23108088

QP CODE: 23108088

Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) SPECIAL SUPPLEMENTARY EXAMINATIONS, APRIL 2023

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

2020 Admission Only

D1F28098

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

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

1. In terms of the Bohr atom model, find the energy of first orbit of He^+ ion.
2. What is meant by a Hermitian operator?
3. Give the physical origin of quantization of energy for a particle confined to moving inside a one-dimensional box.
4. What are the permitted values of quantum number m_l for angular momentum quantum number l = 2?
5. What is the basic assumption involved in the Born-Oppenheimer approximation?
6. What is the wavenumber of radiation used by an FM radio transmitter broadcasting at 90 MHz.
7. Which electromagnetic region has energy corresponding to the energy gap between consecutive rotational energy levels?
8. Give the selection rules governing the transition between vibrational energy levels.
9. Give the difference between singlet and triplet states.
10. What is a bathochromic shift?
11. Give the structure of the reference compound used as standard in the NMR spectroscopy.
12. What is meant by the term 'spin flipping'?

(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) 200 nm (ultraviolet) (b) 150 pm (X-ray).

14. Find the de Broglie wavelength of (a) a 50 g golf ball with a velocity 30 ms^{-1}, and (b) an electron with a velocity o 10^7 ms^{-1}.

15. Discuss the significance of radial and angular part of the wavefunction of a hydrogenic atom.

16. Summarize the important features of MO theory.

17. Discuss the factors on which the vibrational stretching frequency of diatomic molecules depend.

18. What is the finger print region? Discuss its significance in the spectral study of organic compounds.

19. Explain the differences between Stokes and anti-Stokes lines in rotational Raman Spectroscopy.

20. Explain the term chemical shift. How is it expressed?

21. Explain the origin of hyperfine structure in the ESR absorptions. Give the ESR spectrum of methyl radical.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Discuss the postulates of quantum mechanics.

23. Discuss the important features of MO theory and LCAO method. Illustrate the formation of the σ, σ^*, π and π^* – MO's.

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 m_u and 34.969 m_u, respectively)

25. Discuss the basic principles of the Raman spectroscopy, and summarise its important applications.

(2×10=20)