ALKADIENES

Basics of Dienes, some reactions

Dienes are of three types :-

Conjugated diene

Alternate double bonds.

E.g. $(CH_2=CH-CH=CH_2)$

Isolated diene

Separated by a sp^3 carbon.

E.g. $CH_2=CH-CH_2-CH=CH_2$

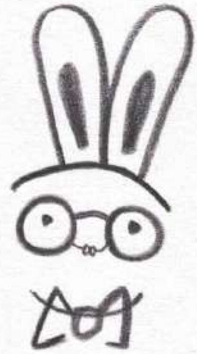
↑ sp^3

Cumulated diene

Adjacent double bonds.

E.g. $CH_2=C=CH_2$

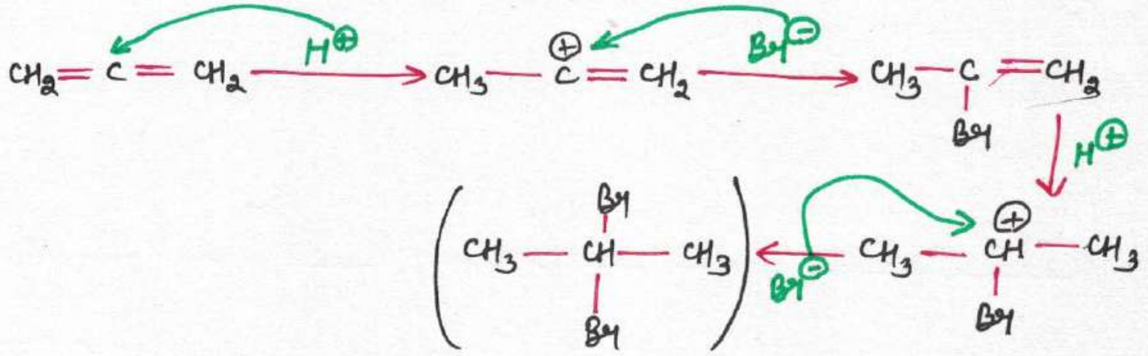
→ This are unstable.



Q

$CH_2{=}C{=}CH_2 \xrightarrow[\text{(excess)}]{HBr} ?$

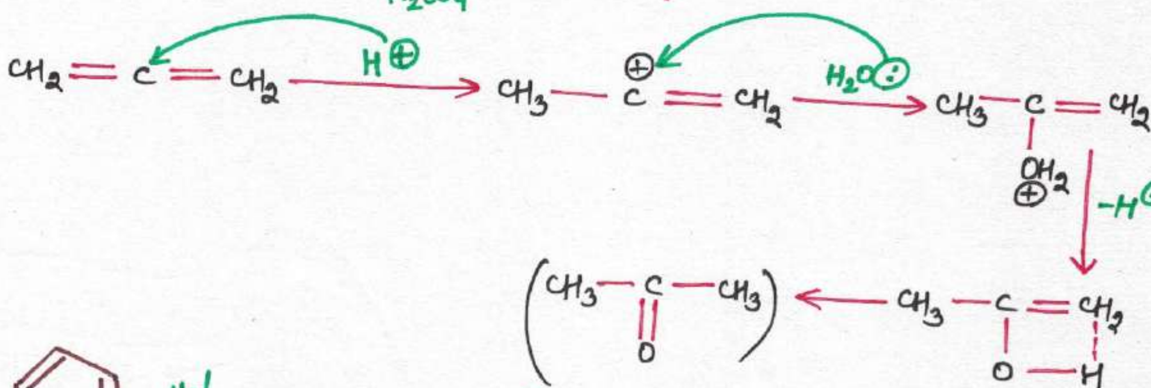
A



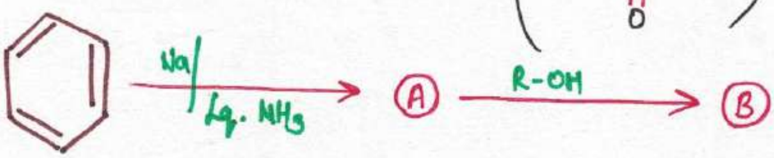
Q

$CH_2 \quad C \quad CH_2 \xrightarrow[H_2SO_4]{\text{dil.}} ?$

A

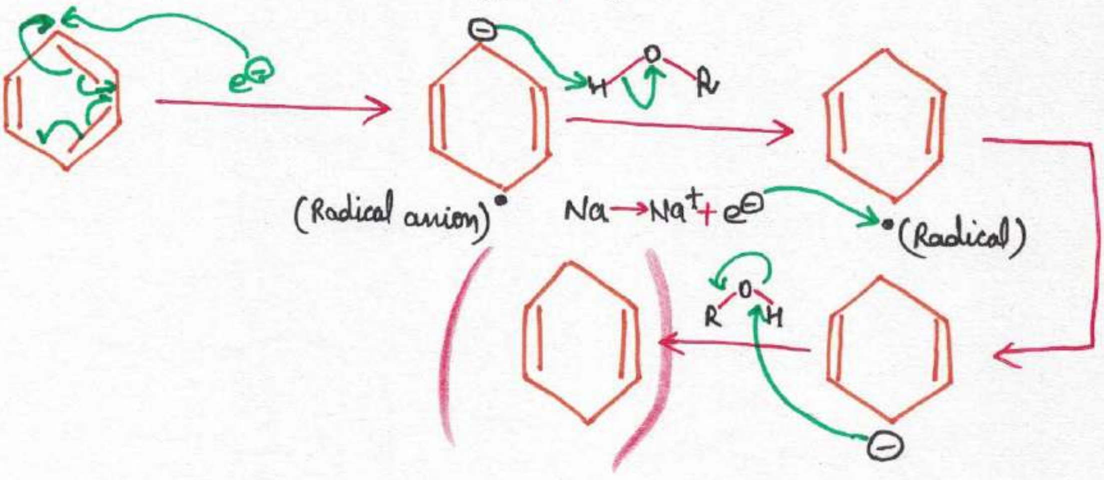


Q



A

$Na \longrightarrow Na^{\oplus} + e^{\ominus}$



Isolated diene

TYPES OF ADDITION

(a) **(1,2) Addition** – Kinetically done, Less stable product. (Lower temp.)

