QP CODE: 21101582

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Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) SPECIAL SUPPLEMENTARY EXAMINATION, JULY 2021

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

2018 Admission Only

6A76E00C

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

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

1. What would be the wavelength of a moving particle if its velocity is doubled?
2. Give the significance of linear operators in quantum mechanics.
3. List the quantum numbers that needed to specify an atomic orbital.
4. What are the permitted values of quantum number l for a principal quantum number n = 4?
5. Comment on the symmetry of MO formed by the combination of two 1s atomic orbitals.
6. Give the relationship between the energy of a radiation with its (a) frequency (b) wavelength.
7. Name the region of electromagnetic radiation used for electronic transitions.
8. In terms of vibrational spectroscopy, define the zero point energy.
9. What is a polarisability ellipsoid?
10. Arrange Rayleigh , Stokes, Anti-Stokes scattering in the increasing order of intensity.
11. Tuning of energy levels is a unique characteristic of NMR spectroscopy. Validate the statement.
12. The ESR spectroscopy is generally less applicable than the NMR spectroscopy. Give reason.

(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. What is the Photoelectric effect? Briefly describe the important experimental results of the photoelectric effect.
15. Briefly describe the important postulates of quantum mechanics.

16. Pictorially represent and discuss, in terms of LCAO method, the combination of two 1s atomic orbitals.
17. Discuss the factors on which the vibrational stretching frequency of diatomic molecules depend?
18. State the ways in which the IR spectrum of CO2 differs from that of NO2.
19. Define the term molal extinction coefficient. A sample of pathlength 2 cm transmits 40% incident light. Find the concentration of the solution, given that ε = 6000 dm3/mol/cm.
20. TMS has several advantages over other substances which have been used as the NMR standards. Substantiate the statement.
21. Discuss the factors that affect chemical shifts in NMR spectroscopy.

(6×5=30)

Part C

*Answer any **two** questions.*

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

22 (a) Solve Schrodinger equation for particle in one-dimensional box with the potential energy value zero inside the box and obtain the expressions for normalized wavefunction and energy.

(b) Calculate the wavelength of light that will be absorbed when a p electron in hexa-1,3,5-triene is promoted from the highest occupied level to the lowest unoccupied level. The average C-C bond length in hexatriene can be taken as 144 pm.

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) Discuss the principle of microwave spectroscopy.
(b) The pure rotational spectrum of gaseous HCl consists of a series of equally spaced lines separated by 20.80 cm-1. Calculate the bond length of HCl. (The atomic mass of Hydrogen = 1.008 g mol-1and that of Chlorine = 35.5 gmol-1)

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)