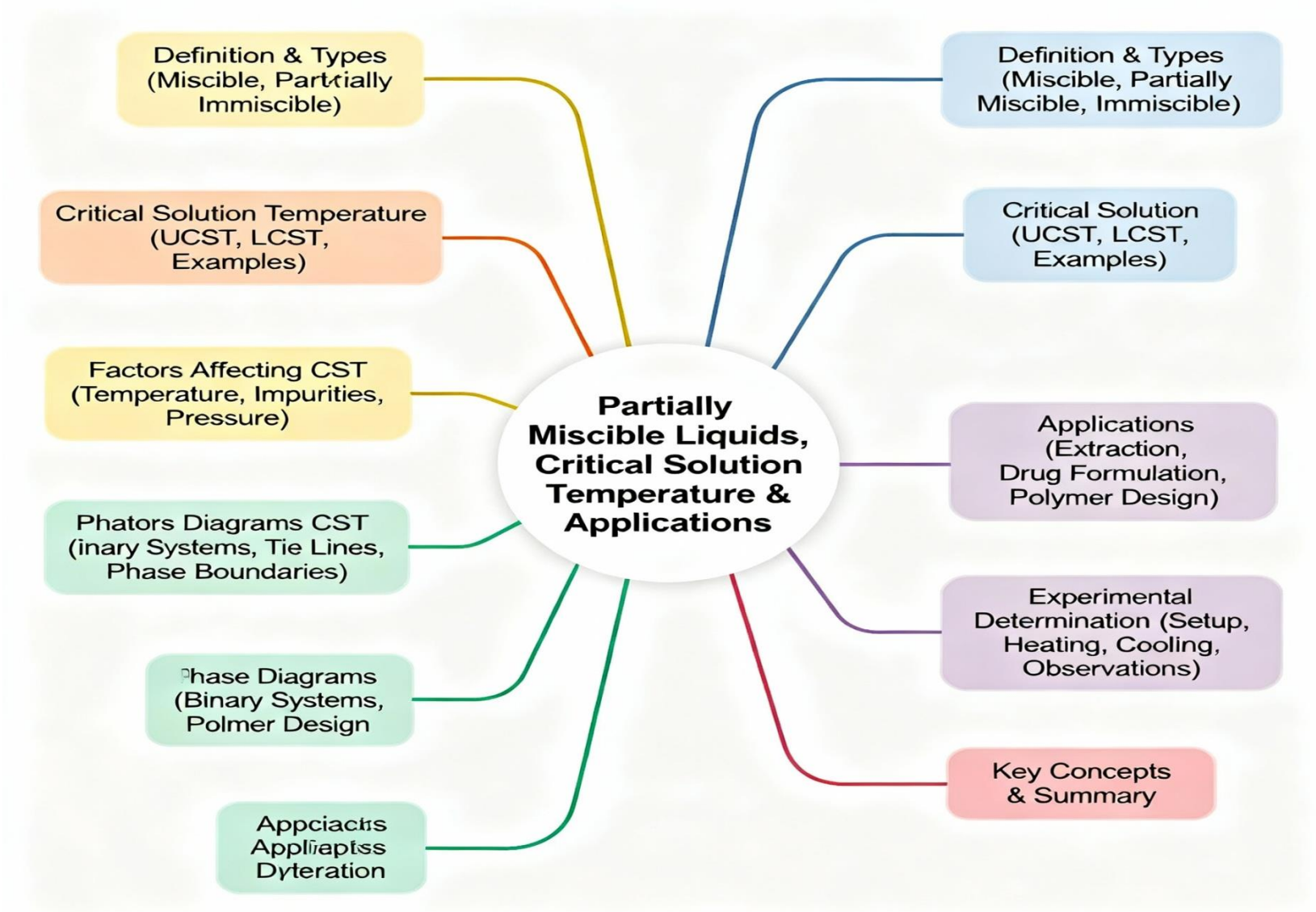
SNS COLLEGE OF PHARMACY AND HEALTH SCIENCES

Affiliated To The Tamil Nadu Dr. MGR Medical University, Chennai
Approved by Pharmacy Council of India, New Delhi.
Coimbatore -641035

COURSE NAME : PHYSICAL PHARMACEUTICS-I (BP302T)

III SEM / II YEAR

TOPIC 1 : Partially Miscible Liquids, Critical Solution Temperature & Applications


Partially Miscible Liquids, Critical Solution Temperature & Applications
Definition & Types (Miscible, Partially Immiscible)
Critical Solution Temperature (UCST, LCST, Examples)
Factors Affecting CST (Temperature, Impurities, Pressure)
Phators Diagrams CST (inary Systems, Tie Lines, Phase Boundaries)
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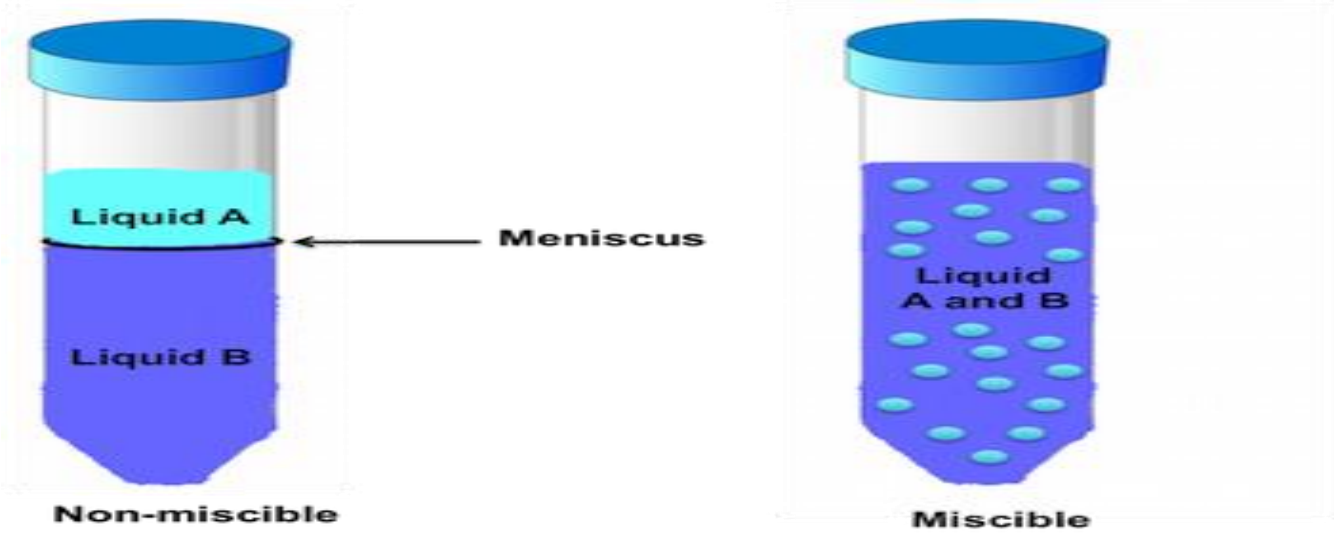
Appciacts Applieptss Dyteration
Definition & Types (Miscible, Partially Miscible, Immiscible)
Critical Solution (UCST, LCST, Examples)
Applications (Extraction, Drug Formulation, Polymer Design)
Experimental Determination (Setup, Heating, Cooling, Observations)
Key Concepts & Summary

