JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -3 EXAMINATIONS- 2025

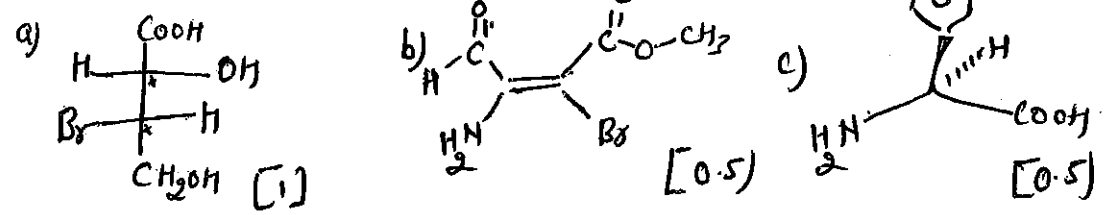
M.Sc.-I Semester (BT&BI)

COURSE CODE (CREDITS):20MSIPH111 MAX. MARKS: 35

COURSE NAME: Basic of Chemistry and Physics

COURSE INSTRUCTORS: GPL & RRS MAX. TIME: 2 Hours

Note: *(a) All questions are compulsory.*
(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems. Use of scientific calculator is allowed.

Q.No	Question	Marks
Q1.	The Haber process synthesizes ammonia by combining nitrogen and hydrogen gases under high pressure and moderate temperature with an iron catalyst. According to Le Chatelier's Principle, increasing pressure favors the forward reaction because fewer moles of gas are produced. However, excessively high pressure raises costs and risks. Similarly, lowering temperature favors ammonia formation (exothermic reaction), but reduces reaction rate. Industrial compromise involves ~200 atm pressure and ~450 °C temperature. This balance illustrates how Le Chatelier's Principle guides industrial optimization between yield and feasibility. $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) + Heat$. a) Analyze how pressure influences ammonia yield in the Haber process. Evaluate why industry does not use maximum pressure despite higher yield? b) What happens to equilibrium when temperature is increased? Evaluate the use of very low temperature in the Haber process. c) Why is a catalyst used?	[2+2+1]
Q2.	a) Evaluate the role of intermolecular and intramolecular forces in biological macromolecules such as proteins. b) Evaluate the relative significance of thermodynamic and kinetic control of chemical reaction. Justify which control is more advantageous under specific reaction conditions. Explain the drawing energy diagram	[2] [4]
Q3.	Answer the following questions. a) Write down the reaction at the following two electrodes as well as the full cell reactions. Zn/ZnO_2^-, //HgO(s)/Hg (Basic Medium) b) What will be the pH value of a solution obtained by mixing 2.5 gm of acetic acid and 5 g of sodium acetate and maintaining the volume to 500 mL (K_A for $CH_3COOH=1.8X10^{-5}$ at 25) (pK_a 4.74). c) Assign R/S or E/Z to following compounds. 	[2x3=6]

Q4.	Explain work, energy, and power with simple examples. Show how energy is converted from one form to another inside living cells.	[3]
Q5.	a) A molecular motor protein exerts a force of 5×10^{-12} N to move a vesicle by 2×10^{-6} m inside a cell. Calculate the work done. b) A 0.02 kg cell culture vial is lifted vertically by 0.5 m. Calculate the increase in potential energy.(Take g = 9.8 m/s²). c) Oxygen diffuses through a membrane of thickness 0.2 mm. The concentration of oxygen on one side is 8 mol/m³, and on the other side is 3 mol/m³. The diffusion coefficient is $D=1.8\times10^{-9}$ m²/s. Calculate the diffusion flux (J). d) A small bead attached to a DNA strand oscillates with a spring constant k = 0.05 N/m and has a mass of 2×10^{-5} kg. Calculate the time period of oscillation.	[1.5x4=6]
Q6.	Choose any one case of diffusion in Biological Processes and Answer/Explain the following questions. a) What is diffusing? b) Why diffusion is important in this process c) How Fick's Law helps to understand the rate of diffusion d) Limitations or challenges in that biological system	[4]
Q7.	Explain simple harmonic motion (SHM) using simple diagrams. Derive equations for displacement, velocity, and acceleration in SHM.	[5]