M 6/164

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B. Pharm 3rd Semester Examination

Physical Pharmaceutics I – Theory

Course Code: BP302T

Full Marks – 75 **Time – 3 hours**

The figure in the margin indicates full marks for the questions.

1. Answer all 20 questions. 1×20=20

a. A pure solvent "X" rises 1.24 cm in a capillary rise apparatus at room temperature. Capillary tube has a radius of 4.6×10^{-2} m and the density of "X" is $0.781 g.cm^3$. Surface tension of "X" will be –
   1. 2.185×10^{-2} N/m
   2. 2.185×10^{-2} J/m
   3. 3.287×10^{-2} N/m
   4. 2.185×10^{-4} N/m

b. For an aqueous solution of a surfactant, how does the surface free energy change with increasing surfactant concentration?
   1. It decreases and then plateaus after reaching the critical micelle concentration (CMC).
   2. It increases linearly with concentration due to enhanced intermolecular forces.
   3. It remains constant until the CMC is reached.
   4. It increases initially and then decreases after reaching CMC.

c. If surfactant A and B have HLB value of 4.3 and 15 respectively than calculated RHLB value for 12 the required parts for surfactant A will be-
   1. 3
   2. 7.7
   3. 6
   4. 5

d. If light is passing from liquid through glass than consider the right statement for incident angle i and refracted angle r –
   1. i>r
   2. r>i
   3. r=i
   4. r>>i

e. Which of the following statements correctly describes surface free energy?
   1. Surface free energy is always a positive quantity due to the cohesive forces among molecules.
   2. Surface free energy is defined as the work required to increase the surface area of a liquid by a unit area.
   3. Surface free energy decreases with temperature due to a decrease in intermolecular attraction.
   4. Surface free energy is independent of the phase in which the substance exists.

f. Which factor most significantly influences the contact angle between a solid and a liquid?
   1. The density of the liquid
   2. The molecular weight of the solid

3. Surface roughness and chemical composition of the solid
4. The molar volume of the liquid

g. If a solid have same refractive index value and electrical conductivity value than it can be called as-
1. Anisotropic
2. Isotropic
3. Both 1 and 2
4. None

h. Determine the fusion temperature in degree Celsius for benzene with melting point 278.5 K.
1. 5.35
2. 7
3. 37.5
4. 13.2

i. Degree of freedom at triple point for water is-
1. 0
2. 1
3. 2
4. Infinity

j. In the context of solubility, which of the following correctly describes the role of solvation?
1. It increases the melting point of solutes in solvents.
2. It involves the interaction between solute and solvent molecules to stabilize the dissolved species.
3. It is the process by which gas solubility in liquids decreases with increasing temperature.
4. It defines the equilibrium between miscible liquids in Raoult's law.

k. When applying the Distribution Law, why does association or dissociation of solutes in one phase lead to deviations?
1. Because the equilibrium constant becomes undefined
2. Because the concentration ratio no longer reflects the true distribution coefficient
3. Because Raoult's law is invalidated under these conditions
4. Because the critical solution temperature is altered

l. Which factor does NOT significantly affect the solubility of a gas in a liquid?
1. Temperature
2. Nature of the solvent
3. Critical solution temperature
4. Pressure above the liquid

m. What is the primary reason polymorphism impacts drug efficacy and stability?
1. It alters the refractive index of the drug molecules.
2. Different polymorphic forms exhibit variations in melting point, solubility, and bioavailability.
3. Polymorphic drugs cannot exist in an amorphous state.
4. It only affects drugs in gaseous states.

n. Eutectic mixtures are characterized by which of the following?
1. The formation of a single crystalline phase upon mixing two substances.
2. A melting point lower than that of the individual components.
3. Immiscibility of components at all proportions.
4. The sublimation of the mixture at ambient pressure.

o. Liquid crystals exhibit properties of both liquids and solids. Which feature is NOT typical of liquid crystals?
1. High degree of molecular order
2. Ability to flow like a liquid
3. Sharp melting point similar to crystalline solids
4. Sensitivity to changes in temperature and pressure

p. The stability of aerosols is most affected by which factor?
   1. Vapor pressure of the propellant
   2. Polymorphic state of the active ingredient
   3. Dielectric constant of the container material
   4. Relative humidity of the environment

q. The buffer capacity is defined as:
   1. The pH range over which the buffer can maintain its capacity.
   2. The amount of acid or base required to change the pH of 1 liter of buffer by 1 unit.
   3. The total concentration of buffer components in a solution.
   4. The ratio of weak acid to its conjugate base in the buffer.

r. Which isotonic solution is most frequently used for intravenous administration?
   1. Phosphate-buffered saline
   2. 0.9% sodium chloride solution
   3. Ringer's lactate solution
   4. Glucose 5% solution

s. The thermodynamic stability constant of a complex is primarily influenced by which factor?
   1. Concentration of the components
   2. Strength of intermolecular interactions
   3. Method of analysis used
   4. pH of the external environment

t. Which type of crystalline structure is typically associated with stronger drug-protein binding?
   1. Amorphous
   2. Hydrate
   3. Polymorphic
   4. Co-crystalline

2. Answer any seven questions from below. 5×7=35
   a. Explain the Raoult's law in terms of solubility.
   b. Explain liquid crystals along with their biological implication.
   c. Solve surface free energy with proper equation.
   d. Explain the formation of inorganic metal complexes.
   e. Explain the concept of polymorphism in terms of stability and boiling point.
   f. Explain dissociation constant mathematically for a weak acid.
   g. Sketch buffer equation for a weak base.
   h. Explain isotonicity. Explain the methods for adjustment of isotonicity.
   i. Explain the mechanisms of solute-solvent interactions and discuss how solvation and association influence the solubility of drugs.

3. Answer any two questions from below. 2×10=20
   a. Explain the adsorption isotherms based on Freundlich and Langmuir along with the variations.
   b. Explain the kinetics of protein binding with appropriate graphical plot.
   c. Explain various factors influencing the solubility of solids.