PeRiodic ClassiFication

PERIODIC CLASSIFICATION – Systematic arrangement of elements in tabular form is known as **periodic table.**

PROUT'S HYPOTHESIS

Atomic mass of elements is integer multiple of atomic mass of Hydrogen.
Atomic mass of any element = n x mass of H.

E.g. H = n×1 = 4 . . . .   Li = 7×1 = 7

But atomic mass of some elements was found to be fractional.

E.g. Cl = 35.5×1 = 35.5   {not integer multiple}

After discovery of isotops, average mass of element come out to be fractional. Even H itself has 3 isotops and its av. atomic mass is 1.008 which is fractional,
This theory was discarded.

DOBEREINER'S TRIADS

Dobereiner's ? arrange three elements (some properties) in increasing order of their atomic mass and found that atomic mass of middle element is arithmetic mean of terminal element.

1.

Li	Na	K
7	23	39

atom mass of Na = $\frac{39+7}{2}$ = 23

2.

Ca	Sr	Ba
40	88.5	137

3. Cl Br I

4. P As Sb

5. S Se Te

But C (12) N (14) O (16) can not be Dobereiner's Triad.
as they don't have similar properties.
Dobereiner Triad is applicable only in groups (not in periods).

NEWLAND'S LAW OF OCTAWS

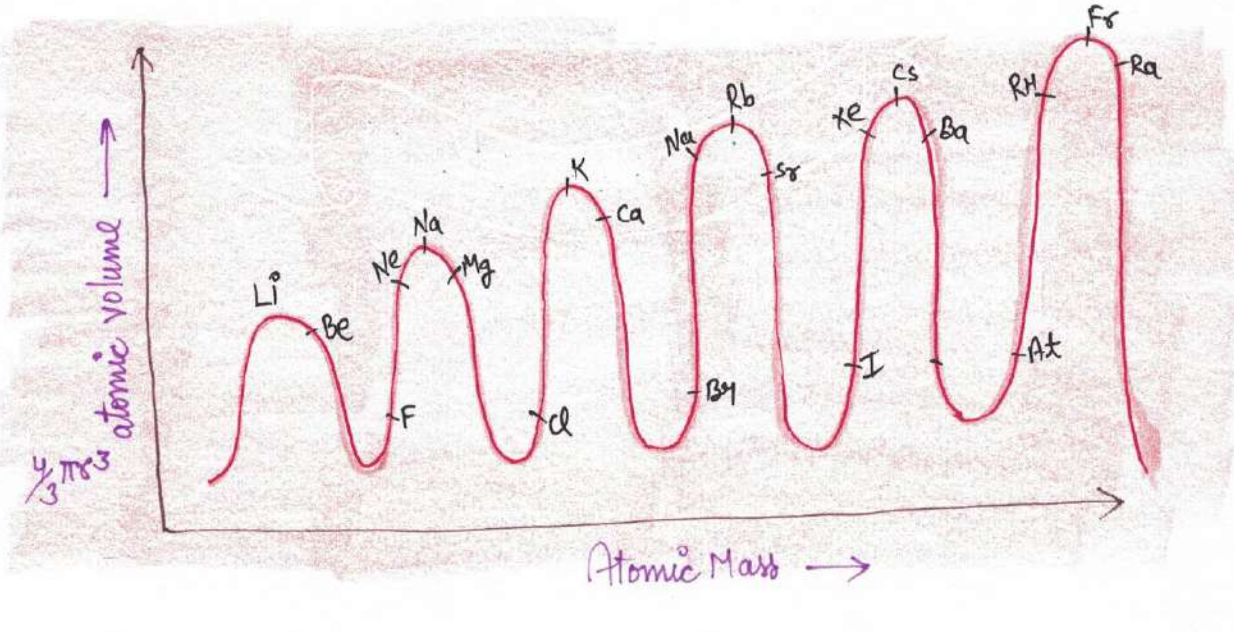
when elements are arranged in increasing order of their atomic masses, then properties of every eight element is similar to that of the first.

Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl
K	Ca					

This law is applicable only upto Ca {atomic no, 20}.

LOTHER MEYER'S CURVE

Lother Meyer plotted a curve of atomic volume versus atomic mass.



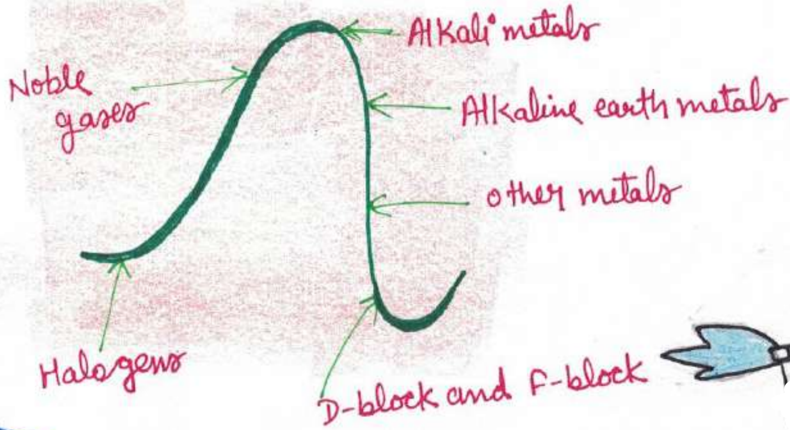
Lothar Meyer found that same properties elements occupy same positions the curve.

