

'GSA'

## Past Paper Questions

Q. (a) Why do atoms form bonds? Name three major types of chemical bonds. (5)

Ans: Atoms form bonds to achieve greater stability. This stability is often attained by reaching a full outer electron shell, which typically makes the atom more energetically favorable. The drive for atoms to bond can be understood through octet rule, which states that atom tends to form bonds to have eight electrons in their valence

shell, similar to the electron configuration of noble gases

## Three Major Types of Chemical Bonds:

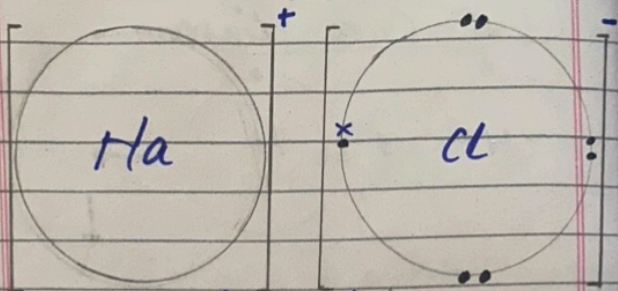
- (1) Ionic Bonds.
- (2) Covalent Bonds.
- (3) Metallic Bonds.

### (1) Ionic Bonds:

Formed when one atom donates one or more electrons to another atom, resulting in positively charged cations and negatively charged anions.

#### Example:

NaCl.

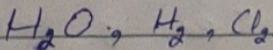


(HCl)  
Dot-and-Cross  
Diagram.

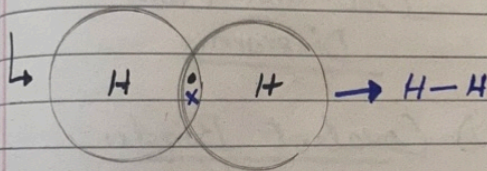
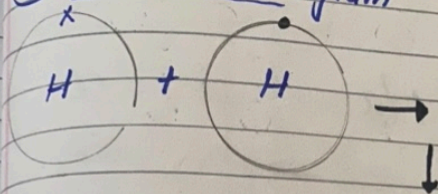
(2) Covalent Bonds:

Formed when  
two atoms share one  
or more pairs of  
electrons. In other words,  
mutual sharing of electrons  
is called covalent bond.

Example:



## Dot-Cross diagram

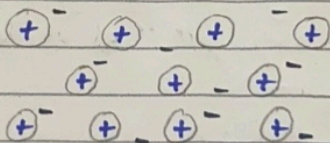


Hydrogen atoms sharing electrons.

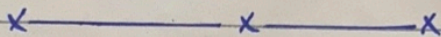
### (3) Metallic Bonds:

Occur between metal atoms when electrons are shared in a "sea of electrons" that are free to move around.





'Sea' of delocalised  
electrons



(b) What is difference  
between the ionic  
and covalent bonding?  
Give examples. (5)

Ans:

Ionic bond

• Definition:

Ionic bonding  
occurs when  
one atom  
donates an electron  
to another,  
resulting in  
the formation

Covalent bond

• Definition:

Covalent bonding  
occurs when  
two atoms share  
one or more  
pairs of electrons,  
allowing each  
atom to achieve

of positively and negatively charged ions that attract each other due to electrostatic forces a full outer shell of electrons

• Formation:

Typically occurs between a metal and a non-metal

• Formation:

Typically occurs between two non-metals

• Electron Transfer:

Involves the complete transfer of electrons from one atom to another.

• Electron sharing:

Involves the mutual sharing of electrons between atoms

• Bond strength:

Generally strong due to the electrostatic attraction between oppositely charged ions

Bond strength:

Can be strong, but generally varies depending on the number of shared electron pairs (single, double or triple bonds).

• Physical properties:

Ionic compounds tend to have high melting and boiling points, are often soluble in water, and can conduct electricity when dissolved or

• Physical properties:

Covalent compounds can have lower melting and boiling points, are often insoluble in water and do not conduct electricity



molten.

• Examples:

(1) Sodium Chloride  
(NaCl)

Formation:

(Na) loses an electron to become  $\text{Na}^+$ , and (Cl) gains that electron to become  $\text{Cl}^-$ . This results in the formation of NaCl

(2) Magnesium oxide  
(MgO)

Formation:

(Mg) loses two electrons

• Examples:

(1) Water ( $\text{H}_2\text{O}$ )

Formation:

Each hydrogen atom shares one electron with the oxygen atom, resulting in two covalent bonds.

(2) Carbon dioxide  
( $\text{CO}_2$ )

Formation:

Each oxygen atom shares



to become  
 $Mg^{2+}$ , and  $(O)$   
gains two  
electrons to  
become  $O^{2-}$ .

Thus, they attract  
each other to  
form  $MgO$ .

two pairs  
of electrons  
with the  
Carbon atom,  
resulting in  
two double  
bonds.

