

Duration: 2:00 Hrs.

- N.B.: 1) All questions are compulsory.
 2) Figures to the right indicate full marks.
 3) Symbols have their usual meanings.
 4) Use of non-programmable calculator is allowed.

Q.1 Attempt any TWO.

1. Define the binding energy and packing fraction. Write the basic properties of nuclei.
2. Explain the stability of nuclei. Draw a graph of N Vs Z.
3. Explain the transient equilibrium. Show that the time taken by the daughter element is $t_m = 1/\lambda_2 - \lambda_1$.
4. Define the artificial radioactivity. Explain the properties of α , β and γ rays.

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Q.2 Attempt any TWO.

1. Derive necessary relation for Geiger's rule. Explain the interaction between particles and matter.
2. Find the Q-value for reaction ${}_8\text{O}^{16} (n,d) {}_7\text{N}^{15}$. Is the reaction exothermic or Endothermic? Why?
Given: Atomic mass of Oxygen = 15.9949, Nitrogen = 15.0001, Neutron = 1.008665, Deuterium = 2.014102.
3. State the various conservative laws on which the balancing of nuclear reaction occurs.
4. What do you mean by mass-energy conservation of nuclear reaction? Derive its expression.

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Q.3 Attempt any TWO.

1. State and prove de -Broglie hypothesis. Explain the wave particle dualism.
2. With the help of neat labeled diagram, explain the setup of Davisson-Germer experiment on electron diffraction.
3. Describe how X-rays are produced using Coolidge tube. Explain the X-ray spectrum.
4. Explain the Compton effect. Show that the Compton shift is

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$$\Delta\lambda = \frac{h}{m_0c} [1 - \cos \theta]$$

Q.4 (A) Attempt any ONE.

1. Write short note on density of nucleus.
2. Write short note on Carbon dating.

04

(B) Attempt any ONE.

04

1. Write short note ionization chamber.
2. Write short note on nuclear fusion and fission.

(C) Attempt any ONE.

04

1. State the Wien's displacement law. When the temperature of blackbody is 60°C , it emits maximum energy at wavelength $11.2 \times 10^{-6}\text{m}$. If its temperature is increased to 100°C , at what wavelength will the maximum energy be emitted.
2. Write a short note on pair production.
