* 1. Chemical Bonding *

* Indian chemistry : Philosophy of atom by Acharya kand :

- Born 600 - 800 BC
- Dwarka in Gujrat
- Acharya kanad is father of Atomic theory
- Discovered that, the smallest paritcle of atom of particle of matter which is not break

* Electronic Theory of valency.

> Discovered by Kossel and Lewis (1916) and applied by Langmuir (1919)

> Stable configuration :- In an electronic configuration present 8 electrons in an outermost shell or orbit (Two electrons present in helium)
than their octet is complet.

E.x. 1] Neon (10) = 2 8
2] Argon (18) = 2 8 8
3] Helium (2) = 2

> If in electronic configuration the last obit is removed than the rest atom is called kernel or core of atom.

* octet rules.

> The tendency of an element to acquire 8 valency electrons in last ob orbit than complet is octet.

* valence electron.

> The number of electrons present in an outer most sell that is know as valence electrons.

* valency.

> The capcity combine two or more elements together its called valency of that element.

(or)

> The lose or gain of electrons or sharing of electrons to each other its called valency.

valence electrons	valency.
1	1
2	2
3	3
4	4
5	3
6	2
7	1
8	0

* Type of Chemical bonds and its formation chemical.

1] chemical bond :-

The chemical force hold together two

or more elements in between formation of bond is called chemical bond
Ex. CH_4, C_2H_6, NH_6, H_2O etc.

* Types of Bond.

1] Ionic bond / electrovalent bond / kernal bond.

> In Ionic compound the electro stastices force of attraction present in opposplency charge particle that cation and anion in between bond Formation is called ionic bond.

or.

> The tranfer of electrons form one atom two another existes cation and anion.

E.g. NaCl, KCl, $MgCl_2$, $CaCl_2$ and MgO

Na. E.C (2,8,1) ⟶ $(2,8)_{Na^{\oplus}}$

Cl E.C (2,8,7) ⟶ $(2,8,8)_{Cl^{\ominus}}$

> Inoic bond is called kernal bond because during Formation of cation this to last ob orbit

e.g Na ⟶ $Na^{\oplus}$

(2,8,1) (2,8)

> electrovalency :-

- The elements in which loss or gain of electrons in the last orbit than complet ele. octtact this type of valency is called electro valency and in between bond is called electro valent bond.

Electrovalency / Ionic valency

↓ possitive electrovalency

↓ Nagative electrovalency.

* possitive electrovalency :-

The valency originated by loss of electrons from mateic atom and complet it's last orbit (octact) is called possitive electrovalency.

∴ K (potasium) - 2, 8, 8, 1 - $K^{\oplus}$ + $e^{\ominus}$ (2, 8, 8)

potasium losses one valency electron in the last orbit therefore oppositive electrovalency of potasium +1.

Sodium 2, 8, 1 $Na^{\oplus}$ + $e^{\ominus}$

2, 8

∴ Sodium = +1

* Negative electrovalency.

It is originated by gains of electrons from non-matalic atom that complet is octact is called negativalency.

e.g. $Cl + e^{\ominus} \longrightarrow Cl^{-}$
(2,8,7) (2,8)

∴ $Fl + e^{\ominus} \longrightarrow Fl^{-}$
(2,7) (2,8)

∴ Negative electrovalency cloride and florid = -1

* properties of ionic bond.

Ionic compounds cation ionic bond they are hard and crystalline solid. Ionic compounds poller in nature that is their are soluable in water but they are insouable in nonpoller solve want, like, Bezin and organic solvent High melthing and boline point Ionic compounds are good conducter of electricity in solvation stright.

* Formation of ionic compound.
E.g. Nacl.

I] Ionization potential / I.E (Formation of cations).

2] electron offinity / I.E Formation anion

1] E.A ⟶ lower Formation anion heigh its depends upon two fachrons

The amount of energy required to remove electron in lest orbit that is know as ionization potential If Formation of cation is high than ionization energy is law and If Formation cation is law than ionization energy is high.

* Electron affinity :- Formation of anion

The amount of energy realse to attach electron in the last orbit of the gaes state is called electron affinity.

