

## TYPES OF BONDS

### IONIC/ELECTROVALENT BOND

- Strong electro static force of attraction between positive and negative ions.
- Crystalline in nature
- High M.P and B.P
- Soluble in Polar Solvents. Eg: NaCl, MgCl<sub>2</sub> etc.

### HYDROGEN BOND

- Bond formed when the -ve end of one molecule attracts the +ve end of H.
- 1. Intermolecular: H-Bonding occur within one single molecule.
- 2. Intramolecular: H Bonding between two different molecules of same or different compounds.

### COVALENT BOND

- Bond formed by mutual sharing of e<sup>-</sup>.
- Low M.P. and B.P.
- Bad conductor of electricity
- Insoluble in polar solvents but soluble in non-polar solvent. Ex: CH<sub>4</sub>, H<sub>2</sub>, Cl<sub>2</sub>.

### CO-ORDINATE BONDING

- Bond formed by one sided sharing of electrons. ie: one atom donates a pair of e<sup>-</sup> while other accepts it.
- Bad conductors of electricity.
- Sparingly soluble in polar solvents but readily soluble in non-polar solvents. eg:- NH<sub>4</sub><sup>+</sup>

### TYPE OF CO-VALENT BOND

- Polar covalent bond Eg: NH<sub>3</sub>, CHCl<sub>3</sub>
- Non-polar covalent bond Eg: Cl<sub>2</sub>, CO<sub>2</sub>.

## THEORIES OF CO-VALENT BOND

### KOSSEL LEWIS APPROACH

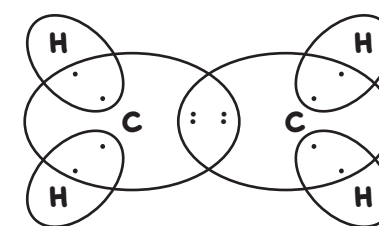
Atoms can combine either by transfer of e<sup>-</sup> or by sharing of valence e<sup>-</sup> in order to have an complete octet in their valence shell.

Octet Rule

### LEWIS SYMBOLS

Valence e<sup>-</sup> are represented by dots around the element.

H: Na: :Cl: :O: :N:



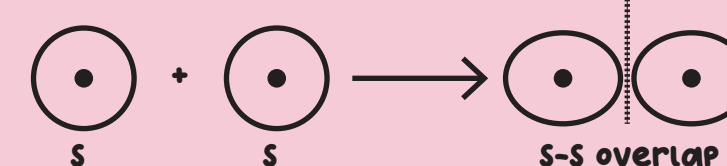
## VALENCE BOND THEORY (VBT)

A covalent bond is formed by the overlapping of two half filled atomic orbitals.

