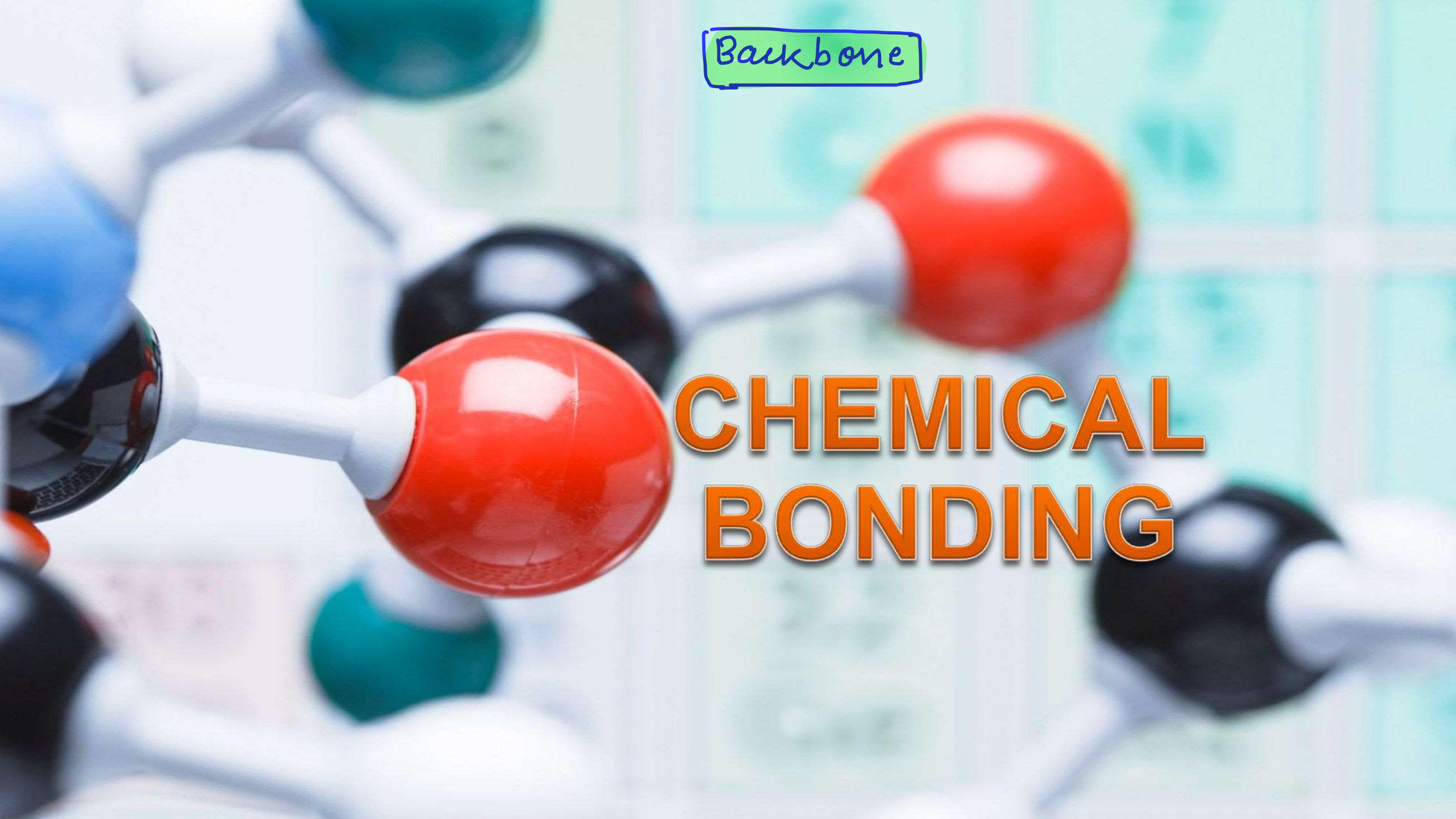
Backbone



CHEMICAL BONDING

CHEMICAL BONDING

CHEMICAL BONDING

A force that acts between two or more atoms to hold them together as a stable molecule.

Cause of Chemical Combination:-

(A) Tendency to acquire state of minimum potential energy:

(a) When two atoms approaches to each other, nucleus of one atom attracts electrons of another atom.

(b) Nucleus and electrons of both atoms repels each other.

(c) If net force is attraction ,then total energy of system(molecule)decreases and a chemical bond is formed.

