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DCCH503



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V Semester B.Sc. Degree Examination, March/April - 2024

CHEMISTRY

Physical Chemistry - III and Spectroscopy - I

(NEP-CBCS Scheme 2023-24 Onwards)

Paper : VI



Time : 2½ Hours

Maximum Marks : 60

Instructions to Candidates:

1. The question paper has three parts, answer **all** the parts.
2. Draw **diagrams** and write chemical equations wherever necessary.

PART - AAnswer any **FIVE** of the following questions. Each question carries 2 marks. (5×2=10)

1. Define temperature coefficient of a reaction.
2. State Grothus - Draper law.
3. What is a freezing mixture? Give an example:
4. What is liquid - junction potential? How is it eliminated?
5. What is Hamiltonian operator.
6. Mention the condition for a molecule to exhibit vibrational spectra.
7. Explain the meaning of nuclear magnetic resonance.

PART - BAnswer any **FOUR** of the following questions. Each question carries 5 marks. (4×5=20)

8. a. Write any three differences between photochemical and thermal reactions.
b. Write Arrhenius equation and mention the term involved in it (3+2)
9. Draw the labelled diagram of phase diagram of Ag - Pb system. Calculate the degree of freedom at the eutectic point. (5)
10. What is buffer action? Discuss the buffer action of an acidic buffer. (5)
11. How do you determine EMF of a cell by compensation method. (5)
12. Sketch the different modes of vibrations of CO₂ molecule. Which of these modes of vibration are degenerate? (5)
13. a. What are stokes and anti - stoke lines? How are they different from Rayleigh line.
b. What is Larmor frequency? (4+1)

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PART - C

Answer any **THREE** of the following questions. Each question carries **10 marks.**(3×10=30)

14. a. Explain the effect of ionic strength on rate of a reaction in solution.
b. Discuss the photochemical decomposition of hydrogen iodide molecule. (6+4)
15. a. What is photosensitization? Explain with an example.
b. What are quantum numbers? Explain their characteristics.
c. The standard emf of the Daniell cell is 1.1V calculate the equilibrium constant for the reaction in the cell at 298K. (4+4+2)
16. a. Draw the phase diagram of water system, calculate the degrees of freedom at the eutectic point.
b. A buffer solution contains 0.5 mole/litre CH_3COONa and 0.5 moles/litre CH_3COOH . Calculate the pH of buffer (Given K_a for acetic acid = 1.8×10^{-5}).
c. Mention any two analytical applications of buffer solution. (5+3+2)
17. a. How do you determine pH of a solution using quinhydrone electrode? Mention any two limitations.
b. Write a note on laplacian operator and Hamiltonian operator. (6+4)
18. a. Derive the relationship between moment of inertia and bond length of a diatomic molecule.
b. Explain
i. Fundamental vibrational frequency.
ii. Hot bands in vibrational spectroscopy.
c. Write the selection rule for rotational - vibrational spectra of a diatomic molecule. (4+4+2)
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