Class ⇒ B.Sc. (Part-II) Subsidiary
Subject ⇒ Chemistry
Chapter ⇒ Solid state
Topic ⇒ Types of crystalline solids.

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Types of crystalline solids

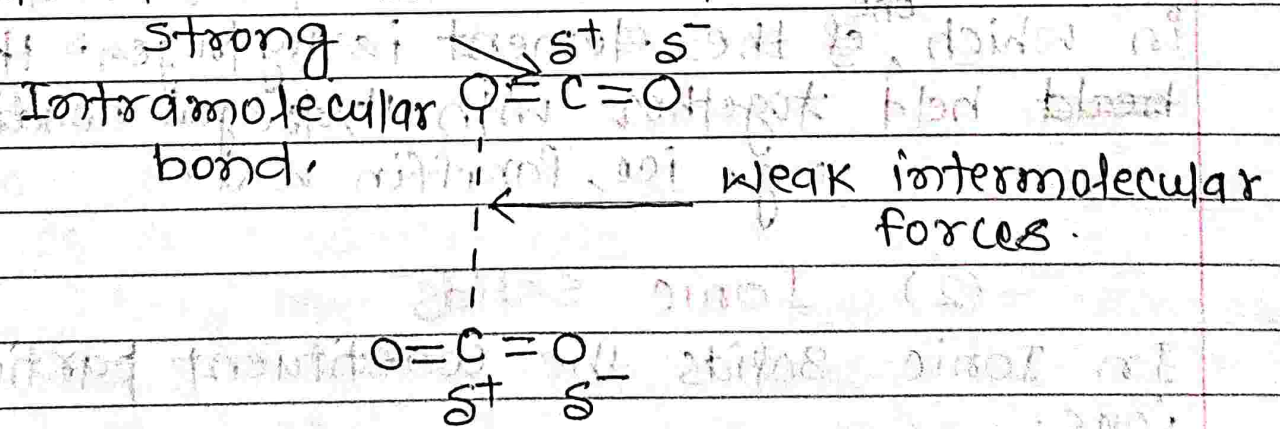
Crystalline solids are classified into four categories based on the nature of intermolecular forces operating between the constituent particles.

(1) Molecular solids
(2) Ionic solids
(3) Metallic solids
(4) Covalent network solids.

(1) Molecular solids

In molecular solids the constituent particles are molecules.

Molecular solids contain both intra-molecular bonds and intermolecular forces.



The molecules in a molecular solids are held together by much weaker intermolecular forces.

Because the forces between these molecules are relatively weak.

Molecular solids are often soft substances with low melting points.

e.g. Dry ice or solid Carbon dioxide

Molecular solids are further classified into following categories

(i) Non-polar Molecular solids ⇒ In non-polar molecular solids, the molecules are held together by weak dispersion forces or London forces.

Thy have low melting point. They are soft and do not conduct electricity.

e.g. Hydrogen, Chlorine, F_2, Br_2, I_2

(ii) Polar Molecular solids ⇒ Polar solids are made up of molecules held together by dipole-dipole interactions.

They are soft, are insulators, have higher melting points than non-polar solids. Mostly liquid and gases at room temperature.

e.g. Solid SO_2, Solid NH_3, HCl, HBr

(iii) Hydrogen bonded Molecular Solids ⇒ These are molecular solids that contain polar covalent bonds in which one of the element is hydrogen. They are ~~held~~ ~~held~~ held together with Hydrogen bonding.

e.g. ice, Paraffin wax.

(2) Ionic Solids

In Ionic solids the constituent particles are ions.

These solids are generally salts such as NaCl, that form an extended three-dimensional

network of ions held together by the strong force of attraction between ions of opposite charge.

These solids donot conduct electricity in solid state because the ions are held together by strong electrostatic forces. In the molten state or in aqueous solution, these ions become free to move and conduct electricity.

e.g. Sodium chloride, Magnesium oxide.

(3) Metallic Solids

Metallic solid consist of positively charged metals ions (kernels) occupying the lattice points which are held together by the metallic bonds. The metallic bond arises due to the presence of mobile electrons. These mobile electrons undergo simultaneous attraction by a number of positive ions and hence the ions are held together.

These solids are hard and good conductors of electricity.

The electrostatic attractions between the metal ions and the electron cloud constitute the metallic bond.

e.g. Silver, copper etc.

(4) Covalent Network Solids

In covalent network solids, the atoms or chemical sub units are bonded by conventional covalent bonds in a continuous network.

They are called gaint molecules because there are no individual molecules and the entire crystal may be considered as a macromolecules.

e.g. Diamond (in the form of pure Carbon, an atom) and Quartz (Silicon dioxide (SiO_2), a chemical subunit)

Since, the atoms are bounded by strong covalent bonds, these crystals are very hard and have very high melting points.

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