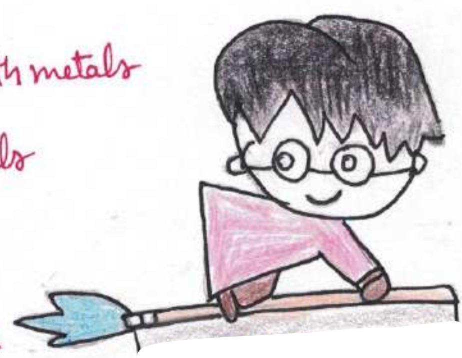
Alkali metals [Li, Na, K, Rb, Cs, Fr] occupy peak position.

Alkaline earth metals [Be, Mg, Ca, Sr, Ba, Ra] occupy descending position on the curve.

Halogens (F, Cl, Br, I, At) and noble gases, [He, Ne, Ar, Kr, Xe, Rn] occupy ascending position.

D-block (transition elements) and F-block (inner transition elements) occupy bottom position.





MENDELEEV'S LAW

Physical and chemical properties of elements are periodic function of their atomic mass.

It means if elements are arranged in increasing order of their atomic mass periodicity occur after certain intervals.

Mendeleev's periodic table consist of two parts 7 horizontal rows and 9 verticle columns where 7 horizonatal rows are periods and 9 verticles columns are groups.

1 Period,	2 elements	(H, He)	–	Very short period
2 Period,	8 elements	(Li to Ne)	–	short Period
3 Period,	8 elements	(Na to Ar)	–	short Period
4 Period,	18 elements	(K to Kr)	–	long Period
5 period,	18 elements	(Rb to Xe)	–	long Period
6 Period,	32 elements	(Cs to Rn)	–	Very Long period
7 Period,	Incomplete	(Fr to --)	–	Incomplete period

BONDING IN COORDINATION COMPOUND

1. Warner Theory
2. EAN Theory (Sidgwick)
3. VBT (Valence Bond Theory)
4. CFST (crystal Field Splitting Theory)

WARNOR THEORY

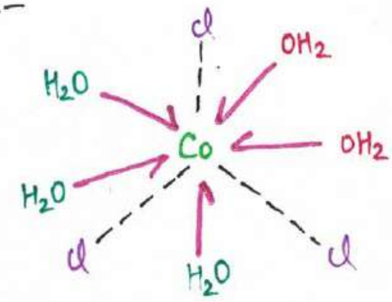
1893

By ALFRED WUNER – FATHER OF CO-ORDINATION CHEMISTRY

According to it there are 2 types of valencies in co-ordination compounds
Primary & secondary

PRIMARY VALENCY	SECONDARY VALENCY
It is satisfied by anions only.	satisfied by neutral species or sometimes by anion also.
It decides the O.S of central atom.	It decides the co-ordination no. of central atom.
Variable in nature	invariable in nature
Denoted by dotted line (------)	Denoted by Dark line (——>)
Non-directional	Directional (decides str.)
ionisable in nature	non-ionisable in nature

on the basis of above postulates, werner decided the str. of $CoCl_3 \cdot 6H_2O$ and $CuSO_4 \cdot 4H_2O$ as:-



$[Co(H_2O)_6]Cl_3$

PV = 3 S.V = 6

CN = 6 O.S = 3 C.V. = 0

(octahedral) (common valency)

$[Cu(OH_2)_4]SO_4$

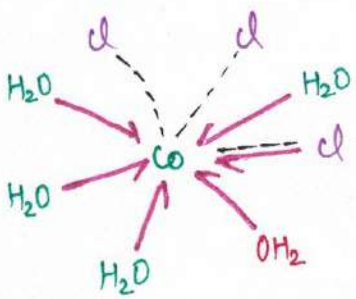
P.V = 1 S.V = 4

C.V = 0 O.S = 2

C.N = 4

Q. Draw the structure of following by using werner concept.

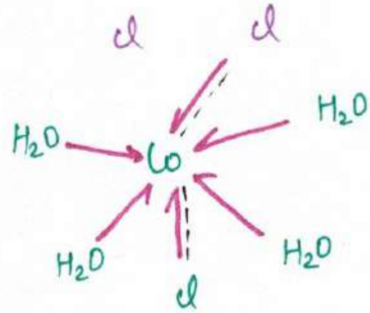
(a) $CoCl_3 \cdot 5H_2O$ (b) $CoCl_3 \cdot 4H_2O$ (c) $CoCl_3 \cdot 3H_2O$



$[Co(H_2O)_5Cl]Cl_2$

P.V = 3 S.V = 6

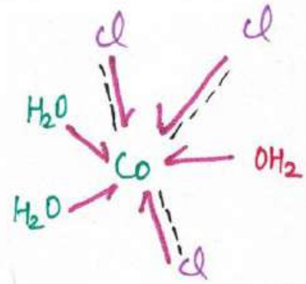
C.V = 1 O.S = +3



$[Co(H_2O)_4Cl_2]Cl$

P.V = 3 S.V = 6

C.V = 2 O.S = +3



$[Co(H_2O)_3(Cl)_3]$

P.V = 3 S.V = 6

C.V = 3

If H_2O is ligand in a complex, then CN = 6 [JEE 2010]

Werner used other following methods for calculation of confi. of co-ordination compounds

Conductivity Method

Conductivity depends on -

(i) no. of ion (ii) Magnitude of charge

Q. $[Co(NH_3)_5Cl]Cl_2$ (I)

$\downarrow$

$[Co(NH_3)_5Cl]^{+2} + 2Cl^-$

3 ions

$[Co(NH_3)_5Cl]SO_4$ (II)

$\downarrow$

$[Co(NH_3)_5Cl]^{+2} + SO_4^{-2}$

2 ions

(I) > (II)

$[Co(NH_3)_5Br]SO_4$ (I)

$\downarrow$

$[\ \ ]^{+2} + SO_4^{-2}$

no. of ions = 2

charge = 4

$[Co(NH_3)_5SO_4]Br$ (II)

$\downarrow$

$[\ \ ]^{+} + Br^{-}$

no. of ions = 2

charge = 2

(I) > (II)

Chemical Reaction Method

$Ag^+ + Cl^- \longrightarrow AgCl \downarrow$ (white)

$Ag^+ + Br \longrightarrow AgBr \downarrow$ (Pale yellow)

$Ag^+ + I^- \longrightarrow AgI \downarrow$ (Yellow)

$Ba^{+2} + SO_4^{-2} \longrightarrow BaSO_4 \downarrow$ (white ppt.)

