

P-940

Total Pages : 3

Roll No.

MPHY-604

Atomic and Molecular Spectroscopy

M.Sc. Physics (MSCPHY)

3rd Semester Examination, 2023 (June)

Time : 2 Hours]

[Max. Marks : 35

Note : This paper is of Thirty Five (35) marks divided into two (02) Sections A and B. Attempt the questions contained in these sections according to the detailed instructions given therein. Candidates should limit their answer to the questions on the given answer sheet. No additional (B) answer sheet will be issued.

SECTION-A

(Long Answer Type Questions)

Note : Section 'A' contains Five (05) long answer type questions of Nine and Half ($9\frac{1}{2}$) marks each. Learners are required to answer any Two (02) questions only.
($2 \times 9\frac{1}{2} = 19$)

1. Give the main features of pure rotational band spectrum of a heteronuclear diatomic molecule. Discuss rotational spectrum of a diatomic molecule, treated it as rigid and non-rigid rotator.

2. What is Raman effect? Explain the theoretical observable characteristics of Raman spectrum of a diatomic molecule. How is it used to explain the structure of a molecule?
3. Explain the intensity distribution in absorption and emission band from Franck-condon principle.
4. Write all the possible multiplet terms for two equivalent p -electrons (p^2), Arrange these terms in order of their increasing stability. Also discuss which configuration of p -electron (p^1 , p^3 , p^4 and p^6) has exactly same set of multiplet terms as p^2 .
5. Discuss the salient features of near IR spectrum of a diatomic molecule and explain how these observations are quantum mechanically established. Why such spectra are not observed for homonuclear molecules?

SECTION-B

(Short Answer Type Questions)

Note : Section 'B' contains Eight (08) short answer type questions of Four (04) marks each. Learners are required to answer any Four (04) questions only. (4×4=16)

1. What is the significance of Lande g -factor? Compute the Lande g -factor for an atom in the state ${}^6F_{1/2}$.

2. What do you mean by Zeeman effect? Distinguish between normal and anomalous Zeeman effect.
 3. Write a short note on Franck-Condon principle.
 4. Discuss Lande's interval rule for L-S coupling.
 5. What do you mean by fundamental, first overtone, second overtone vibrations? Mention their values.
 6. Discuss the principal features of electronic spectrum of a diatomic molecule.
 7. Determine the rotational energy of CO molecule on the quantum levels $J = 1$ and $J = 2$ if the equilibrium nucleus distance of CO is 1.131 \AA .
 8. What is the main condition for a molecule to be IR active? Give some examples.
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