6 SEM TDC CHM M 7

2015

(May)

CHEMISTRY

(Major)

Course : 607

(Spectroscopy)

Full Marks : 48
Pass Marks : 19

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct option : 1×5=5

(a) The radiation in the wavelength range 400 nm–800 nm corresponds to

(i) ultraviolet

(ii) infrared

(iii) visible

(iv) far IR

(Turn Over)

(b) In order to be microwave active

(i) the molecule must have permanent dipole moment

(ii) the dipole moment of the molecule must change during vibration

(iii) the polarizability of the molecule must change during vibration

(iv) None of the above

(c) The multiplicity of the signals in $CH_3CH_2OCH_2CH_3$ in NMR spectrum is

(i) two triplets

(ii) a triplet and a quartet

(iii) two singlets

(iv) two singlets and two triplets

(d) Which of the following solvents cannot be used in NMR spectroscopy?

(i) CCl_4

(ii) CS_2

(iii) $CHCl_3$

(iv) $(CCl_3)_2C=O$

(Continued)

(e) In infrared spectroscopy, the pair of isomers which cannot be distinguished are

(i) *cis-trans* isomers

(ii) functional isomers

(iii) enantiomers

(iv) position isomers

2. Answer any *five* of the following : 2×5=10

(a) The nuclei like ^{12}C and ^{16}C do not exhibit NMR spectra. Explain.

(b) Cu^+ ion does not show ESR spectra but Cu^{2+} ion shows EMR spectra. Why?

(c) Explain why the intensities of Stokes lines are different from that of anti-Stokes lines.

(d) What do you mean by a good solvent in UV spectroscopy and what is its effect on absorption maximum?

(e) What do you mean by fundamental vibrations and overtones?

(f) What is mutual exclusion principle? Explain with examples.

(Turn Over)

UNIT—I

3. *(a)* Discuss the effect of isotopic substitution on the rotational spectra of a diatomic molecule. 3

(b) Calculate the moment of inertia of a diatomic molecule whose internuclear distance is 150 pm and reduced mass is $1 \cdot 5 \times 10^{27}$ kg. 2

UNIT—II

4. *(a)* Show that the frequency of the absorbed radiation in pure vibrational spectra is equal to the fundamental frequency of vibration ν_0 of the molecule. 3

Or

$K^{39}Cl^{35}$ has an intense line at 278 cm^{-1} in infrared spectrum. Calculate the force constant of the molecule.

(b) Roughly sketch the fundamental vibrations of H_2O molecule. Show how many of them are infrared-active and how many of them are Raman-active.

(c) Discuss Fermi resonance with one example.

UNIT—III

5. *(a)* Discuss the quantum mechanical explanation of Raman effect. 3

(b) Discuss about the rotational Raman spectrum in linear molecule. 3

Or

A substance shows a Raman line at 45 68 Å when the exciting line 4332 Å is used. Calculate the wavelengths of Stokes and anti-Stokes lines for the same substance when the exciting line 4036 Å is used.

(c) Write any one difference between Raman spectra and Infrared spectra. 1

UNIT—IV

6. *(a)* Discuss various types of electronic transition with examples. 4

(b) Explain the effects of change of solvents on $n \rightarrow \pi^*$ and $\pi \rightarrow \pi^*$ transitions. 2

Or

Write the selection rules for electronic transitions.

UNIT—V

7. (a) Discuss briefly the principle of NMR spectroscopy. 4

Or

What is chemical shift in NMR spectroscopy? Mention the factors that affect chemical shift. 2+2=4

(b) Draw the high resolution NMR spectra of 1,2-dichloropropane and 1,3-dichloropropane. 1½+1½=3

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