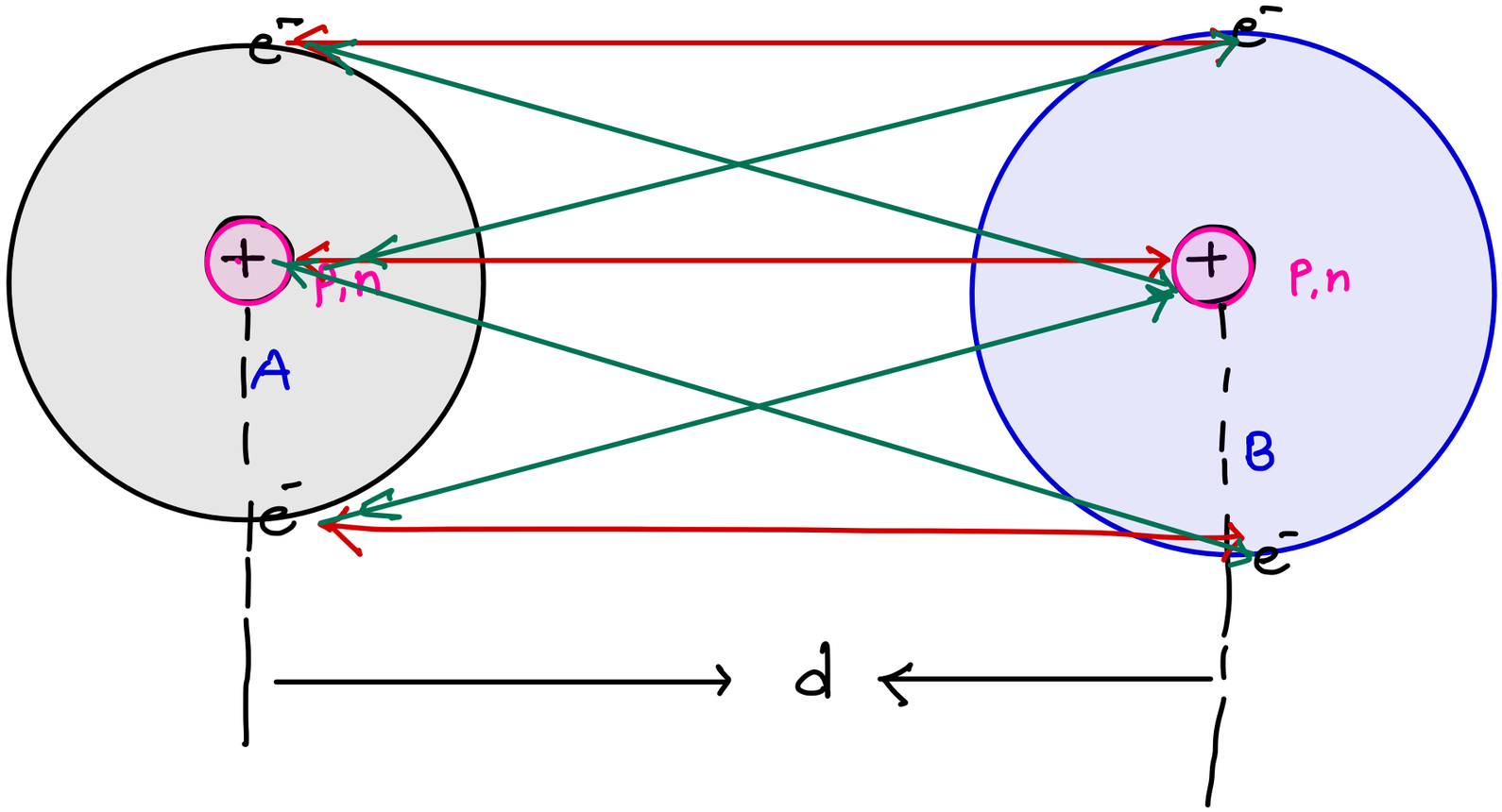
(d) Energy released in bond formation is known as **Bond Energy,** that means bond formation is exothermic.

Strength of chemical bond $\propto$ Bond Energy

CHEMICAL BONDING

$$F = \frac{K q_1 q_2}{d^2}$$

$$PE = \frac{K q_1 q_2}{d}$$



1) Rulsive force :- • Between nucleus of A and nucleus of B

• Between electrons of A and electrons B

F_R = (+ve) , PE > 0 (+ve)

CHEMICAL BONDING

- Attractive forces (-ve) (two)
  - Nucleus of A with electrons of B
  - Nucleus of B with electrons of A

F_a = (-ve)

If attractive forces overcome repulsive forces then only bond formation take place.

