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M.Sc. (Second Semester)
EXAMINATION, MAY-JUNE, 2022
CHEMISTRY
Paper Fourth (CH-10)
(Theory and Application of Spectroscopy- II)

Time : Three Hours] *[Maximum Marks:80*

[Minimum Pass Marks:16

Note: Attempt all sections as directed.

Section-A

(Objectives/Multiple Choice Questions)

(1 mark each)

Note - Attempt all questions.

1. According to Beer's law, the slope of calibration curve is function of

   (A) Concentration

   (B) Wavelength

   (C) Molar absorptivity

   (D) None of these

2. Hyperchromic shift is due to

   (A) Shift in $\lambda \max$ towards shorter values

   (B) Shift in $\lambda \max$ towards longer values

   (C) Increase in absorptivity

   (D) Decrease in absorptivity

3. In Job's method experiment, if the maxima corresponds to mole fraction of metal as 0.33, then the composition of complex in terms of M:L is

   (A) 1:2

   (B) 2:1

   (C) 1:1

   (D) 1:3

4. Incorporation of auxochrome in a molecule containing a chromophoric group results in -

   (A) Diminishing of colour

   (B) Intensification of signal

   (C) Shifting of signal

   (D) No effect on signal

5. According to Frank-Condon principle, the electronic transition is

   (A) Slower than vibrational transition

   (B) Equal speed as that of vibrational transition

   (C) Very fast as compared to vibrational transition

   (D) No relation with vibrational transition

6. Important feature of nephelometry is that

(A) It deals with absorbed light

(B) It deals with scattered light

(C) It deals with transmitted light

(D) It deals with reflected light

7. The SEM technique gives information about

(A) Quantitative analysis

(B) Qualitative detection

(C) Surface area

(D) Surface morphology

8. The transition of electron from S1 state to T1 state can be classified as

(A) Internal conversion

(B) Intersystem crossing

(C) Fluorescence

(D) Phosphosphrescence

9. The Oxygen molecule in ground state is

(A) Singlet

(B) Quatruplet

(C) Doublet

(D) Triplet

10. Which of the following is spin allowed transition?

(A) Fluorescence

(B) Phosphorescence

(C) Intersystem crossing

(D) Spin inversion

11. In mass spectroscopy, the peak position depends on

(A) Mass of ion

(B) Charge on ion

(C) Mass as well as charge on ion

(D) None of these

12. An aromatic compound containing benzyl group when analyzed by mass spectrometry gives intense peak at m/z value of

(A) 53

(B) 68

(C) 113

(D) 93

13. In mass spectrum, the peak with highest intensity is

(A) Molecular peak

(B) Base peak

(C) Fundamental peak

(D) Overtone peak

14. In GC-MS, the function of MS is

(A) Source of radiation

(B) Separation of components

(C) Detector

(D) Multiplier

15. According to Nitrogen Rule, a compound with mass number 123 containing only carbon, hydrogen and nitrogen as

(A) Odd number of nitrogen atoms

(B) Even number of nitrogen atoms

(C) Equal number of C and N atoms

(D) Equal number of C and H atoms

16. The number of peaks in NMR spectrum of 1,1,2-trichloroethene is/are

(A) 1

(B) 2

(C) 3

(D) 4

17. Which of the following compounds will show anisotropic effect in NMR Spectrum?

(A) Acetylene

(B) Benzene

(C) Ethylene

(D) All of these

18. The number of peaks observed in proton NMR of toluene are

(A) 1

(B) 2

(C) 3

(D) 4

19. With increase in field strength of NMR spectrometer, the value of J is

(A) Increased

(B) Decreased

(C) Unaffected

(D) Unpredictable

20. Shielding effect leads to

(A) Increase in delta value

(B) Decrease in delta value

(C) Decrease in tau value

(D) No change in delta value

Section- B

(2 marks each)

(Very Short Answer Type Questions)

Note:- Attempt all questions.

1. Explain the principle of Job's method of continuous variation.
2. Draw the shape of molecular orbital of O_2 molecule that contains two unpaired electrons.
3. Give principle of turbidimetry.

4. Draw Jablonski diagram showing various transitions.
5. Write short note on McLafferty rearrangement.
6. What is meant by resolution in Mass Spectrometry?
7. Define coupling constant and give its unit.
8. Calculate the value of chemical shift on delta scale that is obtained at 300 Hz on NMR spectrometer of 60MHz.

Section C

(Short Answer Type Questions)

(3 marks each)

Note : Attempt all questions.

1. Explain Colour-composition theory and define chromophore and auxochrome.
2. Explain Job's method for determination of stability constant.
3. How is fluorescence radiation filtered in a phosphorimeter? Explain with diagram.
4. Explain the term fluorescence quenching with example.
5. Explain various factors affecting fragmentation pattern in mass spectroscopy.
6. Draw schematic diagram of GC-MS instrument.
7. Explain the effect of hydrogen bonding on NMR spectrum with example.
8. Compare H-1 and C-13 NMR spectroscopies.

Section D

(Long Answer Type Questions)

(5 marks each)

Note : Attempt all questions in about 150 words.

1. Explain various applications of electronic spectroscopy.

OR

Explain appearance of vibrational rotational fine structure of electronic spectrum.

2. Explain principle and instrumentation involved in Scanning Electron Microscopy.

OR

Explain the conditions of light scattering. Explain principle and working in turbidimetry.

3. Explain instrumentation in Mass spectrometry with suitable diagram.

OR

Explain the method of interpretation of molecular structure on the basis of mass spectrum with suitable example.

4. Explain why TMS is used in PMR spectroscopy as a reference.

OR

Explain interpretation of NMR spectrum on the basis of number, position and splitting of signals.