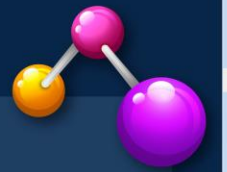
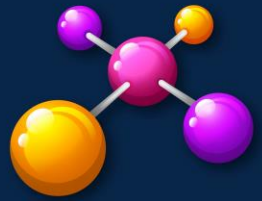
CHEMICAL BONDING - L 1





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Types of Bonds

What is a Chemical Bond?

Ionic Bond

Topics For Today

So Many Why's?

Why do some atoms combine while certain others do not?

Why does definite number of various atoms constitute a particular molecule?

So Many Why's?

Why do molecules have definite shape?

What is the nature of the force that exists between combining atoms?


Chemical Bond

Chemical Bond

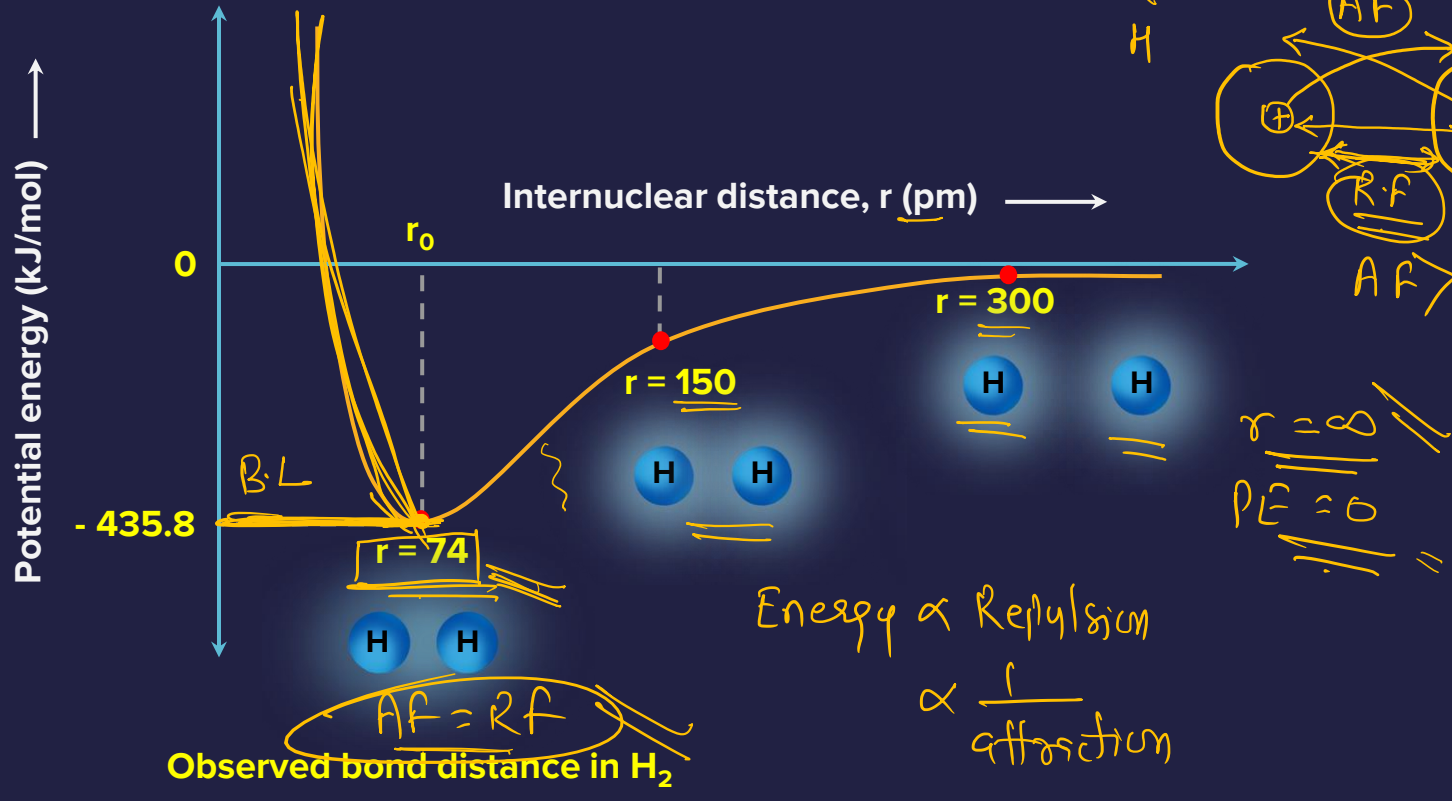
Attractive force which holds various constituents such as **atoms, ions,** etc., together

In different chemical species

Why Chemical Bond forms?

Bonding is a way of **reducing the energy** of a system to **attain stability**

Potential Energy Curve



When two atoms combine to form a molecule, _____.

