Reg. No :.............................

Name :...............................

BACHELOR'S DEGREE (C.B.C.S) EXAMINATION, MARCH 2024
2021 ADMISSIONS REGULAR
SEMESTER VI - CORE COURSE (PHYSICS)
PH6B10B18 - Relativity and Spectroscopy

Time : 3 Hours

Maximum Marks : 60

Part A

I. Answer any Ten questions. Each question carries 1 mark

(10x1=10)

1. If 4 kg of a substance is fully converted into energy, how much energy is produced?

2. Show that acceleration is invariant under Galilean transformation.

3. What do you mean by rest mass ?

4. State the postulates of Bohr atom model.

5. What are the disadvantages of Rutherford atom model?

6. State Larmor theorem.

7. No two electrons can occupy in the same quantum state. Explain.

8. Why are anti stokes lines less intense than stokes lines?

9. Homo nuclear diatomic molecules does not show vibrational spectrum. Why?

10. How does the moment of inertia of prolate and oblate molecules differ? Give one example for each.

11. Define chemical shift in NMR.

12. Draw the magnetic energy levels of a nucleus with half spin.

Part B

II. Answer any Six questions. Each question carries 5 marks

(6x5=30)

13. At what speed should a clock be moved so that it may appear to lose 1 minute in each hour.

14. Find the momentum and velocity of an electron having a kinetic energy 10 MeV. The rest energy of the electron is 0.512 MeV.

15. Write a note on spin- orbit coupling.

16. At what speed must the electron revolve round the nucleus of helium atom in its ground state in order that it may not be pulled into the nucleus by electrostatic attraction.

17. Derive expressions for orbital magnetic moment of electron.

18. Consider the molecules CCl_4, $CHCl_3$, and CH_2Cl_2.(a). What kind of rotor are they? (b) Will they show pure rotational spectra?

19. Calculate the vibrational energy levels of an HCl molecule assuming the force constant to be 516 N/m

20. In the near infrared spectrum of HCl molecule there is single intense band at $2885.9 / cm$. Assuming that it is due to the transition between vibrational levels, show that the force constant k is 480 N/m. (Given $M_H = 1.68 \times 10^{-27} Kg$).

21. Calculate the magnetic field required to produce transition frequency of 120MHz for protons in Benzene. Given μ= 2.792 times nuclear magnetron.

Part C

III. Answer any Two questions. Each question carries 10 marks

(2x10=20)

22. Derive Lorentz transformation equations for co ordinates with necessary explanation.

23. With necessary theory, explain anomalous Zeeman effect.

24. With necessary theory, explain the diatomic vibrational spectra.

25. With a neat diagram, explain the principle and working of ESR spectrometer.