

Handout: Intermolecular (Interparticle) Forces (IMF)

Ranking Intermolecular (Interparticle) Forces from Strongest to Weakest:

(Strongest) Network Covalent (NC) > Ion-Dipole (I-D) > Metallic (M) > H-Bonding (H-B) > Dipole-Dipole (D-D) > London Dispersion Forces (LDF) (Weakest)

Ranking Relative Melting/Boiling Points from Highest to Lowest (Based on Type of Substance):

(Highest) Networks > Ionic > Metallic > Polar Covalent > Non-Polar Covalent (Lowest)

General Intermolecular Force (IMF) Patterns (Based on Type of Substance):

Based on Type of Substance from the given chemical formulas, use this chart as a guide to help you determine correct Intermolecular Force (IMF). The pattern/trend is exactly the same throughout for each subsequent "Type of Substance" that is the same. The only **exception** is Polar Covalent (PC) substances where it is able to have H-Bonding (H-B) or Dipole-Dipole (D-D) Force, depending if the chemical formula contains a hydrogen atom that is attached to either Nitrogen (N), Oxygen (O), or Fluorine (F). → Ex: H_3N ; H_2O ; HF

Type of Substance	Interparticle Force (IMF)	Conductivity	Solubility
<i>Polar Covalent (PC)</i>	<i>H-Bonding (H-B)</i>	<i>NONE</i>	<i>SLIGHT</i>
<i>Polar Covalent (PC)</i>	<i>Dipole-Dipole (D-D)</i>	<i>NONE</i>	<i>SLIGHT</i>
<i>Ionic (I)</i>	<i>Ion –Dipole (I-D)</i>	<i>IN SOLUTION/LIQUID</i>	<i>YES</i>
<i>Non-Polar Covalent (NPC)</i>	<i>London Dispersion Force (LDF)</i>	<i>NONE</i>	<i>NO</i>
<i>Metallic (M)</i>	<i>Metallic (M)</i>	<i>HIGH</i>	<i>NO</i>
<i>Networks</i>	<i>Network Covalent (NC)</i>	<i>NONE</i>	<i>NO</i>

Conductivity and Solubility Characteristics:

- **Conductivity** – Ability of a substance to conduct electricity where there is free movement of electrons.
- **Solubility** – Maximum quantity of a substance that may be dissolved (dissociate into + and – charges) in water. The maximum amount of solute that may be dissolved in a solvent.
- **Molecular** substances (non-metal/non-metal) **DO NOT** conduct electricity, **regardless** of state of matter
- **Ionic** substances (metal/non-metal) **ONLY** conduct when in solution (**aq**) or liquefied (**l**; **melted**)
- **Metallic** substances (either compounds or elements) are able to conduct electricity as a metallic solid (**s**) or metallic liquid (**l**), such as Hg (**l**)
- **Gases** (**g**) are also able to conduct
- **Solid, ionic** compounds **DO NOT** conduct electricity as the compound is too brittle to conduct in the solid state
- **Networks** (NC) **DO NOT** conduct electricity because there are no free-flowing electrons in its bonding molecules