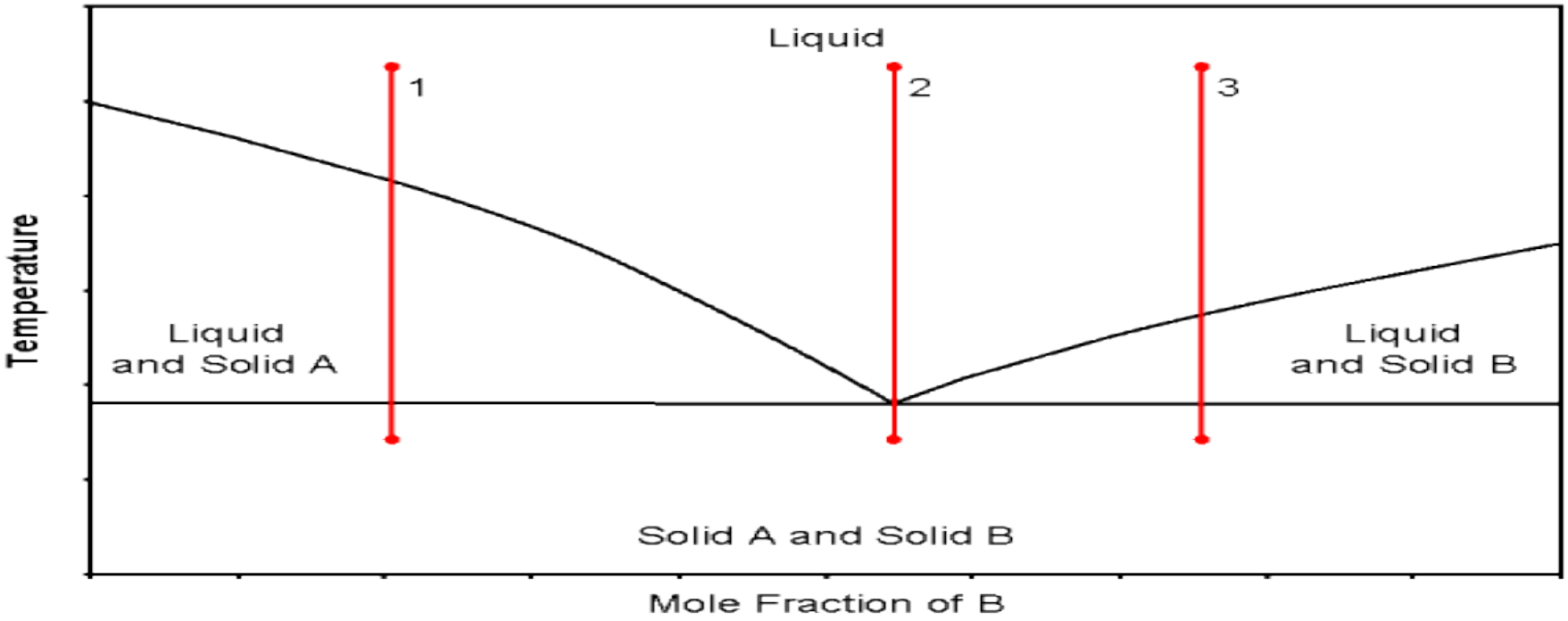
INTRODUCTION

➢Partially miscible liquids form two phases at certain temperatures.



MISCIBLE vs. IMMISCIBLE LIQUIDS

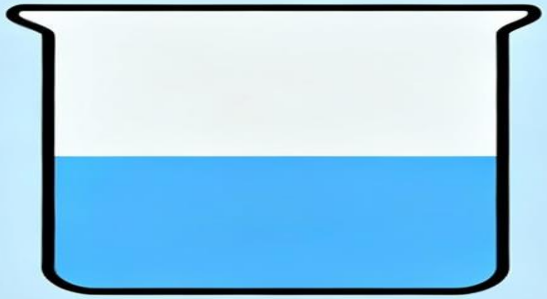
What Are Partially Miscible Liquids?



Liquids with limited solubility that become fully miscible above CST

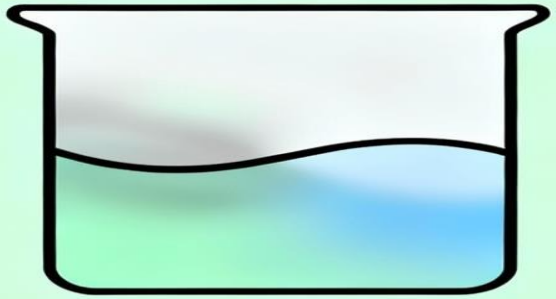
Types of Miscibility

Complete Miscibility



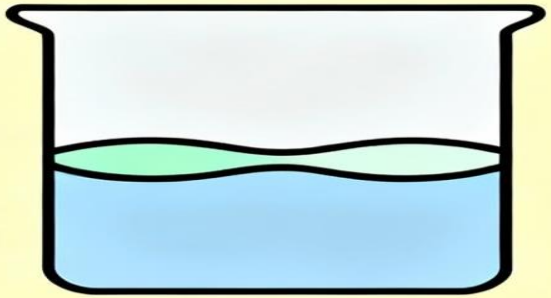
two liquids mix uniformly

Partial Miscibility



liquids mix partially forming two phases

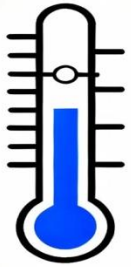
No Miscibility



liquids do not mix, forming separate layers

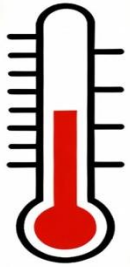
Critical Solution Temperature Overview

Upper Critical Solution Temperature (UCST)



UCST - temperature above which liquids are completely miscible

Lower Critical Solution Temperature (LCST)



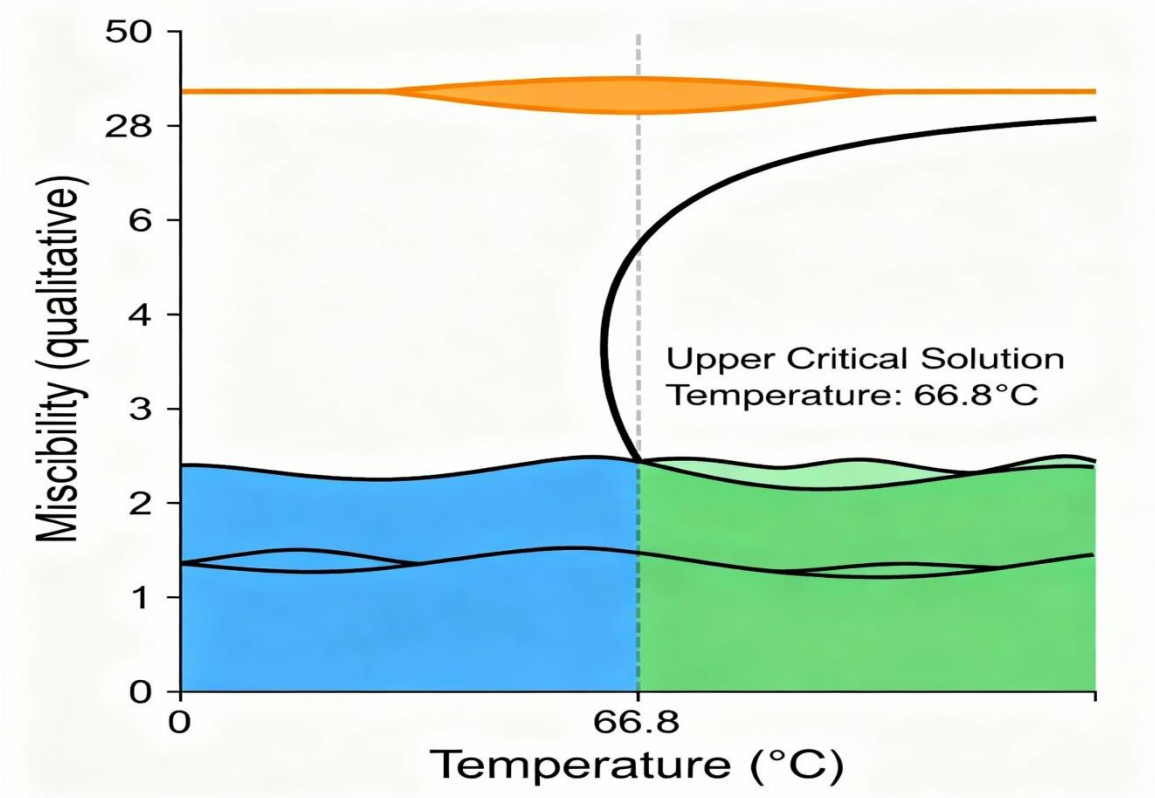
LCST - temperature below which liquids are completely miscible