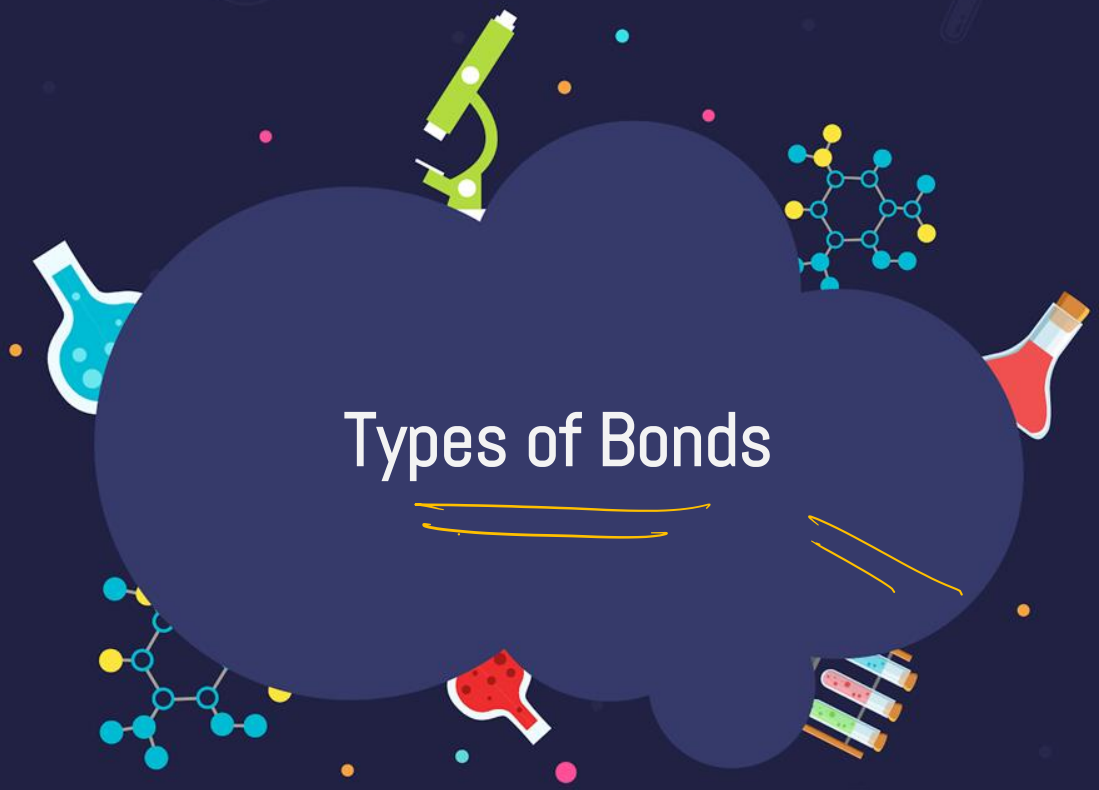
Exo

a) energy is released

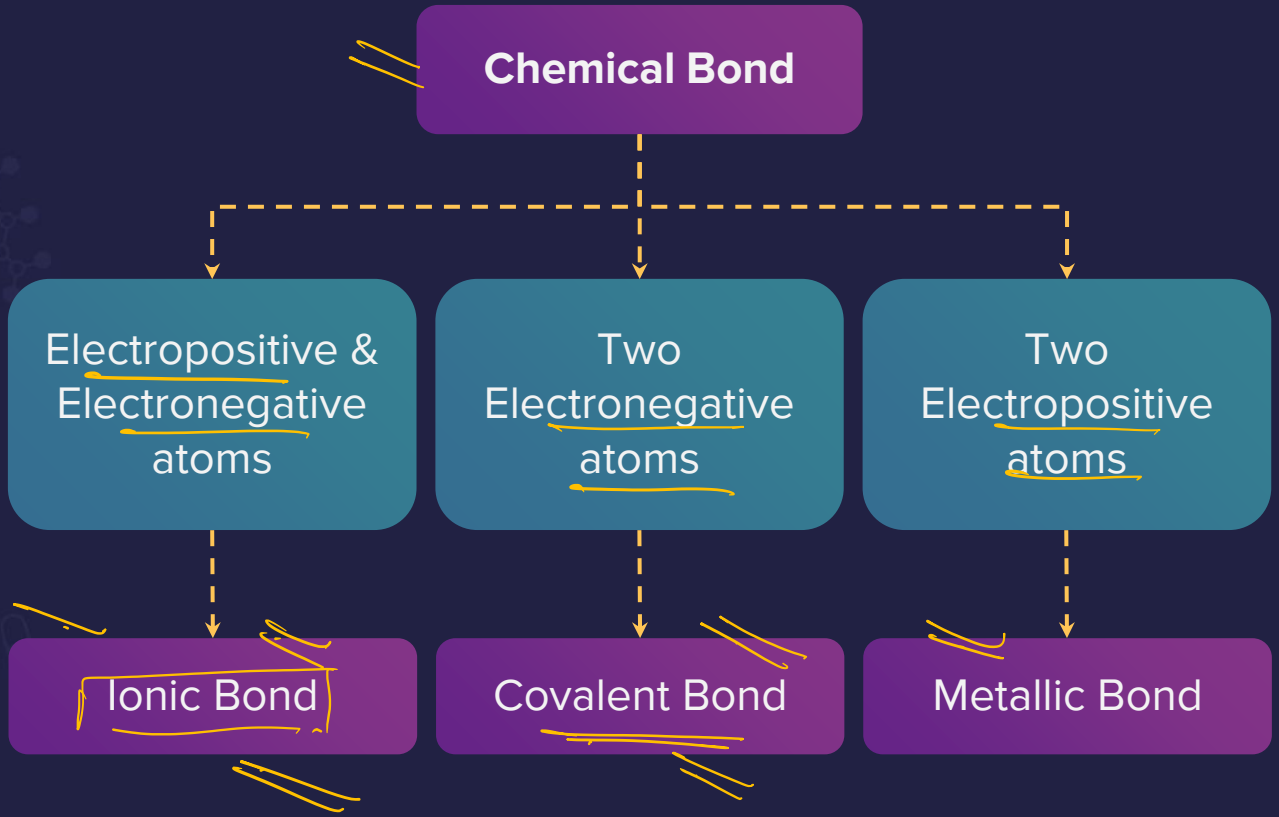
b) energy is absorbed

c) energy is neither released nor absorbed

d) energy is either released or absorbed

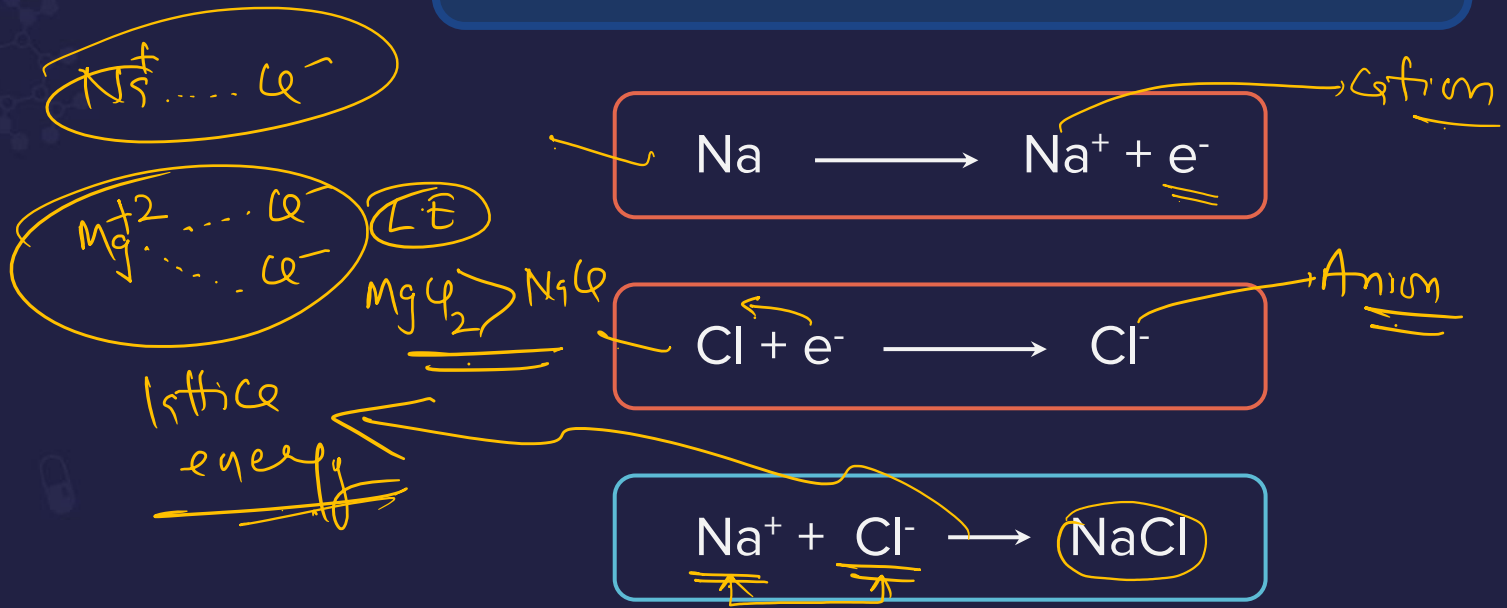

Types of Bonds

Types of Bonds

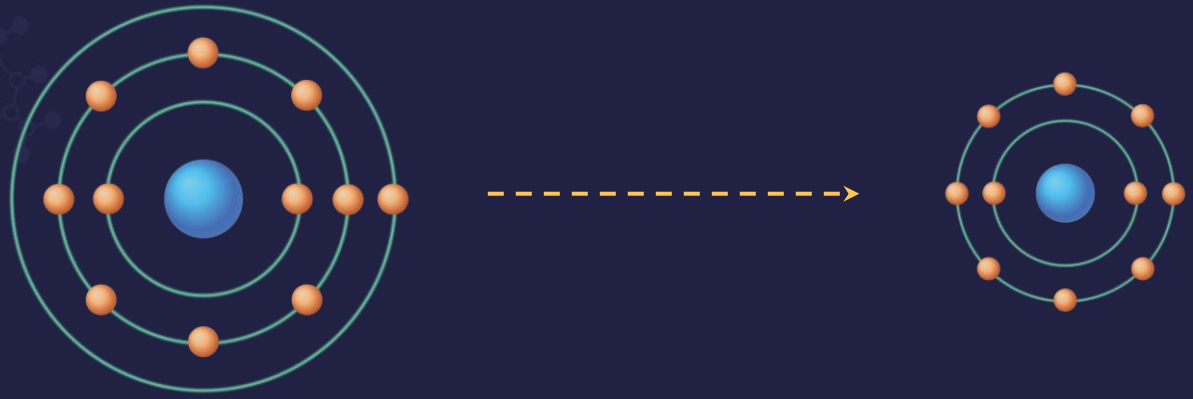


Ionic bond or Electrovalent bond

