Bonding vs. Attractions: IntRA vs IntER

2 Basic Types of Intramolecular forces: attraction when electrons are given, taken, or shared to form a bond.

1. Electrostatic attraction: ion–ion (ionic) or sea of electrons to positive metal cores (metallic)
2. Covalent bonds: mutual sharing of electrons

4 Basic Types of Intermolecular forces (IMFs): attraction between two or more distinct molecules or particles.

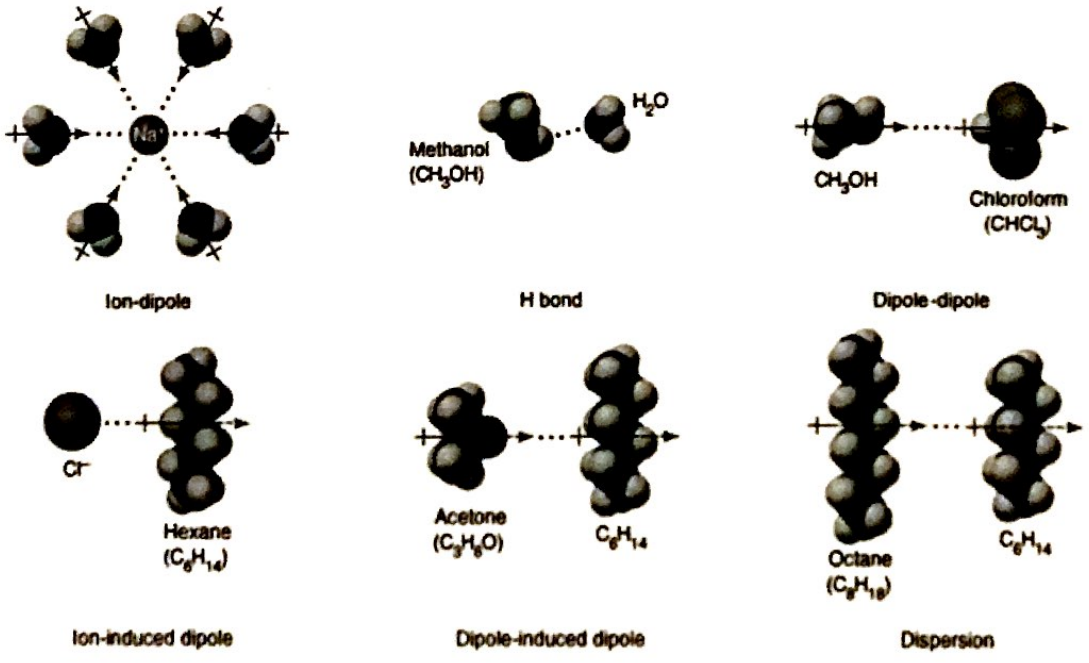
1. **Ion – dipole:** ion is attracted to a polar molecule (strongest of all IMFs)
2. **Dipole – dipole:** polar molecules are attracted to each other
   a. **Hydrogen bonding:** strongest type of dipole – dipole attraction; only when molecules contain an H bonded to an F, O, or N
3. **Dipole – induced dipole:** polar molecules attracted to non-polar molecules
4. **Induced dipole – induced dipole (London dispersion forces, LDFs):** attraction of ALL atoms and molecules to each other due to temporary dipoles caused by the polarizability of the electron cloud
   ↑surface area and/or ↑ # e^- = ↑LDFs

Intramolecular bonds are much, MUCH stronger than intermolecular forces!

Note on language:

→ Bonds are broken

→ IMFs are overcome



How do IMFs affect physical properties?

→ More IMFs means the more energy (heat) needed to put into the solution to overcome the IMFs.

→ Greater IMFS = ↑ melting, boiling points

→ Greater IMFS = ↓ vapor pressure (fewer molecules are in the gaseous state at a given temperature)

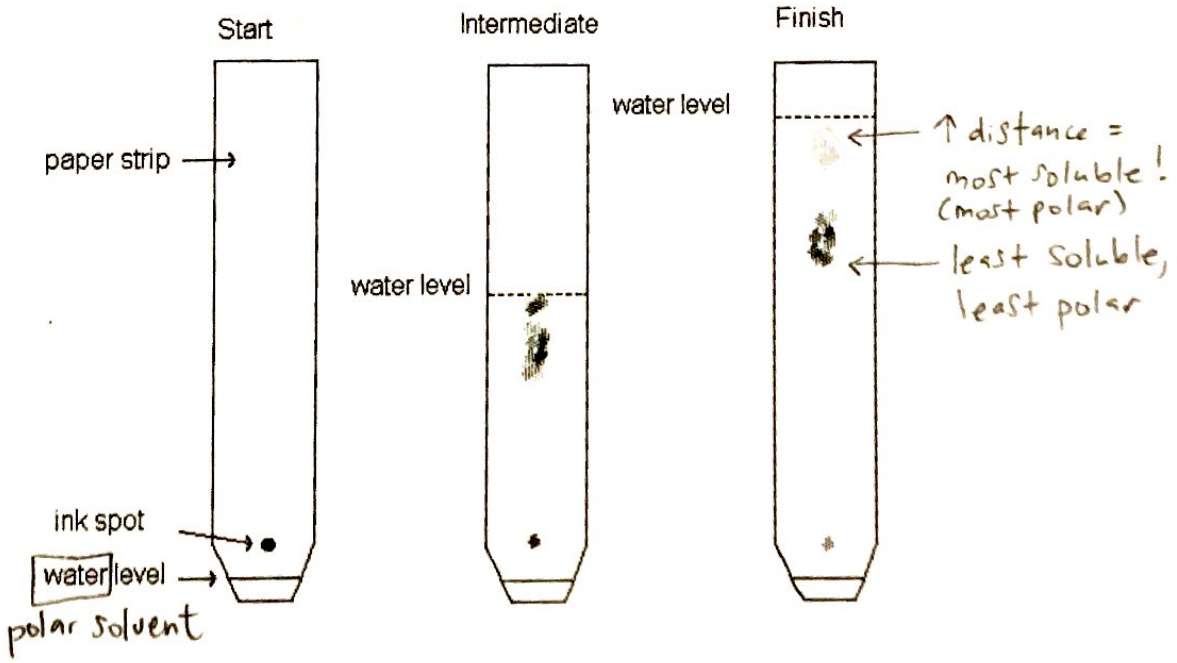
Chromatography: Lab Application of IMFs!

Chromatography: a technique used to separate mixtures of materials based on differences in migration rates among mixture components.

Paper chromatography: a common analytical technique used for Separating and identifying mixtures that are (or can be) colored.

- A small, concentrated spot of the sample is applied to a strip of chromatography paper near the bottom.
- The paper is dipped into a suitable Solvent, such as alcohol or water, and placed into a sealed container.
- The solvent moves up the paper by capillary action, which occurs as a result of the attraction of the solvent molecules to the paper.
- As the solvent rises through the paper it meets and dissolves the sample mixture, which will then travel up the paper with the solvent.
- Different compounds in the sample mixture travel at different speeds due to differences in solubility in the solvent and due to differences in their attraction to the fibers in the paper.
- The more soluble the component the further up it goes.

Chromatographic Separation of Black Ink



In short:

- Polar substances will travel **FARTHEST** in polar solvents
- Non-polar substances will travel **FARTHEST** in non-polar solvents

Why? Intermolecular attractions, of course!

Polar solute + polar solvent OR non-polar solute + non-polar solvent attractive forces are most energetically favorable, increasing solubility and thus mobility.