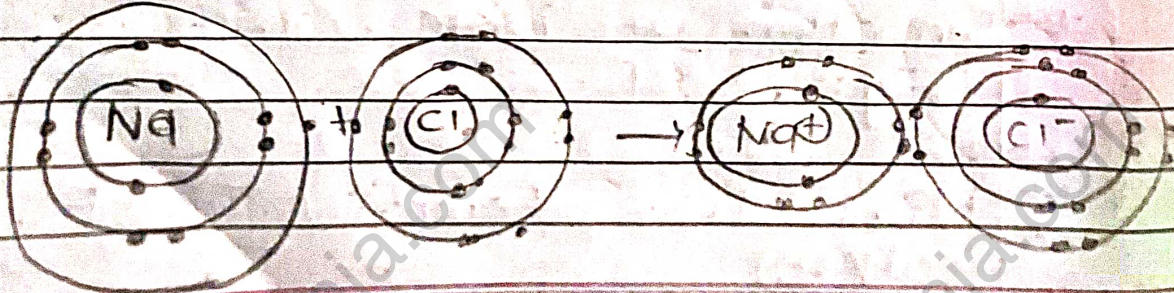
Formation of anion

E.A ⟶ lawer ⟶ Lower

⟶ higher ⟶ higher

e.g. Nacl.

E.C Na (2,8,1) and Cl (2,8,7)



OR :- $Na \times \ddot{\underset{\cdot\cdot}{Cl}}: \longrightarrow Na^+ Cl^-$ (OR) $Na^+ [:\ddot{\underset{\cdot\cdot}{Cl}}:]^-$

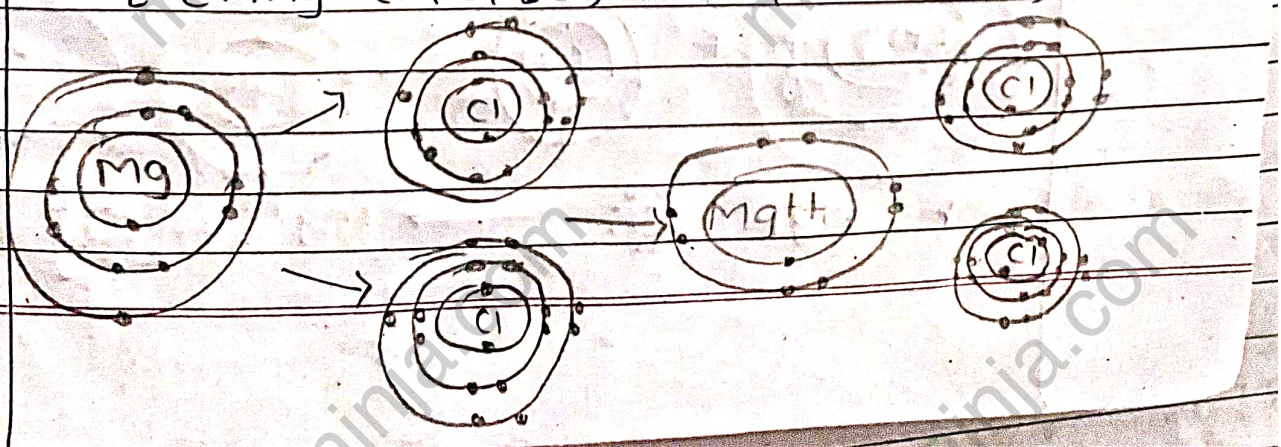
Nacl moluclue contains sodium atom and cl atom to form nutral compound

Sodium atom loss one electron in the last orbit and get one positive charge that is cation stable electronic configence nerest inter gas element like Neon (2,8)

Clorin atoms gain one vatilcy electron and negative charge that is anion on the Cl and Stable electronic configence nearest inrert gas element Argon (2,8,8)
Equal and oppasity charges in between electronic stactic force of attraction and from nutral compound.

* Electrovalent linkage.

The combines of atoms loss and gains of valncy electrons in the last orbit to from compound in between formatt of linkage is called electrovalent linkage
e.g. $MgCl_2$
E.C. mg (2,8,2) Cl (2,8,7)



OR.

$Mg^{\times} + :\underset{:}{\overset{:}{Cl}}: \longrightarrow Mg^{++} [:\underset{:}{\overset{:}{Cl}}:]$ and $[:\underset{:}{\overset{:}{Cl}}:]$

$:\underset{:}{\overset{:}{Cl}}:$

$MgCl_2$ Molucule contains mg atom cl atom to from nutural compound.