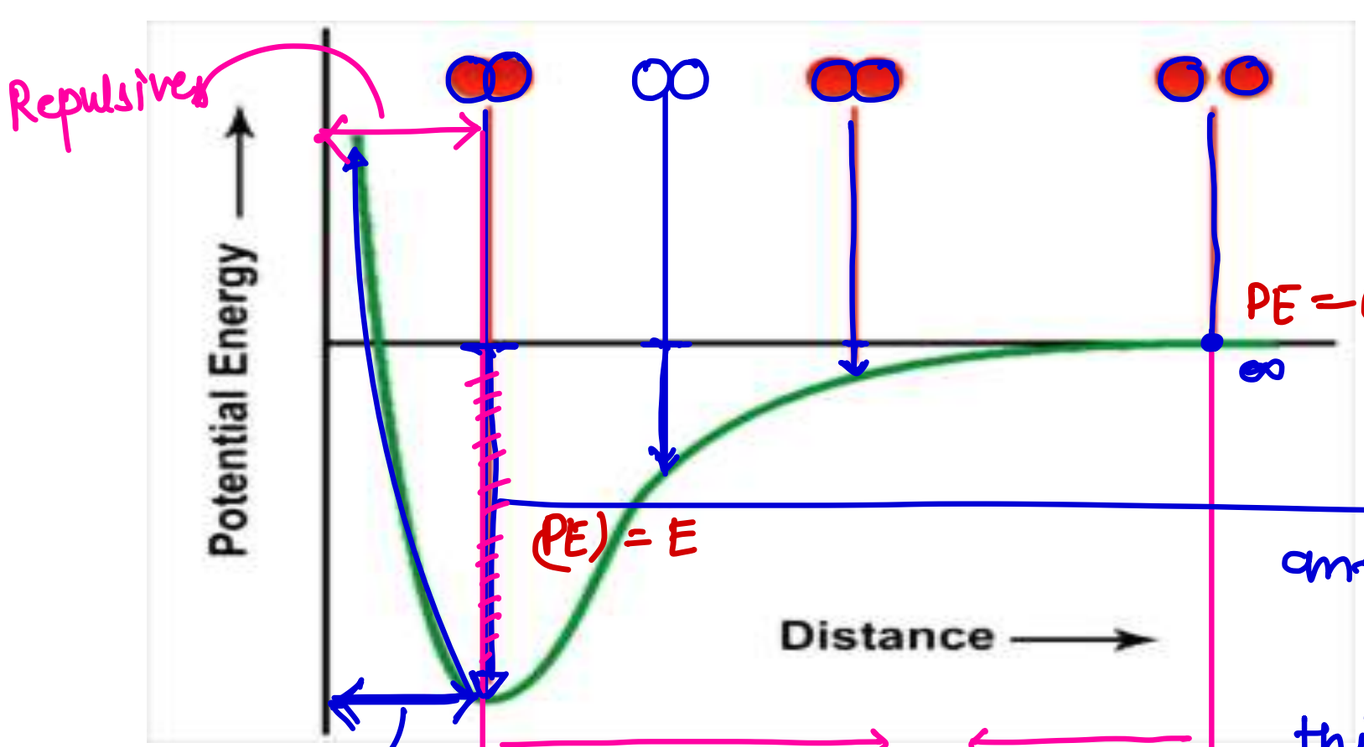
when two atoms come togather attraction forces increases and Potential energy decreases and when a minimum PE achieved. now repulsion forces (starts) so atoms always try to stay at a distance when PE is minimum.

CHEMICAL BONDING

CHEMICAL BONDING

Energy V/s Internuclear distance Curve:-

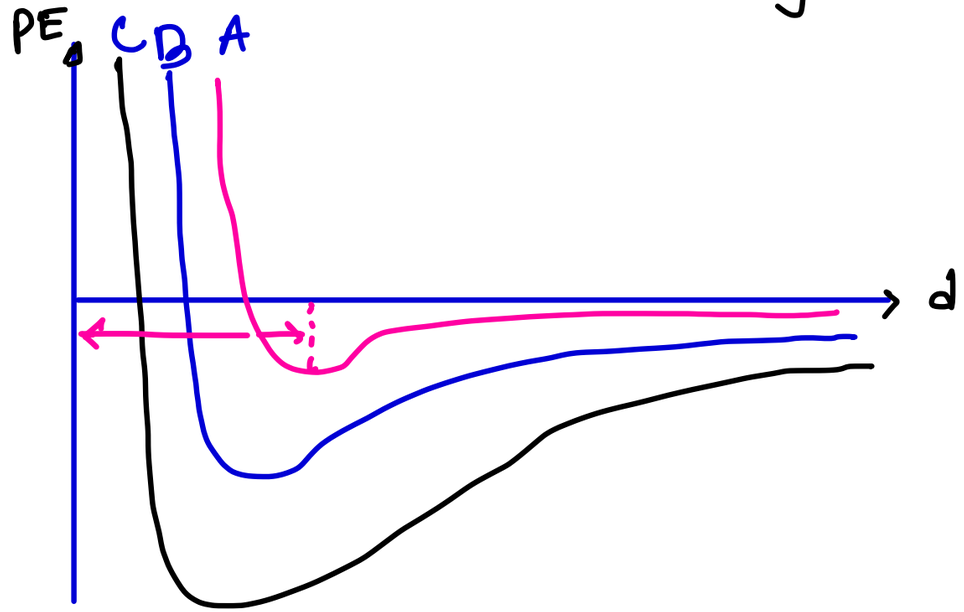
Bond formation process is an exothermic process.



