SNS COLLEGE OF PHARMACY AND HEALTH SCIENCES

Affiliated To The Tamil Nadu Dr. MGR Medical University, Chennai
Approved by Pharmacy Council of India, New Delhi.
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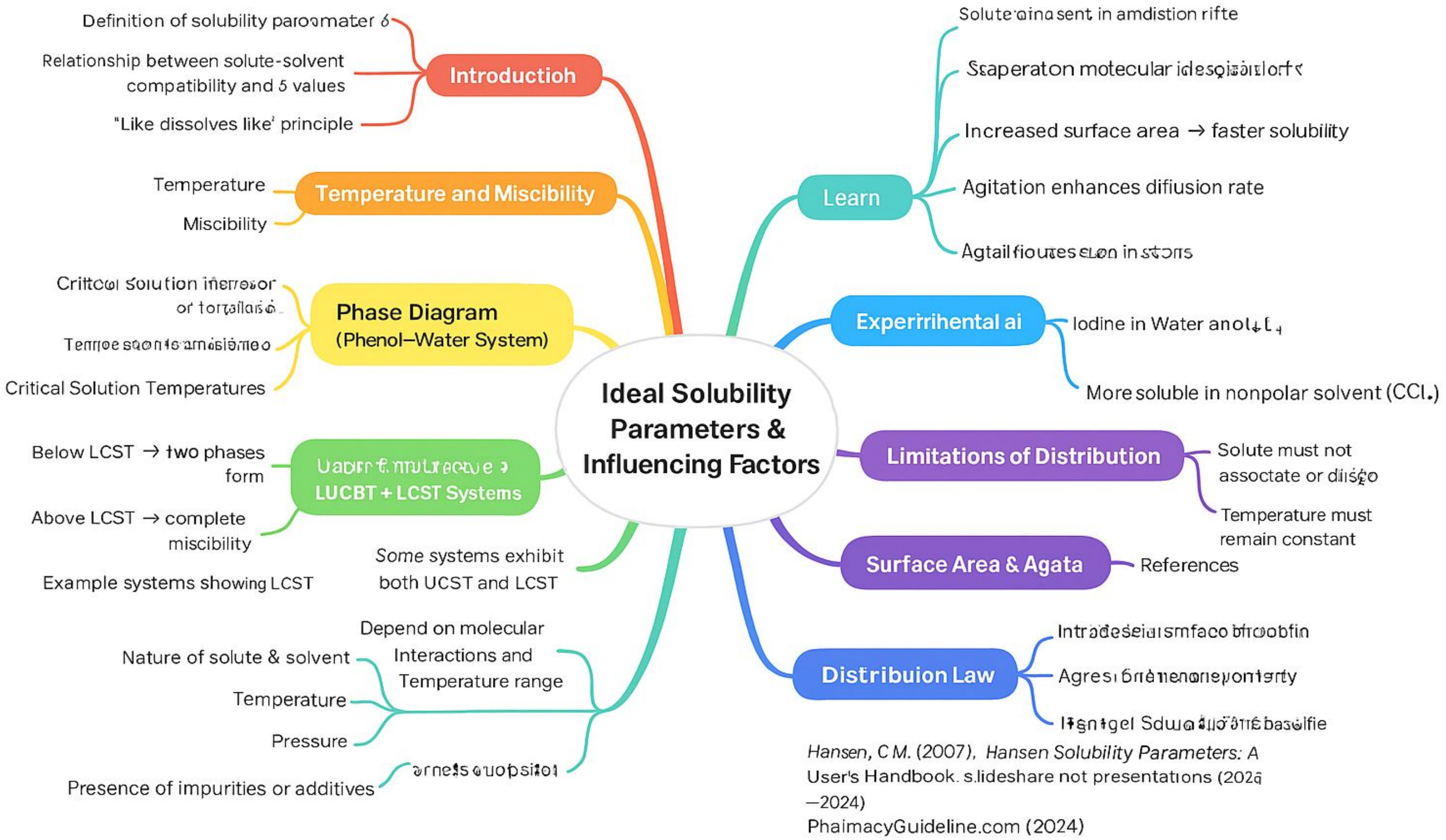
COURSE NAME :PHYSICAL PHARMACEUTICS (BP 302 T)

