PHARMACOLEARN

It's Important to Know!

BP302T — Physical Pharmaceutics I

B.Pharm Semester 3 · Unit 2 — States of matter and physicochemical properties

Unit II: States of matter and physicochemical properties

States and transitions

Solids have defined shape and volume, liquids have defined volume but flow, and gases expand to fill their container. Melting, freezing, vaporisation, condensation, sublimation and deposition are phase changes. Latent heat is absorbed or released during a phase change without a temperature change at equilibrium.

Vapour pressure is the pressure of vapour in equilibrium with its condensed phase. It rises with temperature. The critical point is the end of the liquid-gas coexistence curve. Eutectic mixtures can melt at a temperature lower than either pure component. These concepts matter in drying, storage and processing.

Pharmaceutical solid states

Crystalline solids have long-range order. Amorphous solids lack that long-range order and often have higher apparent energy and faster dissolution, but may be less physically stable. Polymorphs have the same chemical composition but different crystal arrangements. A glassy state is a non-equilibrium amorphous state with a glass-transition temperature.

Relative humidity expresses the amount of water vapour present compared with the saturation amount at that temperature. Moisture can change powder flow, chemical stability and solid form. Aerosols and inhalers require control of particle size, propellant or gas behaviour and delivered dose. Device-specific details should be checked against the manufacturer's instructions.

Physicochemical properties

Refractive index relates the speed of light in a medium to that in a reference medium. Optical rotation describes rotation of plane-polarised light by an optically active substance. Dielectric constant reflects a medium's ability to reduce electrostatic interaction. Dipole moment describes charge separation. Dissociation constant and pKa describe ionisation equilibrium. Each property requires a defined temperature, solvent and method.

Unit II: Frequently asked questions

Q: Why can an amorphous solid dissolve faster than a crystal?

A: Its molecules are not held in a regular crystal lattice and may have higher free energy, although physical instability can follow.

Q: What is a eutectic mixture?

A: It is a mixture with a composition that melts at the lowest temperature in that binary system.

Q: What does pKa describe?

A: It is the negative logarithm of the acid dissociation constant and indicates the tendency of an acid to ionise in a specified medium.

Unit II: Key takeaways

- Phase changes involve latent heat at equilibrium.
- Crystal form, amorphous form, polymorphism and glass transition affect performance.
- Humidity can alter both physical and chemical stability.
- Refractive index, optical rotation, dielectric constant and dipole moment are measured properties with defined conditions.
- Ionisation data are medium-dependent.

Unit II: Practical correlation

Practical correlation: solid-form control. A formulation team should compare polymorph, amorphous content, moisture and thermal behaviour before selecting a manufacturing process. The required solid form for a named drug is set out in its approved specification.