**S.T.E.T WOMEN’S COLLEGE MANNARGUDI**

**DEPARTMENT OF CHEMISTRY**

**PHYSICAL METHODS IN CHEMISTRY-II**

**2 MARKS**

1. **Briefly explain raman scattering?**

If a monochromatic radiation is passed through a substance ,a small amount of radiation energy is scattered. The scattered energy consists of radiation of incident frequency called raman scattering and also of discrete frequencies above and below the incident beam, called raman scattering.

1. **Define stoke’s and Antistokes radiation?**

Radiation scattered with a frequency lower than that of the incident beam is called stoke’s radiation and that with higher frequency is called antistoke’s radiation is generally more intense than antistoke’s radiation.

1. **What is rayieigh scattering?**

It is defined as the scattering of radiation without any change in frequency.

1. **Distinguish the raman spectra and IR spectra?**

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| **IR SPECTRA** | **RAMAN SPECTRA** |
| 1. IT is due to absorption of a radiation by the vibrating molecules. | 1. It is due to the scattering of radiation by the vibrating molecules. |
| 2. The dipole moment of the molecule changes. | 2. The polarisability of the molecule changes. |
| 3. Water cannot be used asit is opaque to IR. | 3. Water can be used as solvent. |

1. **Explain the intensity of raman lines?**

The intensity of raman lines depends upon the frequency of incident radiation. Stoke’s lines are usually stronger than the antistoke’s lines. The reason is that at room temperature, the higher levels are populated than the lower levels.

1. **Write two advantage of raman spectroscopy?**

Raman spectrum is not interfered by the presence of moisture or water in the sample whereas IR spectrum is affected by the presence of water in the sample.

Raman spectra can be obtained clearly in the gaseous, liquid and solid of the compound.

1. **Define microwave active?**

A molecule such as hydrogen chloride in which one atom carries a permanent net positive charge and that the other a net negative charge, is said to have a permanent electric dipole moment.all molecules having a permanent moment are said to be microwave active.

1. **Write a short note on raman spectroscopy?**

When the is irradiated with a monochromatic light of definite frequency , the light at right angles to the incident light contains lines of a) incident frequency.b) also of lower frequency.

Sometimes lines of higher frequency are also obtained.the lines with lower frequency are called stoke’s lines, also the lines with higher frequency are called antistroke’s lines. The line with the incident light is called Rayleigh line.

1. **Applications of raman spectroscopy?**

Raman spectroscopy is a simpler technique and has many advantages over infra red spectroscopy. It is a valuable method for directiy detecting the frequencies of irinactive vibrations.

It helps in studying the structures of molecules and also the structural changes which occur due to association, dissocation and salvation. This technique is also useful is studying the kinetics of fast reactions.

It is quite significant in biological studies since interferences, due to the presence of water are insignificant.

1. **Write the selection rule for raman spectrum?**

For the transistion probability of raman effect ,the molecule must show a change of polarisability along the internuclear axis.

1. **What is meant by mutual exclusion principle?**

In a molecule which has a centre of symmetry, the raman active vibrations are infra red inactive and vice-versa. A linear molecule in which centre of symmetry is absent can simultaneously be IR as well as raman active.

1. **Write the selection rules for pure rotational raman spectra of diatomic molecules and pure vibrational raman spectra of diatomic molecules?**

The selection rules for the pure rotational raman spectra of diatomic molecules are

∆J=0,±2

The selection rules for pure vibrational spectra are

∆α≠0, it means that raman spectrum is due to change in the polarizability along the internuclear axis.

The second selection rule is∆v=±1,±2,±3,.....

1. **Explain the structure of N2O using raman spectroscopy.**

Structure of N2 O; if N2O is symmetrical like CO2 one should expect similar behaviour as seen in carbon di oxide. If it is unsymmetrical as N-N-0, the vibration should be active both in infrared as well as raman.

1. **Explain in brief the rule of mutual exclusion?**

The rule states that if a molecule has a centre of symmetry , then raman active radiations are IR- inactive and vice versa. If the is no centre of symmetry, then some vibrations may be both raman as well as IR inactive.

1. **What is meant by raman spectra?**

Raman spectra can be obtained for a compound in all the three states but infra red specrum is quite diffused in the liquid and the solid state of matter and is not useful.

1. **Define mass spectroscopy?**

In mass spectroscopy the vapours of the substance are bombarded with energetic electrons.

The molecular ion and fragment ions are formed which are separated according to their m/e ratio.

