G.T.N. ARTS COLLEGE (AUTONOMOUS)

(Affiliated to Madurai Kamaraj University || Accredited with 'B' Grade by NAAC)

END SEMESTER EXAMINATION - APRIL - 2021

(UNDER OUTCOME BASED EDUCATION (OBE) PATTERN)

Programme : M.Sc. Physics
Course Code : 20PPHC24
Course Title : Molecular Spectroscopy

Date : 24.06.2021
Time : 10:00 AM - 1:00 PM
Max. Marks : 100

Q. No.	SECTION - A (20 * 1 = 20 Marks) Answer ALL Questions	CO(s)	K - Level
1.	A specific electromagnetic wave has a frequency greater than visible light. The wavelength of this wave is longer than that of X-rays. This electromagnetic wave is… 1.a gamma wave 2.an infrared wave 3.a microwave 4.an ultraviolet wave	CO1	K1
2.	Which among the following has the maximum penetrating power? 1.Radio waves 2.Microwaves 3.Ultraviolet radiation 4.Gamma rays	CO1	K2
3.	During the motion, if the centre of gravity of molecule changes, the molecule possess _____ 1.Electronic energy 2.Rotational energy 3.Translational energy 4.Vibrational energy	CO1	K2
4.	What is the relation between velocity of light and wavelength? 1.$c = \upsilon/\lambda$ 2.$c = \upsilon \lambda$ 3.$c = \upsilon^2\lambda$ 4.$c = \upsilon^2/\lambda$	CO1	K1
5.	What is the source used in the microwave spectrometer? 1.Klystron 2.Globar filament 3.Nernst Glower 4.Fore optics	CO1	K1
6.	For prolate molecules, (A-B) K^2 is always --------? 1.zero 2.Positive 3.Negative 4.Infinity	CO1	K2
7.	In Symmetric Top molecule, what are the possible values of K? 1.+1, +2, ……+J 2.0, +1, +2,……. +J 3.-1, -2,……..-J 4.0, ±1,±2,……..±J	CO1	K1
8.	In rotational Raman spectrum, what is the selection rule for Absorption line? 1.$\Delta J = +1$ 2.$\Delta J = -1$ 3.$\Delta J = +2$ 4.$\Delta J = 0$	CO1	K2
9.	Which of the following is not a composition of Nernst glower or Nernst filament?	CO1	K1

	1.Oxides of Zirconium	2.Oxides of Barium		
	3.Oxides of Yitrium	4.Oxides of Thorium		
10.	Which of the following is not a technique for preparing solid samples in IR spectroscopy?		CO1	K1
	1.Solids run in solution	2.Mull technique		
	3.Solid films	4.Thin films		
11.	What is the selection rule for Vibrational spectroscopy for harmonic oscillator?		CO1	K2
	1.$\Delta v = 0$	2.$\Delta v = \pm 1$		
	3.$\Delta v = \pm 2$	4.$\Delta v = \pm 3$		
12.	Vibrational spectroscopy involves the transitions falling in the spectral range of _____		CO1	K2
	1.100-1000 cm^{-1}	2.300-3000 cm^{-1}		
	3.400-4000 cm^{-1}	4.500-5000 cm^{-1}		
13.	What is/are the main criterion/criteria for the molecule to be Raman active?		CO1	K1
	1.Change in the dipole moment	2.Permanent dipole moment		
	3.Change in Polarizability	4.All of the above		
14.	What is the Raman shift of the first stokes or anti-stokes line from the exciting line?		CO1	K1
	1.2B	2.4B		
	3.6B	4.8B		
15.	For a particular vibrational mode to appear in the Raman spectrum, what must change?		CO1	K1
	1.Frequency of radiation	2.Intensity of radiation		
	3.Molecule's shape	4.Molecule's polarizability		
16.	In Raman spectroscopy, the radiation lies in the _____		CO1	K1
	1.Microwave Region	2.Visible Region		
	3.UV Region	4.X-ray Region		
17.	When B′ > B″, the band head appears on the ------- branch		CO1	K1
	1.P	2.R		
	3.S	4.Q		
18.	When B′ > B″, what happens to the band head?		CO1	K1
	1.zero	2.shifts to high wave number		
	3.shifts to low wave number	4.none of the above		
19.	Which of the following is an application of electronic spectroscopy?		CO1	K1
	1.Detection of impurities	2.Control of purification		
	3.Study of kinetics of the chemical reaction	4.All of the mentioned		
20.	The bands in a particular column where v′ varies and v″ is constant are called -------		CO1	K1
	1.v″ Progressions	2.v′ progressions		
	3.sequences	4.none of the above		

Q. No.	SECTION - B (5 * 6 = 30 Marks)	CO(s)	K -

21. (a)	Discuss the various types of Molecular Energies with neat quantized energy level of a diatomic molecule.		CO1	K3
		[OR]		
(b)	Distinguish between Fluorescence and Phosphorescence with neat energy level diagram.		CO1	K3
22. (a)	Derive the expression of Energy value and Frequency of the transition between the levels of Non-Rigid Rotator.		CO2	K3
		[OR]		
(b)	Derive the Intensity of Rotational lines.		CO2	K3
23. (a)	Explain briefly the Vibrating Diatomic molecule with energy levels showing Fundamental, Overtones and Hot bands.		CO1	K4
		[OR]		
(b)	Briefly explain (i) Fermi Resonance and (ii) Hydrogen Bonding.		CO2	K3
24. (a)	Define Raman effect and write its importance.		CO2	K3
		[OR]		
(b)	Discuss the Sample handling techniques of Raman spectroscopy.		CO1	K4
25. (a)	Discuss the information derived from Vibrational analysis and obtain the dissociation energy equation.		CO1	K4
		[OR]		
(b)	Explain the Fortrat Parabolae with neat schematic representation.		CO1	K4

Q. No.	**SECTION - C (5 * 10 = 50 Marks)**	CO(s)	K -
	Answer ALL Questions		Level

26. (a)	Explicate the Rotation about a symmetry axis of H2O molecule with neat representation.		CO2	K4
		[OR]		
(b)	Illustrate the Rotation reflection or Improper rotation of ethane and N_2F_2 molecules with neat representation.		CO1	K3
27. (a)	The microwave spectrum of CN radical shows a series of lines spaced by a nearly constant amount of 3.798 cm^{-1}. What is the bond length of CN?		CO4	K4
		[OR]		
(b)	Define Stark effect and derive the first order and second order correction terms of Linear and Symmetric Top molecules		CO1	K3
28. (a)	Derive the Vibrational energy of a Diatomic Molecule with neat Morse Curve and energy level diagram of a Diatomic molecule.		CO3	K4
		[OR]		
(b)	Outline the Rotation vibration spectra of Linear, Spherical Top and Asymmetric Top molecules.		CO1	K3
29. (a)	Define Raman effect and write down the various applications of Raman spectra.		CO1	K3
		[OR]		
(b)	Give the theory of Raman Effect and describe an experimental arrangement for studying it.		CO2	K3
30. (a)	Derive the Vibrational analysis of band systems using Deslandres table.		CO2	K4
		[OR]		
(b)	Discuss the components of Photoelectron Spectroscopy with neat schematic diagram.		CO1	K3

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