TB245421K

Reg. No :.....

Name :.....

BACHELOR'S DEGREE (C.B.C.S) EXAMINATION, NOVEMBER 2024

2022 ADMISSIONS REGULAR

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. Calculate the minimum energy that the photon must possess to eject an electron from potassium metal.The threshold frequency of potassium is $5 \times 10^{14}\ s^{-1}$.
3. Define zero point energy of a particle in a one-dimensional box system.
4. Calculate the maximum number of orbitals in the shell n=3.
5. On the basis of Molecular orbital theory predict the magnetic behaviour of F_2 molecule.
6. A typical ultraviolet wavelength is 2000 Å. Calculate the frequency, wavenumber and energy.
7. Predict which among the following shows the highest stretching frequency:

   C≡C C=C C−C
8. Order the following according to the increase in energy: UV, IR, microwave, visible.
9. Describe force constant. Give its relation with bond order and bond length.
10. Predict the number of peaks in the proton NMR spectrum of $CH_2Cl\text{-}CHCl_2$.
11. Give the resonance condition in EPR Spectroscopy.
12. Describe Larmor precession frequency.

Part B

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

13. Give a detailed account of Compton effect.Give its schematic representation.
14. The threshold wavelength of a metal is 6800 Å .Calculate its threshold frequency and work function.Also calculate the kinetic energy of the photoelectron ejected when light of wavelength 5000 Å falls on the surface of the metal.
15. Explain the application of Schrodinger equation to Hydrogen atom.
16. Explain the formation of Bonding and antibonding molecular orbitals.Distinguish between bonding and antibonding MO.
17. Differentiate between fingerprint region and functional group region in an IR spectrum.
18. Explain the term hot bands with regard to vibrational spectroscopy. How can hot bands be distinguished from fundamental and overtones.
19. Explain why anti-Stokes lines are less intense than Stokes line in Raman spectrum.
20. Explain Hyperfine splitting in ESR Spectroscopy. With the aid of example illustrate hyperfine splitting in ESR spectrum of a molecule.
21. Sketch and explain the ESR spectrum of methyl radical.

Part C

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

22. Explain quantum numbers and its significance.

23. a) Explain what would be the ideal source to use for measuring Raman spectra.

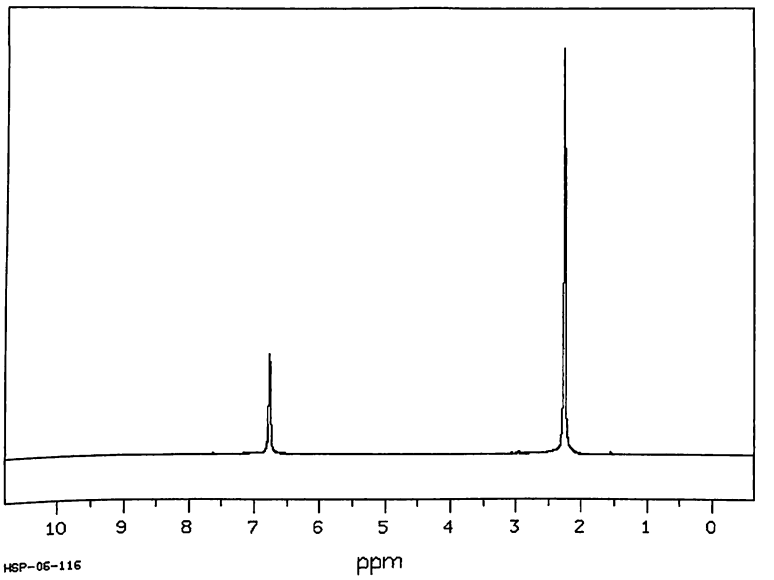
    b) The molecule carbon tetrachloride (CCl_4) has three Raman-active absorptions that occur at 218, 314 and 459 cm^{-1} away from the laser line. Sketch a representation of the Raman spectrum of CCl_4 that includes both the Stokes and anti-Stokes lines.

24. a) Calculate the wavenumber shift for the vibrational mode of Cl_2, given that the force constant k for the bond is 3.23 N cm^{-1}.

    b) Explain why the major constituents of air doesnot absorb infrared radiation.

    c) The greenhouse effect is the process by which radiation from a planet's atmosphere warms the planet's surface to a temperature above what it would be without this atmosphere. Explain why methane and carbondioxide are called green house gases.

25. a) A molecule gives the following proton NMR spectrum (a 9 proton singlet at δ 2.2 ppm and 3 proton singlet at δ 6.9 ppm). Its molecular formula is C_9H_{12}. Find the structure of the molecule.



    b) Explain magnetic anisotropy with an example.