

**Faculty of Health Sciences****Bachelor of Science Honors in Industrial Pharmaceutical Science****IPS 2133 – Physical Pharmacy****Batch 06****2nd Year 1st Semester****End Semester Examination - SEQ**

Date : 28th February 2024**Time : 9.00 a.m. - 11.00 a.m. (Two hours)**

INSTRUCTIONS TO CANDIDATES

- This question paper consists of **FOUR** questions.
- Answer **ALL** the questions.
- Final answers should be given in **lined sheets** legibly in black or blue ink.
- You are allowed to use non-programmable calculators.

Question 01 (100 marks)

- 1.1 Briefly describe the main **two (02)** components of a solution. (20 marks)
- 1.2 List colligative properties of non-electrolytic solutions. (20 marks)
- 1.3 Describe the reason to the elevated colligative properties observed in electrolytic solutions, compared to non-electrolytic solutions with same molality. (30 marks)
- 1.4 Describe the importance of refractive index of materials in pharmaceuticals. (30 marks)

Question 02 (100 marks)

- 2.1 Define following terms.
- 2.1.1 Induced polarization
- 2.1.2 Molar refractivity (20 marks)
- 2.2 “Both benzene and p-dichlorobenzene show 0 Debye dipole moments, whereas m-dichlorobenzene shows a dipole moment of 1.5 Debye.” Justify this statement using appropriate chemical structures. (30 marks)

- 2.3 A sample containing a single enantiomer of salbutamol drug was prepared by dissolving 1.44 g of salbutamol in a solution with a total volume of 3.52 mL. In a polarimeter, it showed a 5.12° clockwise observed rotation. The length of the sample tube was 12.5 dm. Calculate the specific rotation of the sample. (20 marks)
- 2.4 Describe how you would calculate the Gibbs free energy in a system to determine the thermodynamic behavior and to predict the direction of reactions. (30 marks)

Question 03 (100 marks)

- 3.1 Define "open" and "closed" thermodynamic systems. (20 marks)
- 3.2 State the first law of thermodynamics. (15 marks)
- 3.3 A system absorbs 412.30 kJ of heat and does 72.32 J of work on the surroundings. Calculate the internal energy change of this system. (15 marks)
- 3.4 Outline the primary methods used to adjust tonicity. Provide specific examples for each of the method mentioned. (20 marks)
- 3.5 You have a provided a list of drugs along with their freezing point depression (ΔT) and sodium chloride equivalent (E).

Solution, 1% w/v drug °C	ΔT	E
Apomorphine hydrochloride	0.08	0.08
Boric acid	0.29	0.50
Calcium gluconate	0.09	0.16
Pilocarpine nitrate	0.14	0.23
Potassium chloride	0.45	0.76
Sodium chloride	0.58	1.00
Sodium sulphacetamide	0.14	0.23

- Calculate the gram of sodium chloride needed to make 30 mL of a 2% isotonic physostigmine salicylate solution using sodium chloride method. (30 marks)

Question 04**(100 marks)**

4.1 State **three (03)** types of solvents based on the concentration. (15 marks)

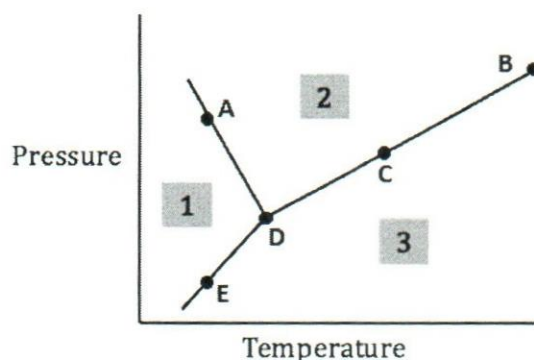
4.2 List **four (04)** factors affecting the solubility of solids in liquid. (20 marks)

4.3 Ammonia is soluble in both water and organic solvents. An aqueous solution of ammonia is shaken with the immiscible organic solvent trichloromethane. The mixture is left to reach equilibrium. Samples are taken from each layer and titrated with dilute hydrochloric acid.

- A 25.0 cm³ sample from the trichloromethane layer requires 13.0 cm³ of 0.100 mol dm⁻³ HCl to reach the end-point.
- A 10.0 cm³ sample from the aqueous layer requires 12.5 cm³ of 0.100 mol dm⁻³ HCl to reach the end-point.

Calculate the partition coefficient (K_{pc}) of ammonia between trichloromethane and water. Show your working clearly. (35 marks)

4.4 Below is a phase diagram of a polar solution.



4.4.1 What is the name of Point D? (06 marks)

4.4.2 What processes are occurring at Point D? (06 marks)

4.4.3 What processes are occurring at Point C? (06 marks)

4.4.4 What processes are occurring at Point E? (06 marks)

4.4.5 Define Point B. (06 marks)
