D5BCH2303 **Reg. No.............................**

Name: ....

FIFTH SEMESTER B.Sc. DEGREE EXAMINATION, NOVEMBER 2025

(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. Give the Freundlich adsorption equation and specify the terms.
2. State Stark-Einstein law. Calculate the energy of an Einstein of radiation of wavelength 100nm.
3. What is meant by the optimum temperature of an enzyme?
4. Define efflorescence.
5. How is absorbance of a solution related to its concentration?
6. What are hyperchromic and hypochromic shifts?
7. The rate constants of two reactions (i) and (ii) are respectively 3.3 x 10^{-5} L $mol^{-1}s^{-1}$ and 6.3 x 10^{-4}mol $L^{-1}s^{-1}$. Identify the order of the reaction in each case.
8. For a first order reaction, k= 0.693 s^{-1}. What is the half-life period of the reaction?
9. When the pressure of a gas is very low, the reaction becomes second order with respect to the reactant in Unimolecular gas phase reactions. Justify.
10. Sketch the schematic ESR spectrum of the hydrogen atom.
11. Give any two differences between a photochemical reaction and a thermochemical reaction giving examples.
12. Explain the chemiluminiscent mechanism when a stream of hydrogen falls on the surface of cold liquid mercury.

SECTION B: Answer the following questions. Each carries *five* marks.

(Ceiling 30 marks)

13. Define order of a reaction. Give an example each for:
    (a) a zero order reaction (b) a fractional order reaction and (c) a third order reaction
14. Explain the term hot bands with regard to vibrational spectroscopy. How can hot bands be distinguished from fundamentals and overtones?

(PTO)

15. One gram of a sample of an adsorbent required 55 mL of nitrogen at STP to completely cover its surface with a monolayer. Calculate the surface area of the adsorbent sample. Given: The area of cross-section of N_2, molecule = 16.2 $A^{\circ 2}$.
16. For the bimolecular decomposition of NO_2, into NO and O_2, the rate constant is 83.9 at 327°C and 407 at 372°C. Calculate the activation energy.
17. Draw the phase diagram of the sodium sulphate-water system and write down the equilibria involved at the invariant points in the diagram.
18. Discuss the applications of NMR spectroscopy.
19. Give two examples for photosensitization, highlighting the role of the photosensitizer.

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

20. (a) State the phase rule and explain the terms involved.

    (b) Explain the significance of 'eutectic point' with reference to a simple eutectic system.
21. (i) Explain the term force constant on the basis of the simple harmonic oscillator model of a diatomic molecule.

    (ii) Given that the fundamental vibrational frequency for HCl is $8.667X10^{13}s^{-1}$, calculate the force constant of the HClbond(H=1.008; Cl=35.45).

(1x 10 = 10 Marks)