INTERMOLECULAR FORCES

Alternative Attractive Forces within Molecules van der Waals Forces Van der Waals forces represent feeble attractive forces between two molecules, whether or not a strong bond is present. These forces derive from electrostatic interactions and can be categorized into three types:

1. Dipole-dipole Interaction
2. Dipole-induced Dipole Interaction
3. Instantaneous Dipole Interaction

1. Dipole-dipole Interaction:

These forces manifest between two polar molecules. The opposing charges of two dipoles attract each other, giving rise to interactions referred to as Keesom forces. For instance, in HCl, dipole-dipole interactions are prevalent.

(a) Stationary Polar Molecules: The energy of dipole-dipole interaction is inversely proportional to the third power of the distance between stationary polar molecules, particularly evident in solids.

(b) Rotating Polar Molecules: In the case of rotating polar molecules, the energy of dipole-dipole interaction is inversely proportional to the sixth power of the distance between the rotating polar molecules, as observed in substances like water.

2. Dipole-induced Dipole Interaction:

This interaction occurs when a polar molecule approaches a non-polar molecule, inducing weak polarity (dipole) in the latter. Consequently, feeble interactions, known as Debye interactions, develop between the polar and induced-polar molecules.

3. Instantaneous Dipole Interaction or London Dispersion Forces:

At any given moment, the distribution of electrons in a molecule is not uniformly symmetrical. An instantaneous dipole is created when electrons temporarily gather on one side of the molecule, inducing polarity. This polar molecule, in turn, induces polarity in another molecule, fostering weak interactions between these instantaneous dipoles. Such interactions are termed Dispersion forces or London forces.

Van der Waals forces are evident in substances such as noble gases, sulfur molecules, iodine molecules, and graphite layers. The liquification of gases provides empirical evidence for the existence of van der Waals forces.