Mass spectrum of a substance is a plot between m/e volues of the ions versus relative abundance.

1. **What do you mean by the base peak?**

The most intense or the abundant peak in the mass spectrum of the compound is called the peak.

1. **Descrite the importance of metastable peaks?**

The metastable peaks in the mass spectrum gretly contribute in structure elucidation.

From the position of the parent ion and the daughter ion, the position of the metastable ion is calculated and confirmed in the spectrum under examination.

Metastable peaks are broadened and less intense.

The most likely reason for this is that some of the excitation energy leading to bond capture may be converted into additional kinetic energy.

1. **What is mc lafferty rearrangement?**

The loss of an alkenefragment by a cyclic rearrangement of a carbonyl compound with ﻻ-hydrogen is termed as mc laffert rearrangement.

1. **What is meant by cotton effect?**

The combination of circular dichorism and circular birefringence is called cotton effect.

CE=CD+CB

1. **What is meant by circular dichorism [cd]?**

The plans polarized light passing through a dissymmetric medium becomes elliptically polarized.

This phenomenon is known as ciculardichorism.

1. **What are the factors affecting the g- value?**

The value of g is affected due to the complete removal of orbital degeneracy

The g-value is affected by Jahn –Teller distortion, because the orbital degeneracy is destroyed by the distortion.

1. **What meant Mc Connell equation?**

The unpaired π-electron dencity of an atom to which the hydrogen is bonded can be calculated by Mc Connell equation

AH =Qρπ

Ρπ= AH/Q

1. **Application of ESR spectroscopy?**

Study of free radicals.

Study of reaction velocities(or) pr

Study of role of electron exchange reactions .

Biological applications

1. **What is meant by octant rule? And its application?**

It is an empirical rule.

Permits are to deduce the sige of the cotton effect forconsiderable number of compounds form tgeir structure, configuration and conformation.

The compoundto be considered is oriented in a three dimensional co-ordinate system.

**Application:**

The substituent’s in upper (Ro) and lower left [L1] octant make a negative contribution.

Substituent as C4 make no cotton effect or contribution.

1. **Hyperfine splitting**

There is magnetic interaction between the electronic spin ‘S’ and nuclear spin ‘I’ in a molecule. It causes the splitting of ESR signal into (2J+D) signals. This is known as hyperfine splitting

Selection rule for hyperfine splitting

∆Ms=±1,

∆MI=0.

1. **Optical rotator dispersion curve?**

The plot of optical rotation (α)versus wavelength (λ) is called ORD curve.

The study of observing the change of optical rotation with wavelength is known as optical rotator dispersion.[ORD].

1. **What is axial haloketone rule?**

It states that the effect of introduction of an axial chlorine, bromine or iodine atom nextto the keto group of a cyclohexanone may effect the sige of the cotton effect of the parent ketone.

1. **Difference b/w NMR and ESR.**

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| **NMR** | **ESR** |
| 1. The magnetic moment of the proton is small | 1. The magnetic moment of an unpaired electron is about 700 times then that at proton. The sensitivity of ESR detection is much more higher then that of NMR. |
| 2. The energy necessary to induce transition between levels corresponding to the radio wave frequency region. | 2. The energy necessary to induce spin transitions corresponding to the microwave region. |

1. **What is meant by positive cotton effect?**

In analmour curve peaks is at a higher wavelength then the through. The cotton effect is called positive cotton effect.

1. **What is meant by negative effect?**

In analmour curve , the through is at a higher wavelength than the peak. The cotton effect is negative cotton effect.

1. **What is means by important features in mass spectroscopy?**

Mass spectrometer gives a record of the relative abundance of ions according to m/e ratio.

Molecular ion peak is generally visible in case of alcohals

A peak corresponding to the ion of maximum abundance is called the base peak

1. **Give the typical fragmentation pattern in benzyl methyl ether?**

Berzyl methyl fragments by the loss of methoxy radicals to give benzyl cation which rearranges to more stable tropyliumcation. Thus the peak due to this is the bare peak. It further fragment to give a peak at m/e 65 due to C6H5+

1. **What is meant by nitrogen rule?**

It states a molecule of even numbered molecular mass must contain no nitrogen atom or an even number of nitrogen atoms. an add numbered molecular mass requires an odd number of nitrogen satoms.

1. **What is meant by ratio Diels – Alder reactions?**

It involves the cleavage of two bonds of a cyclic system resulting in the formation of two stable unsaturated fragments in which two new bonds are formed. The process is not accompanied by any hydrogen transfer rearrangement.