BE = - E

CHEMICAL BONDING

Ex. For given graph for three different molecules A, B, C compare BL and Bond energy and Bond strength for A, B and C.



(A) ✓
(B) ✓
(C) ✓

BL = A > B > C

BE = C > B > A

Bond strength: C > B > A

CHEMICAL BONDING

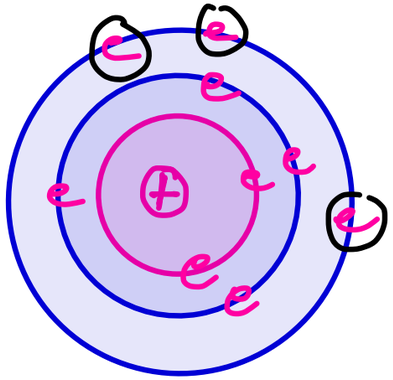
ii) To Attain Electronic configuration of noble gas.

÷ KOSSEL AND LEWIS CONCEPT ÷

- Lewis pictured the atom in term of positively charge Kernel and Valence electron. that can be max. $e^- = 8$

- Lewis found that octet of electrons represent a particle stable electronic configuration. to achieve this Electronic configuration. atom. Looses, gains. or share electrons with other atoms.

CHEMICAL BONDING



A

Kernel + V.e

$[A^{+3}] + 3e^-$

Kernel → If we removed all electrons from valence shell the remaining atom is called kernel.

Lewis symbol :

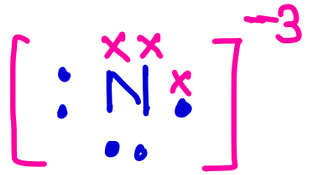
Li →  Li·

CHEMICAL BONDING

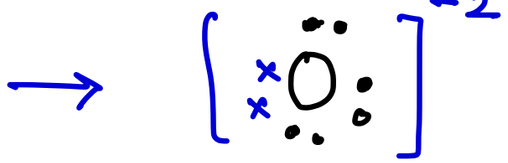
Nitrogen → 

$7 = 2, 5$

oxygen → 

nitride ion N^{-3} → 

Na^+
2, 8

oxide ion O^{-2} → 

HW

Ex. write the Lewis symbol for

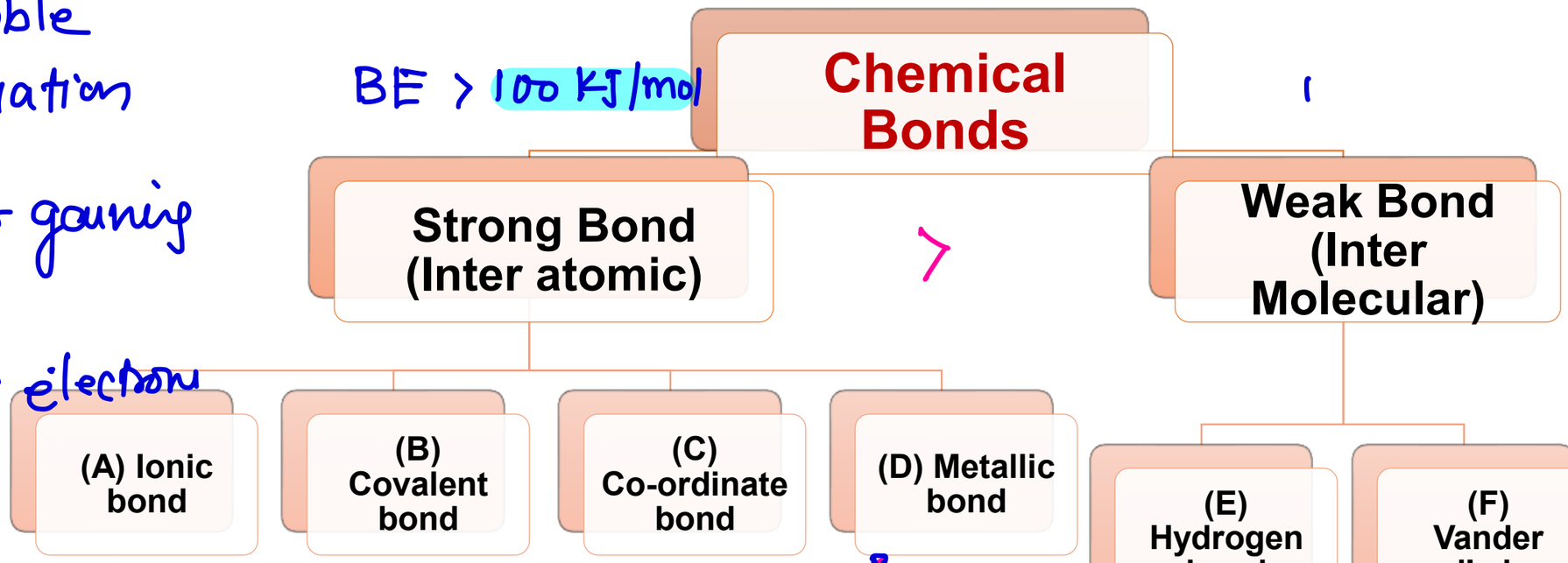
(i) Ca. (ii) S (iii) P^3 (iv) Al^{+3} (v) Na^+ (vi) Cl^-

