Date:

Registration number:

ST. JOSEPH'S COLLEGE (AUTONOMOUS), BENGALURU-27
B.Sc BIOCHEMISTRY - IV SEMESTER
SEMESTER EXAMINATION: April 2022
(Examination conducted in July 2022)

BCH420 – Analytical techniques in Chemistry-1

Time- 1.5 hrs Max Marks-35

This question paper contains two printed pages and four parts

PART- A

Answer any 8 questions out of 10 8 x 1 = 08

1. State Stark-Einstein's law of photochemical equivalence.
2. Distinguish between crystalline and amorphous solids with respect to their melting points?
3. Give the significance of calculating the index of hydrogen deficiency of an organic compound.
4. Write the parameters of the orthorhombic unit cell.
5. Define an auxochrome.
6. What is Fermi resonance?
7. Draw a cube and mark the (011) plane.
8. Why TMS is used as an internal standard in NMR spectroscopy?
9. State the law of constancy of symmetry.
10. Name any one soft ionization technique being used in Mass spectrometry.

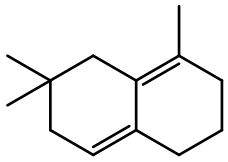
PART- B

Answer any 5 questions out of 7 5 x 2 = 10

11. Calculate the quantum yield for the reaction

$$2HBr \xrightarrow{h\nu} H_2 + Br_2$$

12. Calculate the energy of a photon of wavelength 500nm.
(Given: h = 6.626 X 10^{-34} J s and c = 3 X10^{8} ms^{-1})
13. Using Woodward-Fieser rules calculate the λ_{max} for the following compound

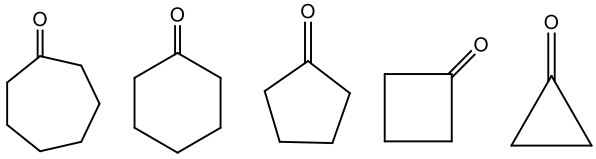


14. Calculate the degree of freedom for CO_2 molecule.
15. Calculate the inter-planar distance of 100 plane, in a cube whose length is 'a'.
16. How many signals would you observe for each of the following molecules in a proton NMR spectrum?
    (i) CH_3-CH_2-CH_2-Cl
    (ii) Br-CH_2-CH-Cl
17. Explain shielding and deshielding effect taking ethyl chloride CH_3-CH_2-Cl as an example?

PART- C

Answer any 4 questions out of 6 4 x 3 = 12

18. Give a self-explanatory Jablonski diagram.
19. Calculate the molecular formula of a compound with molar mass 94 amu and suggest a structure.
20. Draw the pictorial representation showing the 2 fold axis of symmetry and a 4 fold axis of symmetry in a cube. Give the total number of each type.
21. Taking ethene and 1,3-butadiene as examples explain the effect of conjugation on λ_{max}.
22. Arrange the following molecules in increasing order of the stretching frequency of their carbonyl groups. Justify your order.



(a) (b) (c) (d) (e)

23. Using a suitable example explain McLafferty rearrangement?

PART- D

Answer any 1 questions out of 2 1 x 5 = 05

24. a) Answer the following questions with respect to a simple cube
    - i) Calculate the number of particles per unit cell in a simple cube.
    - ii) If 2 additional particles are added to the centre of the opposite faces of the cube, what would be the total number of particles?
    - iii) If there is one particle at the centre of each edge of the cube, calculate the number of particles per unit cell
    - iv) If all the corners are occupied by A and both the particles at the centre of the opposite faces are B, what is the formula of the crystal?

    (b) Why X-rays are chosen for the study of the crystal structure? (4 + 1)

24. A compound with molecular formula $C_{10}H_{12}O$, shows band near 1715 and 1600-1450 cm^{-1} in IR spectrum. The ^1H NMR is given. Deduce its structure.