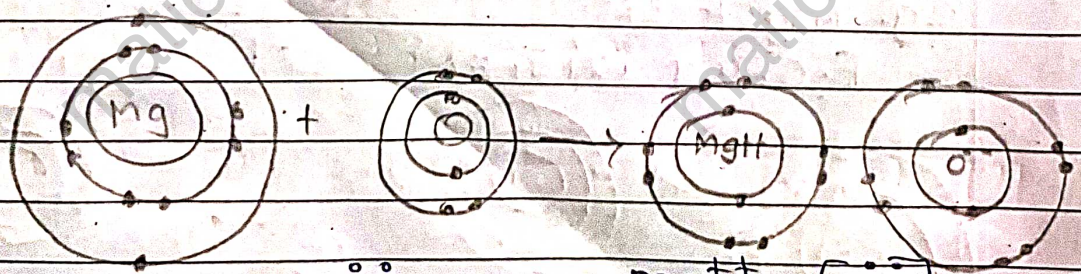
Mg atom loss two electron in the last orbit and get two positive charge that is cation stable electronic confrigreance nearest inert gas element like Neon (2,8)

clorin$_2$ atoms gain two valancy electron and negative charge that is anion an the cl and stable electronic confrigr-eance nearest inert gas element Argon (2,8,8), and (2,8,8)

Equal and oppositly charge in between eletronic stactic force of attraction and form nutural compound.

Eg MgO

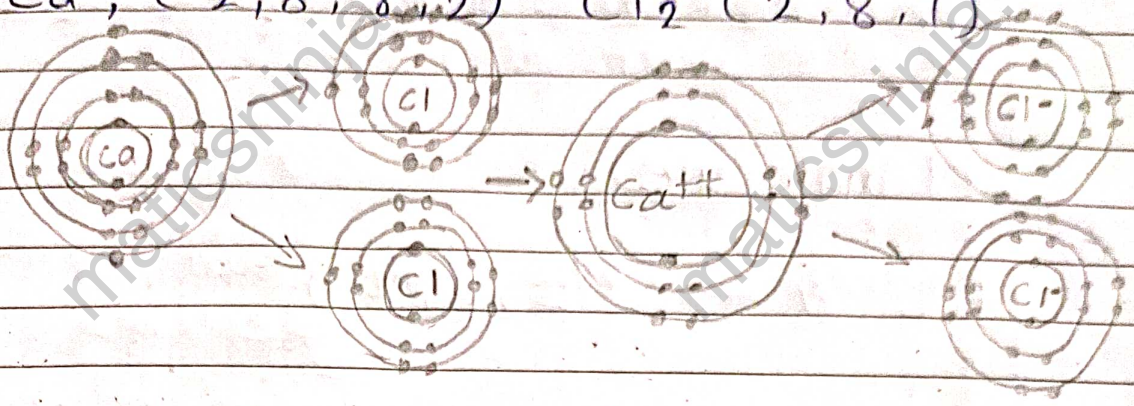
→ Mg (2,8,2) . O (2,6)



or $Mg + :\underset{:}{\overset{:}{O}}: \longrightarrow Mg^{++} [:\underset{:}{\overset{:}{O}}:]$

E.g CaCl

Ca, (2, 8, 8, 2) Cl_2 (2, 8, 7)



* Covalent bond

A type of chemical bond in which mutua sharing of electrons similar or dissimilar of atoms is called covan covalency. and in between bond is called covolent bond.

1) Bonding pair of $e^{\ominus}$

The number of electrons present in form action of bond between similar or dissimilar atoms is called bonding pair of electrons

Ex 1- C–C , C=C C≡C etc.

↓ ↓ ↓

Single covalent bond | Double covalent bond | Triple covalent bond

* Single covalent bond :-

one bonding pair of electrons present in similar or dissimilar atoms

is called single covalent bond
Ex:- H_2, f_2, NH_3, H_2O, Cl_2 etc.

