

33. Derive the wave equation for a particle in a three-dimensional box applying the separation of variables method.
34. (a) Derive the van't Hoff equation showing the temperature-dependence of equilibrium constant and arrive at its integrated form. 7
- (b) Discuss the Lindemann theory of unimolecular reactions with special reference to the use of steady state approximation. 8
35. Discuss the postulates of Langmuir's adsorption theory and derive the Langmuir's adsorption equation.

(2 × 15 = 30 Marks)

(Pages : 4)

T – 1652

Reg. No. :

Name :

Sixth Semester B.Sc. Degree Examination, April 2024

First Degree Programme under CBCSS

Chemistry

Core Course XII

CH 1643 — PHYSICAL CHEMISTRY III

(2020 Admission onwards)

Time : 3 Hours

Max. Marks : 80

PART – A

(Answer **all** questions. Answer in one word to maximum 2 sentences. Each question carries 1 mark).

1. When is a wave function said to be normalized?
2. Write the Schrodinger wave equation.
3. What is meant by chemisorption?
4. What happens to the rate of a reaction with increase in temperature?
5. Define activation energy of a reaction.
6. How does the value of equilibrium constant predict the extend of reaction?
7. Give an example for buffer solution.

8. How many phases would be there in equilibrium in a one component system under a condition of monovariance?
9. Give an example for photosensitized reaction.
10. What is meant by azeotropic mixtures?

(10 × 1 = 10 Marks)

PART – B

(Short Answer type. Answer **any eight** questions. Each question carries **2** marks.)

11. Explain the significance of the wave function ψ .
12. Mention any two applications of colloids.
13. Give Arrhenius equation and indicate what each parameter in it stands for.
14. Explain the term 'sedimentation potential'.
15. Depict the shape of the $\log[a/a-x]$ versus t plot for a first order reaction. What will be the slope?
16. Calculate the number of degrees of freedom of the system at the triple point of water?
17. Give Clausius Clapeyron equation and specify the terms.
18. Give any two postulates of quantum mechanics.
19. What is the effect of pressure on (a) the melting point of ice and (b) the transition temperature of sulphur?
20. Mention any two limitations of distribution law.
21. What is meant by Compton effect?
22. Comment on the observed quantum yield of the hydrogen-bromine reaction.

(8 × 2 = 16 Marks)

PART – C

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

23. What are quantum numbers? Discuss the significance of each quantum numbers.
24. Explain any two methods of determining the order of a reaction.
25. A buffer solution contains 0.50 M acetic acid and 0.50 M sodium acetate at 25°C. Calculate its pH? (K_a for acetic acid = 1.74×10^{-5} at 25°C).
26. Discuss the intermediate compound formation theory of homogeneous catalysis.
27. Derive the Henderson's equation for the pH of basic buffer.
28. Discuss the utility of BET equation in the determination of surface area of an adsorbent.
29. Account for the influence of temperature on the reaction rate on the basis of Arrhenius equation.
30. Discuss the phase diagram of the KI-water system.
31. Explain how distribution law can be applied to the study of association of solutes in the solution phase.

(6 × 4 = 24 Marks)

PART – D

(Answer **any two** questions. Each question carries **15** marks).

32. (a) State Le Chatelier principle and apply it to the equilibrium in the Haber process for the manufacture of NH_3 .
- (b) Write note on (i) Fluorescence (ii) Phosphorescence.