TYPES OF INTERMOLECULAR FORCES

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Intermolecular forces may be attractive or repulsive.

• **Johannes D van der Waals, Dutch, was** the first to postulate intermolecular forces in developing a theory to account for properties of real gases.

Van der waals forces include

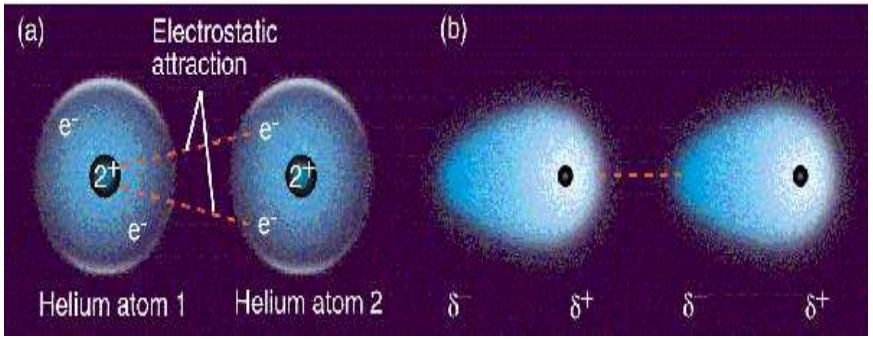
•London forces
•Dipole - dipole forces
•Dipole - induced dipole forces

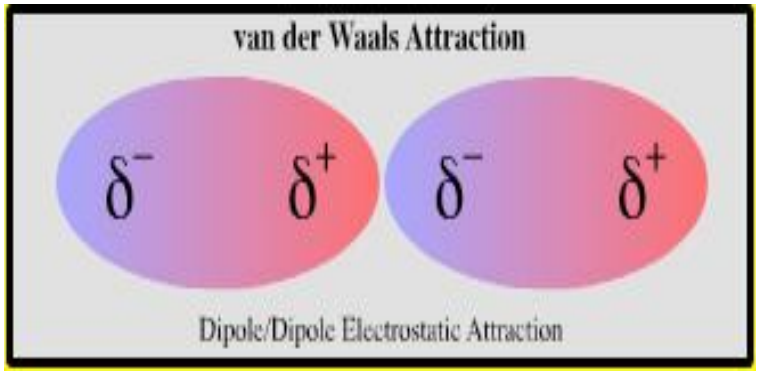
Other intermolecular forces are

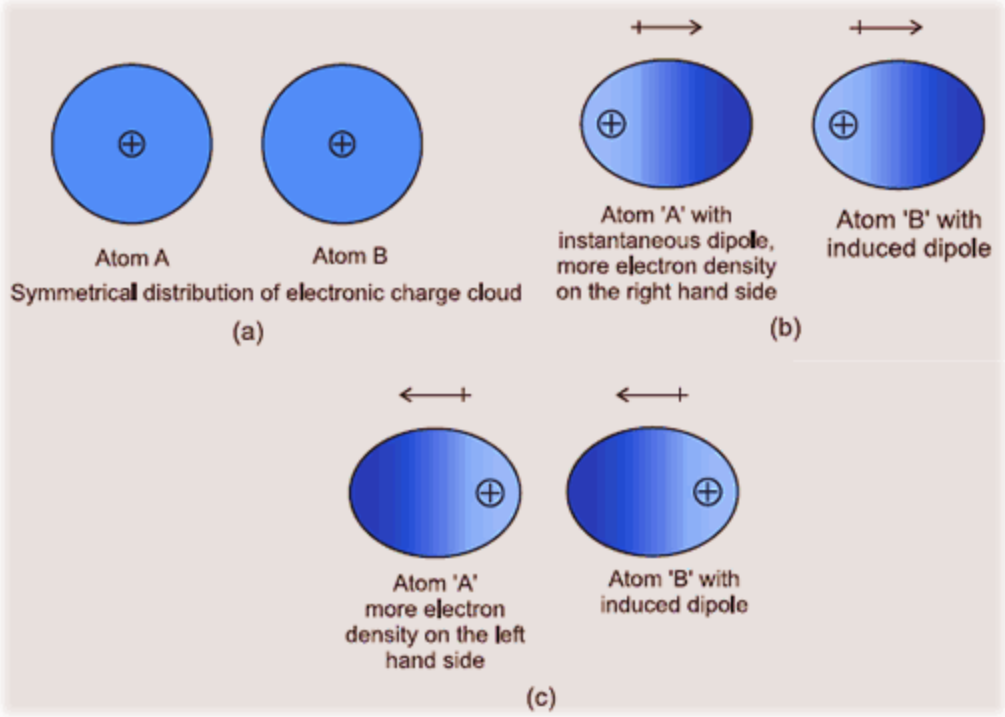
•Ion - dipole interactions
•Ion - induced dipole interactions
•Hydrogen Bonding

LONDON FORCES (DISPERSION FORCES)

These arise from temporary variations in electron density in atoms and molecules. At any instant , the electron distribution may be unsymmetrical and hence produce an instantaneous dipole. This can cause an induced transient dipole in the neighboring molecule and cause the molecules to be attracted.



