G-4/437/21   Roll No. ....

M.Sc. IV Semester Examination, 2021
PHYSICS
Paper I
(Atomic and Molecular Physics)

Time : 3 Hours]   [Max. Marks : 80

Note : *All questions are compulsory. Question Paper comprises of 3 sections. Section A is objective type/multiple choice questions with no internal choice. Section B is short answer type with internal choice. Section C is long answer type with internal choice.*

SECTION A   1×8=8
(Objective Type Questions)

1. Write any two postulates of Bohr's theory.

2. The value of specific charge of electron is (e/m) ....

3. Write the expression for 'Lorentz unit' L for normal Zeeman effect.

4. State the Stark effect.

5. Write the expression for 'rotational constant' B.

6. What are the spherical tops molecules ?

7. What is the percentage value of 'D' (centrifugal

P.T.O.

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distortion constant is terms of rotational constant 'B'.

8. Why pure rotational spectrum is not observed in symmetric top molecules ?

SECTION B   6 × 4 = 24
(Short Answer Type Questions)

Note : Attempt all questions from each unit with internal choice.

Unit-I

1. Explain the variation of Rydberg constant due to finite nuclear mass.

Or

State and discuss the Lande internal rule.

Unit-II

2. Give the detail explanation of normal Zeeman effect.

Or

Write a note on electron spin resonance.

Unit-III

3. Discuss the isotope effect on Rotational spectrum.

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Or

Given that the spacing between the vibrational level of a CO molecule is 8.45×10^{-2} eV, calculate the value of the force constant K of the bond in a CO molecule.

Unit-IV

4. Discuss Born-Oppenheimer approximation.

Or

Explain the intensity distribution in absorption bands from Franck-Condon principle.

SECTION C $12 \times 4 = 48$

(Long Answer Type Questions)

Note : Attempt all questions.

Unit-I

1. State and explain Sommerfield quantisation rules. Use them to deduce Planck's energy quantisation law, and Bohr's angular momentum quantisation law.

Or

Discuss the vector model of an atom consisting of two valence electrons in tems of L-S and J-J coupling.

Unit-II

2. Give the detail explanation of Anomalous Zeeman effect.

Or

Discuss the Weak-Field Stark effect and Strong-Field Stark effect in hydrogen.

Unit-III

3. Obtain an expression for the rotational energy levels of a diatomic molecules.

Or

Discuss the case of vibrating diatomic molecule as a Harmonic oscillator.

Unit-IV

4. Discuss the case of diatomic molecule as rigid rotator and harmonic oscillator.

Or

Discuss the case of rotational five structure of electronic vibrational transitions.

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