Cl molecule

E.C Cl → (2, 8, 7)

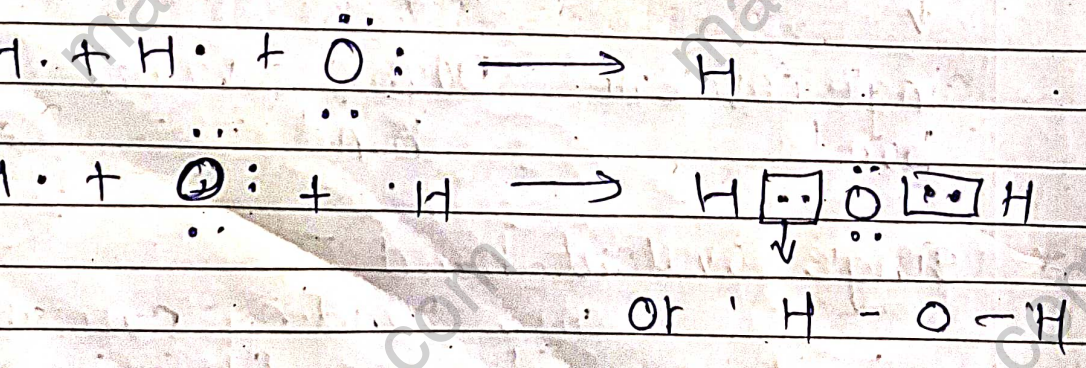
clorin molecule camtails two clorin atom

electronic configreamce of clorin (2, 8, 7) that means 7 valnce electrons present in the clorin atom, one electrons to get complets its octact.

Both the clorin molecule contribut to each other and formation of single ~~covan~~ covalent bond.

H_2O

H (1), O (2, 6)



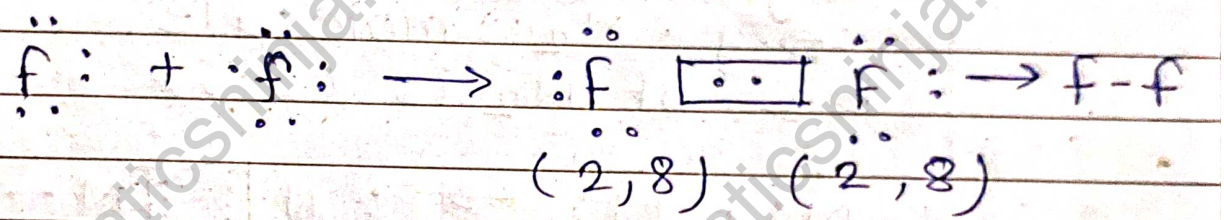
H_2O molecule contains two Hydrogen & one oxgen

Hydrogen complet its Duplet for one electron and oxygen complet its octact for two electron.

oxygen and hydrogen contribute to each other and form single covalent bond.

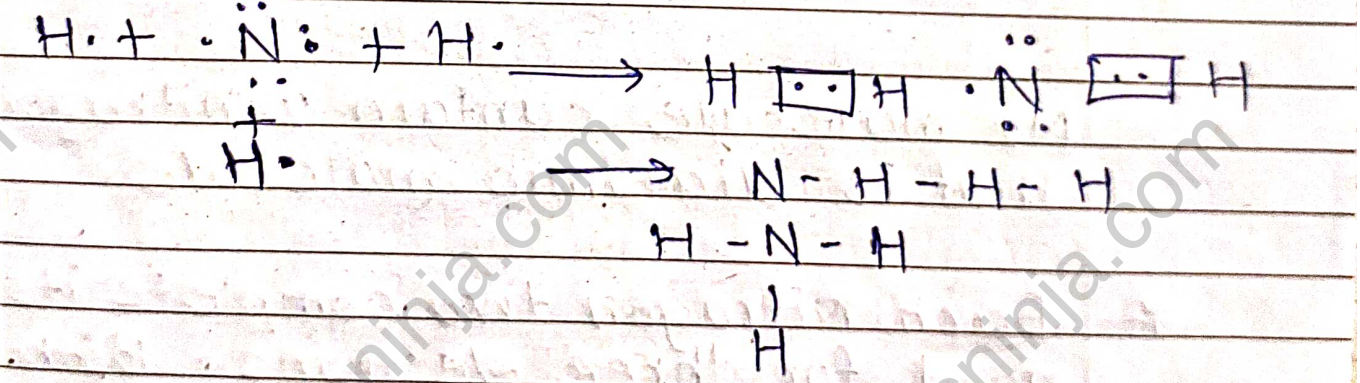
f_2

$f_2 = (2,7)$



NH_3

N - (2,5) H = 1



2] Double covalent bond

Two bonding pair of electrons to from double covalent bond.

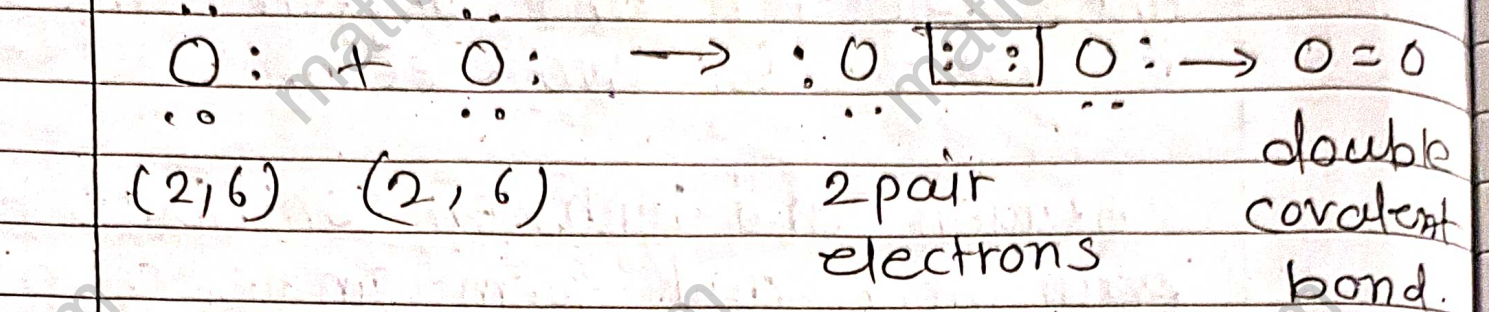
e.g. C_2H_4, O_2

e.g. O_2 molecule

E.C of O_2 is (2,6)

This atom for complete its octet

to need two valence electrons both the combine & mut mutul sharing to 2 pair electrons.

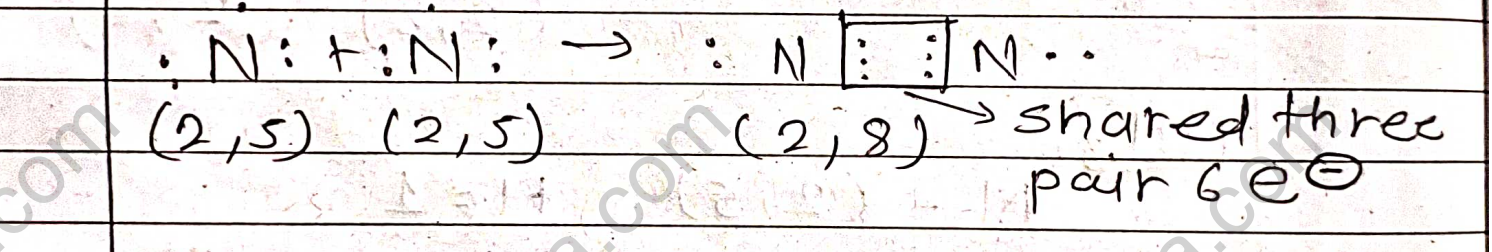


O_2 molecule contains 2 oxgen atoms thas is called diatomic molecu-le

e.g. C_2H_2, N_2 etc

e.g. N_2 molecule

E.C of N_2 is (2,5)



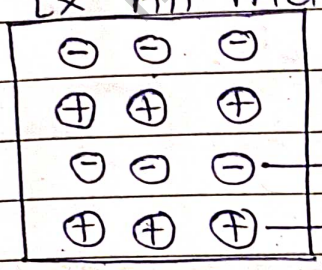
N_2 molecule contain 2 nitrogen atoms that is diatomic molecule.

* Each nitrogen two complete its octet need for three electrons. Both the atoms combine together three pair of sharing of electrons.

* Metallic Bond.

A chemical bond in which possitivly charge ions and Delocalized outer $e^{\ominus}$ s in between electro statices Force of attraction present and formation of bond is called metallic bond.

