

QP CODE: 25003384



Reg No :

Name :

**B.Sc DEGREE (CBCS) SPECIAL REAPPEARANCE EXAMINATIONS, FEBRUARY
2025**

Fifth Semester

CORE COURSE - CH5CRT08 - PHYSICAL CHEMISTRY - II

Common for B.Sc Chemistry Model I, B.Sc Chemistry Model II Industrial Chemistry & B.Sc
Chemistry Model III Petrochemicals

2022 Admission Only

9B9D644C

Time: 3 Hours

Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. Specify the electronic transition in hydrogen spectrum which corresponds to the third line of the Lyman series.
2. What is the ratio of the energies of the first three energy levels of a particle in one-dimensional box of infinite height?
3. Specify the shapes of a dx^2-y^2 orbital and a dz^2 orbital.
4. What are the permitted values of quantum number m_l for angular momentum quantum number $l = 3$?
5. Distinguish between bonding and anti-bonding MO's.
6. Arrange the following electromagnetic radiations in the increasing order of energy: microwave, infrared, ultraviolet.
7. Which electromagnetic region has energy corresponding to the energy gap between consecutive rotational energy levels?
8. In terms of vibrational spectroscopy, define the zero point energy.
9. Arrange Rayleigh, Stokes, Anti-Stokes scattering in the increasing order of intensity.
10. Give two examples of chromophores.
11. Predict the number of signals in the low resolution PMR spectrum of toluene.
12. Which type of chemical species is studied in the ESR spectroscopy?

(10×1=10)





Part B

Answer any **six** questions.

Each question carries **5** marks.

13. Calculate the energy per photon and the energy per mole of photons of radiation of wavelength (a) 600 nm (visible light) (b) 1.00 cm (microwave).
14. In the experiments of Davisson and Germer, an electron beam with an energy of 54.0 eV struck a close-packed nickel surface perpendicularly. A diffracted beam was observed at an angle 500 to the perpendicular. Calculate the wavelength of the electrons.
15. What are quantum mechanical operators? Discuss their significance.
16. Summarize the important features of MO theory.
17. In vibrational spectroscopy, how does an overtone differ from the fundamental?
18. Discuss the condition in which two vibrational modes can couple. What are the consequences of this coupling? Illustrate with an example.
19. In terms of the advantages and disadvantages, compare the Raman spectroscopy and the IR spectroscopy.
20. Explain the term Larmour Precession. What is its significance in the NMR spectroscopy?
21. How will you distinguish between 1-chloropropane and 2-chloropropane using the NMR spectroscopy?

(6×5=30)

Part C

Answer any **two** questions.

Each question carries **10** marks.

22. Discuss the postulates of quantum mechanics.
23. Discuss the solution of the Schrodinger wave equation for the hydrogen molecule-ion, and obtain the normalized MO wavefunctions. Explain the potential energy curves of bonding and anti-bonding MO's, and substantiate the statement "The simple molecular orbital does not provide an accurate value for the bond dissociation energy".
24. (a) Arrive at expressions for (a) moment of inertia and (b) rotational energy of a rigid diatomic molecule.
(b) Evaluate the rotational constant of 2HCl (masses of 2H and Cl are 2.0141 mu and 34.969 mu, respectively)
25. (a) Discuss the origin of the Frank-Condon principle and how it leads to the appearance of vibrational structure in an electronic transition.
(b) Explain how dissociation of a diatomic molecule can occur through absorption of radiation.

(2×10=20)

