

LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – PHYSICS

FIFTH SEMESTER – NOVEMBER 2009

PH 5504 - ATOMIC AND NUCLEAR PHYSICS

Date & Time: 3/11/2009 / 9:00 - 12:00

Dept. No.

Max. : 100 Marks

PART - A

Answer **ALL** the questions

(10 x 2 = 20)

1. State Pauli's exclusion principle.
2. Explain Paschen-Back effect.
3. What are mirror nuclei, give an example.
4. State Geiger-Nuttal Law.
5. Give the reaction through which a free neutron decays.
6. ----- + ${}_{29}^{63}\text{Cu} \rightarrow {}_0^1\text{n} + {}_{30}^{64}\text{Zn}$. Fill in the blank and complete the reaction.
7. Give examples for Bosons and Fermions.
8. What are Van Allen Belts?
9. Write an expression for nuclear magneton and give its unit.
10. What is Larmor precession?

PART - B

Answer **any FOUR** questions

(4 x 7.5 = 30)

11. Discuss the L-S and J-J coupling schemes.
12. a) Define mass defect and binding energy. (3)
b) Find the binding energy per nucleon for ${}_{26}^{56}\text{Fe}$, in electron volts. Given $m_{\text{Fe}} = 55.934939 \text{ u}$, $m_p = 1.007825 \text{ u}$ and $m_n = 1.008665 \text{ u}$. (4.5).
13. a) What are fast breeder reactors. (2).
b) Describe the various components of a nuclear reactor. (5.5).
14. What are cosmic rays? Discuss the effect of Earth's magnetic field on them.
15. Explain chemical shift. Obtain an expression for it.

PART-C

Answer **any FOUR** questions

(4 x 12.5 = 50)

16. a) What is Compton effect? Obtain an expression for the change in wavelength due to Compton scattering. (1.5+8).
b) Monochromatic X-ray beam of wavelength 1.54 \AA undergoes Compton scattering. Find the wavelength of the X-rays scattered at 135° . (3).

17. a) Explain Rabi's method for determining nuclear magnetic moment. (6).
b) Discuss the beta ray spectrum and explain how it was solved. (6.5)
18. a) Discuss the Lawson's criterion for sustained fusion reaction. (5).
b) Explain the various conservation laws obeyed by elementary particle interactions. (7.5).
19. Discuss the liquid drop model and obtain the semi-empirical mass formula.
20. a) What is Mossbauer effect? (3.5).
b) Discuss the spin-lattice and spin-spin relaxations mechanism and the associated relaxation times. (9).