$[Cr(NH_3)_4ClI]Br \xrightarrow{AgNO_3} AgBr \downarrow$ (Yellow)

$[Cr(NH_3)_4IBr]Cl \xrightarrow{AgNO_3} AgCl \downarrow$ (white)

$CoCl_3 \cdot 6NH_3 + AgNO_3$ (excess) $\longrightarrow$ 3 mole AgCl

$[Co(NH_3)_6]Cl_3$

$CoCl_3 \cdot 5NH_3 + AgNO_3$ (excess) $\longrightarrow$ 2 mole AgCl

$[Co(NH_3)_5Cl]Cl_2$

$CoCl_3 \cdot 4NH_3 + AgNO_3$ (excess) $\longrightarrow$ 1 mole AgCl

$[Co(NH_3)_4Cl_2]Cl$

Colligative Properties Method

Q. 0.01 M of a compound containing $CoCl_3$ and NH_3 (1:4 molar ratio) has depression in freezing pt. 0.372. Calculate configuration of the compound. ($K_{f(H_2O)} = 1.86$).

Solution:- $\Delta T_f = ik_f m \Rightarrow 0.0372 = i(1.86)(0.01)$

$i = 2$

no. of ions = 2

$[Co(Cl)_2(NH_3)_4]Cl$

Reaction with conc. H_2SO_4

Conc. H_2SO_4 acts as a dehydrating agent.

on reax with conc^n H_2SO_4 decrease in weight shows that H_2O is present in ionisation sphere.

E.g. $[Co(H_2O)_5Cl]SO_4 \xrightarrow[H_2SO_4]{conc} $ no $\downarrow\downarrow$ in wat

$[Co(H_2O)_4SO_4].H_2O \xrightarrow[H_2SO_4]{conc^n} \downarrow\downarrow$ in wat

EAN (Effective Atomic Number)

by SIDGWICK

EAN = Atomic no (of central atom) − oxidation state + {no. of e^- obtained by Ligand in C.A.
or
$2 \times C.N.$}

According to sidgwick if EAN value of central atom is equal to atomic no. of next nearest noble gas, then compound will be more stable.

Later on this concept was only fulfilled for stability of metal carbonyl compound.

Q. Calculate EAN of following :-

a. $[Fe(H_2O)_6]Cl_2$ EAN = 26 − 2 + 12 ⇒ 23 + 13 = 36 [Kr]

b. $[Zn(H_2O)_4]^{+2}$ EAN = 30 − 2 + 8 ⇒ 36 [Kr]

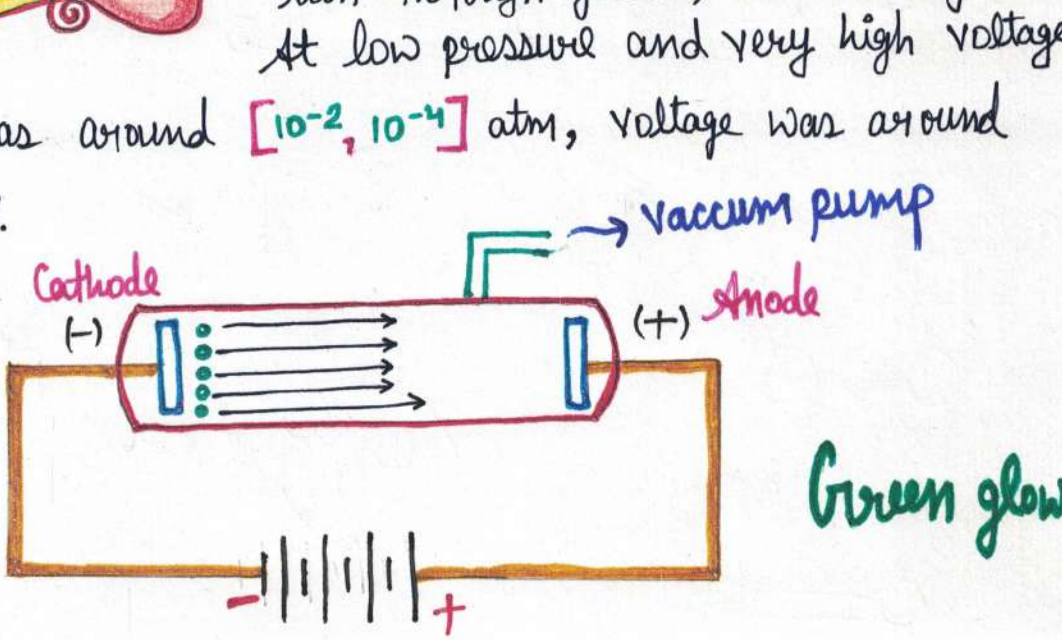
c. $[Cr(H_2O)_6]Cl_3$ EAN = 24 − 3 + 12 ⇒ 33

d. $[Fe(CO_5)]$ EAN = 26 + 10 ⇒ 36 [Kr]

ATOMIC STRUCTURE

DISCOVERY OF ELECTRON

A. CATHODE RAYS – Julius Plucker was working on conduction through gases; on discharge tube. At low pressure and very high voltage, pressure was around $[10^{-2}, 10^{-4}]$ atm, voltage was around $[10^3, 10^4]$ V.



