

PE-490
(524) M.Sc. Physics (Fourth Semester)
Examination June 2022
Compulsory/Optional
ATOMIC AND MOLECULAR PHYSICS
Paper-III

Time: Three Hours

Maximum Marks: 080
Minimum Passing Marks: 029

Note: Answer from both section as directed. The figures in the right-hand margin indicate marks.

SECTION-A

1. Attempt the following objective type questions:- [1 X 10 = 10]
 - (a) The spectra of hydrogen-like ions are similar to hydrogen, but shifted to ----- energy by the greater attractive force between the electron and nucleus.
 - (b) Write the four quantum numbers.
 - (c) A triplet state is an electronic state in which two electrons in different molecular orbitals have parallel spins. (True or False)
 - (d) What is continuous X-ray spectrum?
 - (e) From which part of the atom, X-rays are produced?
 - (f) What are the two types of nuclear-magnetic-resonance?
 - (g) The rigid rotor is a mechanical model of ----- systems.
 - (h) What is internuclear distance?
 - (i) One of the stable states of constant energy of electrons in atoms is called -----.
 - (j) What is bond – dissociation energy?
2. Answer the following short answer type questions:- [2 X 5 = 10]
 - (a) What do you mean by reduced mass?
 - (b) What is the ground energy level of hydrogen?
 - (c) Explain the characteristic X-rays.
 - (d) What does mean by line broadening mechanism?
 - (e) What is IR spectrometer used for?

SECTION-B

- Answer the following long answer type questions:- [15 X 4 = 60]
3. Define the principle of Sommerfeld's elliptic orbit and explain the relativistic corrections for energy levels of hydrogen atom.

Or,

What do you mean by the screening constant of alkali spectra? Explain it in reference to the alkali atom.
 4. Defining the continuous X-ray spectrum, explain how it depends on the applied accelerating voltage across the tube and explain Duane and Hunt's law related to it.

Or,

Discuss the stages at which Zeeman effect and Paschen – Back effect are expected in multiplet $3_P \rightarrow 3_S$. Deduce Paschen – Back pattern of this multiplet.
 5. Explain the electron spin resonance and give the conditions of resonance.

Or,

What is the difference between diatomic linear symmetric top and a symmetric top molecules? Describe the selection rules for the spectra of diatomic linear symmetric top molecules.
 6. Discuss the vibrational – rotational spectra of a diatomic molecule, and write the selection rules for it.

Or,

What are the main assumptions of the Born – Oppenheimer approximation? What are P, Q and R branches in vibrational – rotational spectra?