III SEM / II YEAR

TOPIC 1 : Ideal Solubility Parameters & Influencing Factors


Ideal Solubility Parameters & Influencing Factors
Introductioh
Relationship between solute-solvent compatibility and δ values
"Like dissolves like' principle
Temperature and Miscibility
Temperature
Miscibility
Phase Diagram (Phenol–Water System)
Critical Solution Temperatures
LUCBT + LCST Systems
Below LCST → two phases form
Above LCST → complete miscibility
Example systems showing LCST
Some systems exhibit both UCST and LCST
Depend on molecular Interactions and Temperature range
Nature of solute & solvent
Temperature
Pressure
Presence of impurities or additives
Learn
Increased surface area → faster solubility
Agitation enhances difiusion rate
Experirihental ai
Iodine in Water
More soluble in nonpolar solvent (CCl.)
Limitations of Distribution
Solute must not
Temperature must remain constant
Surface Area & Agata
References
Distribuion Law
Hansen, C M. (2007). Hansen Solubility Parameters: A User's Handbook. s.lideshare not presentations
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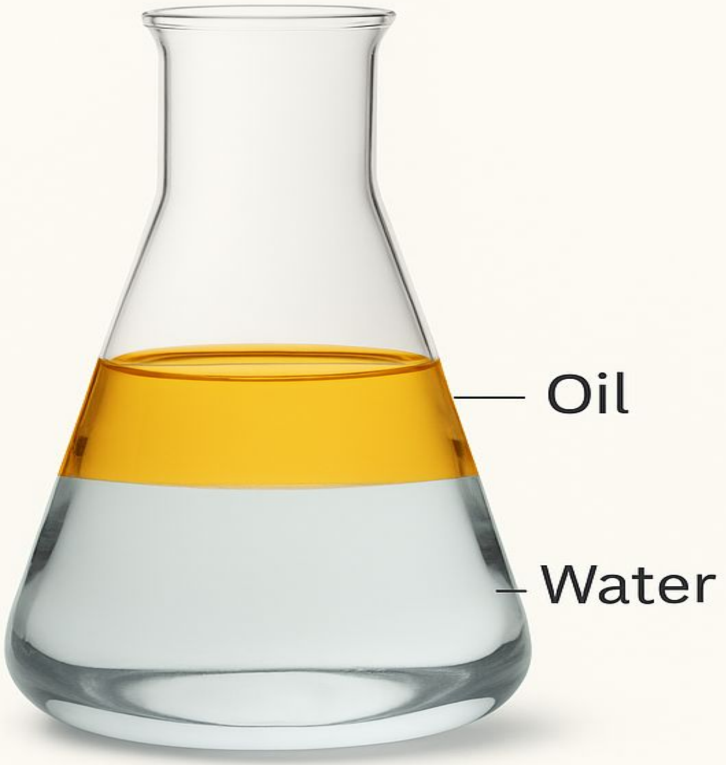
PhaimacyGuideline.com (2024)

Introduction

Miscibility refers to the ability of two liquids to mix in all proportions.

Partially miscible liquids mix only in limited ratios.

