

B. Sc. DEGREE END SEMESTER (SAY) EXAMINATION - MAY 2026**SEMESTER 5 : CHEMISTRY****COURSE : 19U5RCHE08 - PHYSICAL CHEMISTRY – II***(For Supplementary (SAY) 2023 Admission)*

Time : Three Hours

Max. Marks: 60

PART A**Answer All (1 mark each)**

1. Explain the general broadness of spectral bands in UV-visible spectroscopy?
2. State the selection rule for the vibrational transitions of an aharmonic oscillator.
3. The tallest peak in the mass spectrum is called....
4. State Franck-Condon principle and explain it with regard to electronic transitions in a diatomic molecule.
5. What happens to fluorescence of a substance when the source of exciting radiation is removed?
6. Arrange the following radiations in the increasing order of wavelength:
UV, IR, Microwave, Visible
7. What is Raman shift?
8. The chemical shift range (δ value) for aldehydic proton is

(1 x 8 = 8)**PART B****Answer any 6 (2 marks each)**

9. What is the essential condition for the vibration or rotation to be Raman-active?
10. Explain Hypochromic shift taking a specific example.
11. State the principle of mutual exclusion
12. Calculate the energy per photon for a radiation of wavelength 200 nm.
13. Explain theory of electronic spectroscopy taking Born-Oppenheimer approximation?
14. Show diagrammatically the transitions in the electronic spectra of polyatomic molecules?
15. The molecular ion may not be the peak of maximum intensity in the mass spectrum of an organic compound. Justify the given statement.
16. Calculate the energy of one mole of photons of radiation whose frequency is 5×10^{14} Hz.

(2 x 6 = 12)**PART C****Answer any 4 (5 marks each)**

17. The hydrogen halides have the following fundamental vibrational frequencies: H^{35}Cl (2988.9 cm^{-1}) and H^{80}Br (2649.7 cm^{-1}). Calculate the force constants for the hydrogen halide bonds.
18. Explain the term Larmor precession and based on the concept, explain nuclear magnetic resonance?
19. How do fragmentation of sample molecules are carried out in Mass spectrometry?
20. Justify the statement that the absence of common lines in the IR and Raman spectra of a molecular species automatically implies the existence of a centre of symmetry in it.
21. Explain the terms chromophores and auxochromes.
22. Draw the Jablonski diagram and explain the various types of transitions.

(5 x 4 = 20)

PART D

Answer any 2 (10 marks each)

23. Give a detailed account of primary and secondary photochemical processes. Define quantum yield of a reaction explaining the high and low quantum yields citing suitable examples?
24. a) Derive an expression for the moment of inertia of a diatomic rigid rotator. (5 marks)
b) Explain the terms bathochromic and hypsochromic shift with suitable examples (5 marks)
25. Sketch the normal modes of vibration of H_2O and CO_2 and determine which are IR active and Raman active. Give explanation.
26. Explain briefly the basic principle of NMR spectroscopy.

(10 x 2 = 20)