

Solubility of drugs

Solubility Expressions

- Solubility is a fundamental concept in physical pharmaceutics that influences the formulation, efficacy, and bioavailability of drugs.
- Understanding the solubility of drugs is crucial for developing effective pharmaceutical products.

Solubility can be expressed in various ways:

1. Qualitative Expressions:

- **Very Soluble:** Less than 1 part solvent needed to dissolve 1 part solute.
- **Freely Soluble:** From 1 to 10 parts solvent.
- **Soluble:** From 10 to 30 parts solvent.
- **Sparingly Soluble:** From 30 to 100 parts solvent.
- **Slightly Soluble:** From 100 to 1,000 parts solvent.
- **Very Slightly Soluble:** From 1,000 to 10,000 parts solvent.
- **Practically Insoluble (or Insoluble):** More than 10,000 parts solvent.

2. Quantitative Expressions:

- **Molar Solubility:** The number of moles of solute that can dissolve in a liter of solution (mol/L).
- **Mass/Volume Solubility:** The mass of solute that can dissolve in a given volume of solvent (mg/mL).
- **Percentage:** The amount of solute per 100 parts of solution, expressed as a percentage (w/v, w/w, v/v).

Mechanisms of Solute-Solvent Interactions

- Solubility is largely determined by the interactions between solute and solvent molecules.

Steps Involved in the Dissolution of a Solute

1. Detachment of Solute Particles:

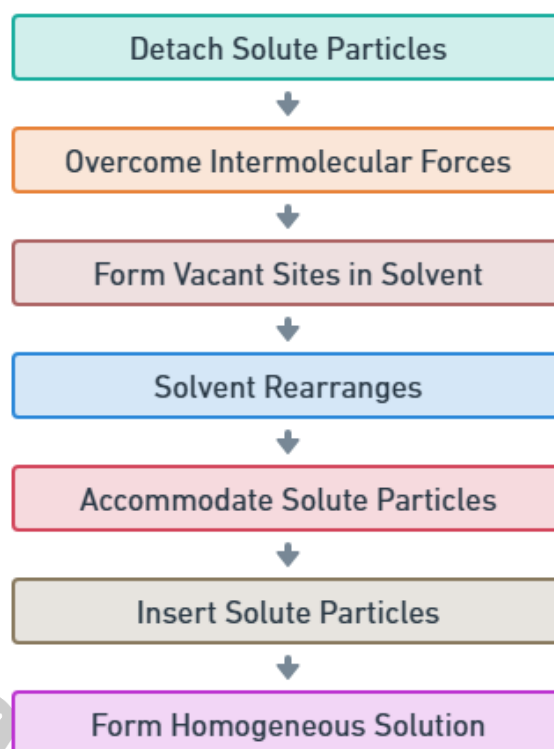
- Solute particles separate from the bulk solute.
- Requires energy to overcome intermolecular forces.

2. Formation of Vacant Sites in Solvent:

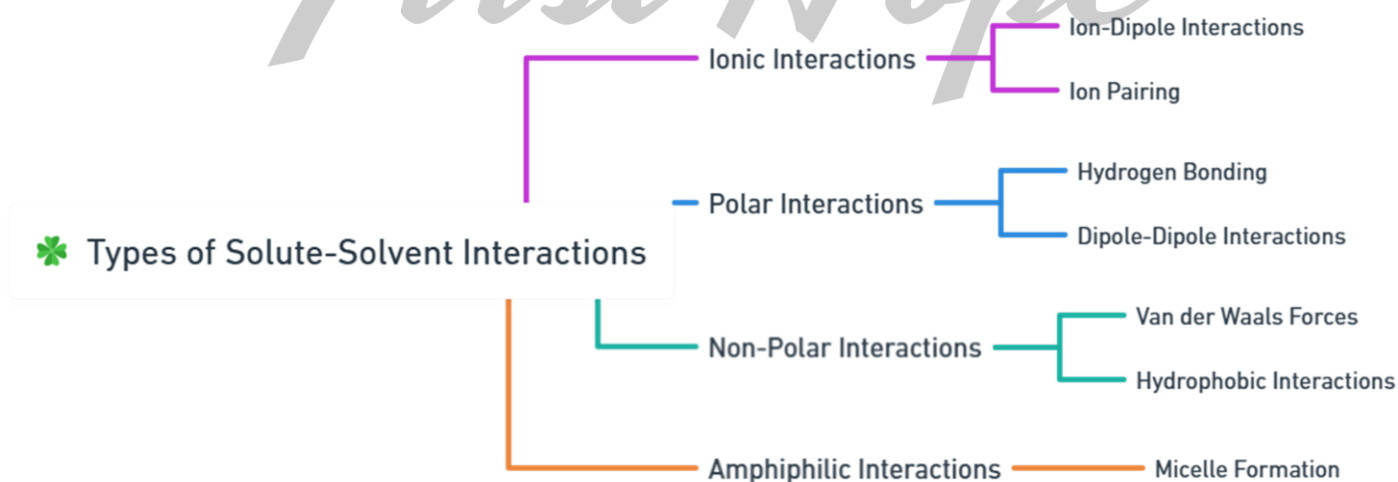
- Solvent molecules rearrange to create vacant sites.
- These sites will accommodate solute particles.

