

HYDROGEN BONDING

Hydrogen bonding is defined as the electrostatic attraction between a hydrogen atom, which is covalently bonded to a highly electronegative atom (N, O, or F), and another electronegative atom with a lone pair of electrons.

This interaction is weaker than covalent bonds but stronger than van der Waals forces. The bond energy of hydrogen bonds typically ranges from 5 to 120 kJ/mol.

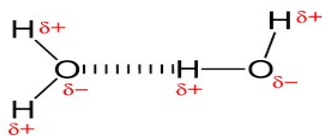
Types of Hydrogen Bonding: It is two types. They are

1. Intermolecular Hydrogen Bonding:

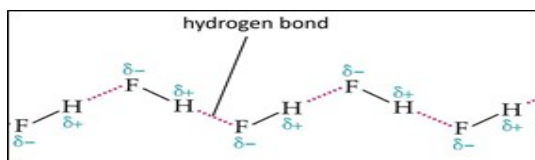
This type occurs between different molecules. It leads to the formation of a network of molecules connected by hydrogen bonds.

Examples:

- i. In water (H_2O), each molecule forms hydrogen bonds with neighbouring molecules, resulting in high boiling and melting points.



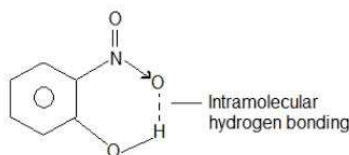
- ii. In HF, hydrogen bonds form long zig-zag chains.



2. Intramolecular Hydrogen Bonding:

This occurs within the same molecule when the molecule has both a hydrogen donor and acceptor in close proximity.

Example: 1. Ortho-nitrophenol shows intramolecular hydrogen bonding between the hydroxyl and nitro groups.



This type can influence molecular shape, reactivity, and volatility.

Hydrogen bonding has significant impact on chemical and biological systems. They are

- 1 Water: The high boiling point, high surface tension, and the lower density of ice compared to liquid water are all due to hydrogen bonding.
- 2 DNA: The double helix structure is stabilized by hydrogen bonds between nitrogenous bases (A–T with two hydrogen bonds, G–C with three).
- 3 Proteins: The secondary structures like alpha-helices and beta-pleated sheets are stabilized through hydrogen bonding.
- 4 Solubility: Compounds capable of hydrogen bonding (e.g., ethanol, glucose) are generally more soluble in water.