Phase Diagram Example: Phenol-Water System

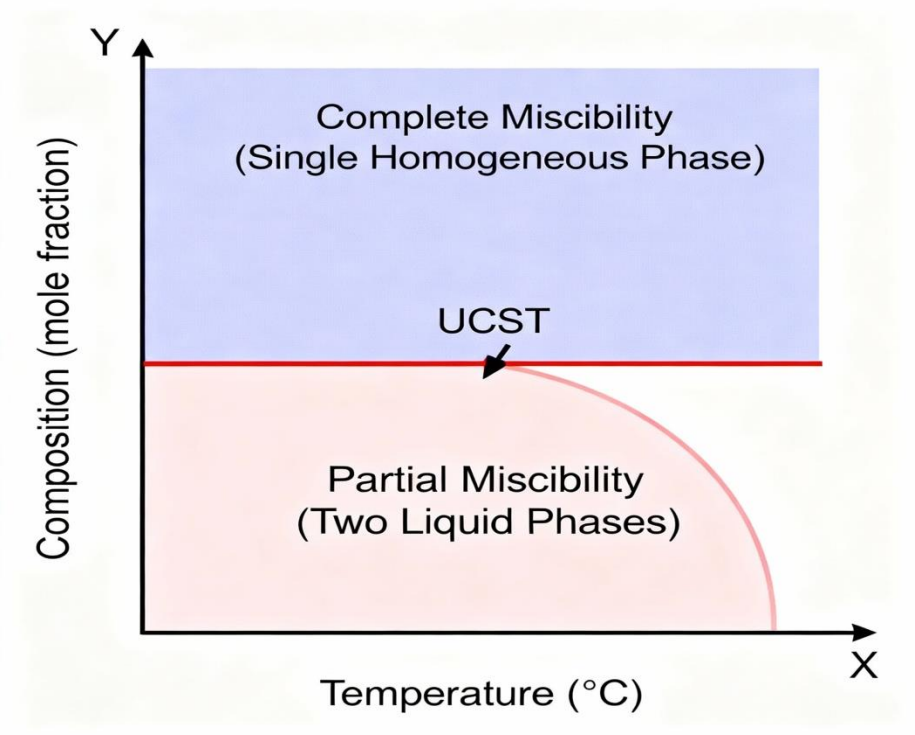
•Phenol and water are partially miscible liquids.

•They form two phases below the critical solution temperature (66.8°C).

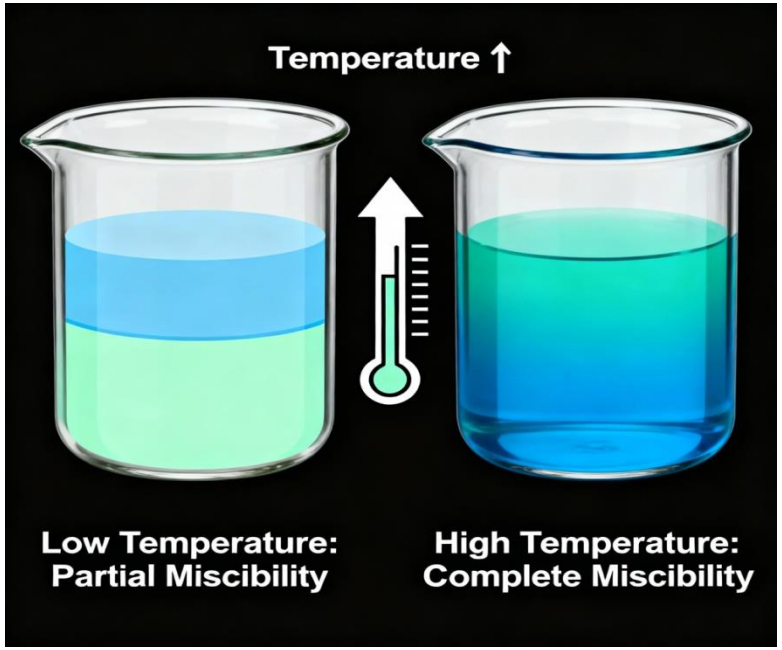
•Above this temperature, they are completely miscible in all proportions.



Lower Critical Solution Temperature (LCST)



Phase diagram with LCST behavior



Miscibility decreases above LCST

Phase Rule & Partial Miscibility

•Phase rule formula: F=C−P+2*F*=*C*−*P*+2

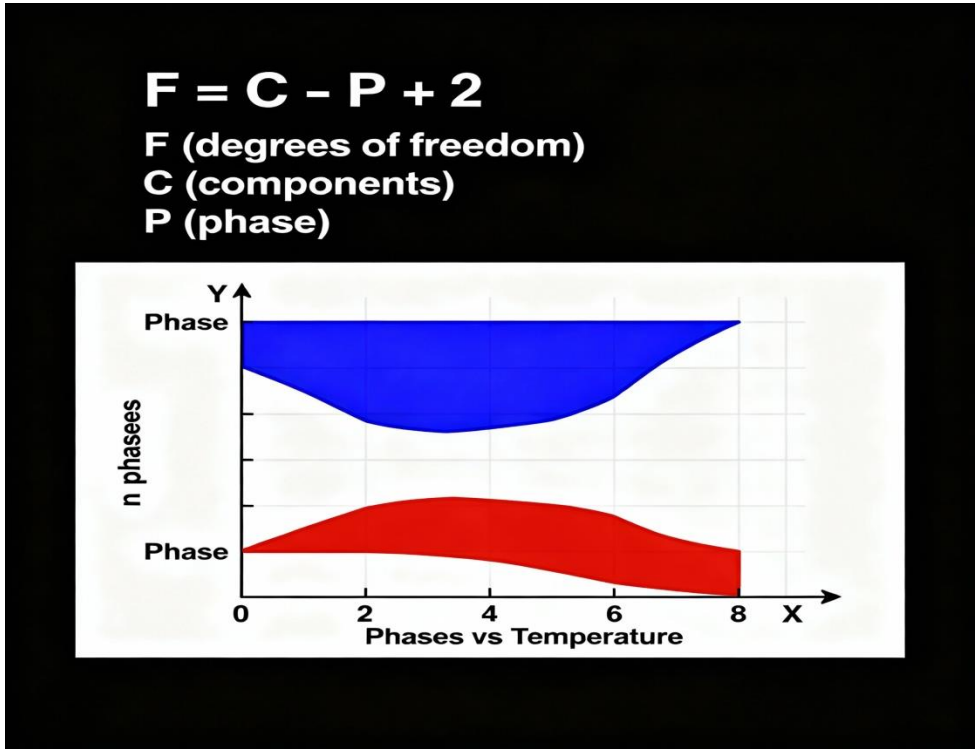
- F*F*: degrees of freedom (variables that can change)
- C*C*: number of components
- P*P*: number of phases present

•Partial miscibility shows different phases depending on temperature.

