Exam. Code : 107405
Subject Code : 1860

B.Sc. Biotechnology 5th Semester

PHYSICAL, ORGANIC & INORGANIC ASPECTS OF SPECTROSCOPY-A

Paper—BT-7

Time Allowed—Three Hours] [Maximum Marks—40

SECTION—A

Note :—ALL questions in this section are compulsory and each question is of **1** mark.

1. Calculate the frequency of radiations having an energy of 1.6×10^{-19} Joules. 1
2. Using IR spectroscopy how will you distinguish between an aliphatic aldehyde and an aliphatic ketone ? 1
3. Why is absorption and not emission spectroscopy used to study the spectra of organic compounds ? 1
4. What is the effect of hydrogen bonding on ultraviolet absorption ? 1
5. What is force-constant ? 1
6. Using IR spectroscopy how will you distinguish between a cis olefin and a trans olefin ? 1

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7. What is fluorescence ? How it is different from Phosphorescence ? 1
8. Describe the effect of ring size on the IR absorption of carbonyl group of cyclo-ketones. 1

SECTION—B

Note :— Attempt any **FIVE** questions from this section. Each question is of **4** marks.

9. How many fundamental vibrational frequencies would you expect to observe in the IR spectrum of CO_2 ? 4
10. Distinguish between the following pairs of compounds with the help of IR spectroscopy :
    (i) Propanol from Propanone 1
    (ii) Ethanol from Ethyl amine 1
    (iii) Aniline from N-methyl aniline 1
    (iv) Acetone from acetylene. 1
11. What is Born-Oppenheimer approximation ? How it is different from Frank-Condon principle ? 4
12. Several ionic crystals such as KBr and NaCl etc. are transparent to ultraviolet regions, but are never used in these regions. Why ? 4

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13. Aniline absorbs at 280 nm (ε_{max} 8600) but in acidic solution the main absorption band is seen at 203 nm (ε_{max} 7500) which is comparable to benzene. Explain. 4

14. (i) Why water can not be used as a solvent in IR spectroscopy ? 2

    (ii) Why methyl alcohol is a good solvent for UV and not for IR determination ? 2

15. What type of transitions are observed in case of α, β-unsaturated carbonyl compounds ? How absorption maximum and intensity are shifted when carbonyl group is not conjugated ? 4

16. What do you mean by a good solvent in UV spectroscopy ? What is the effect of solvent on absorption maximum in case of π to π* transitions of conjugate olefins as well as conjugated carbonyl compounds ? 4

SECTION—C

Note :—Do any **TWO** questions from this section. Each question is of **6** marks.

17. A conjugated diene absorbs at a higher wavelength with higher value of extinction co-efficient as compared to a diene in which double bonds are isolated. Explain giving examples and the chemistry involved. 6

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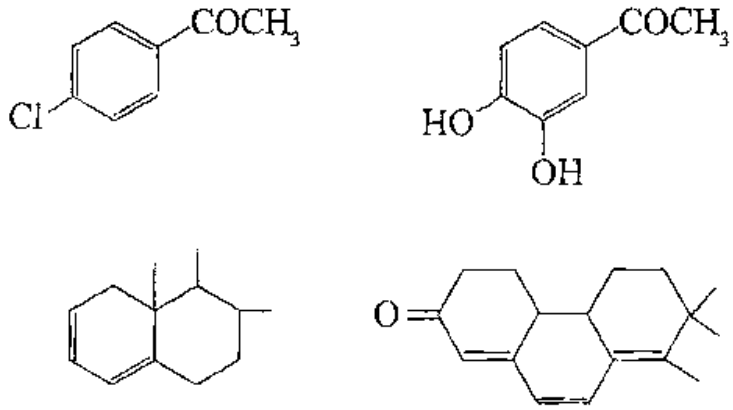
18. Using Woodward Fieser rules calculate the λ_{max} for the following :



1.5+1.5+1.5+1.5

19. Discuss at least three types of groups for which the study of fingerprint region is most essential in IR spectroscopy. 6

20. (i) Discuss with examples the inductive and the mesomeric effects influencing the carbonyl absorption frequency. 4

    (ii) Write the expected IR peaks for p-nitrophenol and p-nitrobenzoic acid. 2

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