

[152] SEAT No. _____
E+G

No. of Printed Pages : 4



SARDAR PATEL UNIVERSITY, V.V. NAGAR
B.Sc. SEMESTER:6 Examination
PHYSICS CODE : US06CPHY22

DATE:- 05/04/2022

Atomic and molecular
spectroscopy

TIME:-3.00 PM to 5:00 PM

Total Marks: 70

- N.B : (1) All the symbols and notations have their usual meanings.
(2) Figure at the right hand side of questions indicate full marks.

Q-1) Choose the correct option for the following questions.

[10]

- (1) Lyman series is observed inregion of EM spectrum.
(a) Infrared (b) Ultraviolet (c) Visible (d) Microwave
- (2) In Ortho-Positronium the spins of two particles are
(a) Parallel (b) Anti-parallel (c) Perpendicular (d) None of these
- (3) The Bohr magneton is given by
(a) $\frac{eh}{2\pi m}$ (b) $\frac{eh}{4\pi m}$ (c) $\frac{eh}{6\pi m}$ (d) $\frac{eh}{8\pi m}$
- (4) The diatomic molecule such as.....does exhibit pure rotational spectra.
(a) N₂ (b) H₂ (c) HCl (d) O₂
- (5) The formula of allowed rotational energies of the molecule is.....
(a) B(J+2) (b) B(J+1) (c) B(J+1) (d) B J
- (6) Vibrational-Rotational spectra observed inregion of EM spectrum.
(a) Near IR (b) Microwave (c) Visible (d) UV
- (7) The vibrational transition from V=1 to V=0 gives..... band.
(a) Fundamental (b) First overtone (c) Second overtone (d) Third overtone
- (8) Raman shift is for Stokes lines of Raman Spectrum.
(a) Negative (b) Positive (c) Zero (d) All of above
- (9) In Raman spectroscopy, the radiation lies in the region.
(a) microwave (b) ultraviolet (c) X-ray (d) visible
- (10) Raman effect is scattering of
(a) Atoms (b) Molecules (c) Protons (d) Photons

Q-2) Fill in the blanks.

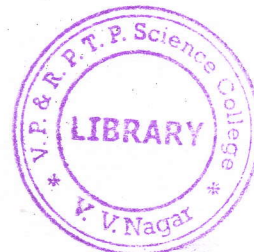
[8]

- (1) The lines of the Paschen series lies in the region of the E.M spectrum.
- (2) In SI system, the unit of rotational constant is.....
- (3) The rotational quantum number is denoted by.....
- (4) Stokes and anti-stokes Raman lines are symmetrically situated on either side of the line.

Write true or false.

- (5) Balmer series lies in the visible region of the electromagnetic spectrum.
- (6) Electronic spectra appear in visible or ultraviolet region.
- (7) The zero point energy for harmonic oscillator is zero.
- (8) Stokes lines are more intense in comparison with Anti-stokes lines.

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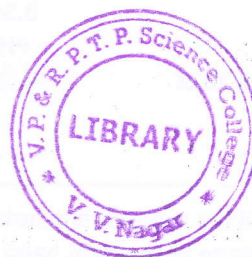


P.T.O.

Q-3) Answer the following short questions.(Any Ten)

[20]

- (1) State Bohr's quantum condition for an atom.
- (2) What is Ritz combination principle?
- (3) What is alkali metals ?
- (4) State the salient features of pure rotational spectra.
- (5) What is rigid rotator ?
- (6) Write down Born-Oppenheimer approximation.
- (7) Draw the block diagram of the arrangement used to observe infrared absorption Spectra-single beam.
- (8) Why vibrational spectra are not obtained for homonuclear diatomic molecule ?
- (9) State the four applications of vibrational spectroscopy.
- (10) What is Raman effect ?
- (11) Give the differences between Raman spectra and Fluorescence spectra.
- (12) State the various applications of the Raman effect in physics.



Q-4) Give Detailed answer of the following questions.(Any Four)

[32]

- (1) Explain Stern-Gerlach experiment.
- (2) Discuss the Franck-Hertz Experiment.
- (3) Discuss rotational spectrum of a diatomic molecule, treated as a non-rigid rotator.
- (4) Discuss the effect of isotopic substitution on the rotational spectra of diatomic molecule.
- (5) Obtain an expression for the vibrational energy levels of a diatomic molecule, taking it as a harmonic oscillator.
- (6) Describe the fine structure of infrared bands of diatomic molecule as rigid rotator and harmonic oscillator with ignoring interaction between them.
- (7) Discuss the classical theory of Raman effect.
- (8) With necessary diagram, explain experimental study of Raman effect.