•At certain temperatures, two liquid phases coexist (P=2)

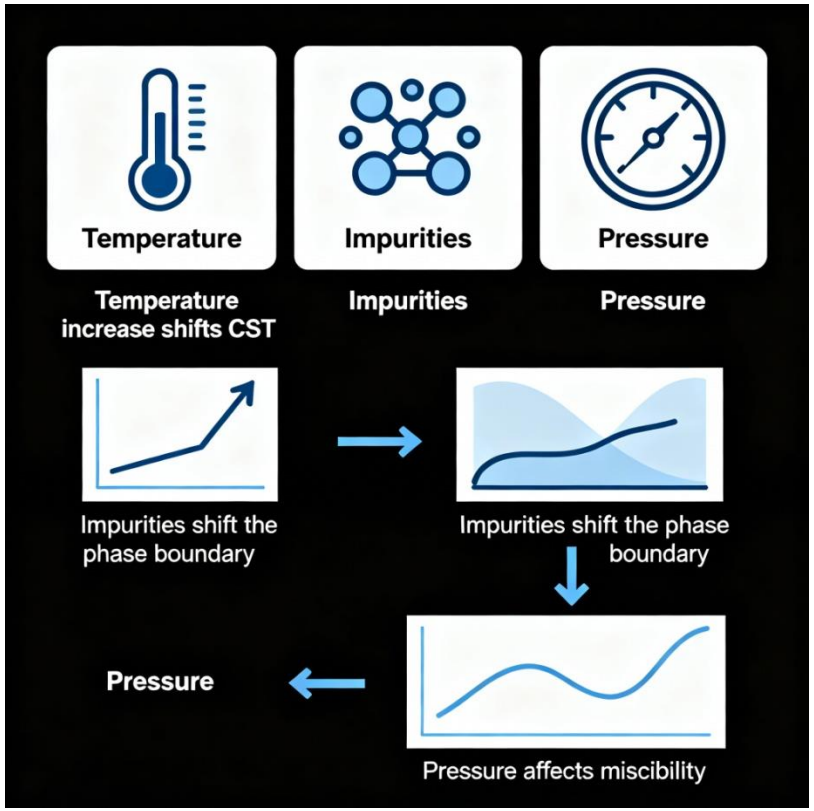
•Above or below that temperature range, single phase exists (P=1).

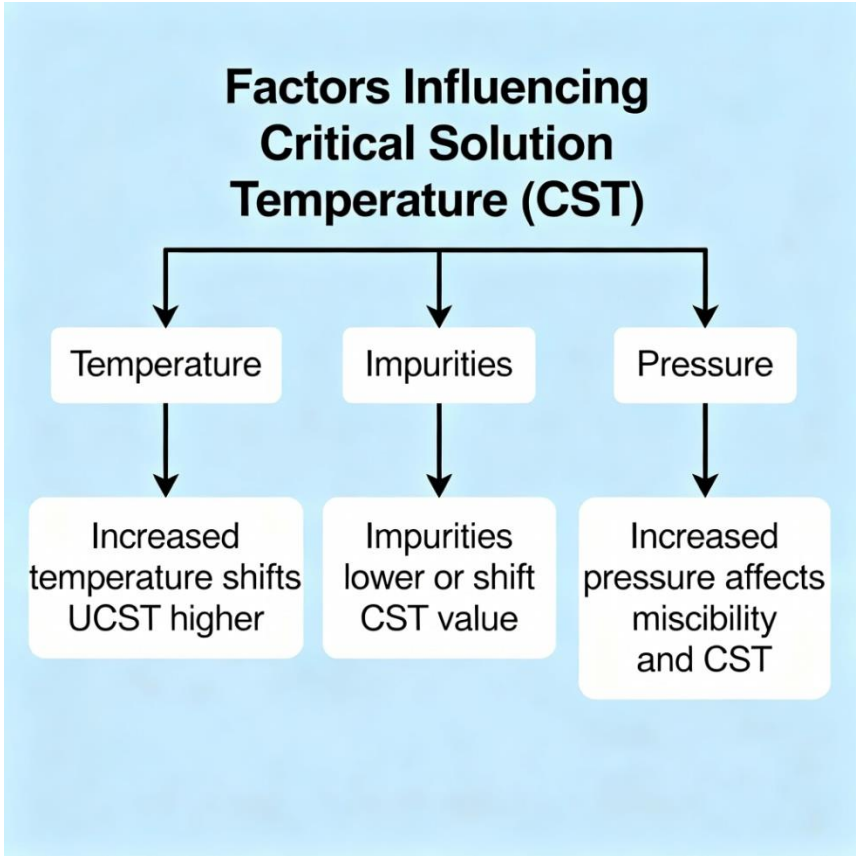
•Number of variables that can be independently changed depends on phases present.



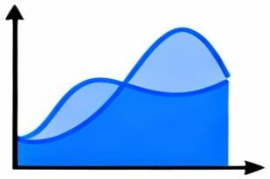
Phases vs. temperature with phase rule equations

Factors Affecting CST

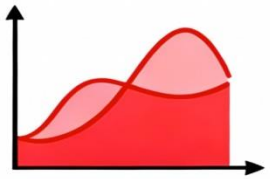




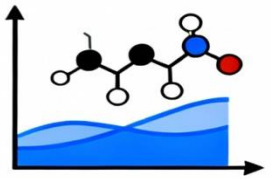
Examples of UCST & LCST



Phenol-Water system (UCST ~66.8° °C)