He observed a way coming from cathode to anode ; consisting of some charge and mass. He named it as **cathode rays.**

PROPERTIES

e^-

1. It travels in a straight line.
2. It consists of mass as pedal wheel will rotate.
3. An applying electromagnetic field, he observed that the cathode rays are negatively charged.
4. It produced green glow on ins screen.
5. It affects the photographic plate.

J.J. Thompson calculated the e/m ratio, i.e specific charge (charge/mass) for different gases and he observed that this ratio is a constant for all gases, and he named it is as <u>electron</u>.

The gases ionised to give e^- $H \rightarrow H^+ + e^-$

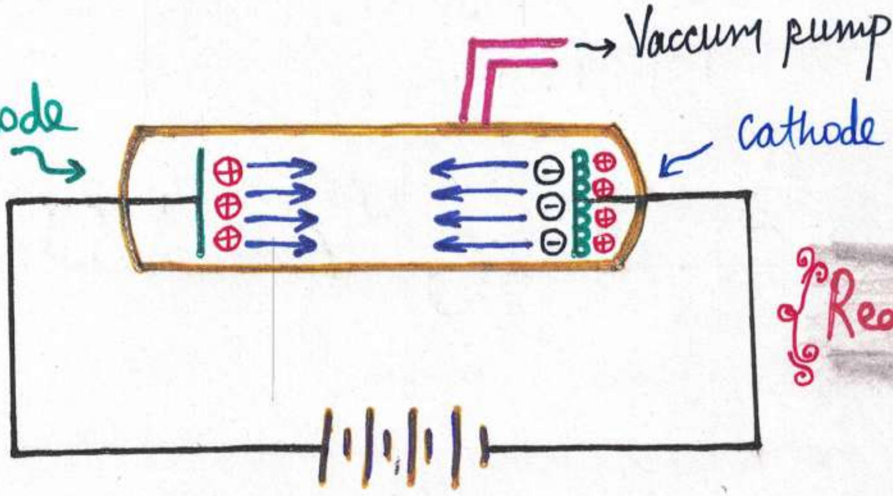
DISCOVERY OF PROTON

Goldstein started to work as perforated cathode in a discharge tabe.

$H \rightarrow H^+ + e^- \longrightarrow e/m$ → changes as the charge is H^+

$He \rightarrow He^+ + e^- \longrightarrow$ Different element

All cathode rays are e^- but all anode rays are not protons.



{Red glow}

These are called as anode rays (canal rays). It consists of positive charge. The specific charge (e/m) will be different for different gases. It is maximum for hydrogen gas. If 'H' gas is used, this will be a ray of protons.

DISCOVERY OF NEUTRON

Chadwick started experiment on be particles. on α bombardment on the Be particle, he observed 1 particle which is neutral. He named it as <u>neutron.</u>

$$_{4}^{9}Be + _{2}^{4}He \longrightarrow _{6}^{12}C + _{0}^{1}n$$

ATOMIC MODELS

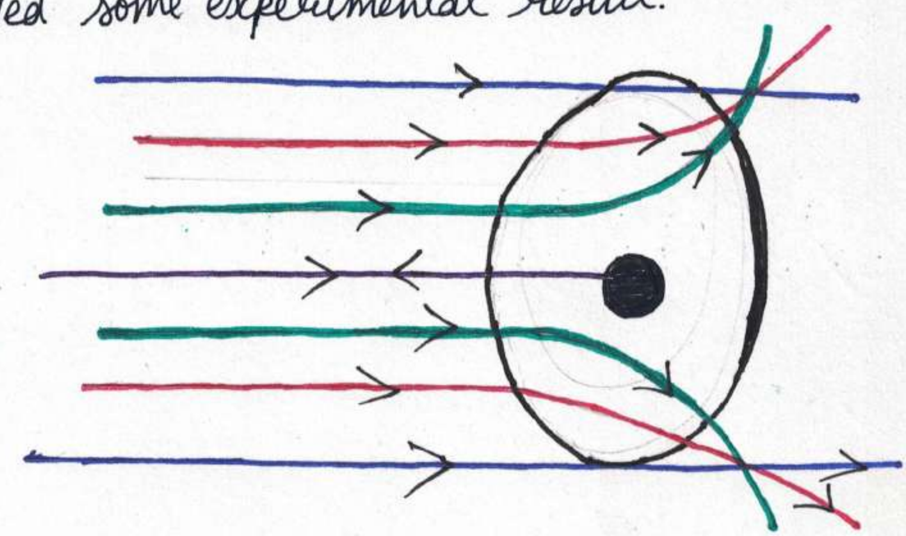
(A.) S.S. Thompson Model

- It is called "Plum-Pudding" model or Watermelon model. According to this model, atom is like a watermelon which consists uniformly distribution of positive charge and e^{-}'s are embedded like seeds in it.

(B) RUTHERFORD Model

- He started experimental on gold foil with α-Particles. He observed some experimental result.

α-Particles



CHEMICAL BONDING

{LET'S PLAY BOND-BOND}

What is chemical Bond?

Force of attraction between 2 atoms which hold them together in a molecule is known as chemical bond.

Types of chemical Bond

chemical bond

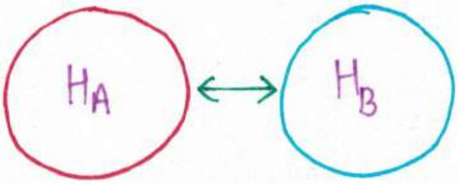
- **Strong Bond**
  - Electrovalent/ionic bond
  - Covalent bond
  - Co-ordinate bond
  - Metallic bond
- **Weak Bond**
  - Hydrogen bond
  - Vander waals forces

Condition Required to form bonds

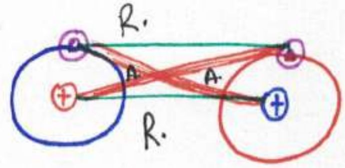
Condition to require chemical bonding of elements:-

a. to acquire stability or to get inert gas configuration

b. to acquire lower energy state.



H_2



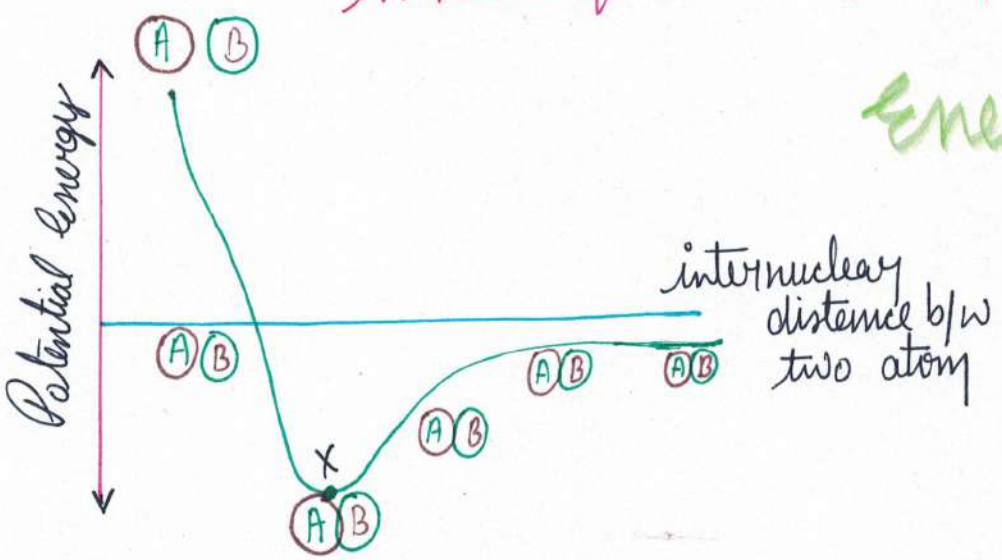
Repulsion ← [Nucleus A - Nucleus B / Electron A - Electron B]

Attraction ← [Nucleus A - Electron B / Nucleus B - Electron A]

Chemical bond is formed when

Attractive force > Repulsion force

Energy Diagram



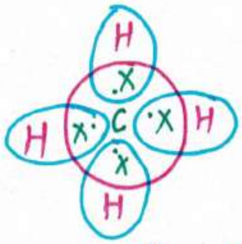
at pt. X bond is formed b/w atom A & B.

LEVI'S OCTAL LAW

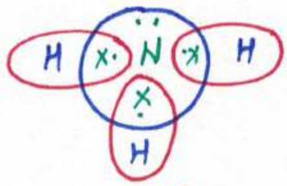
According to Levi's, every element want to get stable electronic configuration [inert gas confi- because noble gases are stable in nature. They are inert to chemical reaction or bonding to achieve inert gas confi element gains electron, loses electron or shares electron.

1. Transfer of e^-s b/w two atom → Electrovalent / Ionic Bond
2. Sharing of electron → Covelent Bond

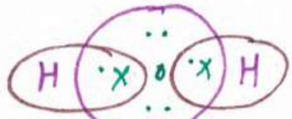
ⓐ Equal sharing → Covelent Bond
ⓑ Unequal sharing → Co-ordinate Bond



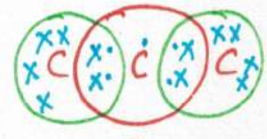
CH mathane



NH_3
ammonia



H_2O
Water

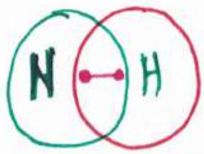


CO_2
Carbondioxide

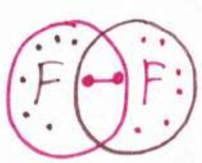
Levis-Dot-Structure

In this structure, the no. of valence shell electrons in an element are represented by dots or crosses.

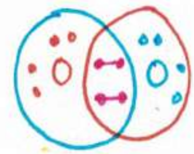
Covelent Bond

duplet 

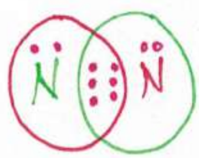
H_2 single bond
H-F sharing of $2e^-$

Octel 

F_2 single bond
F-F

Octel 

O_2 double bond
O=O sharing of $4e^-$

Octel 

N_2 triple bond
N≡N sharing of $6e^-$

Types Of Electronic Configuration

(A) INERT GAS CONFIGURATION

noble gas → ns^2np^6 [except $He = 1s^2$]

The cation or anions which completes their octel or duplet are said to have achieved inert gas configuration.

Li^+ Be^{+2} H^- = [He]

Na^+ Mg^{+2} Al^{+3} = [Ne]

elements which follow octel :- Na^+, K^+, Rb^+, Cs^+, Mg^{+2}, Ca^{+2}, Sr^{+2}, Ba^{+2}, F^-, O^{-2}, Cl^-, Br^-, I^-, S^{-2}, N^{-3}, P^{-3}, Se^{-2}, Sc^{+3}, Ti^{+4}, V^{+5}, Cr^{+6}, Mn^{+7}

(B) PSEUDO-INERT GAS CONFIGURATION

Stability of elements possessing this configuration is like inert gas but configuration is not like inert gas. Cations having 9 to 18 e^-'s, in valence shell then the config. They get is known as pseudo inert gas configuration.