Electrostatic force of attraction between **oppositely charged ions**



Cation formation

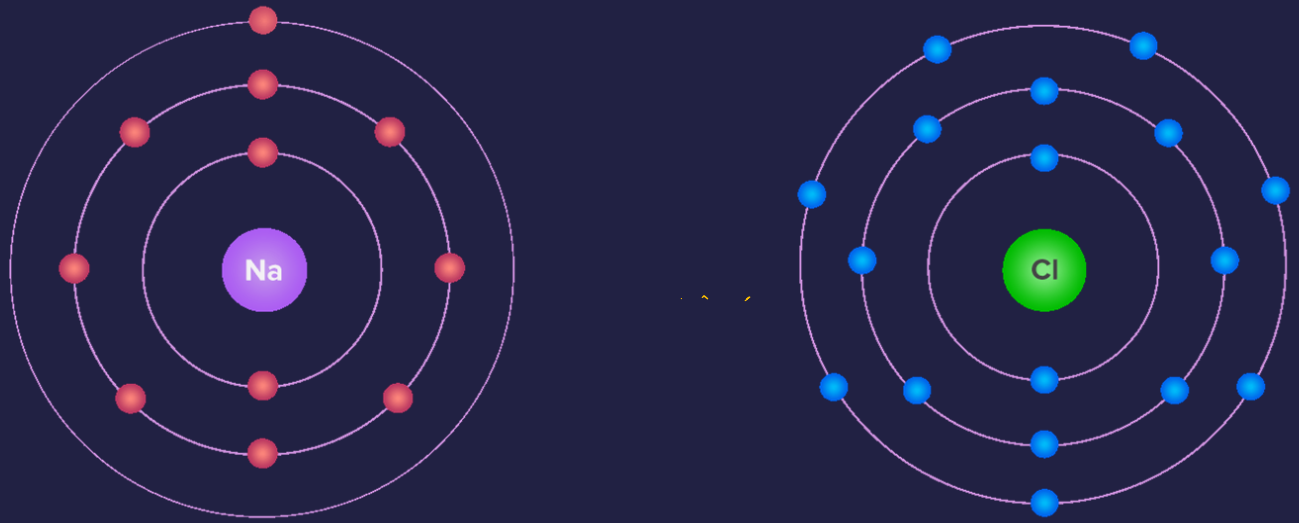


Na

$Na^+ + e^-$

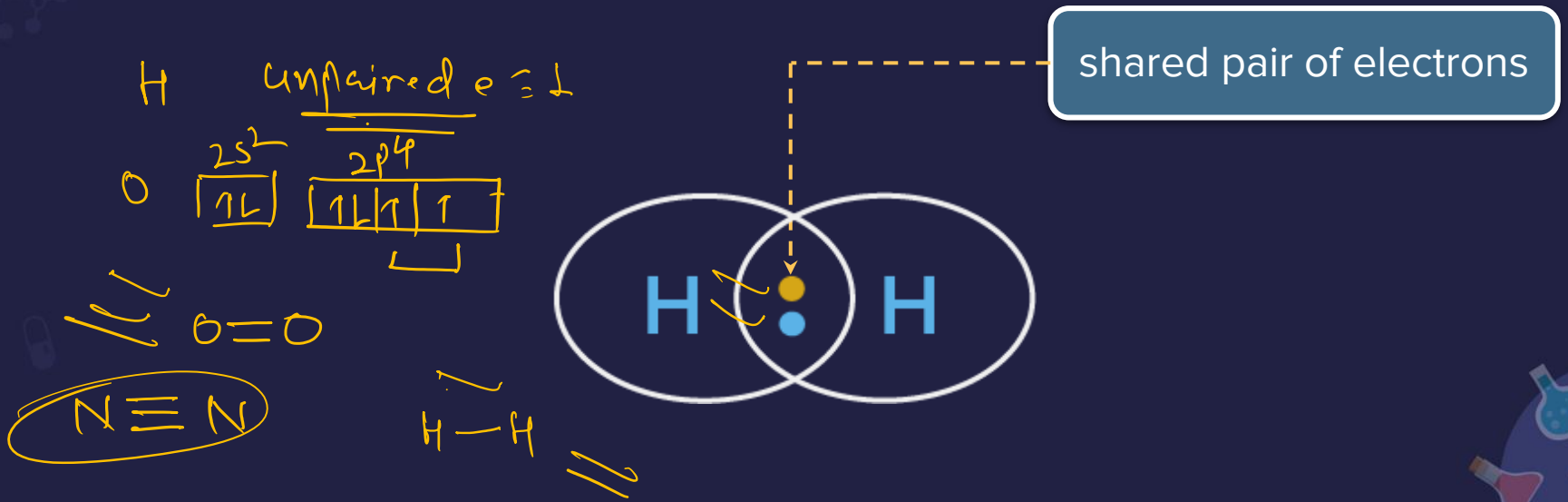
Anion formation

Ionic Bond or Electrovalent Bond



Covalent Bond

Formed by **sharing** of a **pairs of electrons**



Single Covalent Bond

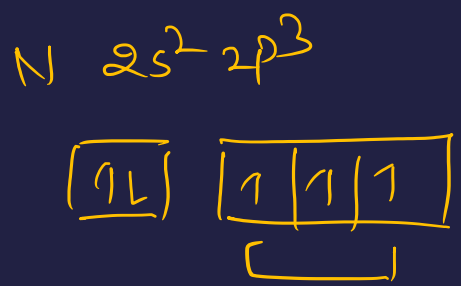
Formed by **sharing** of **two electrons**