Ex All metal. Cu, Al and their Alloys



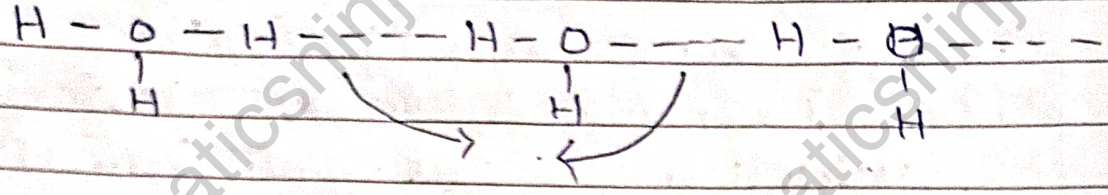
* propeties of metallic bond.

> Metalic bonds found in all metals.
> melting and boling point of metalic compound is high.
> They are good condcoter of electricity and heat.
> metals are malleable and ductile.
> metallic strength increasezes when Numbe valance electrons increase and decrease atomi c size.
> Metals are luster.

* Hydrogen bond (- - - - - dotted line)

The Formation of bond is present between hydrogen atom electro negative atom (Nitrogen, oxygen, flurin) in between Formation of bond is called hydrogen bond.

Ex:- H_2O, HF, p-nitrophenol, o-nitrophenol etc.

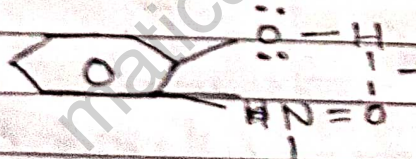


* Hydrogen bond.
  - Intramolecular hydrogen bonding
  - Intermolecular hydrogen bonding

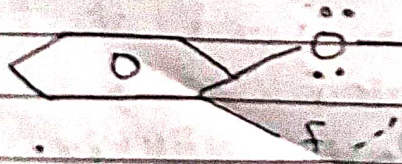
1] Intramolecular hydrogen bonding.

The bonding is formed by hydrogen atom and electron negative atom (Nitroge oxygen, flurin) in the same molecul is called intramolecular hydrogen bonding.

Ex o → Nitrophenol



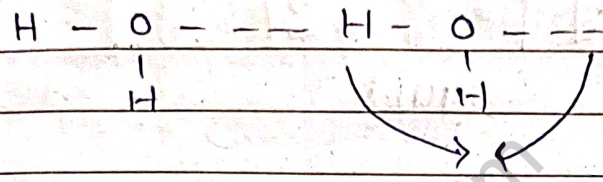
O → hydroxy bezalole



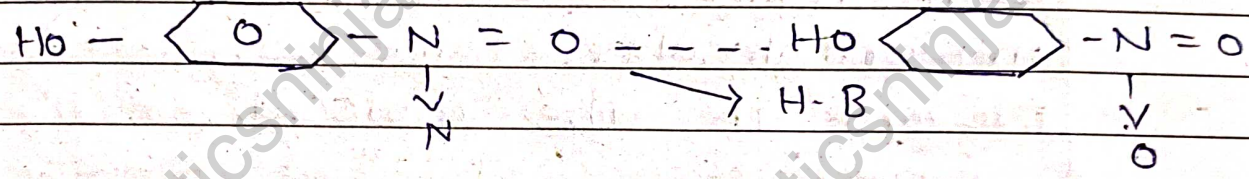
O → flurophenol

2] Intermolecular hydrogen bonding.

The bonding formed by in between hydrogen and electro negative atoms (Nitrogen, oxygen, Fluir) of the different molecul in the same substance.
Ex: H_2O, HF, P- nitrophonal.



Hydrogen bond.



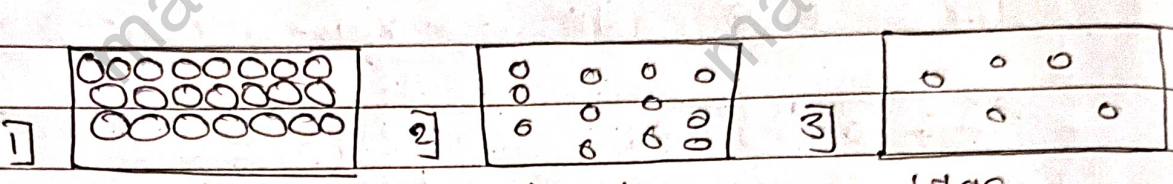
P ⟶ Nitrophonal.

* properties of hydrogen bonding.

