PD-490

M.Sc. Physics (4th Semester)

Examination, June 2021

ATOMIC AND MOLECULAR PHYSICS

Paper- III

Time : Three Hours] [Maximum Marks : 80

[Minimum Pass Marks : 29

नोट : दोनों खण्डों से निर्देशानुसार उत्तर दीजिए। प्रश्नों के अंक उनके दाहिनी ओर अंकित हैं।

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

Section-A

1x10=10

1. Attempt the following objective type questions:-

(a) Spectral lines are produced by transitions of …… within atoms or ions.

(b) How many energy levels are in an atom of hydrogen?

(c) Energy levels are the fixed distances of ……. From the nuclear of an atom.

(d) What is the interaction energy between two similarly charged particles?

(e) Write the moseley's law related to X-rays.

(f) What the effect of magnetic field on atoms?

(g) The …… tops are molecules with two rotational axis have same inertia and one unique rotational axis with a different inertia.

(h) The distance between two nuclei in a molecule is called ……

(i) Interatomic force constants are the proportionality coefficients between the displacements of atoms from their equilibrium positions. (True/False)

(j) What is meant by dissociation energy?

2x5=10

2. Answer the following short answer type questions :-

(a) What is space quantization?

(b) What do you mean by spin-orbit interaction?

(c) Explain Duane and Hunt's law for X-rays.

(d) What is the principle of electron spin resonance?

(e) What types of molecules exhibit vibrational rotational spectra?

Section-B

15x4=60

Answer the following long answer type equations:-

3. Explain the Pauli's vector atom model and obtain spin orbit interaction energy in alkali atom.

Or

What do you mean by penetrating orbits? Differentiate between penetrating and non penetrating orbits.

4. Define L-S and J-J coupling. Derive the expression for interaction energy in L-S coupling.

Or

Explain the gyro magnetic ratio and find its value for the orbital and spin motion of charged particle.

5. Explain the nuclear magnetic resonance (NMR) and give the conditions of resonance.

Or

Describe the rotational energy levels of nonrigid rotor and explain its spectra. How does it differs from a rigid rotor?

6. What do you mean by anharmonicity of the molecular vibrations? Calculate the anharmonicity constant for the harmonic oscillator.

Or

What is meant by Franck-condon principle? How are Franck-condon factors calculated?