$_{30}Zn^{+2} = 1s^2\ 2s^2\ 2p^6\ \underbrace{3s^2\ 3p^6\ 3d^{10}}_{18e^-}$

$_{29}Cu^{+2} = 1s^2\ 2s^2\ 2p^6\ \underbrace{3s^2\ 3p^6\ 3d^9}_{17e^-}$

$_{25}Mn^{+2} = 1s^2\ 2s^2\ 2p^6\ \underbrace{3s^2\ 3p^6\ 3d^5}_{13e^-}$

$_{23}V^{+3} = 1s^2\ 2s^2\ 2p^6\ \underbrace{3s^2\ 3p^6\ 3d^3}_{11e^-}$

$_{22}Ti^{+3}$ = $1s^2\ 2s^2\ 2p^6\ \underbrace{3s^2\ 3p^6\ 3d^2}_{10e^-}$

$_{31}Ga^{+3}$ = $1s^2\ 2s^2\ 2p^6\ \underbrace{3s^2\ 3p^6\ 3d^{10}}_{10e^-}$

$_{47}[Ag]^{+1}$ = $_{18}[Ar]\ 3d^{10}.\ \underbrace{4s^2\ 4p^6\ 4d^{10}}_{18e^-}\ 5s^0$

PSUEDO-INERT GAS [ns^2] CONFIGURATION

$(n-1)\ s^2\ p^6 d^{10} + ns^2$

$_{31}Ga^{+1} = 1s^2\ 2s^2\ 2p^6\ \underbrace{3s^2\ 3p^6\ 3d^{10}}_{18}\ \underbrace{4s^2}_{2}$

$_{81}Tl^{+1} = 54[Xe]\ 4f^{14}\ 5d^{10}\ 6s^2\ 6p^0$ [inert-pair effect]

$_{31}Ge^{+1} = 1s^2\ 2s^2\ 2p^6\ \underbrace{3s^2\ 3p^6\ 3d^{10}}\ \underbrace{4s^2}$

Limitation of Octel Law

electron precise compound → 8e⁻ present in vallence shell of central atom after bonding.

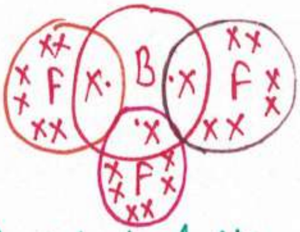
CO_2, H_2O, PCl_3, NH_3

1. HYPOVALENT COMPOUND

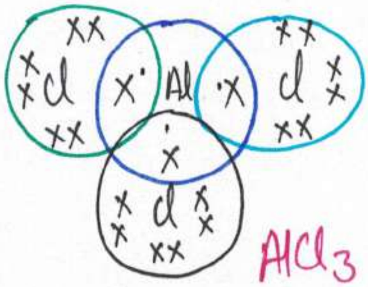
Compound in which less than 8e⁻ present in valence shell of central atom after bonding.

e.g:- III A group elements form hypovolent Comp.

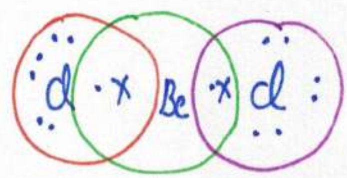
BF_3, BCl_3, BBr_3, BI_3



B → Central Atom
F → Bounded Atom



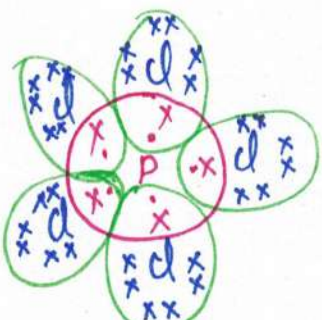
$AlCl_3$
$6e^-$ in central atom



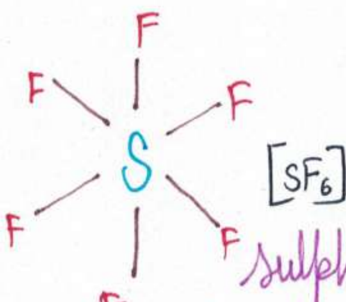
$BeCl_2$
$4e^-$ in central atom

2. HYPERVALENT COMPOUNDS

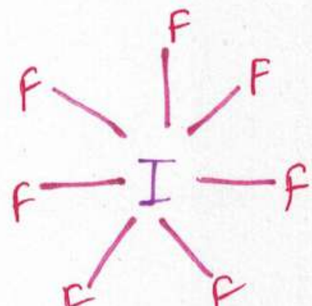
Compounds in which more than $8e^-$ present in valence shell of central atom after bonding.



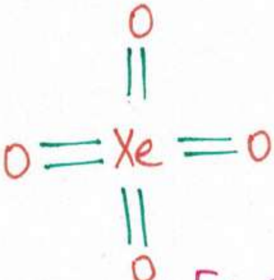
[PCl_5] [Phosphorus pentachloride]
$10e^-$ in central atom



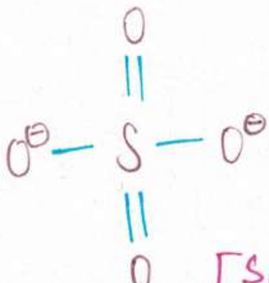
[SF_6] sulphur hexafloride
$12e^-$ in central Atom



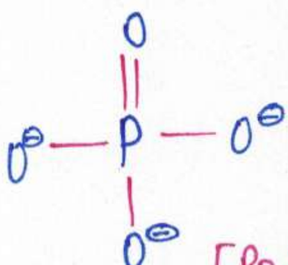
[IF_7]
$14e^-$ in central atom



[XeO_4] Xenon Tetraoxide
$Xe = 8 \times 2 = 16e^-$



[SO_4^{2}] sulphate
central atom $6 \times 2 = 12e^-$



[PO_4]^3 Phosphat
$C.A. = 10e^-$

IONIC EQUILIBRIUM

In this chapter, we'll study about equilibrium of weak electrolytes.

There are 2 types of substances.

Non electrolyte – which does not ionise in their aqueous solution.
e.g:– urea, glucose, sucrose etc.

Electrolyte – which will dissociate into ions in their aqueous solution.