(vii) C (viii) Xe (ix) I (x) Si

CHEMICAL BONDING

CHEMICAL BONDING

Classification of Bonds (on the basis of bond energy)



BE > 100 KJ/mol

BE = 8 – 10 KJ/mol

BE < 8 KJ/m

How to attain noble gas configuration

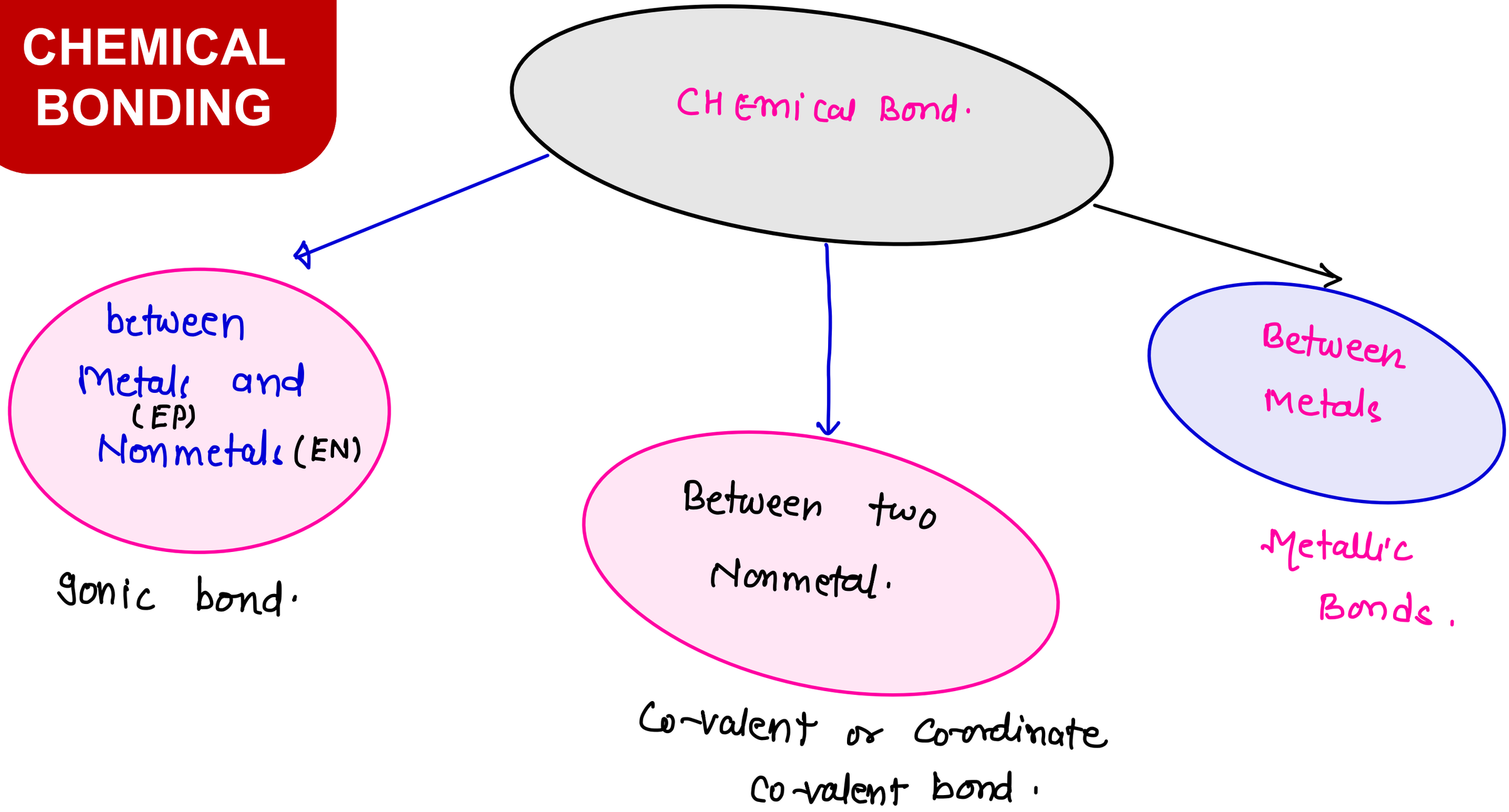
(1) By loosing or gaining e⁻s.