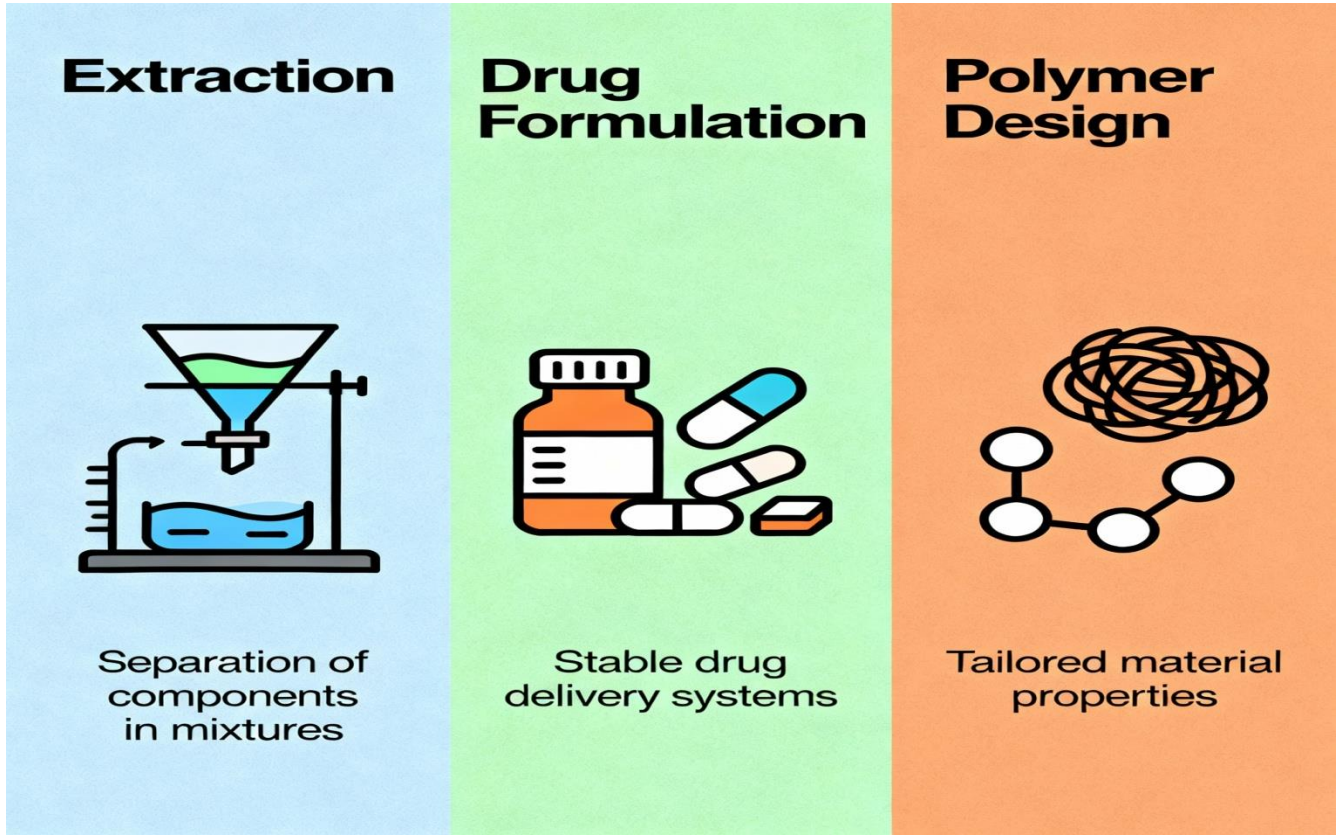


Triethylamine-Water system (LCST ~19°C)



Nicotine-Water system (UCST) UCST ~61°C)

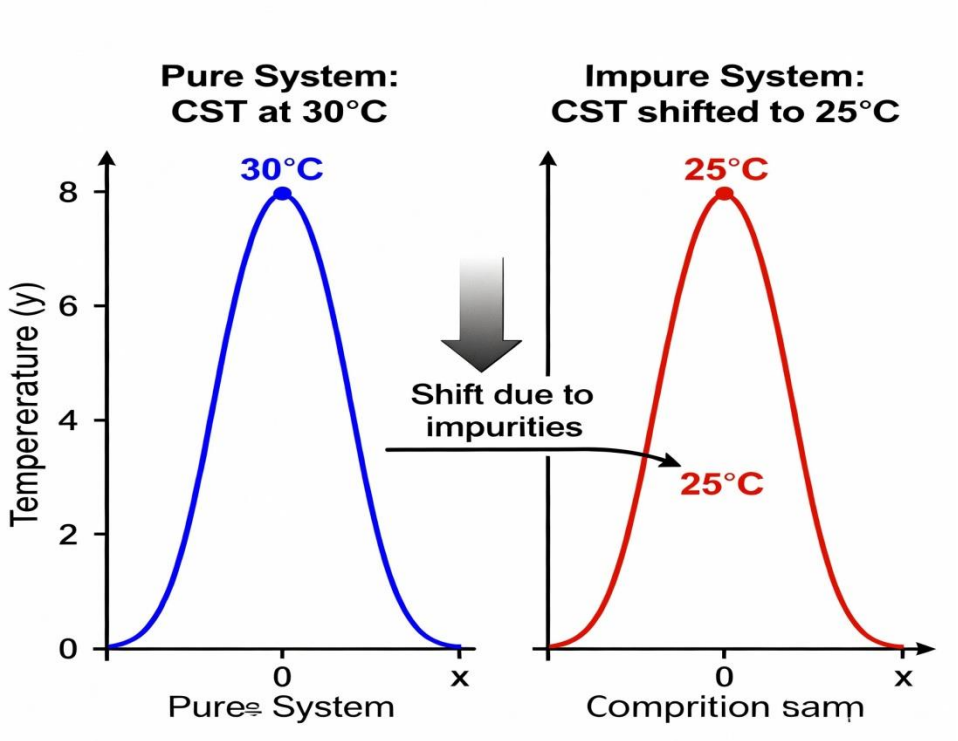
Applications of Partially Miscible Liquids



