbitals in a given subshell and orientation of different orbitals in space.
e.g. for n = 4, $l$ = 0 to 3

| $l$ | 0 | 1 | 2 | 3 |
|---|---|---|---|---|
| m | 0 | +1,0,−1 | +2,+1,0,−1,−2 | +3,+2,+1,0,−1,−2,−3 |
| Possible Orientations | 1 | 3 | 5 | 7 |
| Orbitals | s | $p_x, p_y, p_z$ | $d_{z^2}, d_{x^2-y^2}$ $d_{xy}, d_{yz}, d_{xz}$ | Not in syllabus |

(iii) The orbital having same value of n and $l$ but different value of m, have same energy in absence of external electric & magnetic field. These orbitals having same energy of a particular subshell is known as Degenerate orbitals.

***An additional quantum number is used to characterize an electron present in the orbital.***

**Spin Quantum number (s) :**

(i) While moving around the nucleus, the electron always spins about its own axis either clockwise or anticlockwise.The spin quantum number represents the direction of electron spin(rotation) around its own axis (clockwise or anticlockwise)

(ii) There are two possible values of 's' are $+\frac{1}{2}$ & $-\frac{1}{2}$ and represented by the two arrows ↑ (spin up) and ↓ (spin down).

## ELECTRONIC CONFIGURATION :

**Electronic configuration of atoms :**

The distribution of electrons in various shells, subshells and orbitals, in an atom of an element, is called its electronic configuration.

$nl^x$ ← no. of electrons in subshell
↑↑ └— represents subshell
(represents shell)

$2p^5$ ← no. of electrons in p-subshell
↑↑ └— p subshell
second shell