Double Covalent Bond

Formed by **sharing** of **four electrons**

Triple Covalent Bond

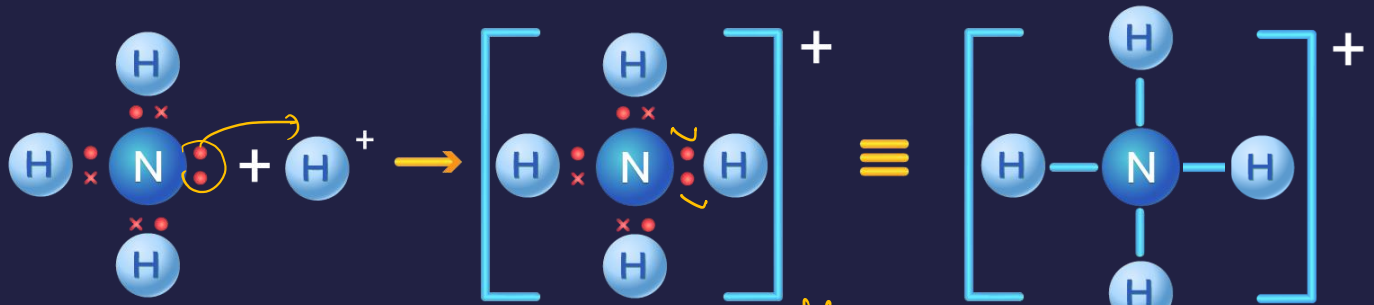
Formed by **sharing** of **six electrons**

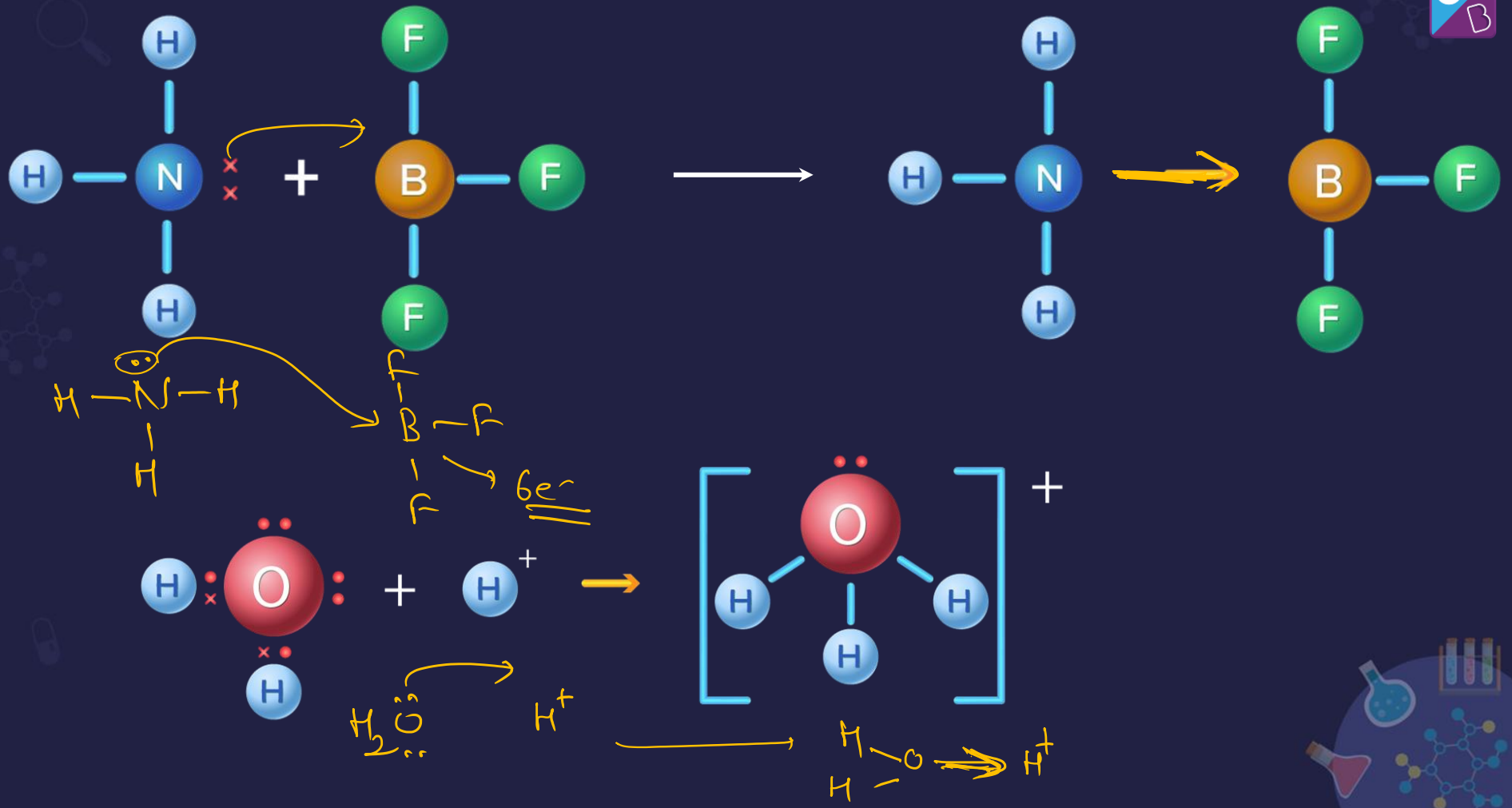


Coordinate Bond

or Dative bond

A bond in which the **shared pair of electrons** originate from **one atom and none from the other**




H
N
F
B
6e⁻
O
+
H_2O
H^+

Metallic Bond

Electrostatic force of attraction between a **metal kernel** and a **valence electron**

Metallic Bond

Electrostatic force of attraction between a **metal kernel** and a **valence electron**

