QP CODE: 24028956

24028956

Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) REGULAR / REAPPEARANCE EXAMINATIONS, OCTOBER 2024

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

2017 Admission Onwards

855FAF82

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, specify the ratio of radii of first three orbits of hydrogen atom.
2. Write the expression for the Laplacian operator.
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 = 3?
5. Construct the Hamiltonian for the hydrogen molecule-ion by applying the Born-Oppenheimer approximation.
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. Stokes lines are much more intense than Anti-stokes lines.Give reason.
10. What is a chromophore?
11. How is the magnitude of the nuclear magnetic moment of a nucleus related to its spin quantum number?
12. What is meant by the term 'spin flipping'?

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. A sodium lamp emits yellow light (550 nm). How many photons does emit each second if its power is (a) 1.0 W, (b) 100 W?

14. Write a note on the wave-particle duality of electron.

15. What are well-behaved functions? Describe and justify the Born interpretation of the wavefunction.

16. Pictorially represent and discuss, in terms of LCAO method, the combination of two 1s atomic orbitals.

17. In vibrational spectroscopy, How does an overtone differ from the fundamental?

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

19. Explain the Franck-Condon principle, in the context of electronic spectroscopy.

20. Explain the nuclear shielding and the deshielding as applied to the NMR spectroscopy.

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. (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. Discuss the principle and applications of microwave spectroscopy.

25. (a) Compare and contrast pure vibrational spectroscopy and pure Raman vibrational spectroscopy.
(b) Outline the advantages and limitations of Raman spectroscopy over other spectroscopic techniques.

(2×10=20)