NON-COVALENT INTERACTIONS

- Does not involve sharing of electrons but involves more dispersed variations of electromagnetic interactions between or within molecules.
- Attractive or repulsive forces between molecules and between non-bonded atoms
- Four types: hydrogen bonds, hydrophobic interactions, ionic bonds, van der Waals forces

HYDROGEN BONDS

- Form between a covalently bonded hydrogen atom in a donor group and a pair of non-covalent electrons on an acceptor group
- Ability of a group to act as a hydrogen bond donor depends on its electronegativity (only oxygen and nitrogen)
- Strongest hydrogen bonds : donor atom and acceptor atom are 180° apart
- Unique properties : forms H bonds with itself and other molecules, tetrahedral shape, strongest non-covalent bond, specific, responsible for thermal properties, both a H bond accpetor and donor

HYDROPHOBIC INTERACTIONS

- Interaction between hydrophobes (low water-soluble molecules) in a polar solvent (usually water)
- Hydrophobes: non-polar molecules with long carbon chain that do not interact with water
- Important for folding of proteins : keeps protein stable and biologically active by decreasing surface area of protein to prevent undesirable interaction with water
- Strength increases with temperature, number of carbons in the chain and in linear chain shape

IONIC BONDS

- Electrostatic force of attraction between two oppositely charged ions
- Generally occurs between metals and non-metals
- Non-metals gain electrons to gain negative charge and form anion whereas metals lose electrons to gain positive charge and form cations
- Properties of ionic compounds: high melting and boiling points, form crystals, brittle, soluble in water but insoluble in organic solvents, only conduct electricity in molten state, higher enthalpies of fusion and vaporization

VAN DER WAALS FORCES

- Weak intermolecular forces caused by attractions between very small dipoles in molecules
- Van der Waals forces are induced dipole-dipole forces that exist between polar and non-polar molecules
- As the number of electrons increases so does the size of the oscillating and induced dipoles, the size of the attractive forces between the molecules, and the size of the van der Waals forces.
- Two types: London Dispersion forces and dipole-dipole forces