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It's Important to Know!

BP302T — Physical Pharmaceutics I

B.Pharm Semester 3 · Unit 1 — Solubility and distribution phenomena

Unit I: Solubility and distribution phenomena

Solubility and expressions

Solubility is the amount of solute that dissolves in a specified amount of solvent at a specified temperature and pressure. It may be expressed as mass per volume, molarity, molality, mole fraction or percentage. Intrinsic solubility describes the neutral form, while total solubility can include ionised forms.

Solute-solvent interaction, crystal lattice energy, temperature, pH, particle size, salt form, polymorphism and cosolvents can affect dissolution. A solution is ideal when intermolecular interactions are sufficiently similar for activity to approximate concentration. Real solutions show activity coefficients that differ from one.

Gas and liquid solubility

Gas solubility in a liquid commonly changes with pressure and temperature. Henry-type relationships describe dilute gas systems, but the constant and concentration convention must be specified. Miscible liquids form a single phase over the composition range. Partially miscible liquids have limited mutual solubility and may show a critical solution temperature.

Raoult's law relates the partial vapour pressure of a component in an ideal solution to its mole fraction and pure-component vapour pressure. Deviations occur when unlike and like molecular interactions differ. Exact treatment of a named system should be checked against the prescribed text.

Distribution law and diffusion

At equilibrium, a solute distributes between two immiscible solvents in a constant ratio when it remains in the same molecular state and the system is dilute. Ionisation, association, complexation and concentration can invalidate the simple form. Distribution behaviour supports extraction and can influence membrane transport.

Diffusion is net movement caused by a concentration gradient. Fick's laws describe steady and unsteady diffusion. In biological systems, membrane area, path length, partitioning, viscosity and the concentration gradient affect flux.

Unit I: Frequently asked questions

Q: What is intrinsic solubility?

A: It is the equilibrium solubility of the neutral form of a compound, without the contribution from ionised species.

Q: Why can pH change drug solubility?

A: Ionisation changes the balance between neutral and charged species, and charged species often have different aqueous solubility.

Q: What is the main condition for a simple distribution law?

A: The solute should remain in the same molecular form in both phases and the system should be sufficiently dilute and at equilibrium.

Unit I: Key takeaways

- Solubility depends on both solute-solvent interactions and solid-state energy.
- pH and ionisation can change apparent solubility.
- Ideal and real solutions differ in activity behaviour.
- Distribution law supports extraction but has important limitations.
- Diffusion depends on gradient, area, path length and resistance.

Unit I: Practical correlation

Practical correlation: formulation screening. A preformulation study should record temperature, pH, solid form, equilibration time and analytical method when measuring solubility. The acceptance range for a named product is set out in its approved specification.