Kernel

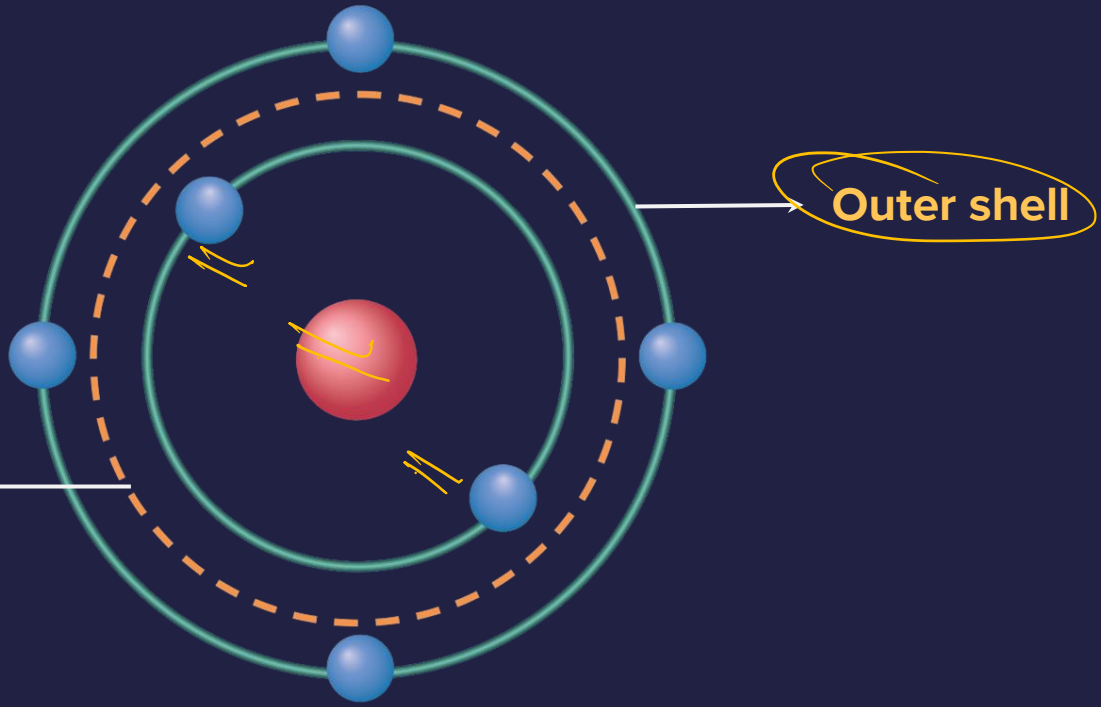
Nucleus plus the inner electrons

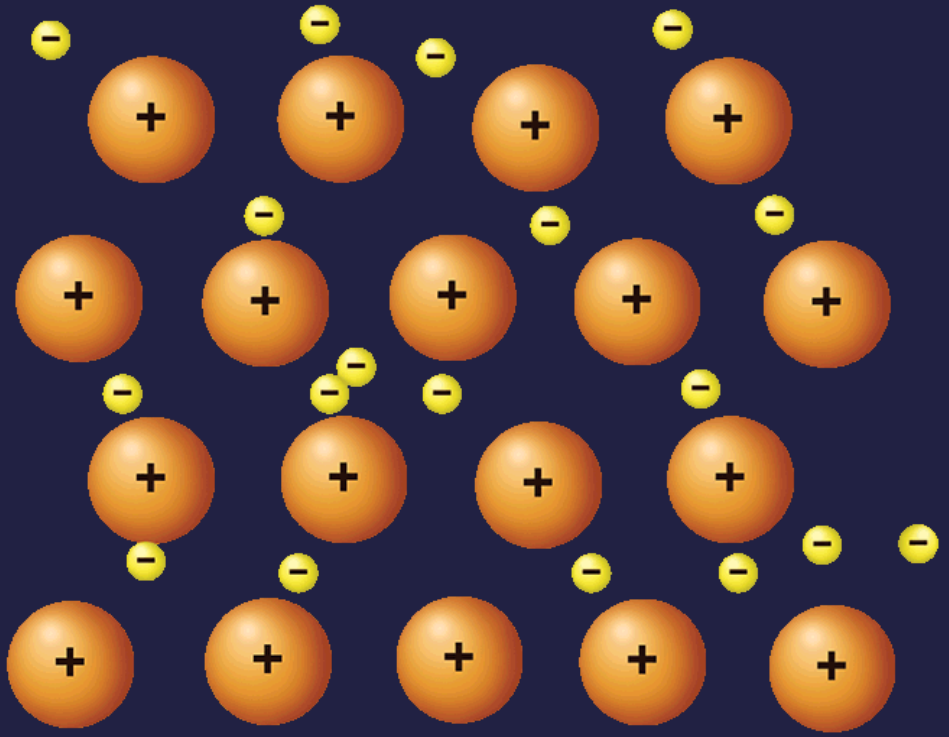
Na 2, 8, 1

Mg 2, 8, 2

Valence electrons

Mobile or free electrons


Outer shell
Kernel




Ionic Bond

Why Ionic Bond forms?

To attain **stable electronic configuration**

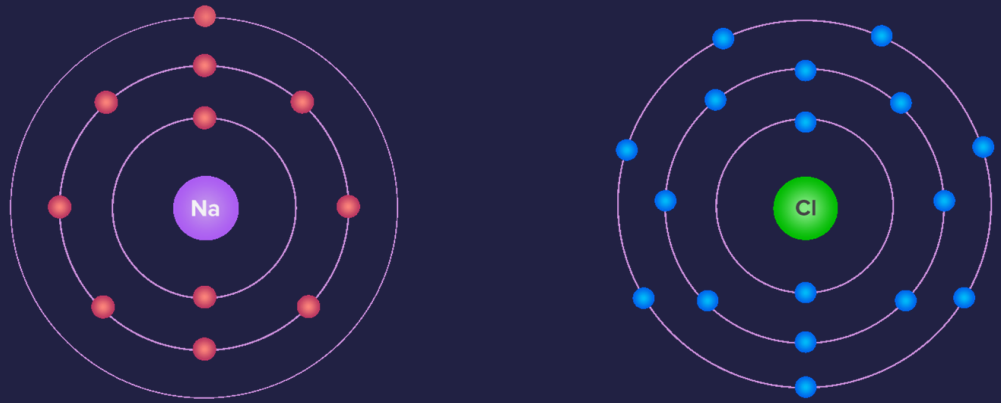
Elements **lose or gain electron(s)** in order to have an **octet** in their **valence shell**

Ionic Bond or Electrovalent Bond

Electropositive atom

e^-

Electronegative atom



Did you know?