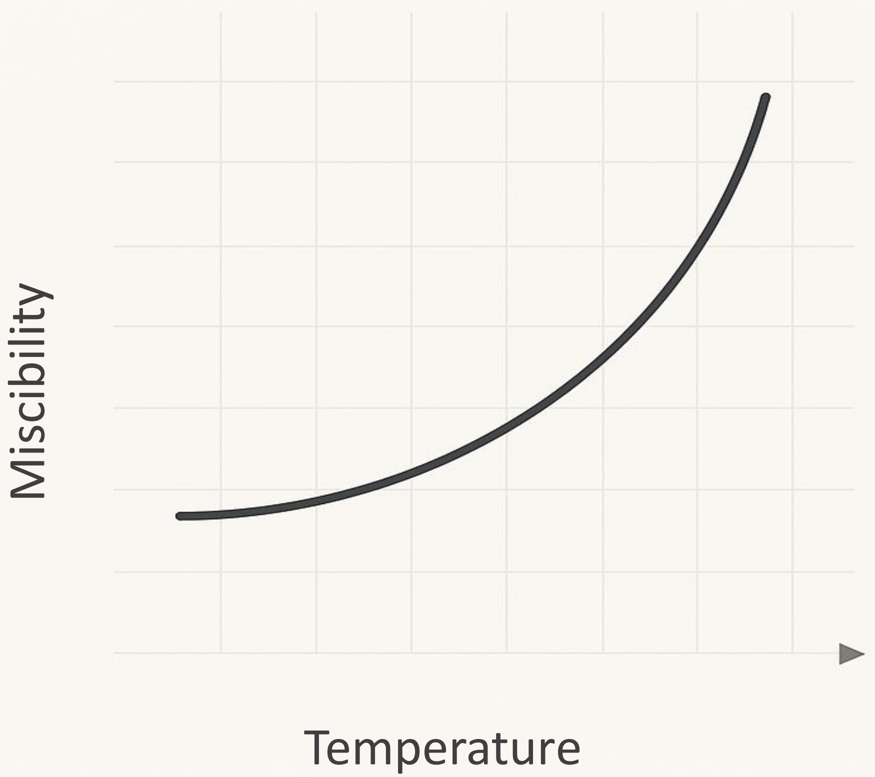


Partially Miscible Liquids

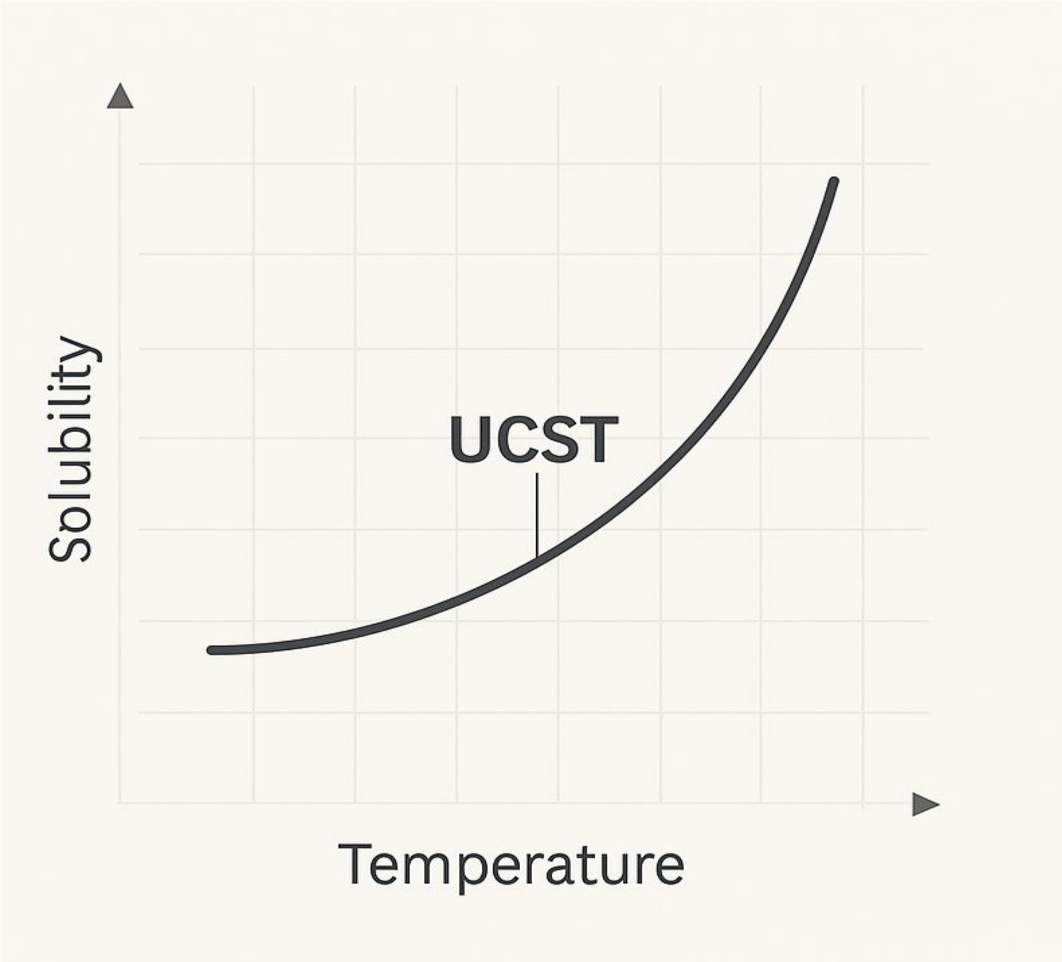
- Two liquids dissolve in each other only partially.
- Examples: Phenol–water, Nicotine–water

Temperature and Miscibility

- Temperature strongly affects miscibility.
- Higher temperature increases solubility for most pairs



Phase Diagram (Phenol–Water System)



This diagram shows how temperature influences the solubility of phenol and water.
At lower temperatures, the two liquids form separate layers, but as temperature increases, their mutual solubility rises until they become completely miscible at the Upper Critical Solution Temperature (UCST ≈ 66°C).

Lower Critical Solution Temperature (LCST)

