

- (c) Calculate the binding energy per nucleon of the ${}^4_2\text{He}^+$ nucleus. Given $m_n = 1.008665 \text{ u}$ and $m_H = 1.007825 \text{ u}$. 5

8. (a) Why is it important to monitor radiation? List three different types of radiation detectors. 4+3=7
- (b) What does radiation exposure mean, and what radiation dose levels are deemed safe? 4+4=8

[This question paper contains 4 printed pages]

Your Roll No. :

Sl. No. of Q. Paper : 3525 I

Unique Paper Code : 2174001010

Name of the Paper : GE – Radiochemistry in Energy, Medicine and Environment

Name of the Course : B.Sc.(H)/B.Sc. Prog.

Semester : I/III/V

Time : 3 Hours Maximum Marks : 90

Instructions for Candidates :

- (a) Write your Roll No. on the top immediately on receipt of this question paper.
- (b) Attempt any **six** questions in **all**. Each question carry 15 marks.

1. (a) ${}_1\text{H}^2 + {}_1\text{H}^2 \rightarrow {}_2\text{He}^4 + Q$. Calculate the value of Q (given binding energy per nucleon for deuteron = 1.1 MeV and for helium = 7.0 MeV) 5

- (b) Assume that a neutron breaks into a proton and an electron. Calculate the energy released during this process. (Mass of neutron = 1.6725×10^{-27} kg, Mass of proton = 1.6725×10^{-27} kg, Mass of electron = 9×10^{-31} kg). 5
- (c) Explain the process of generating energy from uranium ore in a nuclear reactor. 5
2. (a) What are the somatic and genetic effects? Provide a detailed explanation of how ionizing radiation impacts living cells. 3+4=7
- (b) Give a brief summary of the management strategies for nuclear disasters. 5
- (c) What are radiopharmaceuticals? 3
3. (a) Define the terms isotones, isobars, and isotopes and specify the radioactive isotope of water. 7
- (b) What is meant by Q value of nuclear reaction? 3
- (c) Derive the equation for radioactive decay. 5
4. (a) What is the principle of nuclear fusion? 5
- (b) What are the main disadvantages of nuclear fusion? 5

- (c) Atoms ${}_7X^A$, ${}_8Y^B$ and ${}_9Z^{17}$ are such that ${}_8Y$ is an isobar of ${}_7X$ and atom ${}_9Z^{17}$ is isotone of ${}_8Y$. Calculate the mass number of X and the number of neutrons in Y? 5
5. (a) What do we do with nuclear waste? How is it treated? 5
- (b) Can nuclear energy be qualified as low carbon? 5
- (c) Can a nuclear reactor explode like an atomic bomb? 5
6. (a) If the binding energy per nucleon in ${}_3Li^7$ and ${}_2He^4$ nuclei are 5.60 MeV and 7.06 MeV respectively, then in the reaction : 5
- $$p + {}_3Li^7 \rightarrow 2 {}_2He^4$$
- Calculate the energy of proton.
- (b) Describe the process of extracting uranium from its ore. 10
7. (a) Consider the following decay i.e., ${}_Z X^A \rightarrow {}_{Z-1} Y^A + {}_0^0 e (\beta^+)$. X is unstable; elaborate the probable reason behind the instability of the same. 5
- (b) Explain different types of radioactive decay with suitable example. 5