TB205130V **Reg. No :.....**

Name :.....

B. Sc. DEGREE (C.B.C.S.) EXAMINATION, NOVEMBER 2022

2020 ADMISSIONS REGULAR AND 2019, 2018 ADMISSIONS SUPPLEMENTARY

SEMESTER V - CORE COURSE (CHEMISTRY)

CH5B08B18 - PHYSICAL CHEMISTRY – II

Time : 3 Hours **Maximum Marks : 60**

Part A

I. Answer any Ten questions. Each question carries 1 marks **(10x1=10)**

1. Give schematic representation of an ideal black body.
2. State and give mathematical representation of Heisenberg's Uncertainity principle.
3. Explain the orthogonality condition of wave functions.
4. Define zero point energy of a particle in a one-dimensional box system.
5. Define orthonormality condition of wave function.
6. List the essential condition for a vibration or rotation to be Raman active.
7. List the region of the electromagnetic radiation where vibrational transitions occur.
8. In the spectrum of HBr is a series of lines having a separation of 16.94cm^{-1}. Calculate the moment of inertia and the internuclear separation in HBr.
9. Order the following according to the increase in energy: UV, IR, microwave, visible.
10. Describe Larmor precession frequency.
11. List any two examples of standards used in EPR spectroscopy.
12. List the requirements for molecules to show ESR Spectroscopy? Identify electromagnetic radiation used to induce transition in ESR spectroscopy.

Part B

II. Answer any Six questions. Each question carries 5 marks **(6x5=30)**

13. Explain the dual nature of electrons.
14. Explain the origin of hydrogen spectrum. Calculate the wavelength of the radiation emitted when the electron in the hydrogen atom is excited to the 5th energy level returns to the 2nd energy level.In which part of the electromagnetic spectrum does this line lie? (Rydberg constant = 1.097 X 10^7 m^{-1})
15. Discuss the criteria for the formation of Molecular orbitals from Atomic orbitals? Distinguish between Bonding MO and Antibonding MO.
16. Explain the application of Schrodinger equation to Hydrogen atom.
17. Discuss briefly the selection rules in microwave spectroscopy.
18. Describe how you will show the presence of intramolecular hydrogen bonding in o-hydroxy benzaldehyde.
19. The bond length in HBr is 141 pm. Calculate the wavenumber in cm^{-1} for the transition J=0 to J=1 for this molecule. [Atomic mass: H = 1.008 × 10^{-3} kg mol^{-1}; Br = 79.909 × 10^{-3} kg mol^{-1}.]
20. Distinguish between the two isomers of C_2H_6O using NMR spectroscopy.
21. Calculate the ESR frequency of an unpaired electron in a magnetic field of 0.33 T, given that for a free electron g value is 2.

Part C

III. Answer any Two questions. Each question carries 10 marks **(2x10=20)**

22. a)On the basis of MO theory arrange the following molecules in the increasing order of their bond order and bond length. O_2, O_2^+ , O_2^-, O_2^{2-} .
    b)With the aid of suitable example, illustrate the application of particle in a box model.
23. Explain Stokes and anti-Stokes lines.
24. a) If the force constant of HI is 283.4 Nm^{-1}, calculate the fundamental vibrational frequency in cm^{-1}.
    b) List the normal modes of vibration in water and explain how many of them are IR active.
25. Discuss the various applications of electronic spectroscopy.