3. Insertion of Solute Particles into Solvent:

- Detached solute particles fit into the vacant sites in the solvent.
- Results in the formation of a homogeneous solution.



Types of Solute-Solvent Interactions



1. Ionic Interactions:

- **Ion-Dipole Interactions:** Ionic solutes (e.g., salts) dissolve in polar solvents (e.g., water) by interacting with solvent dipoles.
- **Ion Pairing:** High solute concentrations may form ion pairs, affecting solubility.

2. Polar Interactions:

- **Hydrogen Bonding:** Hydrogen bonds form between solute and solvent molecules, enhancing solubility for substances like alcohols and carboxylic acids.

- **Dipole-Dipole Interactions:** Weaker than hydrogen bonds but contribute to solubility in polar molecules.

3. Non-Polar Interactions:

- **Van der Waals Forces:** Weak forces in non-polar solvents (e.g., hexane) due to temporary dipoles.
- **Hydrophobic Interactions:** Non-polar solutes aggregate in water, resulting in low solubility.

4. Amphiphilic Interactions:

- **Micelle Formation:** Amphiphilic molecules (e.g., surfactants) form micelles in water, trapping hydrophobic solutes and increasing apparent solubility.

Ideal Solubility Parameters

- Ideal solubility parameters provide a quantitative measure of the solubility of substances.
- They are based on the concept that similar intermolecular forces between solute and solvent lead to better solubility.
- The most common parameter is the **Hildebrand solubility parameter** (δ), which is defined as:

$$\delta = \sqrt{\frac{\Delta H_v - RT}{V_m}}$$

Where:

- ΔH_v = Enthalpy of vaporization
- R = Universal gas constant
- T = Temperature in Kelvin
- V_m = Molar volume

Ideal Solubility Concept:

- For a solute to dissolve ideally in a solvent, their solubility parameters should be similar.
- This is often summarized by the "like dissolves like" principle:
 - Polar solutes dissolve better in polar solvents.
 - Non-polar solutes dissolve better in non-polar solvents.

Solvation

- Solvation is the process of surrounding solute particles with solvent molecules, leading to the formation of a solution.



FREE PREVIEW

[Click here to visit our website](#)

PHARMACY PREMIUM NOTES

Complete subject
and semesters are
available on
FirstHope app only.



[Scan or click here](#)

Click here to get the app



Available on Google Play

JOIN THE FIRSTHOPE COMMUNITY

Join our Telegram channel

Click here to join Telegram



[Scan or click here](#)

@FirstHopeNotes

Instagram

@firsthope.official

[Click here to follow >](#)

YouTube channel

FirstHope-Pharmacy / Live streams

[Click here to watch >](#)

WhatsApp channel

Follow FirstHope on WhatsApp

[Click here to join >](#)

FirstHope website

firsthopenotes.com

[Click here to visit >](#)

B.Pharm / D.Pharm / M.Pharm / Pharm.D

Preview notes. Complete subjects and semesters in the FirstHope app.