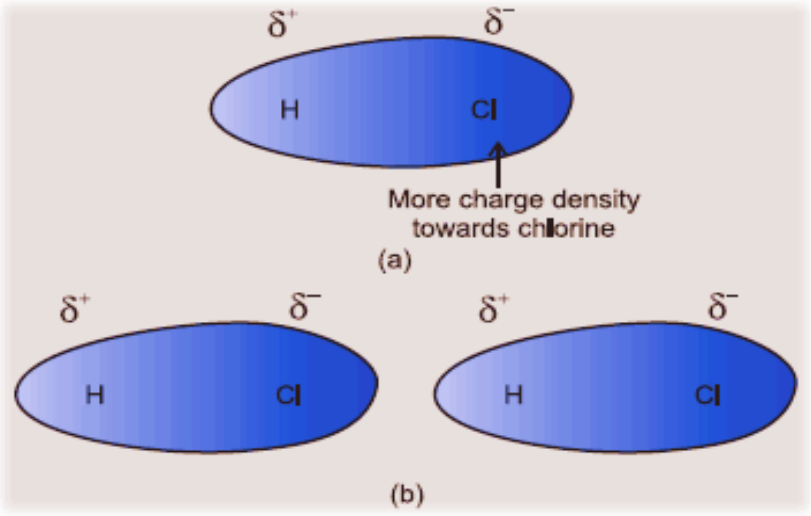




The London dispersion force is the weakest intermolecular force. The London dispersion force is a temporary attractive force that results when the electrons in two adjacent atoms occupy positions that make the atoms form temporary dipoles. This force is sometimes called an induced dipole induced dipole attraction. London forces are the attractive forces that cause non polar substances to condense to liquids and to freeze into solids when the temperature is lowered sufficiently.

DIPOLE - DIPOLE FORCES

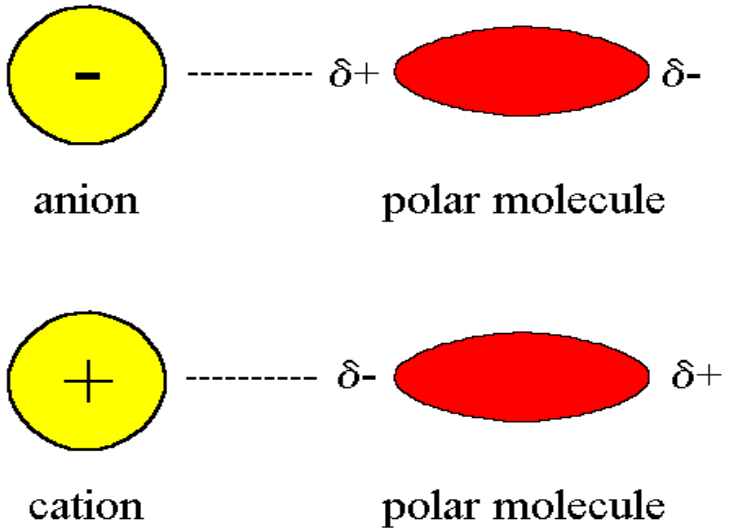
Dipole-dipole forces are attractive forces between the positive end of one polar molecule and the negative end of another polar molecule. Dipole-dipole forces have strengths that range from 5 kJ to 20 kJ per mole. They are much weaker than ionic or covalent bonds and have a significant effect only when the molecules involved are close together (touching or almost touching).



INDUCED - DIPOLE FORCES

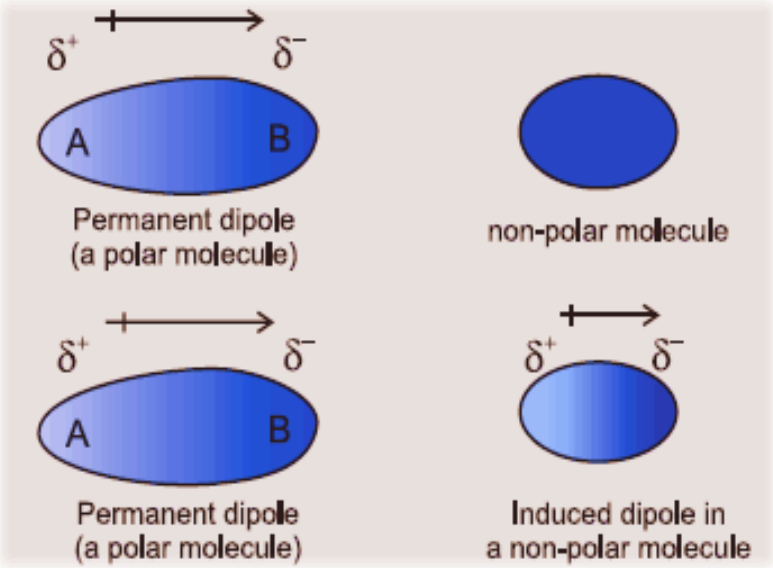
Ion – induced dipole forces

An ion-induced dipole attraction is a weak attraction that results when the approach of an ion induces a dipole in an atom or in a non polar molecule by disturbing the arrangement of electrons in the non polar species.



Dipole – Induced Dipole Forces

A dipole-induced dipole attraction is a weak attraction that results when a polar molecule induces a dipole in an atom or in a non polar molecule by disturbing the arrangement of electrons in the non polar species.



HYDROGEN BOND

The hydrogen bond is a special dipole-dipole interaction between the hydrogen atom in a polar N-H, O-H or F-H bond and an electronegative O, N or F atom.

A – H ----B or A – H ----A

A and B are O, N and F