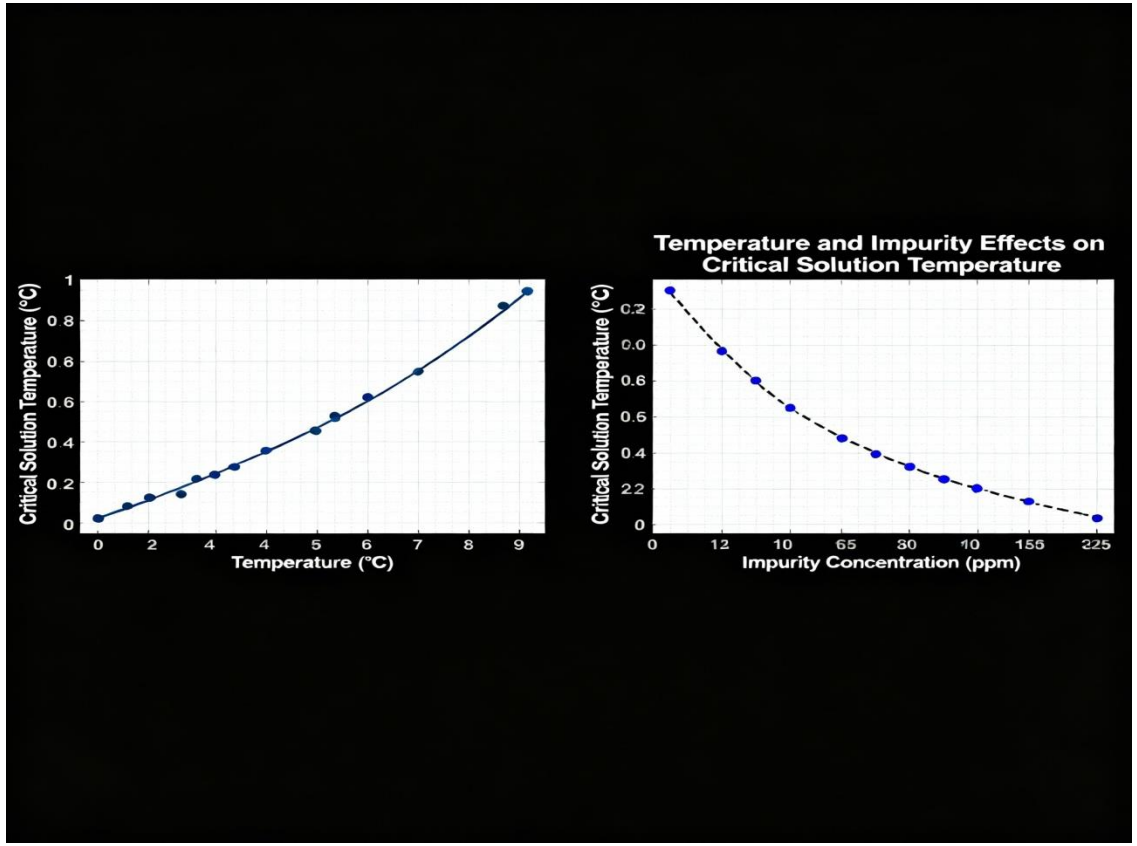
Practical Uses in Industry & Lab

Effect of Impurities & External Conditions

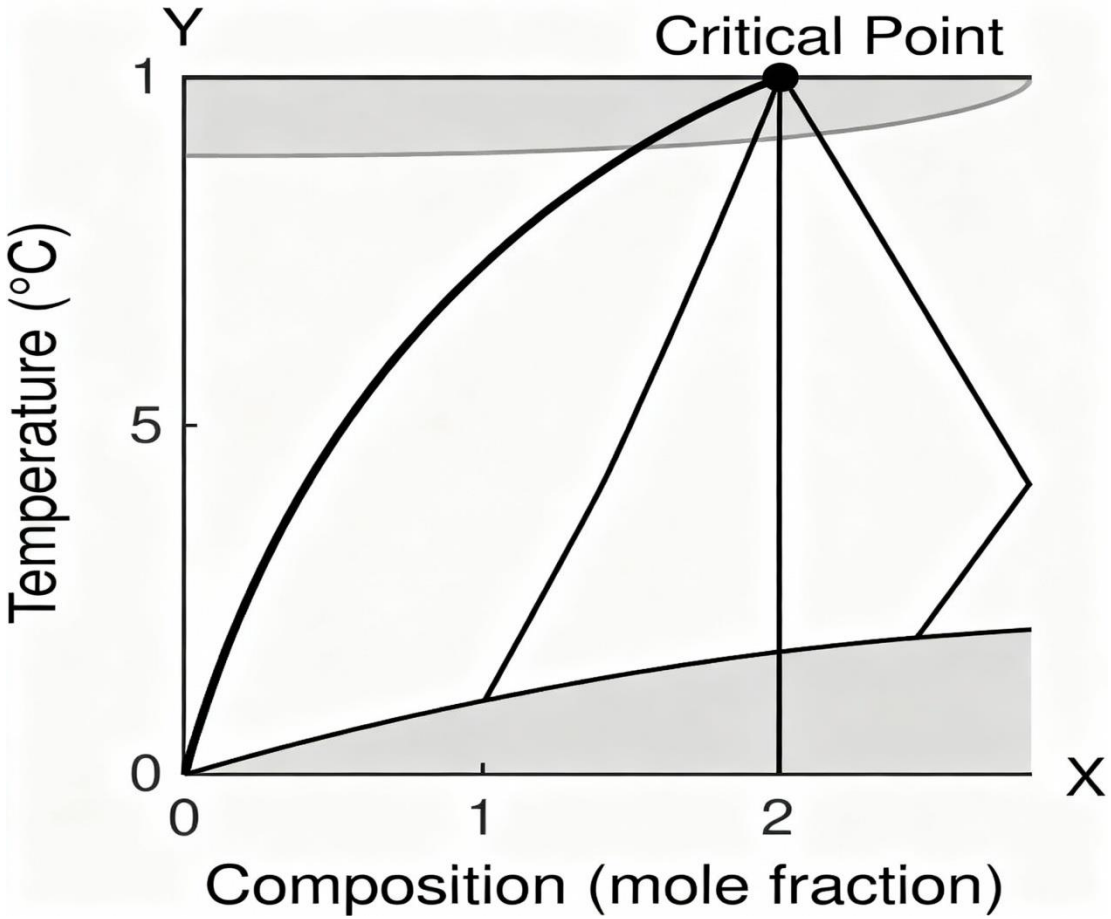
Impurities shifting CST



Temperature and impurity effect graphs

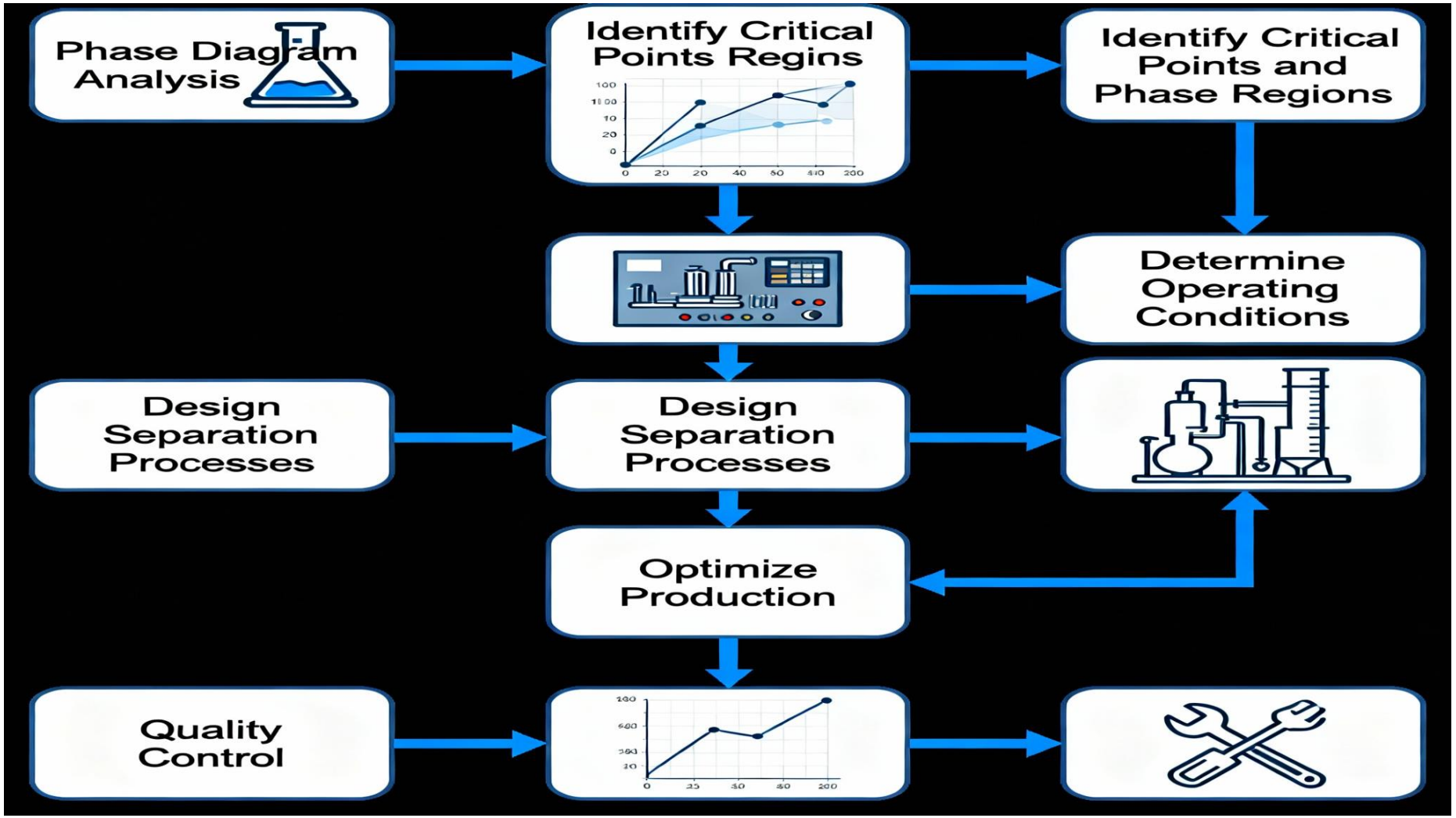


Miscibility & Phase Diagrams