- Hydrogen bonding conta moleculs are highly solubal in the water.
- The mething & boiling point is high because present hydrogen bonding.
- There are good conductor of heat and electricity.
- The ~~stick~~ Stickiness of gum and honey are present in their hydrogen bonding.

- The coin of DNA are held together because present of hydrogen bonding.

* Molecular Arrangement of solid, liquid and vias.



solid liquid vias.

> The solid molecul are closly attached to each other because their are weak in termolecular forces of attraction present in the molecul.

> They are diffent shape and difnight volume.

> ~~In solid moleculs are losely attach to eachother the sapece is large present~~

> In solid moleculs strongly forces of diaffraction present in them.

> know any shapes present in solid moleculs.

Ex :- Diamond, Nacl, sugar etc.

2] Liquid :-

> The liquid moleculs are losely attach to eacther the sapece is large present

in liquid moleculs.

> Liquid molecul are large intermolecular force present.

> They do no't have difinight shape but they have difinite volume.

Ex Waters H_2O, all chemical liquid Milk.

3] Gas :-

> Gases molecuars are sperated by one another and very large intermolecular force present.

> They do not have difinite volume and difinit shape.
Ex. Air, Oxygen, Nitrogen gas, CO_2 All Gases moleculas.

* Structure of Solid.

Crystalline Solid

Amorphous Solid.

* crystalline solid.

In crystalline solid the contuleresel

particals (atoms, ions, moleculs) they are arranged in difinite order (difinite shape and difinite volume) is called crystalling solid)

Ex. Diamond, sugar, graphile etc.

properties of crystalline solid.

> Ionic solid are crystalline in netcur
> Melthing and boiling point of crystallin solid are high.
> They are good condctor of heat and electricity
> Crystalline solid are long range order
> They are Anisotropic their for the phycial properties are different in different direction.
Ex. Diamond, sugar, graphit ete.
> Crystalline solid are solubal in water

* Amorphous solid.

In Amorphous solid the constitude particals (atoms) iron, molecules) they are arrangend in doesn't difinite order (difinite shape and difinite volume) is called Amorphous solid.

* properties of Amorphous solid.

> Covalent compounds are amorphous in neture.

- Amorphous solids are short range order
- They are bad conductor of heat and electricity.
- They are hot solubal in water.
- melthing and boiling point of Amorphas solid are law.
- They are Isotropic
  ∴ physical properties are same in same direction.

Ex. Glass, Coals, coke, plastics, Rubber etc.

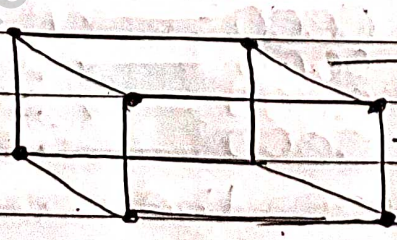
* Types of ionic crystals

- Ionic crystals.
  The compounds in which ionic bonding present is called ionic crystals.

* Unit cells

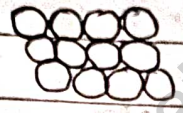
The arrang ment of particals, sphere, all the are represent in intayer crystal structure which are repited more time is called unit cell.

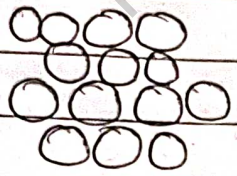
Ex.



* Co-ordination number:

The Number of sphere are surrounding to the central atom of sphere and touches central atom sphere. This number is called co-ordination number

 → co-ordination no is 4

 → co-ordination no is 6

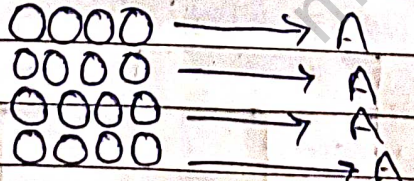
* Types of Ionic crystals

Their are four types of Ionic crystals

1] Simple cubic packing (SCP)
2] Body centred cubic packing (BCC)
3] Hexagonal close packing (HCP)
4] Face center packing. (or) cubic close packing (fcD or CCP)

1] Simple cubic packing.

Simple cubic packing moleculs are in to dimentional.



In above figure the arament of sphere in first row are same to the all remaing rows.

- This type of packing is called AAAA simple cubic packing.
- In simple cubic packing the co-ordination number is 4.
- Is sphere attch to the four sphere to the central atom all sphere.
Ex. Nacl, kcl, polonium ele

1] Anisotropic :-

The phyicial propetices are different in different direction is called as Anisotropic

2] Istrophic :-

The physical properties are same direction is called as Introphic.

