Chemical Bonding

INTRAMOLECULAR BONDS - Bonds *Within* a Molecule

Intramolecular bonds are very strong bonds which hold atoms together as a molecule. These include **ionic bonds**, **covalent bonds** and **coordinate covalent bonds**.

Ionic Bonds

In ionic bonds, **electrons are transferred**, not shared, thereby forming positive and negative ions. These bonds exist because of **electrical attraction**. They are formed when the **electronegativity difference** between the atoms involved is **greater than or equal to 1.7**.

Covalent Bonds

Covalent bonds are formed due to the **sharing of electrons**. Covalent bonds may be **polar** or **non-polar**.

In polar covalent bonds, two atoms are held together by the sharing of two electrons, one from each atom. This **electron pair is pulled towards** the atom with **greater electronegativity**, forming a **dipole**. The **difference in electronegativity** between the two atoms must be **less than 1.7**.

In non-polar covalent bonds (also known as **purely covalent bonds**), the electron pair is **shared equally between** the two atoms; thus the bonds formed have no polarity. This occurs when the **difference in electronegativity is approximately zero**.

Coordinate Covalent Bonds

Atoms are held together by the sharing of electrons, but **both electrons are donated by the same atom**.

INTERMOLECULAR FORCES - Bonds *Between* Molecules

Intermolecular bonds hold molecules together by way of weak forces of attraction between molecules. These include **van der Waals forces**, **dipole-dipole attractions** and **hydrogen bonding**.

van der Waals Forces

van der Waals forces arise due to **fluctuations in the electron distribution** around molecules. These fluctuations create an **asymmetric charge distribution** large enough to hold neighbouring molecules to each other. The forces play a significant role in the attraction of **non-polar molecules**. They are the **weakest** of the three forces listed in this section.

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Dipole-Dipole Attractions

Dipole-dipole attractions occur in **slightly-polarized**, **asymmetric molecules**. Dipoles are attracted to another, just like magnets. This type of bond has an **intermediate strength** between that of the other forces in this section.

Hydrogen Bonds

Hydrogen bonds occur in **highly-polarized**, **asymmetric molecules**. They are an **extremely strong form of dipole-dipole attraction**. They occur when hydrogen is **covalently bonded** to a small, highly electronegative element, such as **fluorine**, **oxygen**, or **nitrogen**, so hydrogen bonds can occur in molecules like H_2O, HF and NH_3.

OTHER NOTES

→ Molecules with a small molecular weight would require less energy (a lower temperature) to evaporate.

→ The polarity of a molecule is not dictated by the polarity of its bonds. For example, a *symmetric* molecule with *polar* bonds will result in a *non-polar* molecule.

→ The strength of van der Waals forces *increases* with an *increase* in the number of electrons.