ELECTROLYTES

Strong Electrolytes

- Completly dissociate into ions
- $\alpha = 1$
- e.g:– HCl, H_2SO_4, etc

Weak Electrolytes

- Partially dissociate into ions
- $\alpha < 1$
- e.g:– CH_3COOH, NH_3, etc

We will frequently use an operator in this chapter $\equiv P$

$$P \equiv -\log$$

e.g:- $-\log [H^+] = pH$ $-\log [OH] = pOH$

$-\log [Ka] = pKa$ $-\log [Kb] = pKb$

BASICS OF LOGARITHM

- $\log m^n = n \log m$
- $\log mn = \log m + \log n$
- $\log \frac{m}{n} = \log m - \log n$
- $\log_a m = \frac{\log_b m}{\log_b a}$
- $\ln x = (\log_{\circ} x) 2.303$
- $\log 1 = 0$
- $\log 10 = 1$
- $\log 2 = 0.3$
- $\log \frac{1}{x} = -\log x$
- $\log 3 = 0.48$
- if $\log_a x = Y$
  antilog $x = a^Y$

QUESTION Calculate the following

1. $\log 25$
2. $\log 1.8$
3. $\log \frac{21}{7}$
4. $\log 5$
5. $\log \frac{22}{3}$

Solution

1. $\log 25 = \log (5)^2 = 2(\log 10/2)$

$2[\log 10 - \log 2]$

$2[1 - 0.3] = 2(0.7) = 1.4$

2. $\log 1.8 = \log 18/10 = \log 18 - \log 10$

$= \log 3^2 \times 2 - 1$

$= 2(0.48) + 0.3 - 1$

$= 0.96 + 0.3 - 1 = 1.26 - 1 \Rightarrow 0.26$

3. $\log \frac{21}{7} = \log 3 \Rightarrow 0.48$

4. $\log 5 = \log 10/2 = 1 - 0.3 \Rightarrow 0.7$

5. $\log \frac{22}{3} = \log 22 - \log 3$

$= \log 2 + \log 11 - 0.48$

$= 0.3 + \frac{\log 10 + \log 12}{2} - 0.48$

$= -0.18 +$

$\Rightarrow 0.86$

Que:- 1. $\log 1.8 \times 10^{-5}$

2. $\log 14 \times 10^{-6}$

3. $\log 7 \times 10^{-5}$

Ans:- 1. $\log 1.8 \times 10^{-5} = 0.26 - 5 = -4.74$

2. $\log 14 - 6 = \log 7 + 0.3 - 6$

$= 0.84 + 0.3 - 6$

$= 1.14 - 6 \Rightarrow -4.86$

3. $\log 7 \times 10^{-5} = \log(7 - 5) = 0.84 - 5$

$\Rightarrow -4.16$

REMEMBER

$\log 1.8 = 0.26$

$\log 7 = 0.84$

$\log 5 = 0.7$

$\log 2 = 0.3$

$\log 3 = 0.48$

ACID BASE CONCEPT

1. ARRHENIUS THEORY

According to Arrhenius, substances that provide H^+ ion in their aqueous solution are acids and substances which provide OH^- ion in their aqueous solution are base.

For eg:- $\underset{\text{acid}}{HCl} \rightleftharpoons H^+ + Cl^-$ $\qquad$ $\underset{\text{base}}{NaOH} \rightleftharpoons Na^+ + OH^-$

2. BRONSTED AND LOWRY THEORY

Proton acceptors are bases and Proton donors are acid.

- $\underset{\text{base}}{B} + H^+ \longrightarrow BH^+$ ← Conjugate acid

  $\underset{\text{acid}}{HA} \rightarrow H^+ + A^-$ ← Conjugate base

For eg:- $\underset{\text{acid}}{H_2SO_4} \longrightarrow H^+ + HSO_4^{2-}$ ← Conjugate base

$\underset{\text{acid}}{HSO_4^-} \longrightarrow H^+ + SO_4^{2-}$ Conjugate base

but $\underset{\text{acid}}{H_2SO_4} \longrightarrow 2H^+ + SO_4^{2-}$ ← Not Conjugate base

- $H_3PO_4 \longrightarrow H^+ + H_2PO_4^-$

  $H_2PO_4 \longrightarrow H^+ + HPO_4^{2-}$

  $HPO_4^{2-} \longrightarrow H^+ + PO_4^{3-}$

but acids $\qquad$ Conjugate base

$\underset{\text{acid}}{H_3PO_4} \longrightarrow 3H^+ + PO_4^{3-}$ ← Not Conjugate base

3. LEWIS THEORY

Lone pair donors are base.
Lone pair acceptors are acids.

$$H_3N: \longrightarrow BF_3$$

▷ According to first two theories, water is a neutral solution but according to third theory H_2O is Lewis base.

PROPERTIES OF WATER

1. It is a Neutral Solution.
2. It is a pure liquid having concentration $= \frac{1000}{18} = \boxed{55.55\,M} = 55.55\,m$
3. At 25°C H_2O dissociates into H^+ and OH^- ion having concentration 10^{-7}M each.

$$\underset{(l)}{H_2O} \rightleftharpoons \underset{10^{-7}M}{H^+} + \underset{10^{-7}M}{OH^-} \qquad \Delta H > 0$$

4. K_w = ionic product of water

$$K_w = [H^+][OH^-]$$

taking -log on both sides

$$-\log K_w = -\log [H^+][OH^-]$$

$$pK_w = -\log[H^+] - \log[OH^-]$$

$$\boxed{pK_w = pH + pOH}$$

at 25°C $pK_w = \boxed{pH^+ + pOH = 14}$

We can predict the nature of solution by p^H or p^{OH}

ⓐ. $[H^+] = [OH^-]$ Natural Solution

$-\log[H^+] = -\log[OH^-]$

$p^H + p^H = p^{OH} + p^H$

$2p^H = 14$

$p^H = 7$

ⓑ. $[H^+] > [OH^-]$ Acidic solution

$-\log[H^+] < -\log[OH^-]$

$p^H + p^H < p^H + p^{OH}$

$2p^H < 14$

$p^H = 7$

$[H^+] < [OH^-]$ Basic Solution

$-\log[H^+] > -\log[OH^-]$

$p^H + p^H > p^{OH} + p^H$

$2p^H > 14$

$p^H > 7$