

The exact mass of $_{13}\text{Al}^{27}$ isotope may be taken as 26.9815 u and that of $_{14}\text{Si}^{30}$ as 29.9738 u. (Mass of $_{2}\text{He}^{4+} = 4.0026$ u and mass of $_{1}\text{H}^1 = 1.0078$ u.). (5)

8. (a) Explain the application of radioisotopes as tracers for studying chemical reactions involved in Friedel-Crafts reaction and photosynthesis. (5)
- (b) Calculate the energy equivalent of 1 amu using $E = mc^2$. (5)
- (c) Write short notes on: (5)
- (i) Nucleus composition
 - (ii) Elementary particles

[This question paper contains 4 printed pages.]

Your Roll No.....

Sr. No. of Question Paper : 3322

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

Duration : 3 Hours

Maximum Marks : 90

Instructions for Candidates

1. Write your Roll No. on the top immediately on receipt of this question paper.
 2. Answer six questions in all.
 3. Each question carries 15 marks.
1. (a) What is nuclear fusion? Explain with suitable examples. (5)

- (b) What is meant by the term nuclear medicine? Explain with a suitable example. (10)
2. (a) Explain the term "radiometric dating." (5)
- (b) Write a brief note on the medical applications of radiotracers. (5)
- (c) Describe natural and artificial radioisotopes. (5)
3. (a) Differentiate α and β decay with suitable example. (5)
- (b) Explain the terms half-life period, average life period and disintegration constant of a radioactive substance. How are they related? (7)
- (c) Define fusion energy. (3)
4. (a) Explain the components of a nuclear reactor, followed by its working, with an illustration. (10)
- (b) The binding energy per nucleon of ${}^8\text{O}^{16}$ is 7.97 MeV and that of ${}^8\text{O}^{17}$ is 7.75 MeV. Calculate the energy required to remove a neutron from ${}^8\text{O}^{17}$. (5)
5. (a) Differentiate among mean tissue dose, equivalent dose and effective equivalent dose. (5)

- (b) Discuss the role played by neutron/ proton ratio on the stability of a nucleus. Does radioactivity depend upon temperature and pressure? (10)
6. (a) Discuss the nature of forces that hold nucleons together in a small nucleus. Explain the role of π mesons in this connection. (5)
- (b) Why is ${}_{92}\text{U}^{238}$ not suitable for a chain reaction? (5)
- (c) A sample of pitchblende has a lead-uranium weight ratio of 9/40. Calculate the age of the mineral. The half-life of uranium is 4.5×10^9 y. The atomic weights of lead and uranium are 206.0 and 238.4, respectively. (5)
7. (a) Discuss benefits of irradiation of food in the field of agriculture. (5)
- (b) Bring out the significance of critical mass in a fission reaction. What is meant by sub-critical and super-critical states of a system? (5)
- (c) Calculate Q-value of the following nuclear reaction:

