

8. IONIC BONDING

<https://subarnam.com.np/>

Learning outcomes

Candidates should be able to:

1. Define ionic bonding
2. Describe ionic bonding, using the examples of sodium chloride, magnesium oxide and calcium fluoride, including the use of 'dot-and-cross' diagrams.

Definition

What is Ionic Bonding?

Ionic bond = The **STRONG** attraction between positively charged ions and negatively charged ions in a crystal lattice.

Think of it like: Opposites attract! Positive and negative ions stick together like magnets.

An ionic bond (also called an **electrovalent bond**) is the strong force of attraction between the positive ions (cations) and negative ions (anions) in the ionic crystal lattice. For example, bonds in sodium chloride crystals.

Cations, or positively charged ions, are formed when an atom loses one or more electrons. Metal atoms usually lose electrons and form positive ions.

Anions, or negatively charged ions, are formed when an atom gains one or more electrons. Non-metal atoms usually gain electrons and form negative ions.

Generally, compounds containing a metal, particularly a group 1 or 2 metal, and a non-metal, particularly a group 6 or 7 non-metal, have ionic bonding.

The attraction between the positive and negative ions is the ionic bond. It is not the transfer of electrons. This is a common error.

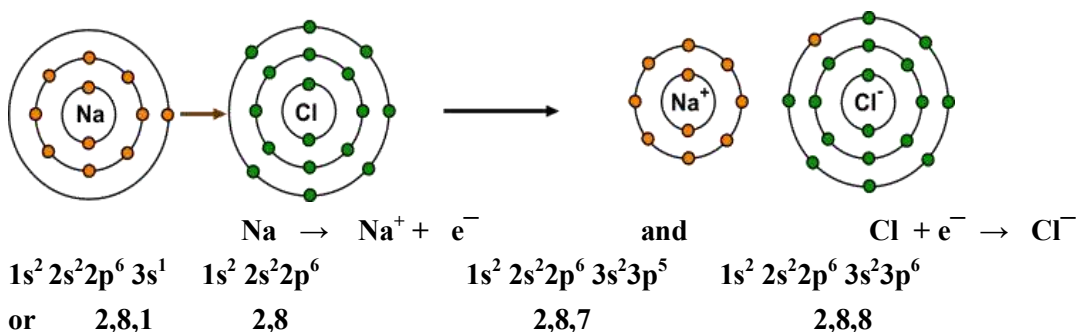
When elements form compounds, they either gain, lose or share electrons to get to the nearest stable noble gas electronic configuration.

The Golden Rule: Atoms want to be like noble gases (stable and "happy"). They gain, lose, or share electrons to get there.

✦ **Remember: The bond is the ATTRACTION, NOT the electron transfer itself!**

Explanation with an example

Ionic bonds tend to be formed between elements whose atoms need to "lose" electrons to gain the nearest noble gas electronic configuration (n.g.e.c.) and those which need to gain electrons. The electrons are transferred from one atom to the other.



An electron is transferred from the 3s orbital of sodium to the 3p orbital of chlorine; both species end up with the electronic configuration of the nearest noble gas. The resulting ions are held together in a crystal lattice by electrostatic attraction.

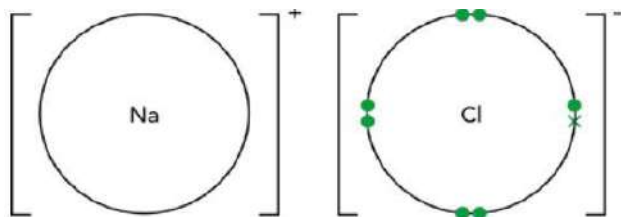
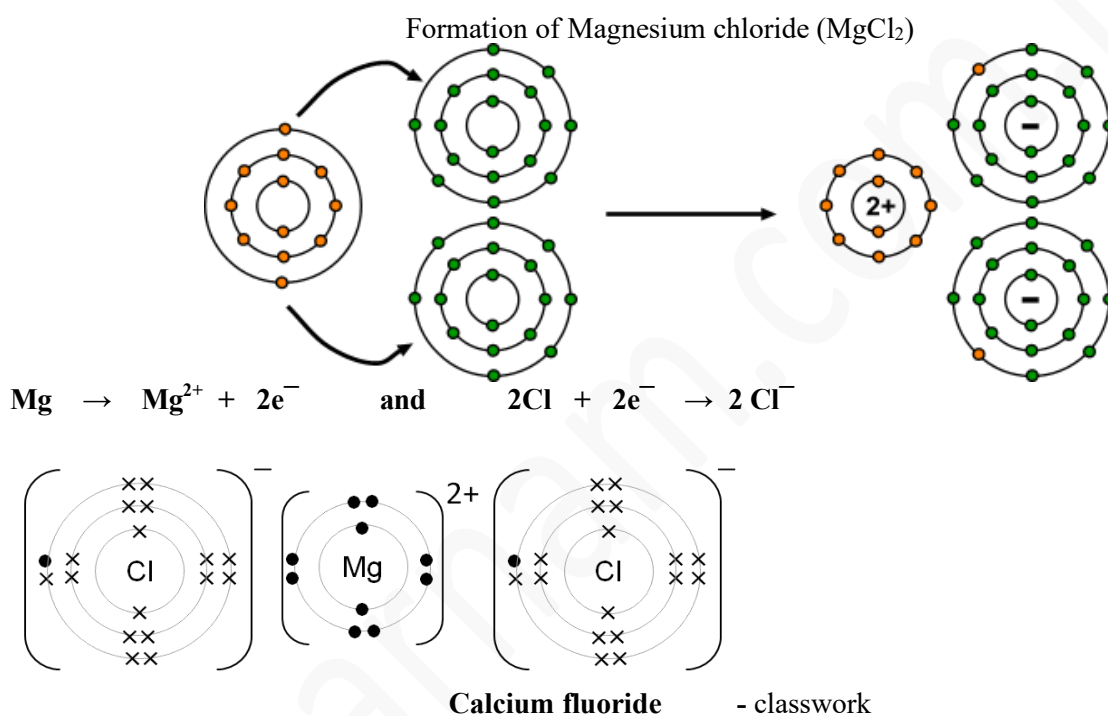


Figure: Dot and cross diagram of sodium chloride (showing only outer electrons)



Physical properties of ionic compounds

Melting point

Very high A large amount of energy must be put in to overcome the strong electrostatic attractions and separate the ions.

Strength

Very brittle Any dislocation leads to the layers moving and similar ions being adjacent. The repulsion splits the crystal.

Electrical

conductivity don't conduct when solid - ions held strongly in the lattice. Conduct when molten or in aqueous solution - the ions become mobile, and conduction takes place.

Solubility

Insoluble in non-polar solvents but soluble in water. Water is a polar solvent and stabilises the separated ions.

Much energy is needed to overcome the electrostatic attraction and separate the ions; the stability attained by being surrounded by polar water molecules compensates for this

Quick Review

1. Ionic bonds = attraction between + and - ions
2. Metals lose electrons → positive ions
3. Non-metals gain electrons → negative ions
4. Goal: Achieve noble gas configuration
5. Key property: High melting point, brittle, conducts when melted

.....

<https://subarnam.com.np/>