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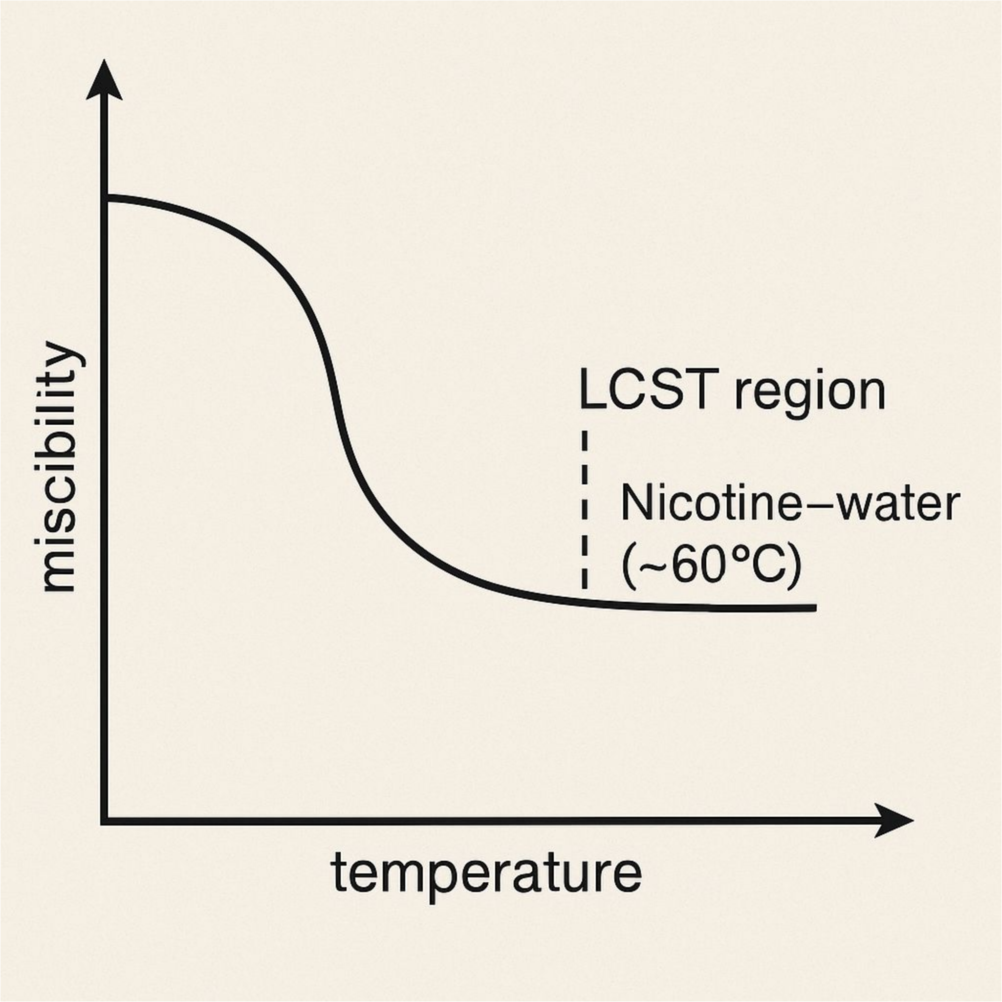
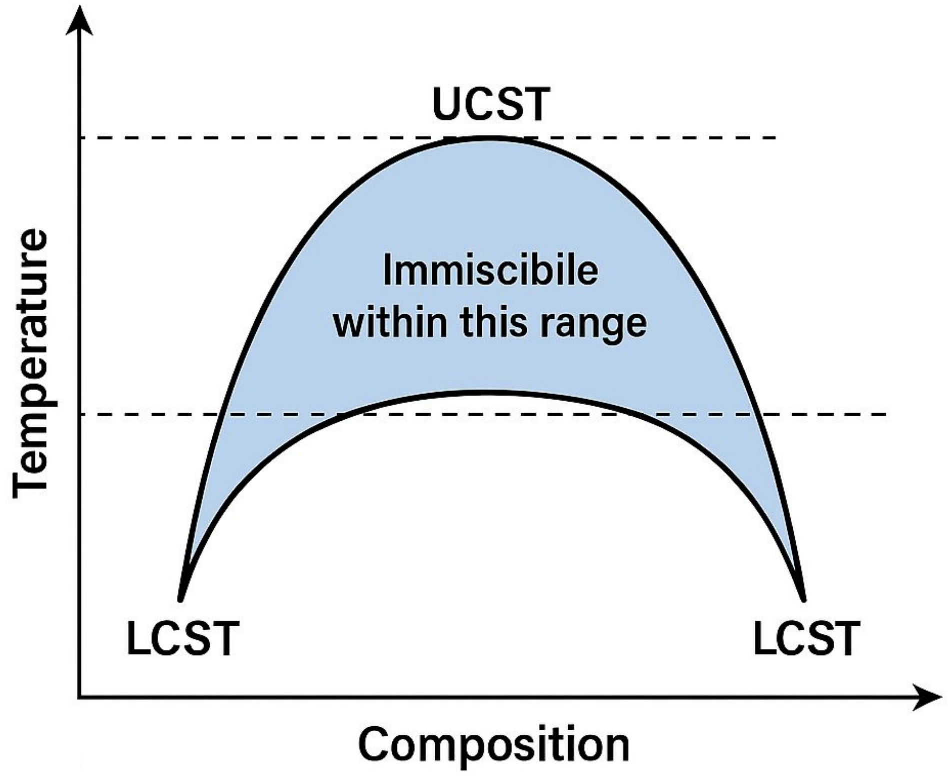


Some systems become immiscible when heated.
This behavior is known as the Lower Critical Solution Temperature (LCST) phenomenon.
At temperatures below the LCST, the liquids are completely miscible,
but above this temperature, they separate into two distinct layers.
An example is the Nicotine–Water system (~60°C), where heating reduces solubility due to weakened molecular interactions.

Systems with Both UCST and LCST

Some mixtures (e.g., Triethylamine–water) show both UCST & LCST.



