

Class – B.Sc III
Subject – Physics
Paper – A

Time Allowed : 3 Hours

Maximum Marks : 35

Attempt Five questions by selecting one from each section.

SECTION-A

- 1. What is binding energy? Draw binding energy per nucleon Vs mass number curve and discuss its main features. How energy release during nuclear fission and nuclear fusion can be explained from the curve? 7
- 2. (a) Discuss failure of Proton-Electron hypothesis of nuclear constitution. 3
- (b) Explain the term Electric Quadrupole moment and magnetic moment w.r.t. nucleus. 4

SECTION-B

- 3. Outline the basic features of shell model of the nucleus. How does it account for the existence of magic numbers? Also discuss schematic energy level diagram. 7
- 4. Discuss the basic assumptions made in liquid drop model of the nucleus. Show how this brings about semi-empirical mass formula. 7

SECTION-C

- 5. (a) Explain how the theory of β -decay accounted for existence of neutrino. 4

- (b) When ${}^7_3\text{N}$ atom decays into ${}^6_6\text{C}^{13}$ atom by the emission of β^+ particle, the maximum kinetic energy of positron is 1.202 Mev. Calculate the mass of ${}^7_3\text{N}$ atom, given the mass of ${}^6_6\text{C}^{13} = 13.003354$ a.m.u. 3

- 6. (a) Discuss the theory of successive disintegration of radioactive substance and obtain conditions for transient and secular equilibrium. 4

- (b) Calculate the activity of 10mg of Ra^{226} which has half life of 1620 years. 3

SECTION-D

- 7. (a) Define Q-value of a nuclear reaction. Obtain an expression for Q and hence write the condition for exo-ergic and endo-ergic nuclear reactions. 4½

- (b) What is nuclear reaction? Which conservation laws are obeyed during nuclear reaction? 2½

- 8. (a) What do you mean by nuclear reaction cross-section? Obtain an expression of nuclear reaction in terms of cross-section for a slab of infinitesimally small thickness. 3½

- (b) Explain Geiger Nuttal law and show that according to this law $R \propto E^{1/2}$ where E is kinetic energy and R is range of α particles. 3½

SECTION-E

(Attempt all Parts)

- (i) Define Parity. What is odd and even parity?
- (ii) Explain on the basis of shell model, why no. of neutrons is more than protons for heavy nuclei?

- (iii) Calculate total angular momentum of ${}_{8}\text{O}^{17}$ nucleus.
- (iv) Neptunium series is generally not considered, why?
- (v) Define Half life of radio active substance and how it is related with mean life.
- (vi) What is inverse β -decay? What is its importance?
- (vii) What is difference between electron capture and internal conversion? (1 × 7)