Ionic compounds exist as **crystals rather than molecules**

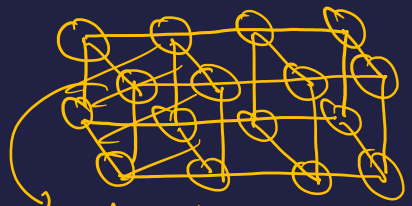
Ionic Compounds

Highly **ordered 3-D arrangement** of **cations and anions**

held together by **electrostatic attractions**

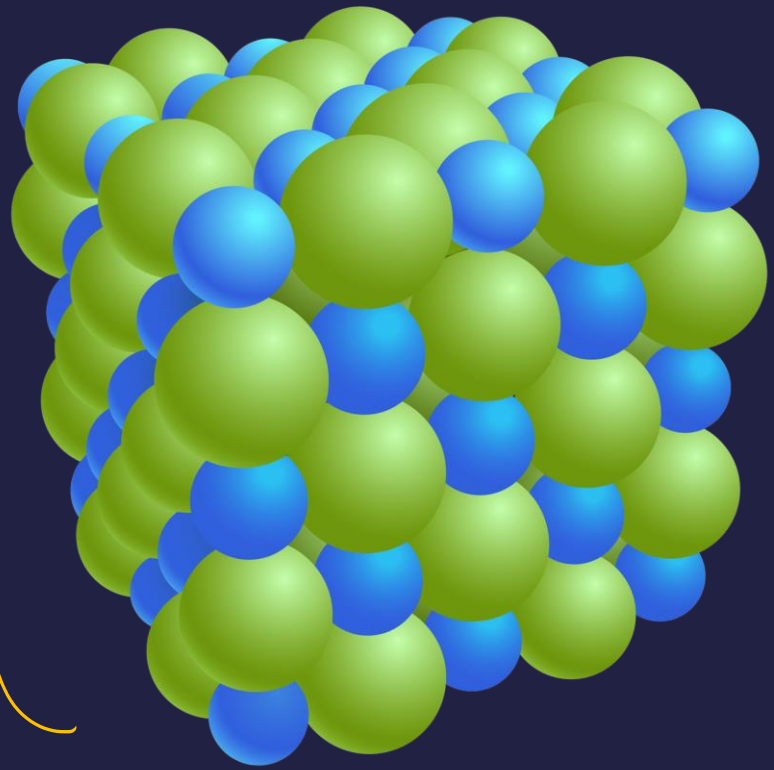
known as **Lattice**

Ionic Compounds



= lattice

unit cell



The crystal lattice of electrovalent compound is composed of:

Ionic

a) Atoms

b) Molecules

c) Oppositely charged ions

d) Both molecules and ions

Electrovalency

Number of **electrons lost** or **gained** in formation of **ionic solid**

$Na \longrightarrow Na^{+} + e^{-}$

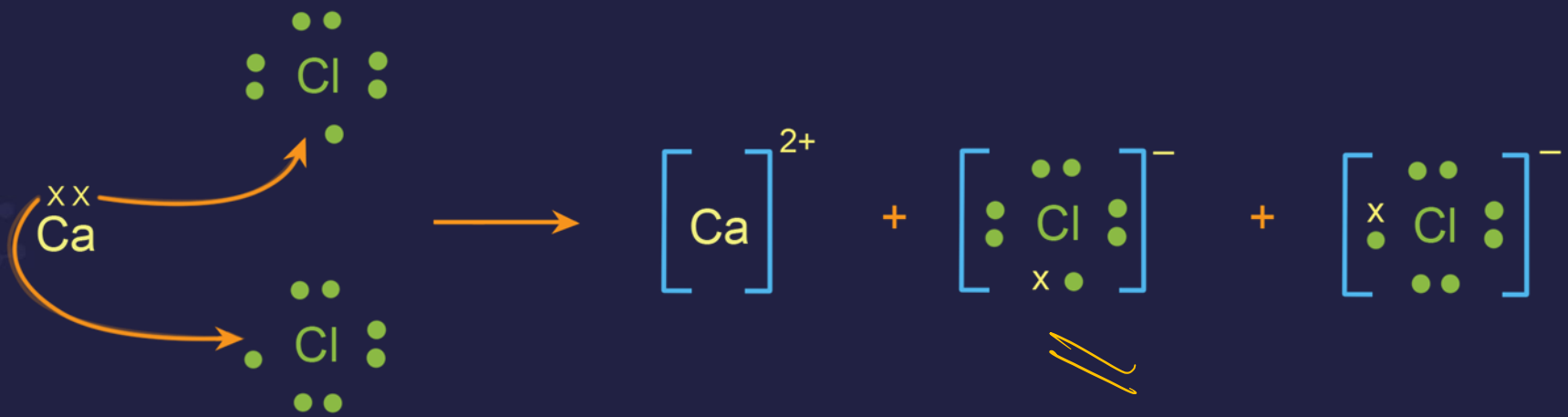
$Mg \longrightarrow Mg^{+2} + 2e^{-}$

Electrovalency

Example:

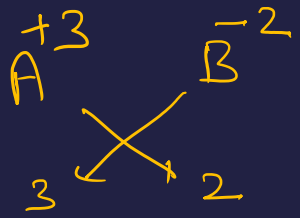
Electrovalency

Electrovalency



Electrovalency of Ca	2
Electrovalency of Cl	1

Element A has three electrons in its outermost orbit and B has six electrons in its outermost orbit. The formula of the compound will be:



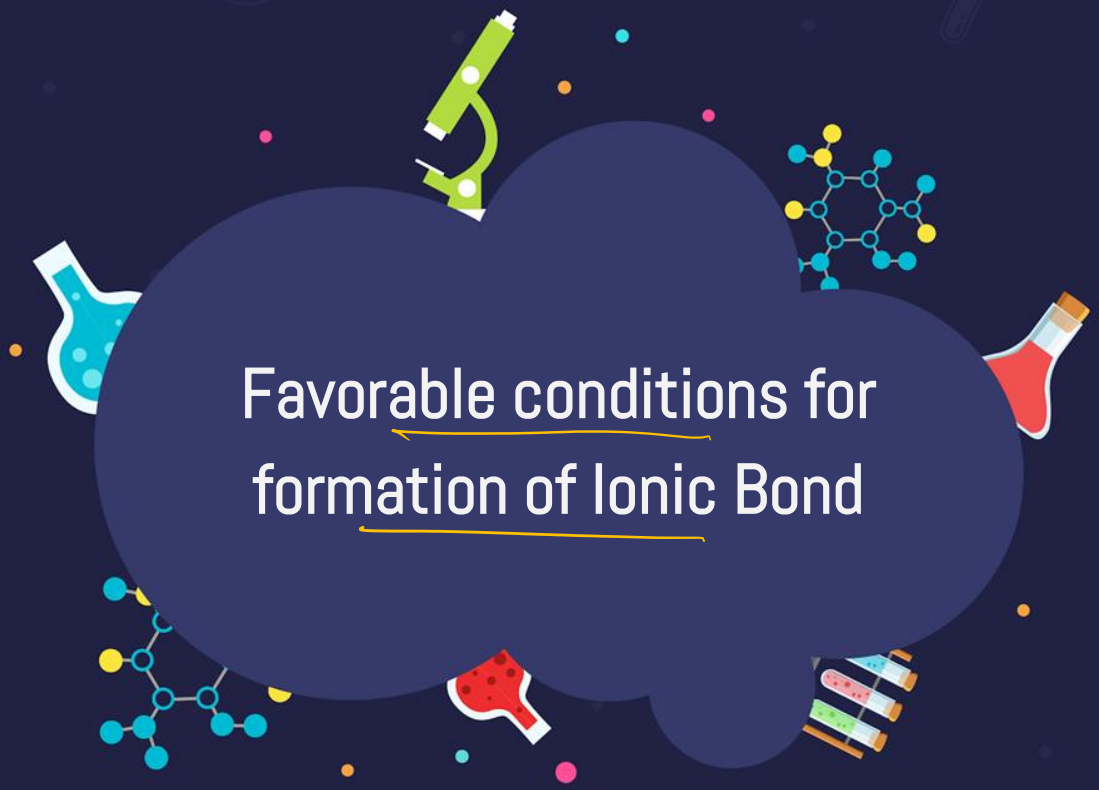
A_2B_3

a) A_2B_3

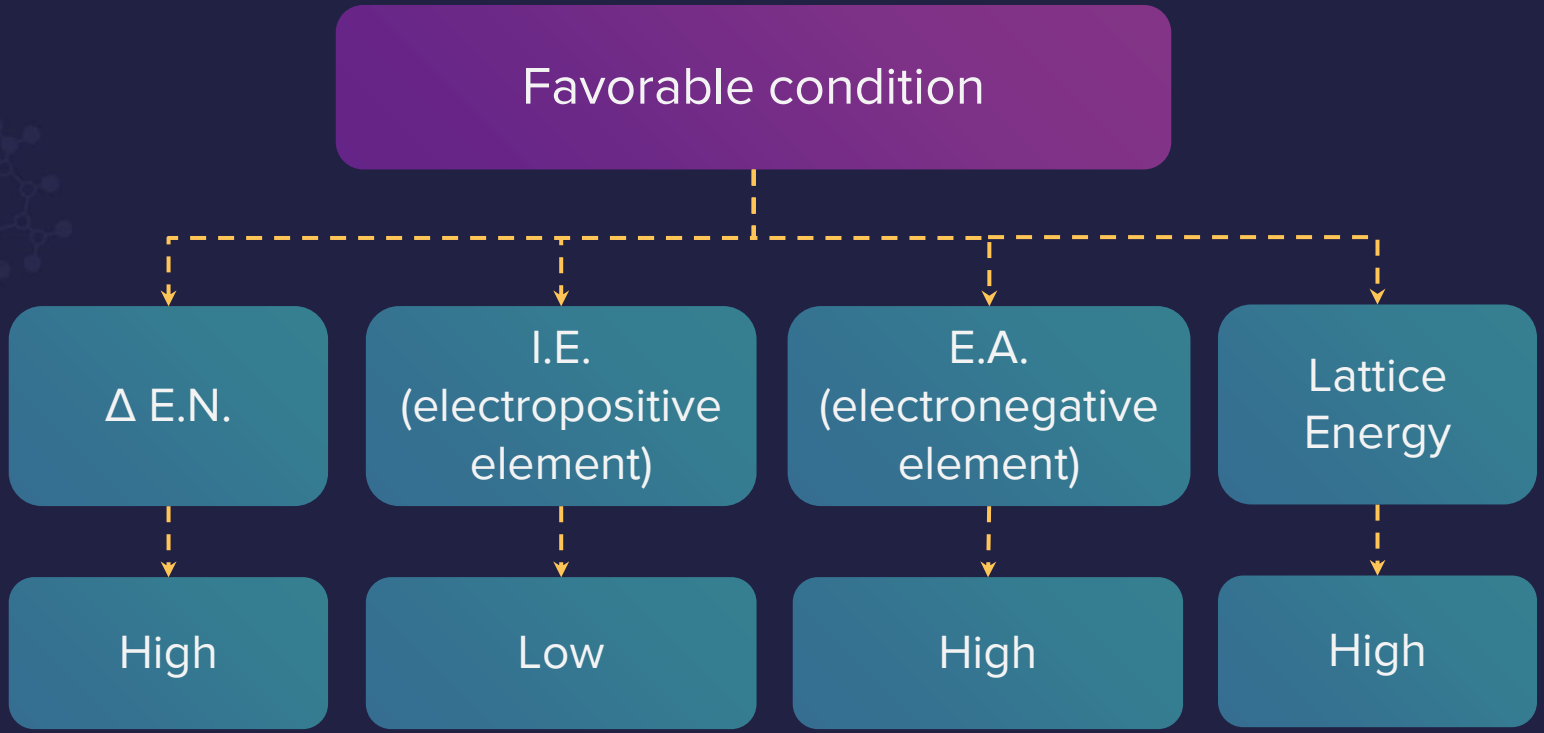
b) A_2B_6

c) A_2B

d) A_3B_2


Favorable conditions for
formation of Ionic Bond

Favorable conditions for formation of Ionic Bond



Δ E.N.

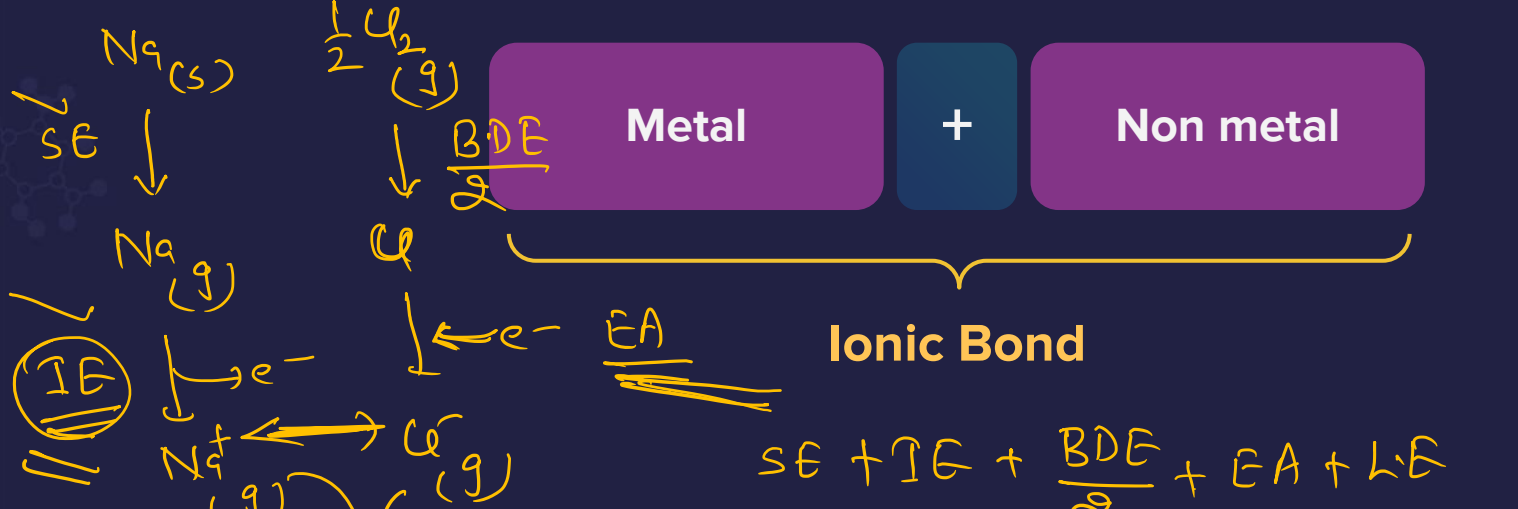
Ionic bond is formed between
metal and a non metal