Factors Affecting Miscibility

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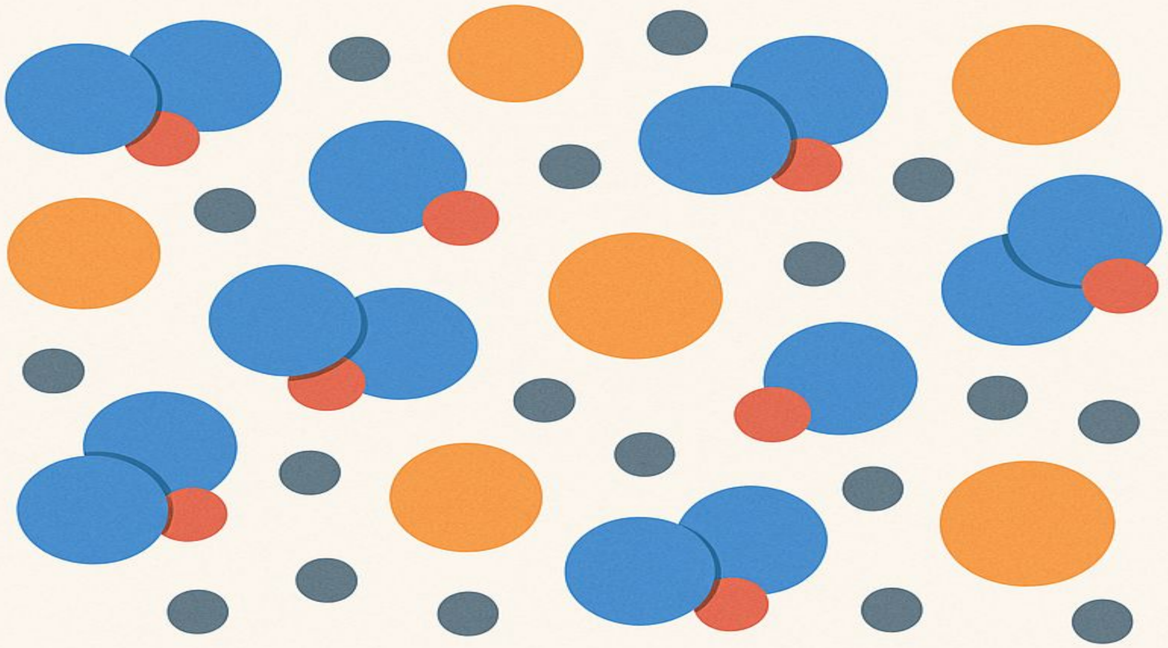
- Temperature & pressure
- Nature of liquids
- Presence of solutes/impurities



