2025

(Session : 2022-26)

Time : 3 hours

Full Marks : 75

Candidates are required to give their answers in their own words as far as practicable.

The figures in the margin indicate full marks.

Answer from both the Groups as directed.

Group – A
(Compulsory)

1. Answer **all** questions of the following : 1×5 = 5

(a) Radius of a nucleus is :

(i) $RoA^{\frac{1}{3}}$

(ii) $RoA^{\frac{2}{3}}$

(iii) RoA

(iv) $RoA^{\frac{3}{2}}$

(b) The collective model of nucleus was developed by :

(i) de-Broglie

(ii) Bohr and Moltelson

(iii) Nilsson

(iv) Fermi

(c) β-ray emitted by a radioactive material is :

(i) E.M. radiation

(ii) Orbital electrons

(iii) Charged particles from nucleus

(iv) Neutral particles

(d) The scattering of an energetic charged particle in matter is mostly due to interaction with :

(i) Electrons

(ii) Nucleii

(iii) Quarks

(iv) All of these

(e) Cyclotron is used to accelerate :

(i) Electrons

(ii) Positive ions

(iii) Neutrons

(iv) Both (i) and (ii)

2. What is Q-value of nuclear reaction ? Discuss its significance. 5

3. Explain the non-existence of electrons inside the nucleus on the basis of wave mechanical considerations. 5

Group – B

Answer any **four** questions of the following : 15×4 = 60

4. Define Mass defect and Binding energy. How does binding energy per nucleon vary with mass number ? What is its significance ?

5. What is β-decay ? Using energy Kinematics derive the condition for spontaneous emission of β^- and β^+ particles and discuss the β^- particle spectrum.

6. Explain compton effect. Write down its significance.

7. Write in detail the principle and working of Van degraph generator. Write down its advantages and disadvantage.

8. Derive Bethe-Bloch formula for loss of energy due to ionisation when heavy charged particle move in a medium.

9. Write a short notes on any **two** of the following :

   (a) Quark Model

   (b) Liquid drop Model

   (c) Geiger - Nuttal Law

   (d) Photo electric effect