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Reg. No. :

Name :

Third Semester B.Sc. Degree Examination, January 2023

First Degree Programme under CBCSS

Chemistry

Complementary Course for Botany

CH 1331.3 — PHYSICAL CHEMISTRY

(2019 Admission)

Time : 3 Hours

Max. Marks : 80

SECTION – A

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

1. What is meant by bathochromic shift?
2. What are isotonic solutions?
3. Define the term 'Tyndall effect'.
4. Why TMS is used as reference compound in NMR spectroscopy.
5. Benzene, Naphthalene and Anthracene among this, which molecules have the lowest electronic transitions. Why?
6. The half-life of a given reaction is doubled if the initial concentration of the reactant is doubled. What is the order of the reaction?
7. Calculate the pH of a 0.01M HCl solution.

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8. What is meant by buffer capacity?
9. Define critical solution temperature.
10. Give two examples each for Lewis acids and bases.

(10 × 1 = 10 Marks)

SECTION – B

(Short answer type)

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

11. Differentiate between order and molecularity of a chemical reaction.
12. Give an example of zero order and first order reactions, justify.
13. A first-order reaction was 25 percent complete in 10 minutes. What is the rate constant of the reaction?
14. Describe two applications for osmotic pressure.
15. The resulting solution when sodium acetate is dissolved in water is basic. Why?
16. Explain the term distribution coefficient.
17. What is UCST and LCST?
18. What are the conditions of validity for Nernst distribution law?
19. What are the conditions for a nucleus to be NMR active?
20. What are chromophores and auxochromes with an example?
21. What is vant-Hoff equation for dilute solutions?
22. Distinguish between ideal and non-ideal solutions.
23. Explain the process electro dialysis.
24. Arrange the following molecules in the order of coagulation ability of negatively charged sol KCl, MgCl₂ and AlCl₃ and justify.

25. Explain why the addition of a non-volatile solute increases the boiling point of a liquid.
26. What are abnormal colligative properties? Mention the various reasons for the same.

(8 × 2 = 16 Marks)

SECTION – C

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

27. Derive integrated rate equation for first order reaction.
28. The rate constants of a reaction at 500 K and 700 K are 0.02s^{-1} and 0.07s^{-1} respectively calculate the activation energy.
29. What is heterogeneous catalysis? Discuss with examples.
30. Derive Henderson equation for basic buffer.
31. Prove that $\text{pK}_w = 14$. Derive relationship between pK_a , pK_b and pK_w .
32. Discuss the principle of steam distillation.
33. Discuss the BP–composition curve for nicotine–water system.
34. Define molar extinction coefficient. How it relates to the concentration of molecules.
35. Sketch the schematic NMR spectrum of $\text{CH}_3\text{CH}_2\text{OH}$, TMS as reference.
36. The depression of freezing point of a solution containing 3 gm of a solute in 22 gm of water is 1.45 K. Determine molecular mass of solute? ($K_f = 1.86 \text{ K Kg/mol}$)
37. Briefly discuss about the electrical double layer and how it relates to zeta potential.
38. How does reverse osmosis work?

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. Long essay type. Each question carries **15** marks.

39. What is meant by rate of reaction? How temperature affects the rate of reaction, How collision theory explains the effect of temperature on reaction rate.
40. What is meant by colligative property, discuss briefly about any two colligative properties? Derive Van't Hoff equation.
41. (a) How does NMR Spectroscopy useful for distinguishing the following molecules $\text{CH}_3\text{CH}_2\text{OH}$, $\text{CH}_3\text{-O-CH}_3$.
- (b) Comment on Hyperchromic and Hypochromic effects.
42. Discuss the optical, kinetic and electrical properties of colloids.
43. (a) Discuss the Arrhenius and Bronsted Lowry concepts of acids and bases with examples.
- (b) Differentiate between peptization and coagulation.
44. (a) What is a buffer solution and discuss the different types of buffer solution?
- (b) Derive the salt hydrolysis constant for NH_4Cl and CH_3COONa .

(2 × 15 = 30 Marks)