Applications of CST

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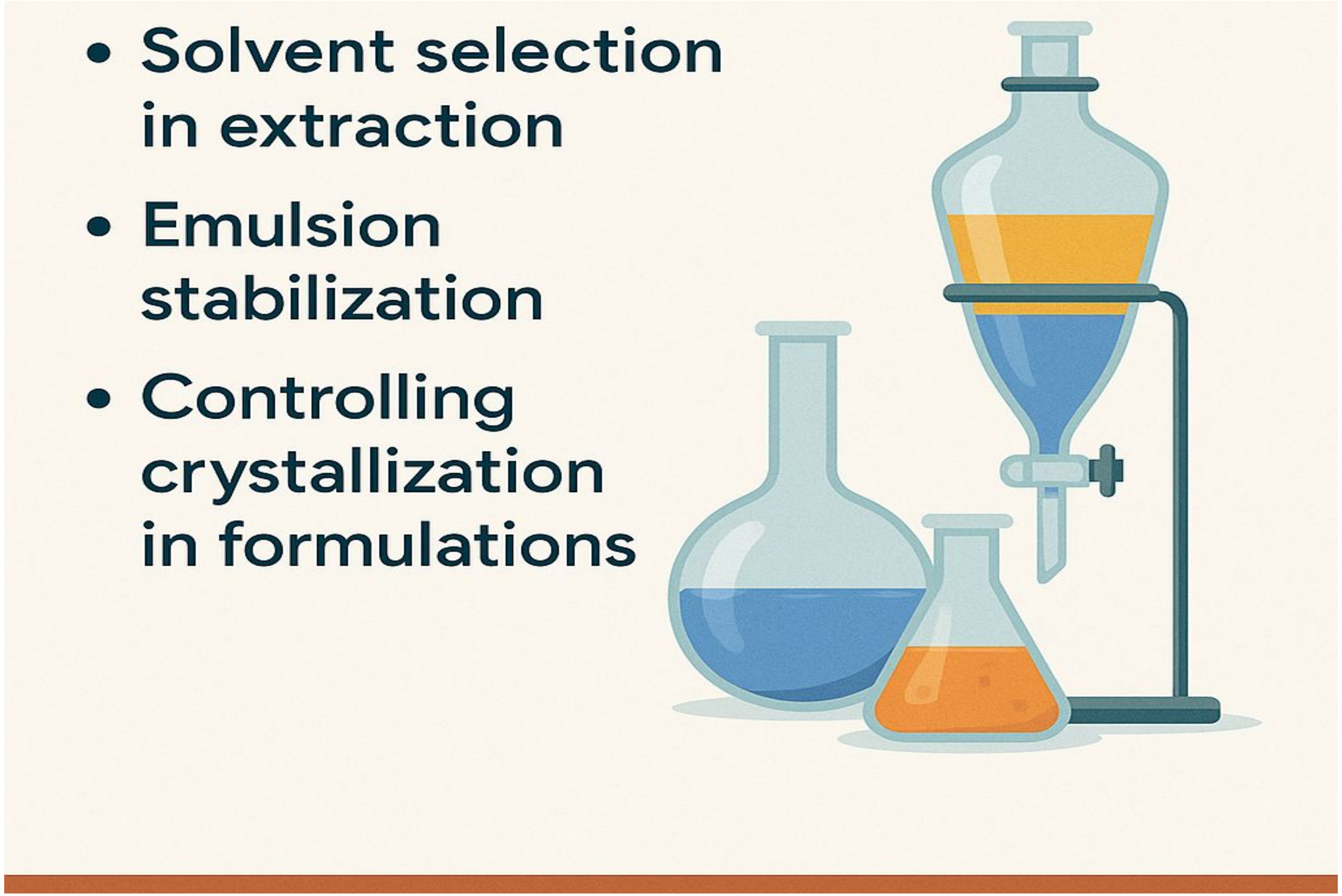
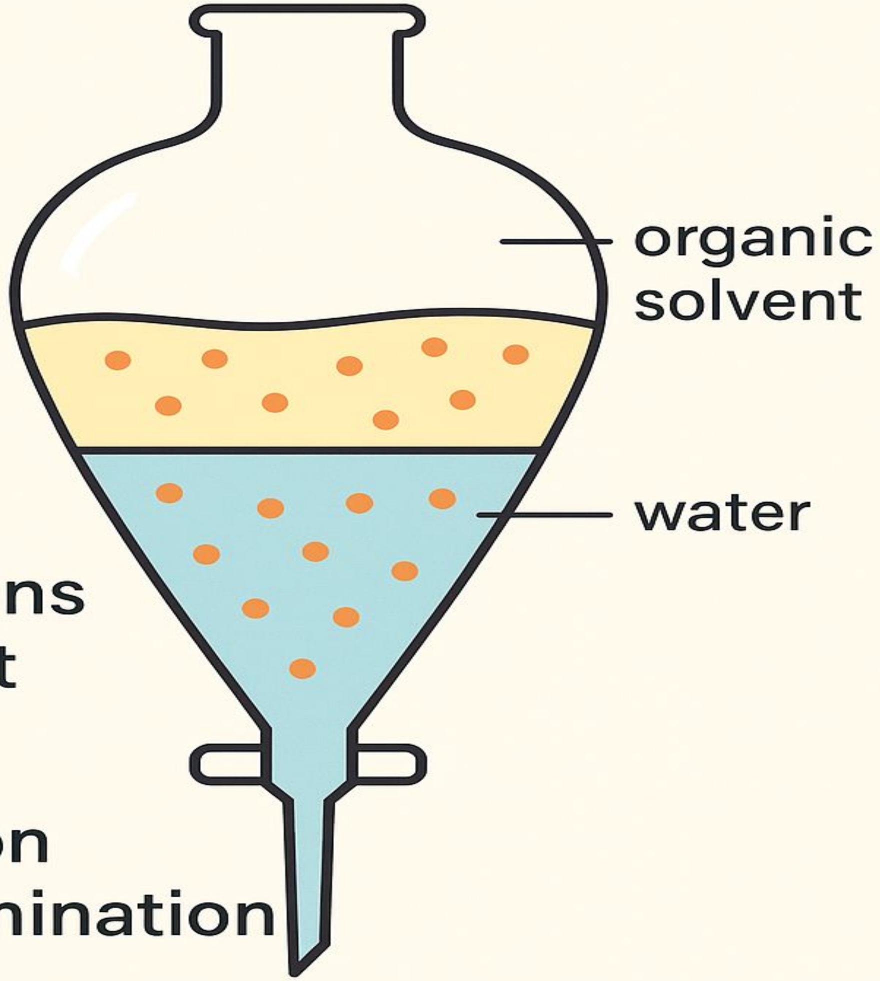


