Roll No. .....

E–752

M. Sc. (Third Semester)
EXAMINATION, Dec.-Jan., 2020-21

PHYSICS

Paper Second

(Atomic and Molecular Physics)

Time : Three Hours] [*Maximum Marks : 80*

Note : Attempt all Sections as directed.

Section—A 1 each

(Objective/Multiple Choice Questions)

Note : Attempt all questions.

Choose the correct answer :

1. What is the expression of Bohr's second assumptions ?

(a) $P_\phi = \frac{nh}{2\pi}$

(b) $P_\phi = \frac{n + l}{2\pi}$

(c) $P_l = \frac{nh}{2\pi}$

(d) $P_h = \frac{n.h}{2\pi}$

2. The value of magnetic orbital quantum number is :

   (a) $M_l = l \cos\theta$

   (b) $M_l = l \tan\theta$

   (c) $M_l = l \sin\theta$

   (d) $M_l = l \sec\theta$

3. In selection of magnetic total quantum number change in ΔM_j is :

   (a) $0, \pm 1$

   (b) $0, + 1$

   (c) 0

   (d) None of the above

4. How many series are there in hydrogen atom ?

   (a) 3

   (b) 4

   (c) 5

   (d) 6

5. The type of Zeeman effect observed in 1 and 2 respectively are :

   (a) Normal—Normal

   (b) Anomalous—Anomalous

   (c) Anomalous—Normal

   (d) Normal—Anomalous

6. Which of the following experiments involves the formation of discrete energy levels ? Larmor precision space quantization and L-S coupling :

   (a) Frank-Hertz experiment

   (b) Sun and Gorlach experiment

   (c) Stark effect

   (d) Zeeman effect

7. How many line Broadenings are exist in Atomic Spectra ?

   (a) 3

   (b) 7

   (c) 8

   (d) 6

8. The Pauli's principle gives the solution of spectra like :

   (a) Complex spectra

   (b) Line spectra

   (c) Band spectra

   (d) Line-band spectra

9. The kinetic energy of on electron in atom is :

   (a) Half of its potential energy

   (b) Twice of its potential energy

   (c) Equal to its potential energy

   (d) None of the above

10. IMVL source is a signed :

    (a) Multiplication

    (b) Addition

    (c) Division

    (d) None of the above

11. The range of visible region is :

    (a) 4000-7000 Å

    (b) 3000-5000 Å

    (c) 2000-4000 Å

    (d) 1000-3000 Å

12. In Raman spectra of branch is :

    (a) Absent

    (b) Present

    (c) Presence or appearance depends on the state of polarization of the molecule

    (d) None of the above

13. At ordinary temperature the molecules remain in their :

    (a) Lowest vibrational level

    (b) Highest vibrational level

    (c) Can remain in any vibrational level

    (d) Do not show any vibration

14. L-S coupling occurs often in :

    (a) All atoms

    (b) Lighter atoms

    (c) Heavier atoms

    (d) Occurs only in nuclei

15. The splitting of a spectral line in the presence of magnetic field is called :

    (a) Raman effect

    (b) Stark effect

    (c) Zeeman effect

    (d) Rotational effect

16. Raman effect is due to collection of :

    (a) Photon with electron

    (b) Photon with molecule

    (c) Electron with atom

    (d) Electron with photon

17. There is no infrared absorption for nitrogen molecule because :

    (a) Its polarization is zero

    (b) It has no vibrational level

    (c) It has no dipole moment

    (d) None of the above

18. The charge of an electron is :

(a) 1.6×10^{-27} Coulomb

(b) 6.1×10^{-27} Coulomb

(c) 1.6×10^{-19} Coulomb

(d) 6.1×10^{-19} Coulomb

19. In which year Stark effect was discovered ?

(a) 1912

(b) 1914

(c) 1915

(d) 1920

20. In L-S coupling :

(a) L + S = J

(b) L – S = J

(c) L + J = S

(d) L – J = S

Section—B 2 each

(Very Short Answer Type Questions)

Note : Attempt all questions.

1. What is complete quantum state of spin of electrons ?
2. What is hydrogen spectrum in one electron system ?
3. What is hyperfine structure ?
4. What is normal Zeeman effect ?

5. What is Stark effect ?
6. What are Raman spectra ?
7. What are symmetric top molecules ?
8. Explain P. Q. R. branches.

Section—C 3 each

(Short Answer Type Questions)

Note : Attempt all questions.

1. Explain line broadering mechanism.
2. Write a short note on IR spectrometer.
3. Explain Pauli's principle.
4. Explain anomalous Zeeman effect.
5. Explain rotational spectra.
6. Explain Rigid rotator model.
7. What are azimuthal quantum numbers ?
8. Explain vibrational-rotational spectra.

Section—D 5 each

(Long Answer Type Questions)

Note : Attempt all questions.

1. Explain quantum state of Hydrogen atom.

Or

Explain Pauli's principle with example.

2. Explain vector model and nromal Zeeman effect.

Or

State, explain and prove Stark effect.

3. Explain the rotational energy level for non-rigid rotator and give its spectra.

Or

Explain symmetric top and asymmetric top molecules.

4. Explain interaction of rotation and vibration and fine structure of P. Q. R. branches.

Or

Explain vibrational spectra of molecule with simple harmonic model and its energy level and spectrum.