(2) By sharing of electron

1) Molecule comes togather to decrease PE and also attain noble gas configuration.

Molecules come togather to decrease PE

CHEMICAL BONDING



CHEMICAL BONDING

CHEMICAL BONDING

(B) Tendency to complete octet (Lewis Octet Rule) :-

(a) Every atom has a tendency to complete its octet and acquire nearest inert gas configuration (ns^2np^6).

(b) Atoms loose ,gain or share electrons to complete octet.

(c) H & Li completes its duplet (ns^2).

- **Atoms Complete their octet:-**

(i) By loosing or gaining of electrons (complete transfer of electrons):- Ionic bond is formed

$$\underset{2,8,1}{Na} \longrightarrow \underset{2,8}{Na^+} \qquad \underset{2,8,7}{Cl} \longrightarrow \underset{2,8,8}{Cl^-}$$

$$\underset{2,8}{Na^+} \text{ ---- } \underset{2,8,8}{Cl^-}$$

ionic bond

CHEMICAL BONDING

Ex. In which of the following ionic compound Cation and Anion has gained electronic configuration of same inert gas.

KCl, NaCl, MgO, MgF_2, NaF,

$KCl \longrightarrow (K^+)\ (Cl^-)$

$[2,8,8]\ [2,8,8]$

$[Ar]\ Ar$

$NaCl \longrightarrow (Na^+)\ (Cl^-)$

$(2,8)\ (2,8,8)$

$Ne\ Ar$

$MgO \longrightarrow (Mg^{+2})\ (O^{-2})$

$(2,8)\ (2,8)$

$Ne\ Ne$

$MgF_2 \longrightarrow (F^-)\ (Mg^{+2})\ (F^-)$

$2,8\ 2,8\ (2,8)$

$Ne\ Ne\ Ne$

$NaF \longrightarrow (Na^+)\ (F^-)$

$(2,8)\ (2,8)$

$Ne\ Ne$

CHEMICAL BONDING

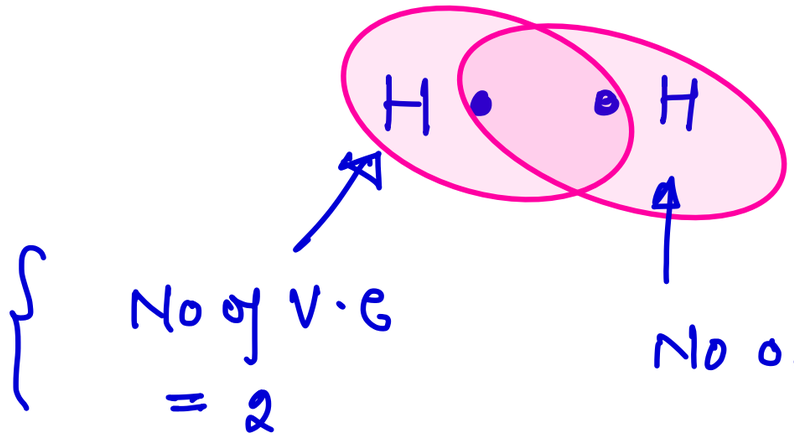
The Capacity of element to loose or gain e^- is called electrovalency of that element.

Ex. Electrovalency of sodium = +1

Electro valency of oxygen = -2

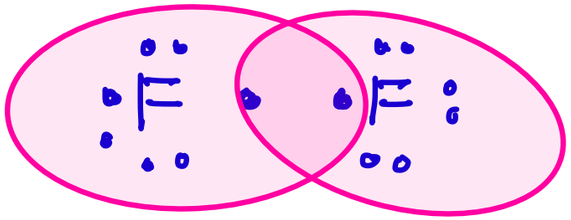
÷ Co-valent Bond ÷

A Co-valent bond is formed by mutual sharing of electrons to attain Noble gas electronic configuration

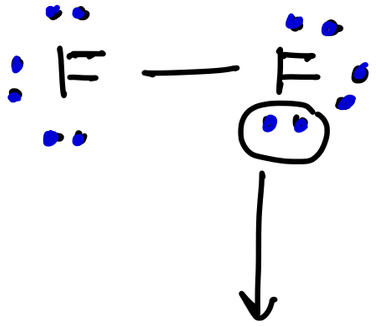


→ H—H [Single bond]

CHEMICAL BONDING



Lewis dot structure



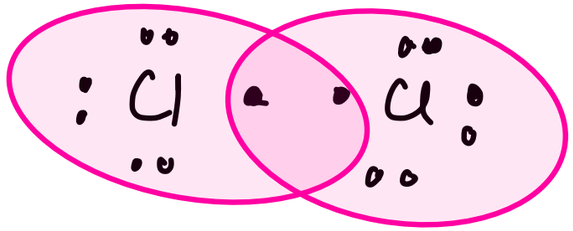
Cooper structure

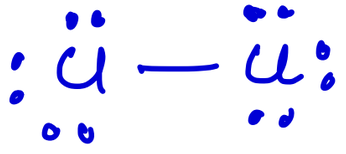
unshared electron pairs are called lone pairs

Ex. No of bond pair and lone pair in F_2 molecule.

Ans. 1 bond pair (σ) 6 lone pair

Ex. No of bond pair and lone pair in Cl_2 molecule ?





(Bond pair = 1 = σ)
Lone pair = 6

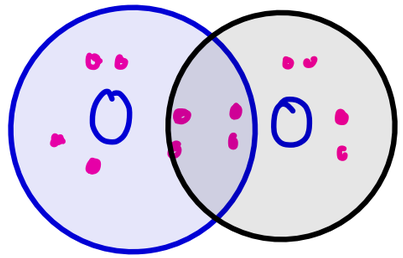
CHEMICAL BONDING

Ex. Find out lone pair, bond pair for following

O_2, N_2, H_2O, CCl_4, CO_2, C_2H_6

C_2H_4 C_2H_2.

- O_2

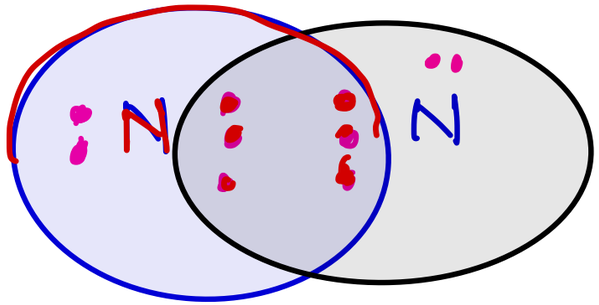


$\Rightarrow$ $\ddot{O} = \ddot{O}$

Bond pair = 2 → 1 σ bond, 1 π bond

lone pair = 4

- N_2



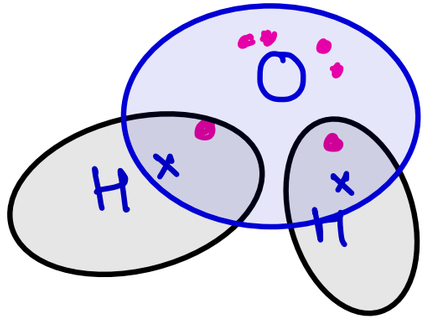
$\Rightarrow$ $:N \equiv N:$

Bond pair = 3 → 1 σ, 2 π

lone pair = 2

CHEMICAL BONDING

- H_2O

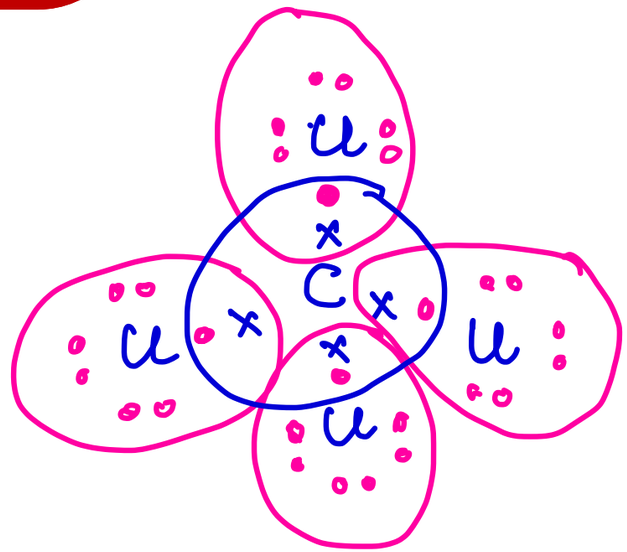


→ bond pair = 2 (σ)

