Unit 3: Intermolecular Forces and Properties

AP Chem: College Board Daily Video Notes

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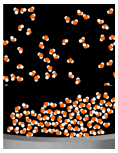
1 3.1.1 - Intermolecular Forces

1.1 What happens to waters IMFs when the water is boiled?

When water is boiled, instead of separating the molecule into $H+$ and O^{2-} ions, instead the intermolecular forces between water molecule breaks. The atoms of each molecule remain bonded to each other

- Chemical Equation: $H_2O(l) \rightarrow H_2O(g)$



1.2 Inter vs Intra -molecular forces

Intermolecular Force is the interaction within a single molecule (covalent bond). **Intramolecular Force** is interaction between 2 different molecules. Water is a polar molecule with a partial negative side on the oxygen, and a partial positive side on the hydrogen.

Intramolecular forces are also Coulombic forces but much weaker than covalent bonds.

1.3 Dipole-Dipole Interaction

- Occurs between 2 polar molecules

There can be attractiveness or repulsion. but the molecules will orient themselves to maximize attraction. The strength of the interactions depend on the magnitude of the dipole, **the greater the dipole moment, the greater the interaction**.

1.4 Intermolecular forces between non-polar molecules and polar molecules

When a dipole of water gets close to the nonpolar oxygen molecules, the electrons of Oxygen are repelled by the negative parts of water, and oxygen has a dipole (induced dipole). This dipole is *temporary*, the interaction is always attractive.

- **Known as LDF: London Dispersion Forces**

1.4.1 LDF

- All molecules exhibit LDF, even polar ones
- Primary type of interactions between non-polar molecules

The strength of the LDF depends on how easily the electrons can disperse, the larger the electron

cloud the more polar and the greater the strength of the interactions. LDF's are strong if the molecules is large enough.

1.5 Molecule Comparison

Element	Boiling Point
F_2	188.1° C
B_2	58.8° C
I_2	184.3° C

I_2 has the highest boiling point due to the energy needed to break its bonds. Since I_2 is the largest molecule in size, it has stronger LDF requiring a lot of energy to break its bonds.

1.6 Strength of Intermolecular Force

What accounts for the difference in enthalpy of vaporization

Substance	Δ $H_{vaporization}$	Dipole Moment
$Cl2$	24.4	0
HCl	162	105

$Cl2$ has a high vaporization, so its LDF is stronger. HCL's electron cloud is much larger and more polarizable'

1.7 Chapter Summary

- The molecular forces that form between different types of compounds depends on whether or not the molecules themselves are polar or not.
- Intermolecular forces are covalent bonds between different atoms in a compound

2 References