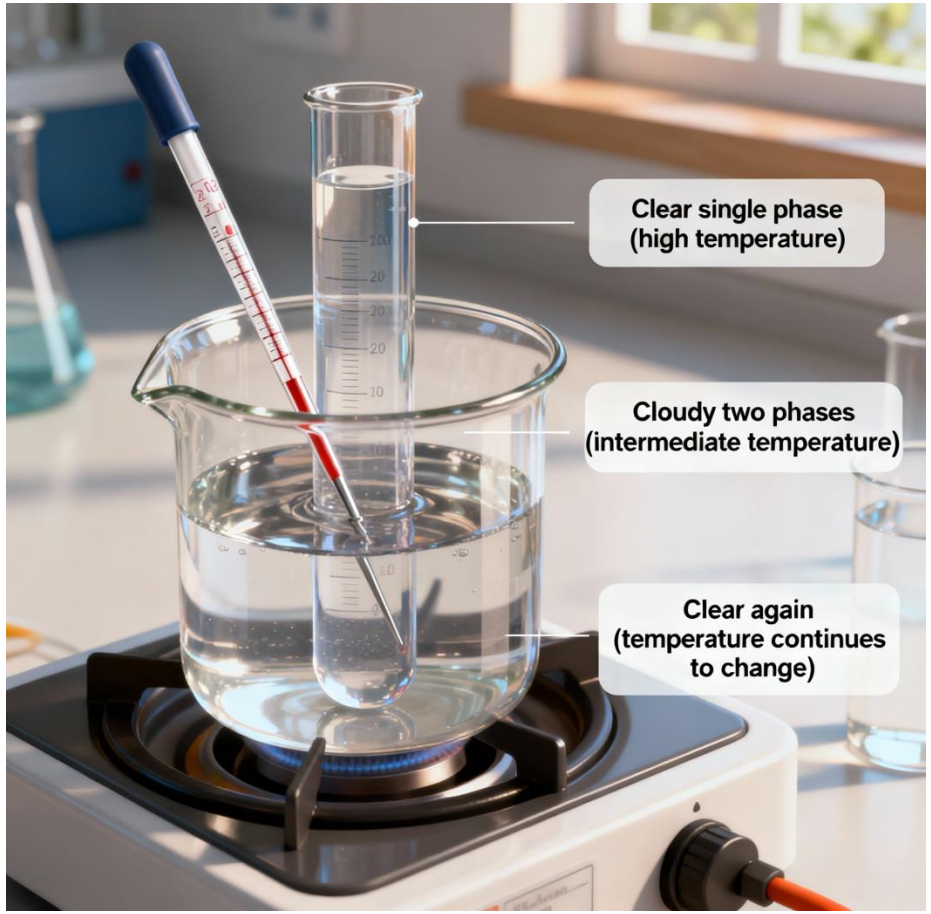


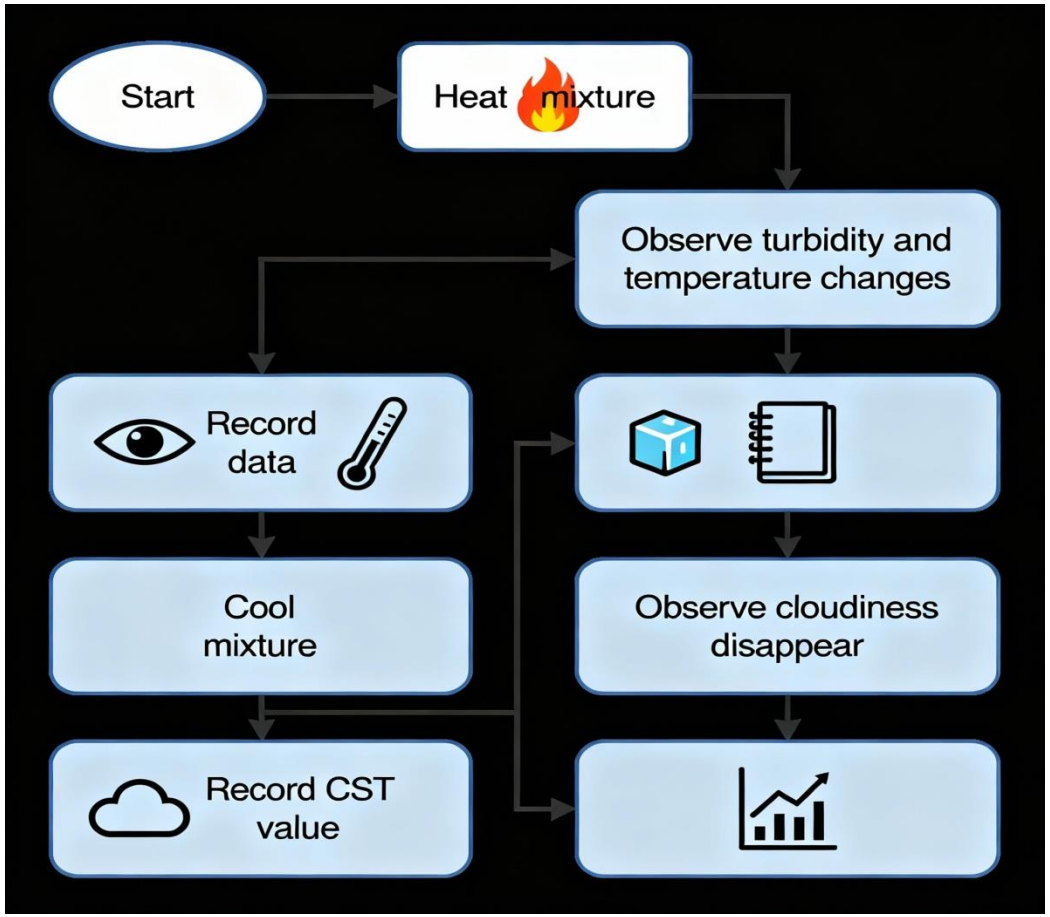
- **Tie Lines**: Connect compositions of two coexisting liquid phases at the same temperature.
- **Phase Boundaries**: Curve separating single-phase region from two-phase region.
- **Critical Point**: Highest temperature where two phases can coexist.