→ lone pair = 2

- CCl_4

≈



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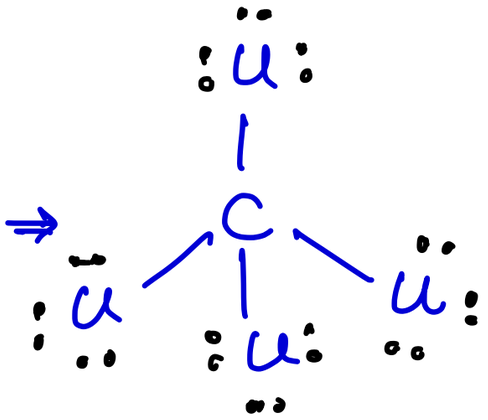
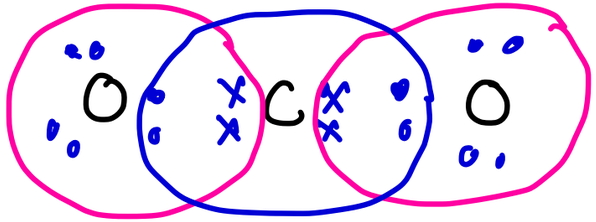


→ bond pair = 4 (σ)

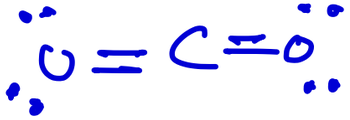
→ lone pair = 12

- CO_2

≈



→

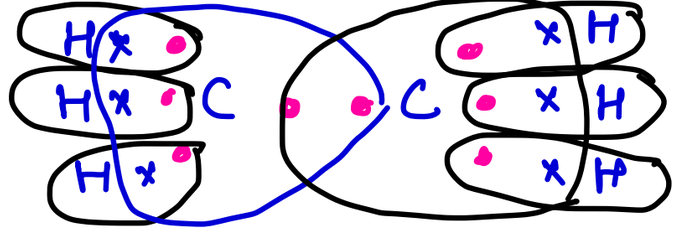


→ bond pair = 4 (2σ, 2π)

→ lone pair = 4

CHEMICAL BONDING

C_2H_6



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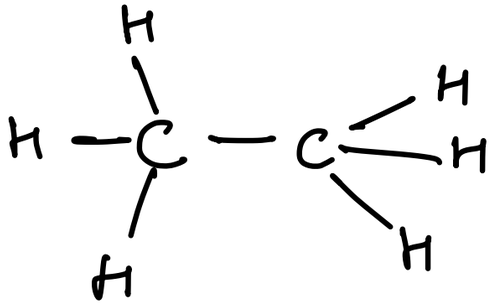
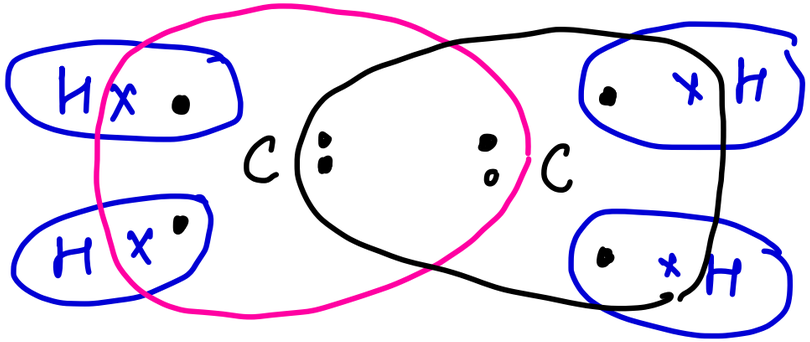


Ethane

bond pair
- 6 C–H (σ)
- 1 (C–C) (σ)

lone pair = 0

C_2H_4



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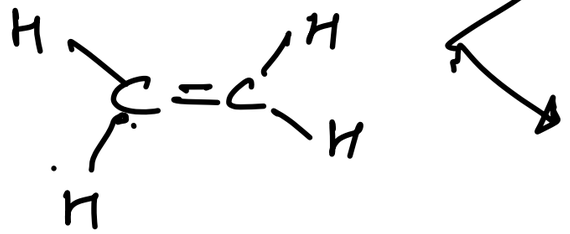

5σ

bond pair = 6 → 1π

lone pair = 0

CHEMICAL BONDING

* C_2H_2

Ex. Find No of σ bond and π bond in following structure.