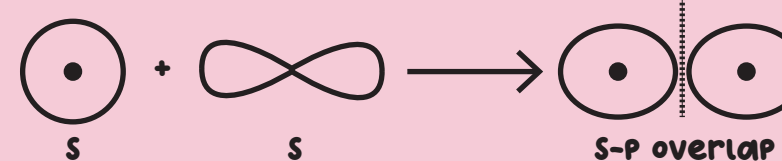
### Type of overlapping

#### Sigma(σ) Sidewise overlapping

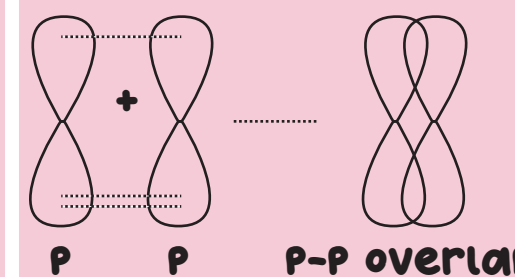
##### S-S overlapping



##### S-P overlapping



#### Pi(π) Sidewise overlapping



### HYBRIDISATION

Concept of mixing atomic orbital to form new hybrid



## CHEMICAL BONDING AND MOLECULAR STRUCTURE

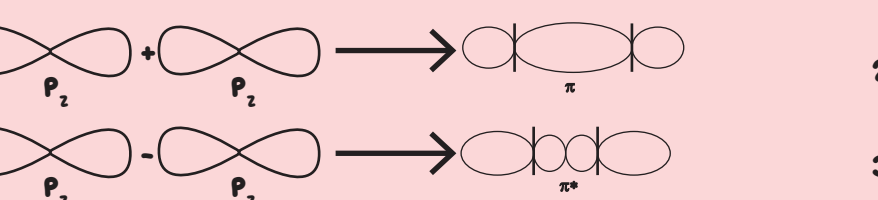
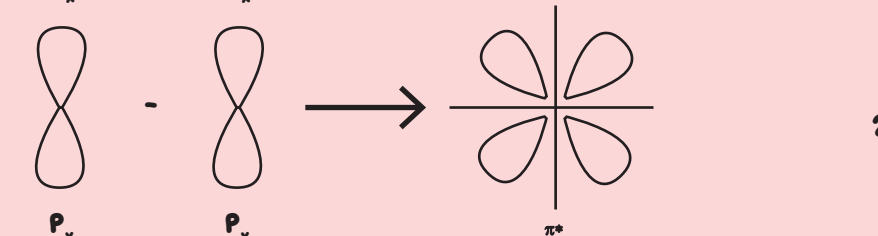
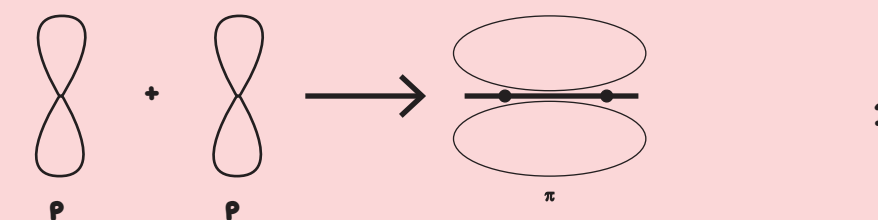
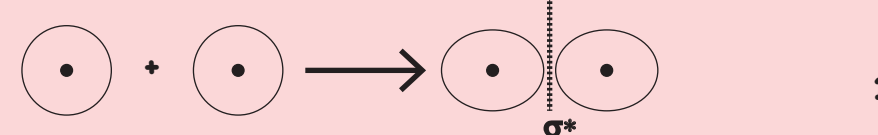
### VSEPR THEORY

The shape of a molecule depends upon the numbers of valence shell e<sup>-</sup> (B.P or L.P) surrounding in the central atom.

Decreasing order of repulsive interaction: lp - lp > lp - bp > bp - bp

TYPE OF MOLECULE	No. of Bonding Pair	No. of Lone Pair	Arrangement of e <sup>-</sup> pair	SHAPE	EXAMPLE
AB <sub>2</sub> E	2	1	Trigonal planar	Bent	SO <sub>2</sub> O <sub>3</sub>
AB <sub>3</sub> E	3	1	Tetrahedral	Trigonal pyramidal	NH <sub>3</sub>
AB <sub>3</sub> E <sub>2</sub>	2	2	Tetrahedral	Bent	H <sub>2</sub> O
AB <sub>4</sub> E	4	1	Trigonal bi-pyramidal	See saw	SF <sub>4</sub>
AB <sub>3</sub> E <sub>2</sub>	3	2	Trigonal bi-pyramidal	T-Shape	ClF <sub>3</sub>
AB <sub>5</sub> E	5	1	Octahedral	Square Pyramid	XeF <sub>5</sub>
AB <sub>4</sub> E <sub>2</sub>	4	2	Octahedral	Square Planar	XeF <sub>4</sub>

### Formation of Molecular Orbitals



### MOLECULAR ORBITAL THEORY

MOT states that each atom tends to combine together and form molecular orbitals

No. of molecular orbitals = No. of atomic orbital combined.

### MOT

Bonding molecular orbitals

Anti bonding atomic orbitals

### ELECTRONIC CONFIGURATION

Electron filling order upto 14 electrons

$\sigma_{1s} < \sigma_{1s}^* < \sigma_{2s} < \sigma_{2s}^* < \pi_{2p_x} \equiv \pi_{2p_y} < \sigma_{2p_z} < \pi_{2p_x}^* \equiv \pi_{2p_y}^* < \sigma_{2p_z}^*$

Electron filling order for more than 14 electrons

$\sigma_{1s} < \sigma_{1s}^* < \sigma_{2s} < \sigma_{2s}^* < \sigma_{2p_z} < \pi_{2p_x} \equiv \pi_{2p_y} < \pi_{2p_x}^* \equiv \pi_{2p_y}^* < \sigma_{2p_z}^*$

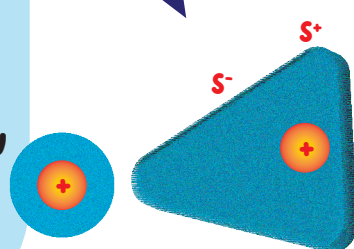
### FAJAN'S RULE

No compounds is 100% ionic or 100% covalent

Covalent Nature  $\propto$  Charge on cation

Covalent Nature  $\propto \frac{1}{\text{size of cation}}$

Polarising Power  $\propto$  Covalent C



Cation

Polarized anion

Polarization of anion by cation

## BOND PARAMETERS

### FORMAL CHARGE

$$FC = V - N - \frac{B}{2}$$

• Bond length: distance between the nuclei of two bonded atom

bond length  $\propto \frac{1}{\text{bond order}}$

### BOND ORDER

&

### BOND ANGLE

Angle between the orbitals containing bonding e<sup>-</sup> pair around central atom.

### BOND ENTHALPY

Amount of energy required to break one mole of bonds.

### DIPOLE MOMENT

Product of the magnitude of the charge and distance between centres of positive and negative charge.

$\mu = \text{charge} \times \text{Distance Between two atoms}$