3] Electrovalency :-

The element in which loss or gains of electrons in the last orbit than complet octtact this type of valency is called electrovalency.

4] Covalency :-

A type of chemical bond in which mutcal shering of electrons similar or dissimilar of atoms is called covalency

5] Amerphoue Solid :-

In Amerphous solid the constitude particals (atom, ions, moreculas) they are arranged is doem't difinite orders (difinite shap and difinite volume) is called Amorphouss solid.

6] Metallic solids :-

Metalic solids are the types of solids that are closely arranged in a way that electrons are free to move in the direction of current is called as metallic solids.

Q.2 Write difference beteeem positive and Negtive electrovalency.

positive electrovalency	Negtive electrovalency
The ions that have a positive electrovalency are oxidized form their elemental states. Sodium has a positive electrovalency of 1	They have negative electrovalncy if they are reduced form their elemental states. Chlorin has a negative electrovaleney of 2.

Q.3 Write Note an Hydrogen bond and co-ordinate bond.

1] Hydrogen bond.

- The established order of hydrogen bonds, which can be a type of appealing Intermolecular force. is known as hydrogen bonding.
- Hydrogen bonding is a special type of dipoledipole attraction between molecule hota covalent bond to a hydrogen atom.
- In water molecules, for example, hydroge is covalent hydrogen bonded to the greater electronegative oxygen atom.

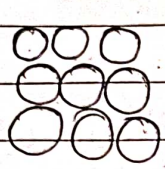
2] co-ordinate bond :-

- In this type of bonding, the atom that shares an electron pair form it self is termed as the donoer.
- The other atom which accepts these shared pair of electrons is known as a receptor or acceptor.
- The bond is represented with an arrow → pointhing towards the acceptor form the doner atom.
- After sharing of electron pairs, each atom gets stability.
- This type of bonding is central to the Lewis theory.

- Gething a good understanding of co-ordinate covalent bonds can help in properly designing complex orgnic molecules.

2] Body centred cubic paking (BCP)

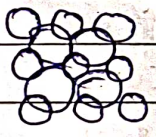
In this packing the sphere are arranged alternative.



1st layer

2nd layer

- When 2nd layer is placed over 1st layer than and new wind Generate
- Than 3rd layer con 2nd layer than new wide is Covered.



3rd layer

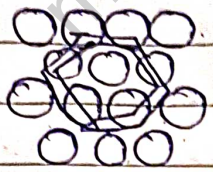
- The co-ordination number body center cubic is 8.
  ∴ Four shepere are above and Four shepere are below.
- The Bcc strutcher are more compack than simple cubic packing.

Ex. Fe (Iron), (crcchromium) Nq, Bq, etc

3] Hexagonal close packing (Hcp)

Hcp in 2D arrangement

Hcp in 3D arrangement

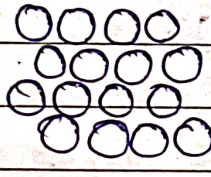


1st layer 2D.
In this arrangment 1st row and 2nd row are different.

So this types of packing is called ABAB type of Hcp.

The co-ordinate number is 6.

* Hcp in 3D arrangment



1st layer
In coidi arrangment in the 1st layer generated triangle void for this void placend on 2nd layer than new void are generated. That is two void generated

i] Tetrachedral and octahedral.

When 3rd layer is placed on 2nd layer than tetrachedral void is covered and 3rd layer is aline with 1st layer and this type of arrangement Hcp in 3D diamention

Ex. Zn (zinc) cobalt (Co) Mg (magnesium) etc.

4] Face centred cubic packing (CCP)

1st layer

The co-ordination number of Hcp in 3D is 12

∴ T: 3 sphere are above 0 and in immidle 6 sphere attach to the central

- When on the first layer is placed over 2nd layer than new void generated that is Tetrahedal and octhardal

- Few covered octharadal void put an 3rd layer than this layer do not aline with 1st and 2nd row. So this type of packing is called A·B·C A B C type packing

- The co-ordination number is above three sphere and belowe three sphere in midle 6 sphere there for co-ordination number is 12.

Ex:- Aluminum, copper, platinum & Nikel etc.