

Reg. No. :

Name :

Third Semester B.Sc. Degree Examination, February 2024

First Degree Programme under CBCSS

Chemistry

Complementary Course for Botany

CH 1331.3 : PHYSICAL CHEMISTRY

(2020 Admission Onwards)

Time : 3 Hours

Max. Marks : 80

SECTION – A

Answer **all** questions. Each question carries **1** mark.

1. Define activation energy of a reaction.
2. What is the unit of second order rate constant?
3. What are isotonic solution?
4. What is critical micelle concentration (CMC)?
5. Give one example for Lewis base.
6. Give an example for a binary system of partially miscible liquids showing both upper and Lower CST and draw its phase diagram.
7. What is *bathochromic shift*?
8. How will you distinguish between a true solution and a sol?

- Define the term Van't Hoff factor.
- What are colligative properties?

(10 × 1 = 10 Marks)

SECTION – B

Short answer. Answer any **eight** questions. Each question carries **2** marks.

- What is meant by *steady state approximation*?
- Explain the term pseudo first order reaction with a suitable example.
- What are buffer solutions? Give examples.
- What are the limitations of *Lowry-Bronsted theory* of acids and bases?
- At 353 K, benzene and toluene form nearly ideal solution. The vapour pressures of pure benzene and toluene are 760 mm and 290 mm. Calculate the total vapour pressure and vapour composition for a solution containing 0.5 mole fraction of benzene.
- Specify how a given volume of extracting solvent must be used to extract a greater amount of a given solute out of another solvent immiscible with the extracting solvent.
- What is the most common reference compound used in NMR spectroscopy? Why is it advantageous to use it as a reference compound?
- What are *auxochromes*? Give two examples.
- Calculate the molality of a 12% (w/w) solution of H_2SO_4 .
- Define the term *osmotic pressure*. How does the osmotic pressure of a given solution vary with temperature?
- What are *associated colloids*?
- Explain the *optical property* of colloids.

(8 × 2 = 16 Marks)

SECTION – C

Short Essay. Answer any **six** questions. Each question carries **4** marks.

23. Distinguish between homogeneous and heterogeneous catalysis with examples.
24. Explain the *Lowry-Bronsted* concept of acids and bases with suitable examples.
25. Explain how distribution law can be applied to the study of association of solutes in the solution phase.
26. Draw the schematic sketch of the PMR spectrum of *methoxymethane* and discuss it in the light of the structure of the compound.
27. Arrive at a relationship between the *elevation of boiling point* for a dilute solution of a solute and the *molar mass of the solute*.
28. A solution of $\text{Hg}(\text{CN})_2$ (molar mass=252.6 g/mol) containing 3 g/L has an osmotic pressure of $3.092 \times 10^4 \text{ N/m}^2$ at 298 K. Calculate the apparent molar mass of the solute and its degree of dissociation at this concentration.
29. Discuss the principle of steam distillation with a neat diagram.
30. Write a note on the purification of colloids.
31. A first order reaction is 20% complete in 15 min at 40°C and in 3 min at 60°C . Calculate the energy of activation for the reaction.

(6 × 4 = 24 Marks)

SECTION – D

Essay. Answer any **two** questions. **Each** question carries **15** marks.

32. What are the main postulates of the *collision theory of bimolecular reactions*? Derive the rate equation for *bimolecular* reaction using *collision theory*.
33. (a) How does the solvent influence the strength of an acid? Illustrate with an example. 5
(b) Derive expressions for the hydrolysis constant of a salt of a strong acid and a weak base in aqueous solution, its degree of hydrolysis and the pH of the solution. 10

34. (a) At a pressure of 760 mm, a mixture of nitrobenzene and water boils at 90°C. The vapour pressure of water at this temperature is 733 mm. Find the proportion of water and nitrobenzene obtained by the steam distillation of impure nitrobenzene. 7
- (b) Explain the distillation behaviour of a completely miscible binary system showing *large negative deviations*. 8
35. (a) State and explain Hardy Schulze rule. What is meant by a protective colloid? 5
- (b) Briefly discuss the classification of colloids. 5
- (c) Explain the terms *electrical double layer* and *zeta potential*. 5

(2 × 15 = 30 Marks)