Introduction to Distribution Law

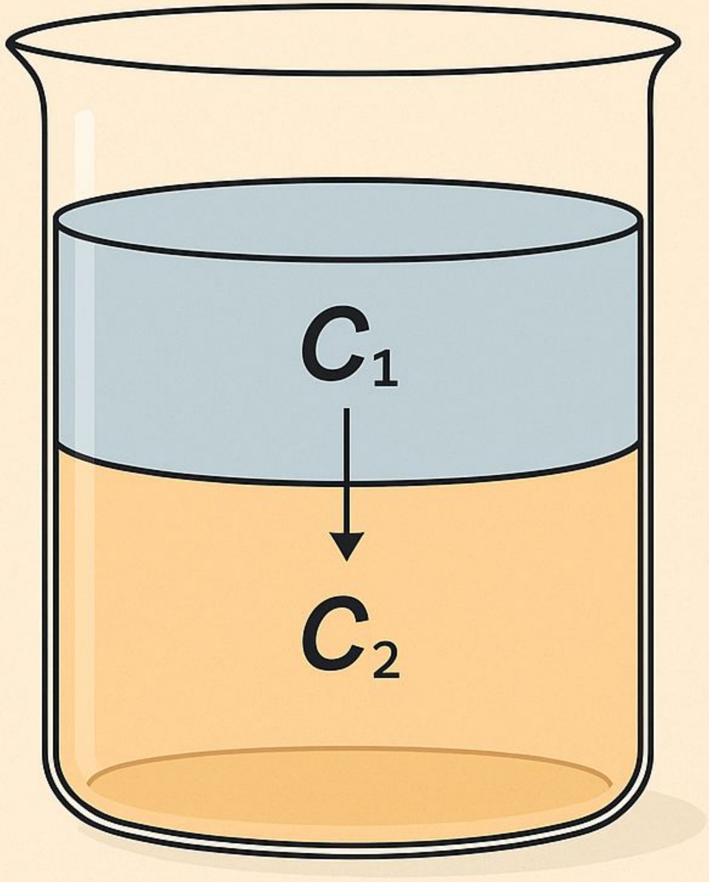
Proposed by Nernst, the law explains how a solute distributes between two immiscible liquids at equilibrium.

At constant temperature, the ratio of solute concentrations in both layers remains constant ($C_1/C_2 = K$)

It is the basis for drug extraction and partition coefficient determination



Nernst Distribution Equation



$$\frac{C_1}{C_2} = K$$

C_1 = concentration of solute in solvent 1

C_2 = concentration of solute in solvent 2

K = partition coefficient (constant)

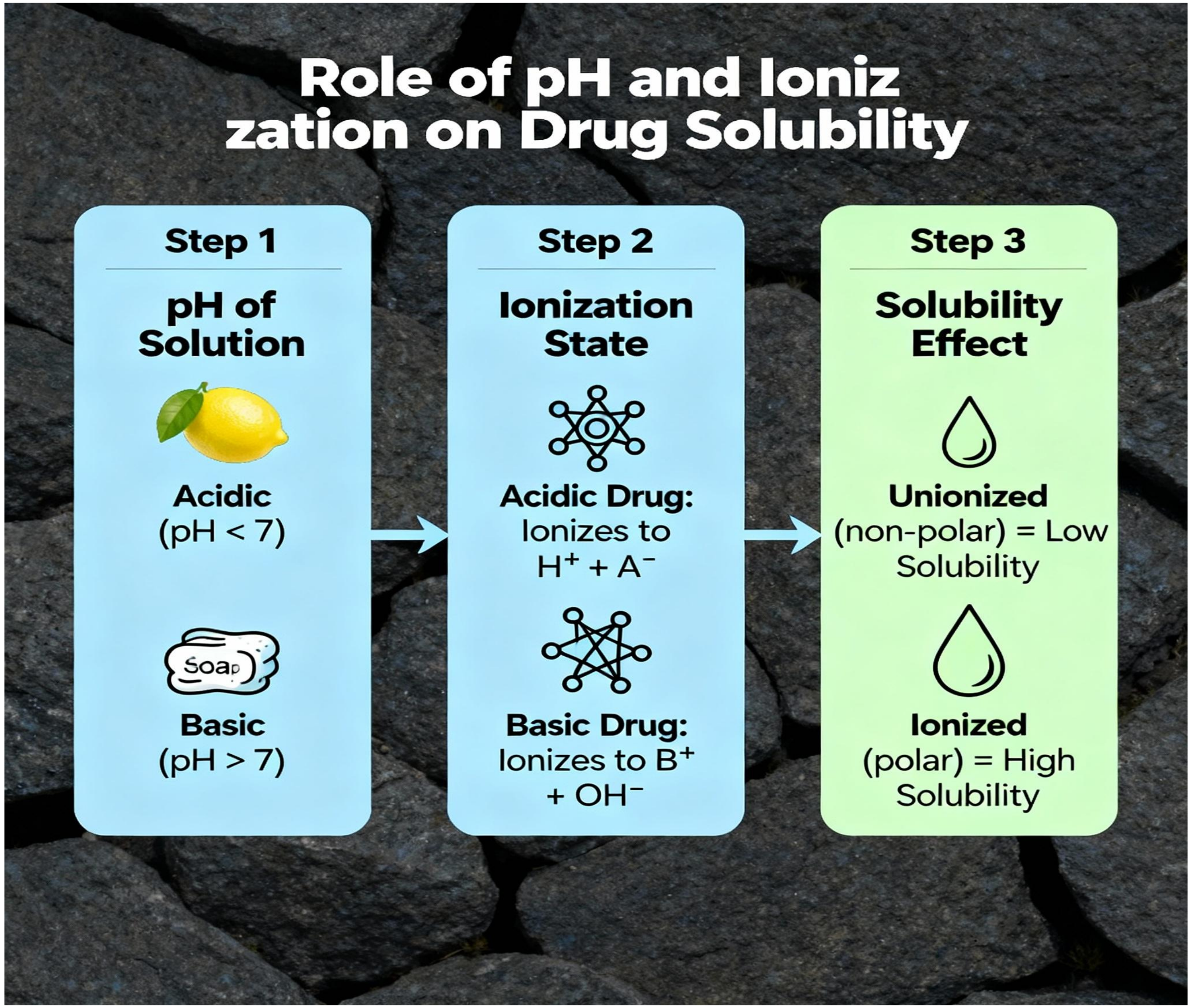
Experimental Example

Iodine distributed between water and CCl_4

More soluble in nonpolar solvent

Limitations of Distribution Law

- Solute must not associate/dissociate
- Temperature constant
- Solvents should be immiscible



