

TB145170A

Reg. No.....

Name.....

B. Sc. DEGREE (C.B.C.S.S.) EXAMINATION, OCTOBER 2016
SEMESTER V – CHEMISTRY
CHE5QMS – QUANTUM MECHANICS AND SPECTROSCOPY

Time: Three Hours

Maximum Marks: 60

PART A

Short answer questions

I. Answer all questions. Each question carries 1 mark.

1. What are Eigen functions?
2. Number of radial nodes in 2s orbital is
3. What is Heisenberg uncertainty principle?
4. Give the selection rule for a rotational transition.
5. State Franck-Condon principle.
6. State Stark-Einstein law.
7. What is chemiluminescence?
8. What is photochemical reaction?

(8×1=8)

PART B

Brief answer questions

II. Answer any six questions. Each question carries 2 marks.

9. What is Compton effect?
10. What is Planck's radiation law?
11. Among the given molecules, reason out which of the molecules are microwave active - H₂, CO₂, HCl, N₂, CO
12. Explain Born-Oppenheimer approximation.
13. List the various regions of the electromagnetic spectrum. Which electromagnetic radiation is used in NMR spectroscopy and electronic spectroscopy?
14. What is the zero point energy of a diatomic vibrating molecule?
15. Explain Larmor precession.
16. Why TMS is used as an internal standard in NMR spectroscopy?
17. Briefly explain the principle of Mass spectrometry.
18. What is Beer Lambert's law?

(6×2=12)

PART C

Short essay questions

III. Answer any four questions. Each question carries 4 marks.

19. What are operators? What is a Hamiltonian operator?
20. Explain the quantum theory of Raman spectroscopy.
21. Calculate the number of normal modes of vibration for H₂O and CO₂ molecule.
22. Explain spin spin splitting and coupling constant.

23. Sketch and discuss the NMR spectrum of high resolution PMR spectrum of acidified ethanol.
24. Draw and discuss Jablonski diagram.

(4×4=16)

PART D

Long essay type questions

IV. Answer any two questions. Each question carries 12 marks.

25. Derive the expression for energy of a particle moving in a one dimensional box. Show the quantization of energy levels using an energy level diagram.
26. Explain a) Failure of classical mechanics b) Postulates of quantum mechanics c) Quantum numbers
27. Explain a) Mutual exclusion principle b) Polarisability c) Overtones and hot bands
28. Explain the principle of NMR spectroscopy.

(2×12=24)