Δ E.N. ↑

Ionic Bond

formation of NaCl

Cl + Cl → 2Cl



Metal + Non metal

Ionic Bond

$SE + IE + \frac{BDE}{2} + EA + L.E$

Endo | Exo

$SE + IE + \frac{BDE}{2} < EA + LE$ (Exo)

Ionization Energy

Amount of energy required to **remove** the **most loosely bound electron** from an **isolated gaseous atom** to form a **cation**

Low I.E.

$$Na\,(g) \longrightarrow Na^{+}\,(g) + e^{-}\,(g)$$

Electron Gain Enthalpy

Energy change when an **electron is added** to the **valence shell** of an **isolated gaseous atom**

High | $\Delta_{eg}H$ |

$$Cl\,(g) + e^- \longrightarrow Cl^-(g)$$

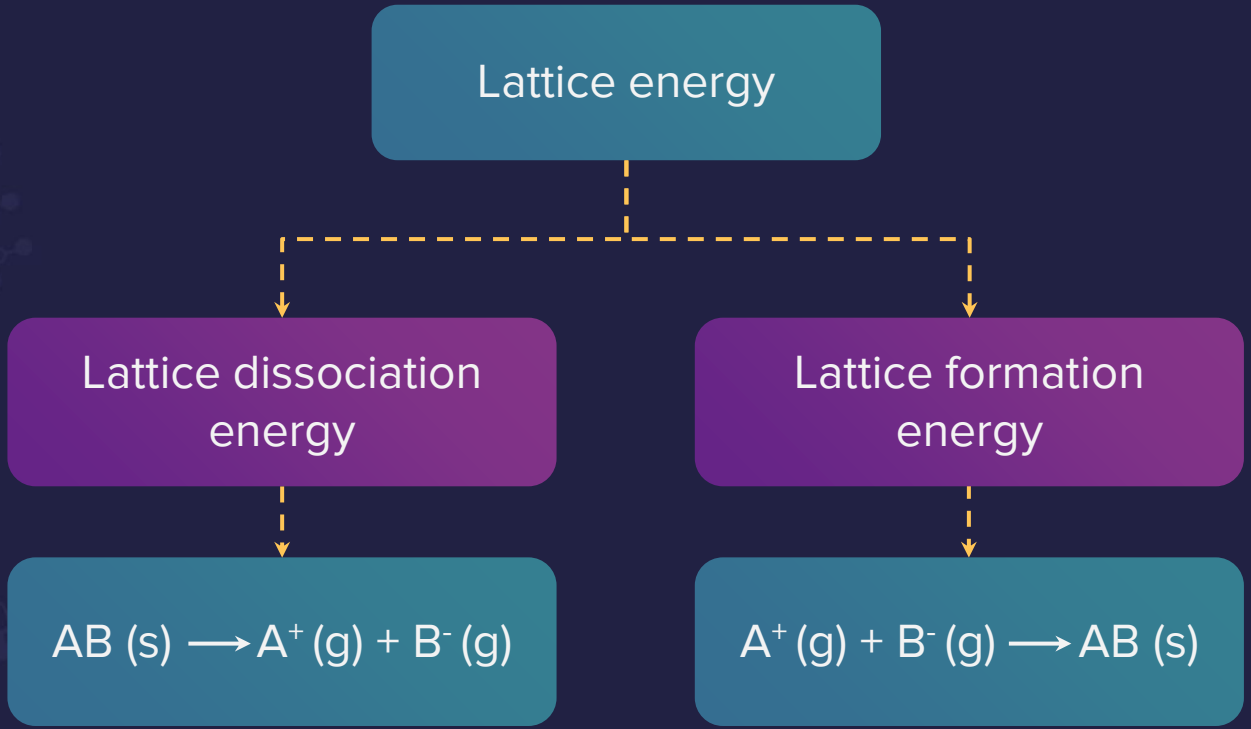
Lattice Energy

Energy required to completely **separate**

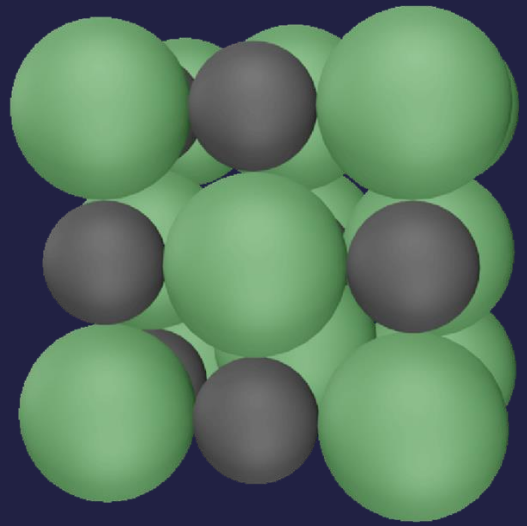
One mole of a **solid** ionic compound into **gaseous** constituent ions

$$NaCl\ (s) \longrightarrow Na^{+}\ (g) + Cl^{-}\ (g)$$

Lattice Energy



Lattice Energy



Energy

Ionic Compound

For **stable** ionic Compound

$$\text{I.E.} - |\Delta_{eg}H| - |\text{L.E.}| < 0$$

Example

$Na\ (g) \longrightarrow Na^{+}\ (g) + e^{-}$ I.E. = + 495 kJ/mol

$Cl\ (g) + e^{-} \longrightarrow Cl^{-}\ (g)$ $\Delta_{eg}H$ = -348.7 kJ/mol

Lattice enthalpy of NaCl = 788 kJ/mol

I.E. - | $\Delta_{eg}H$ | - | L.E. | **<** **0**

The magnitude of the lattice energy of a solid increases if:

a) the ions are large

b) the ions are small

c) the ions are of equal size

d) charges of the ions are small


Properties of Ionic compounds

Properties of Ionic compounds

1. Physical State : Generally Solid
2. High M.P. & B.P. : Strong electrostatic force of attraction
3. Hard & Brittle
4. Rigid & non directional

Properties of Ionic compounds

5 Soluble in polar solvent

6 Conduct electricity in aqueous & molten state

An ionic compound A^+B^- is most likely to be formed when:

a) the I.E. of A is high and E.A. of B is low

b) the I.E. of A is low and E.A. of B is high

c) both I.E. of A and E.A. of B are high

d) both I.E. of A and E.A. of B are low

Which combination will give the strongest ionic bond?

a) Na^{+} and Cl^{-}

b) Mg^{2+} and Cl^{-}

c) Na^{+} and O^{2-}

d) Mg^{2+} and O^{2-}

Lattice energy of an ionic compound depends upon:

a) Charge on the ion only

b) Size of the ion only

c) Packing of the ion only

d) Charge and size of the ion

Element X is strongly electropositive and Y is strongly electronegative. Both are univalent. Then the formula of the compound formed would be:

a) $X^{+}Y^{-}$

b) X - Y

c) $X^{-}Y^{+}$

d) $X \longrightarrow Y$

“Stay Positive, Work Hard. Make It Happen!”

THANK YOU