Role of pH and Ioniz
zation on Drug Solubility
Step 1
pH of
Solution
Acidic
(pH < 7)
Soap
Basic
(pH > 7)
Step 2
Ionization
State
Acidic Drug:
Ionizes to
H⁺ + A⁻
Basic Drug:
Ionizes to B⁺
+ OH⁻
Step 3
Solubility
Effect
Unionized
(non-polar) = Low
Solubility
Ionized
(polar) = High
Solubility

Surface Area and Agitation Effects

Drug Solubility Classification

Class I: High Solubility, High Permeability	Class II: Low Solubility, High Permeability	Class III: High Solubility, Low Permeability	Class IV: Low Solubility, Low Permeability
Solubility: ≥85% dose dissolved Permeability: ≥90% absorption	<Solubility: <85% dose dissolved Permeability: ≥90% absorption	Solubility: ≥85% dose dissolved Permeability: <90% absorption	Solubility: <85% dose dissolved Permeability: <90% absorption
Amoxicillin, Metoprolol	Ibuprofen, Griseofulvin	Cimetidine, Ranitidine	Furosemide, Ketoconazole

ASSESMENTS

1.Explain how concentration gradient drives the diffusion process in biological systems and give an example related to drug absorption.

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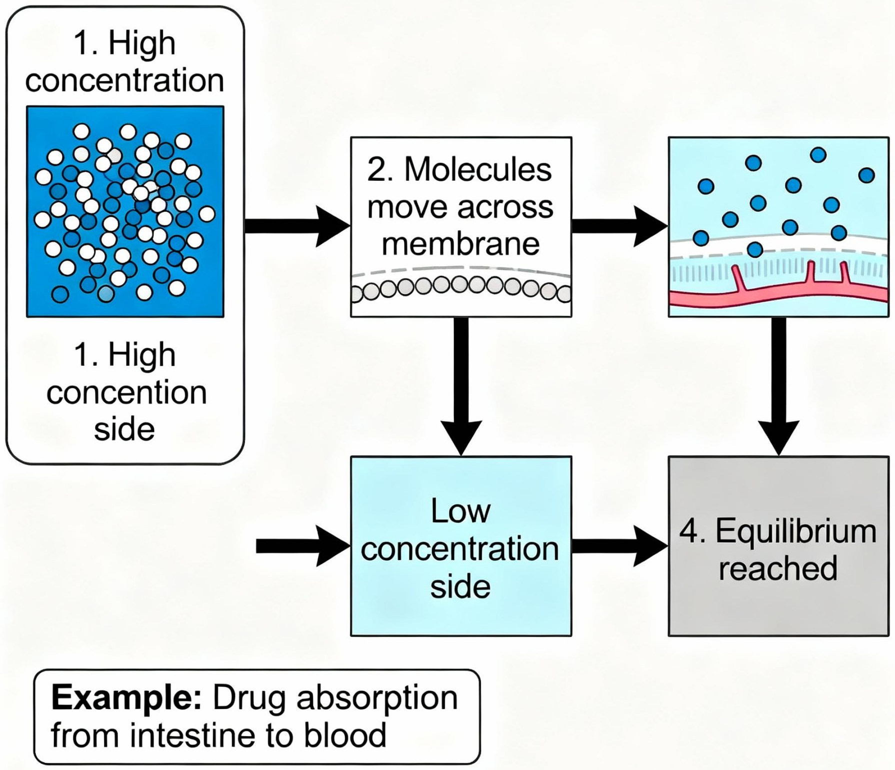

2.Describe the role of diffusion in nutrient transport across cell membranes and why it is vital for cellular function.

Describe the role of diffusion in nutrient transport across cell membranes and why it is vital for cellular function.

- Diffusion allows nutrients to passively move from areas of high concentration outside the cell to lower concentration inside, without energy use.
- This process helps cells take in essential molecules like oxygen and glucose while removing waste.
- It is vital because it supports cell metabolism and maintains balance in the cell environment.

REFERENCES

- Physical Pharmaceutics textbooks and lecture notes on solubility and solution chemistry.
- Hansen, C. M. (2007). Hansen Solubility Parameters: A User's Handbook. CRC Press.
- "Solubility and Solute-Solvent Interactions," Slideshare.net, 2023-2024 presentations.
- PharmacyGuideline.com article on "Solubility Expressions and Mechanisms of Solute Solvent Interactions," 2024.


Thank You