

JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT
TEST -1 EXAMINATION- 2026
B. Tech-III Semester (CE)

COURSE CODE (CREDITS): 25B11CE311 (3)

COURSE NAME: CHEMISTRY

COURSE INSTRUCTOR: Prof. Gopal Singh Bisht

MAX. MARKS: 15

MAX. TIME: 1 Hour

Note: (a) All questions are compulsory.

(b) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

(c) Use of calculator is allowed

Q. No	Question	CO	Marks
Q1	Answer the following questions. a) A solution is prepared by dissolving 4.90 g of H_2SO_4 (molar mass = 98 g mol⁻¹) and making the volume up to 250 mL. If 25.0 mL of this solution is diluted to 500 mL, determine the molarity of the final solution. b) 100 mL of 0.10M HCl is mixed with 200 mL of 0.040 M NaOH. Calculate the pH of resulting solution. c) Two substances are dissolved separately in water: NaCl and CH_3OH (methanol). Analyse, how water interacts with each solute and explain why water is an effective solvent for both substances, despite their different chemical structures.	1	6
Q2	a) Water has a much higher boiling point than H_2S, even though both molecules belong to the same group of the periodic table. Evaluate and explain this observation using molecular polarity, hydrogen bonding, and intermolecular forces rather than simply comparing molecular masses. b) Consider the following compounds: CH_4, CH_3Cl, CH_3OH and CH_3NH_2. Analyse the dominant intermolecular interactions in each compound and explain why their boiling points would not be determined by molecular mass alone.	III	4
Q3	A buffer has $\text{pK}_a = 5.0$. Which ratio $[\text{A}^-]/[\text{HA}]$ will produce $\text{pH} = 4.0$?	I	2
Q4	Consider two atoms approaching along the internuclear z-axis. One atom contributes a 1s orbital, while the other contributes a 2pz orbital. (a) Determine whether the 1s and 2pz orbitals can combine effectively to form molecular orbitals. (b) Explain why the corresponding 2px or 2py orbitals would not form an equivalent bonding interaction with the 1s orbital when the internuclear axis is the z-axis. (c) Sketch or describe the resulting bonding (σ) and antibonding (σ^*) molecular orbitals.	II	3