LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034
B.Sc. DEGREE EXAMINATION – PHYSICS
V SEMESTER – NOVEMBER 2003
PH 5500 / PHY 507 — ATOMIC & NUCLEAR PHYSICS

03-11-2003 100 Marks
1.00 – 4.00

PART – A

*Answer **All** questions* (10 x 2 = 20 marks)

01. State and explain Pauli's exclusion Principle.
02. What is normal Zeeman effect?
03. An x-ray machine Produces 0.1Å x – rays. What accelerating voltage does it employ?
04. What is Auger effect?
05. Determine the ratio of the radii of the nuclei $_{13}Al^{27}$ and $_{52}Te^{125}$
06. State Geiger-Nuttall Law.
07. Mention the properties of the nuclear force.
08. Explain latitude effects in Cosmic rays.
09. What are slow neutrons and fast neutrons?
10. Distinguish between Fluorescence and Phosphorescence.

PART – B

*Answer any **FOUR** only* (4 x 7 ½ = 30 marks)

11. Explain Frank and Hertz method of determining critical potentials.

12. a) Explain the origin of characteristic x-rays. (3 ½ mark)

    b) A ray of ultraviolet light of wavelength 3000 Å falling on the surface of a material whose work function is 2.28 eV ejects an electron. What will be the velocity of the emitted electron? (4 mark)

13. a) Show that the energy equivalent of 1 a m u is 931 MeV (2 mark)

b) What is meant by binding energy of the nucleus. Find the binding energy and binding energy per nucleon of $^{31}_{15}P$ of mass 30.973763 amu

M_H = 1.007825 amu and M_N = 1.008665 amu. (5 ½ mark)

14. What are elementary particles? How are they classified on the basis of their masses and interactions?

15. a) Distinguish between nuclear fission and fusion (2 mark)

    b) Explain with a neat diagram, the Bohr's theory of Compound nucleus. (5 ½ mark)

PART – C

*Answer any **FOUR** only* (4 x 12 ½ = 50 marks)

16. a) Describe Thomson's parobola method to measure the specific charge of positive ions. (8 ½ marks)

b) In a Bainbridge mass spectrograph, singly ionised atoms of Ne^{20} pass into the deflection chamber with a velocity of 10^5 m/s. If they are deflected by a magnetic field of flux density 0.08T, calculate the radius of their path and where Ne^{22} ions would fall if they had the same initial velocity. (4 mark)

17. a) Explain compton scattering and derive an expression for the wavelength of the Scattered beam (8 ½ mark)

b) Estimate the value of compton wavelengths when the scattered angles are (i) $\frac{\pi}{2}$ and (ii) π (4 mark)

18. Give the origin of β - ray line and continuous spectrum. Outline the theory of β - disintegration.

19. Describe the 'liquid drop model' of the nucleus. How can the semi – empirical mass formula can be derived from it? Mention the uses of this model.

20. a) Derive the four factor formula for a thermal nuclear reactor. (8 ½ mark)

b) Calculate the power output of a nuclear reactor which consumes 10 kg of U – 235 per day, given that the average energy released per fission is 200 MeV. (4 mark)

# # # # #