Use of Phase Diagrams in Industry

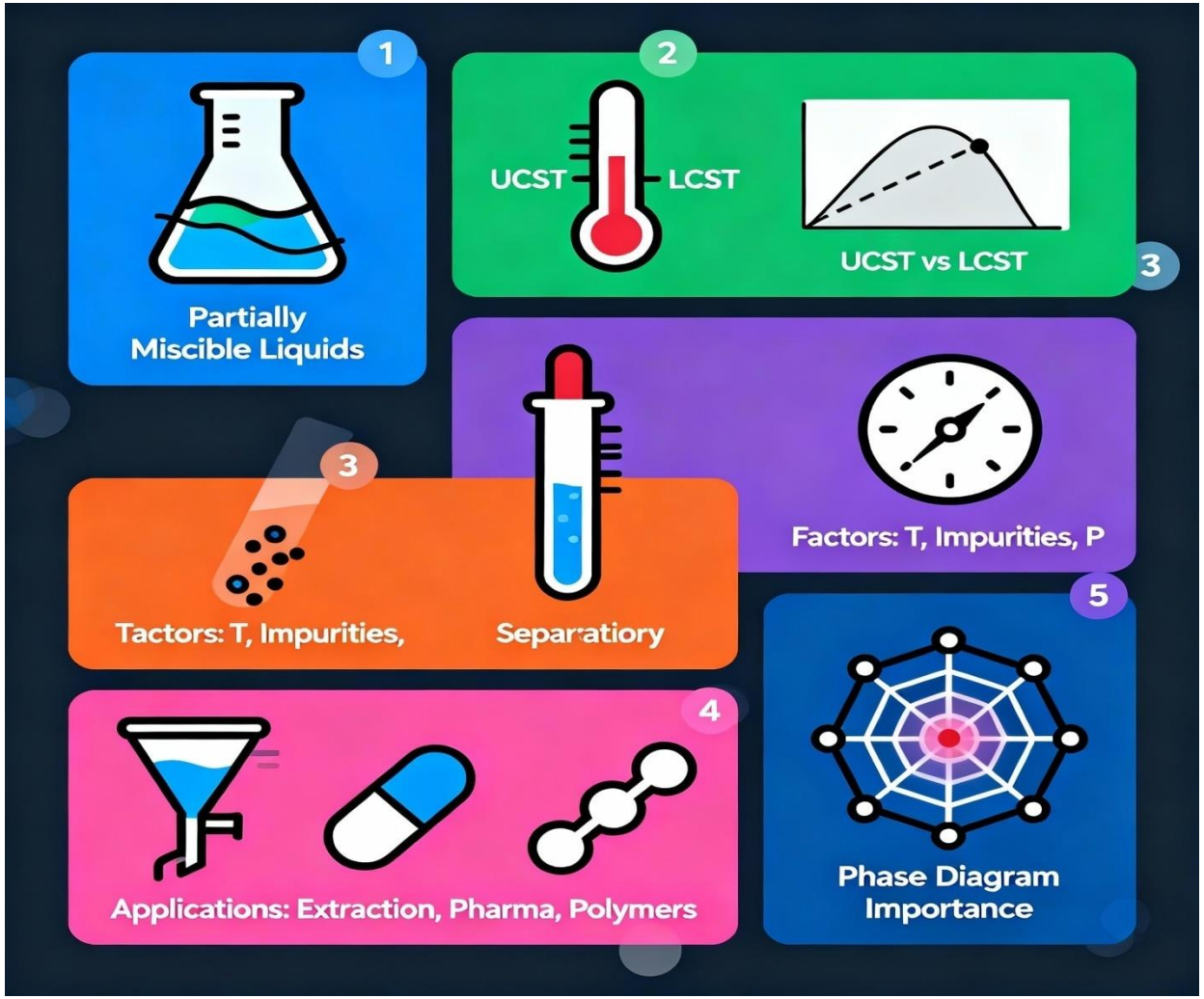


Experimental Determination of CST



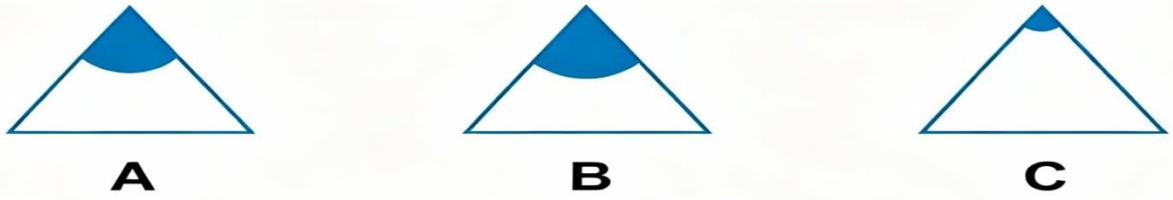


Summary of Key Concepts

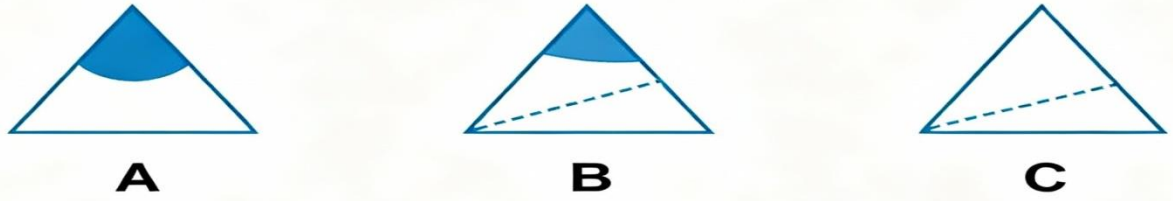


Assessment

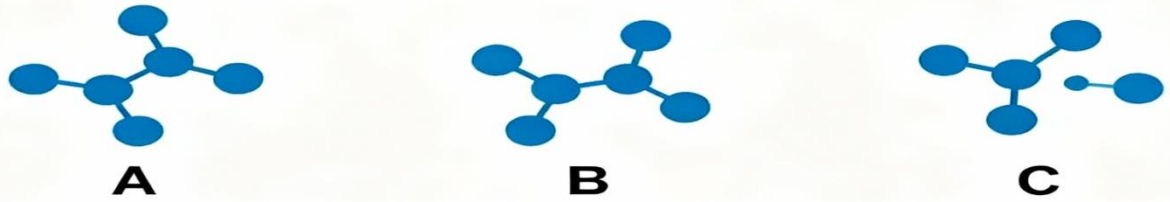
Quert1: Which diagram represents UCST behavior?



2. What happens to miscibility above the UCST?



3. Which system shows LCST?



REFERENCES

Key Sources:

•Atkins, P. W., & de Paula, J. (2014). *Physical Chemistry for the Life Sciences*. Oxford University Press.
•Castellan, G. W. (1983). *Physical Chemistry* (3rd ed.). Addison-Wesley.
•Prigogine, I., & Defay, R. (1954). *Chemical Thermodynamics*. Longmans Green.
•Rosenfeld, L. (2017). *Liquid Phase Separation: Theory and Applications*. Academic Press

Further Reading:

•Phase diagrams in binary systems
•Critical phenomena in thermodynamics
•Miscibility and solubility in pharmaceuticals
•Industrial applications of liquid-liquid extraction


Thank You