LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

B.Sc. DEGREE EXAMINATION – **PHYSICS**

FIFTH SEMESTER – **NOVEMBER 2013**

PH 5507/PH 5504/PH 5500 – ATOMIC AND NUCLEAR PHYSICS

Date : 05/11/2013 Dept. No. Max. : 100 Marks

Time : 9:00 - 12:00

PART - A

Answer **ALL** questions. (10 × 2 = 20 Marks)

1. State and explain Pauli's exclusion principle.
2. What is Stark effect?
3. What do you mean by mirror nuclei? Give two examples.
4. Give any two important properties of neutrino.
5. What are thermal neutrons?
6. State Lawson's criterion for the chances of nuclear fusion in a hot plasma.
7. What are magic numbers?
8. What are leptons? How many leptons are there?
9. Define coupling constant between two adjacent nucluei.
10. What do you understand by Mossbauer spectroscopy?

PART – B

Answer any **FOUR** questions. (4 × 7.5 = 30 Marks)

11. (a) State and explain Compton effect. (2 +1)

    (b) Describe experimental verification of the Compton effect. (4 ½)

12. (a) Explain the terms mass defect and binding energy of a nucleus. (2 +2)

    (b) Find the binding energy and binding energy per nucleon $_{15}P^{31}$ of mass 30.973763 amu. ^{M}H=1.007825 amu and M_n= 1.008665amu. (3 ½)

13. (a) How was the neutron discovered? (3 ½)

    (b) Mention the important properties of the neutrons. (4)

14. (a) What do you understand by hard and soft components of cosmic rays? (2 +2)

    (b) Write a note on Van Allen radiation belts. (3 ½)

15. Write notes on: (i) Larmor precession (3 ½)

    (ii) Relaxation processes (4)

PART – C

Answer any **FOUR** questions. (4× 12.5 = 50 Marks)

16. (a) What are positive rays? (2 ½)

    (b) Describe Thomson's parabola method for determining the ratio of charge to mass of the positive rays. (10)

17. (a) Give an account of the β-ray spectrum. (8)

    (b) Explain the role of neutrino hypothesis in understanding the spectrum. (4 ½)

18. (a) Distinguish between nuclear fission and nuclear fusion. (3)

    (b) Give an explanation of nuclear fission by the liquid drop model of the nucleus. (7)

    (c) When a U-235 nucleus undergoes fission, 200 MeV energy is released. How much energy in joules would be released when1g of U-235 is fissioned. (2 ½)

19. (a) Obtain an expression for the binding energy of a nucleus in the ground state on the basis of semi-empirical mass formula of Weizsäcker. (10)

    (b) Give a brief account of cosmic ray showers. (2 ½)

20. (a) Define chemical shift. (3 ½)

    (b) Explain how it is measured. (9)

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