Reg. No. : ....

Name : ....

Fifth Semester B.Sc. Degree Examination, December 2021

First Degree Programme under CBCSS

Physics

Core Course VIII

PY 1544 : ATOMIC AND MOLECULAR PHYSICS

(2014, 2016 & 2017 Admission)

Time : 3 Hours　　　　　　　　　　　　　　　　　　Max. Marks : 80

SECTION – A

Very short answer type questions. (Answer **all ten** questions of **1** mark each).

1. What is correspondence principle?

2. State Pauli's exclusion principle.

3. Define Bohr radius.

4. Define rotational constant.

5. Which spectral line of hydrogen atom is in the visible region.

6. Define gyromagnetic ratio.

7. How many electrons can be in $n = 6$, $l = 3$ subshell?

8. Define polarizability of a molecule.

9. What is vibrational coarse structure in electronic transition?

10. What is a spherical top molecule?

(10 $\times$ 1 = 10 Marks)

SECTION – B

Short answer type questions. Answer any **eight** questions. **Each** question carries **2** marks.

11. Define Larmor's theorem.

12. Write a note on spin orbit coupling.

13. Discuss about the magnetic dipole moment of electron due to orbital motion.

14. State Moseley's Law.

15. What is Wilson Somerfield quantization?

16. Sketch the normal mode of vibrations of CO_2 molecule.

17. The average spacing between adjacent rotational line of CO molecule is 3.8626 cm^{-1}. Calculate the length of the CO bond.

18. Distinguish between prolate and oblate symmetric top molecule.

19. Homonuclear diatomic molecule do not show vibrational spectra. Why?

20. Will the molecule $^{17}O - ^{16}O$ show a rotational spectrum? Explain.

21. An unpaired electron gives ESR resonance at 35 GHz when a magnetic field is 1.3 T. Calculate the electron g-factor.

22. What is isomer shift?

(8 $\times$ 2 = 16 Marks)

M – 1473

SECTION – C

Answer any **six** questions. **Each** question carries **4** marks.

23. Explain the significance of Stern-Gerlach experiment.

24. Determine the separation of the first line of Balmer series in a spectrum of ordinary hydrogen and tritium (mass No.3)

25. Discuss the experimental study of Stark effect.

26. Discuss about LS and j-j coupling.

27. Evaluate the Lande's g-factor for (a) pure orbital angular momentum (b) pure spin angular momentum and (c) the state $^3P_1$.

28. With the help of an energy level diagram, explain Rayleigh line, stokes line and anti-stokes line in Raman scattering.

29. Explain Franck-Condon Principle.

30. The HCL molecule gives the vibrational absorption line of wavelength 3465 A°. Calculate the force constant of the H-Cl bond. Given that 1H = 1.0087 u, 35Cl = 35.453 u and u = 1.67 × 10^{-27} kg.

31. Explain the principle of Mossbauer spectroscopy.

(6 × 4 = 24 Marks)

SECTION – D

Answer any **two** questions. **Each** question carries **15** marks.

32. What are the quantum numbers associated with the vector atom model? Explain.

33. Briefly discuss Zeeman effect. Also mention the quantum mechanical explanation of the normal Zeeman effect.

34. Discuss about the rotational spectra of diatomic molecule.

35. Explain the principle of NMR and ESR and mention their applications.
(2 × 15 = 30 Marks)

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