D5BCH2203   Reg. No..............................

                                                           Name: ....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2024
(Regular/Improvement/Supplementary)
CHEMISTRY
GCHE5B08T: PHYSICAL CHEMISTRY II

Time: 2 Hours   **Maximum Marks: 60**

SECTION A: Answer the following questions. Each carries *two* marks.
(Ceiling 20 marks)

1. Draw the labelled phase diagram for a two component system belonging to the simple eutectic class.

2. Distinguish between adsorption and absorption.

3. Give the BET equation, specifying the terms involved.

4. If for a decomposition reaction, the time in seconds required for half of the substance decompose is found to be inversely proportional to its molar concentration, identify the unit of its rate constant.

5. Define quantum yield of a photochemical reaction. Give an example for (i) high quantum yield reaction and (ii) reaction with quantum yield 1.

6. How many normal modes of vibration are possible for (a) the H_2O molecule and (b) the CO_2 molecule?

7. Calculate the number of degrees of freedom of the system at the triple point of water.

8. How is the magnitude of the nuclear magnetic moment of a nucleus related to its spin quantum number?

9. Give an example for binary condensed system involving formation of a compound having incongruent melting point.

10. How will you relatively express the rate of the gaseous reaction:

    $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$ in terms of the concentration of each species?

11. Write the equation for the rate of a bimolecular reaction derived using Collision theory and explain the terms.

12. What happens to the rate of a reaction with increase in temperature?

(PTO)

SECTION B: Answer the following questions. Each carries *five* marks.
(Ceiling 30 marks)

13. Briefly discuss the theory of homogeneous catalysis.

14. Draw a labelled schematic diagram of the proton NMR spectrum of acetone.

15. If the half-life of a first order reaction is 1 hour, what will be the time taken for 80% completion?

16. Explain the terms eutectic point and congruent melting point with suitable examples.

17. Derive Nernst's distribution law.

18. The fundamental vibrational frequency of HCl is 8.8652×10^{13} s^{-1}. Calculate the frequency of the first Stokes line obtained in s^{-1} if HCl is irradiated with 436.8 nm mercury line.

19. The rate constant of a reaction is 2.56×10^{-5} s^{-1} at 298 K and 1.35×10^{-4} at 308 K. Calculate the energy of activation of the reaction.

SECTION C: Answer any *one* question. The question carries *ten* marks.

20. Bring out the relationship between the vibrational energy and frequency of oscillation of a diatomic molecule based on the simple harmonic oscillator model. Comment on the spacing of the vibrational levels and bring out the significance of zero-point energy.

21. (a) Derive the Beer-Lambert's law. What are its limitations?

    (b) A 0.02 molL-1 solution of a substance has an absorbance of 2.0 at 660 nm in a cell of length 1 cm. Calculate the percent absorption for a 0.1 molL-1 solution in the same cell.

(1 X 10 = 10 Marks)