

MAHATMA GANDHI UNIVERSITY, KOTTAYAM

B.Sc. (Hons) Physics – Semester V

MG5DSEPHYA00

Introduction to Radiological Physics

(2024 ADMISSION ONWARDS)

Duration: 2 Hours

Maximum Marks: 50

PART – A

Short Answer / Problems

Answer any 10 questions. Each carry 2 marks

1. What are the characteristic and continuous spectra of X-rays? [U][CO1]
2. A medical facility requires a high-energy beam of charged particles for radiotherapy. Which accelerator Van de Graaff generator or linear accelerator is more suitable? Give one reason. [A][CO1]
3. Distinguish between a cyclotron and a synchrotron. [U][CO1]
4. What is meant by artificial radioisotopes? Mention one medical application. [U][CO2]
5. Describe the role of work function in the photoelectric effect? [U][CO2]
6. An X-ray photon of energy 100keV undergoes photoelectric absorption in an atom. If the emitted photoelectron carries 75% of the photon energy, determine the binding energy of the electron. [A][CO2]
7. A detector is required to measure the energy of incident gamma radiation. Which is more suitable, a GM counter or a scintillation detector? Give one reason. [A][CO3]
8. What is meant by the quenching of a GM counter? [U][CO3]
9. What is the principle of operation of a scintillation detector? [U][CO3]
10. What is a thermoluminescent dosimeter (TLD)? [K][CO4]
11. Define linear energy transfer (LET). [K][CO4]
12. Why is shielding with a suitable material necessary when working with ionizing radiation? [U][CO4]
13. Define half-life and write its relation with the decay constant. [U][CO5]
14. What is meant by radioactive equilibrium? [U][CO5]
15. A radioactive substance has a half-life of 10 days. What fraction of the original radioactive nuclei remains after 30 days? [A][CO5]

$$10 \times 2 = 20$$

PART – B

Short Essays / Problems

Answer any 6 questions. Each carry 5 marks

16. An X-ray technician operates an X-ray tube to obtain a medical image. Apply your knowledge of electron-target interactions to explain how X-rays are produced and how continuous X-rays differ from characteristic X-rays. [A][CO1]

17. Explain the principle, construction and working of a cyclotron. Mention its applications. [U][CO1]
18. Explain the production of artificial radioisotopes and discuss their applications in medical fields. [U][CO2]
19. Explain the interaction of charged particles with matter. [U][CO2]
20. Explain the operating regions of gas-filled radiation detectors with a suitable diagram. [U][CO3]
21. Describe the construction and working of a solid-state detector. [U][CO3]
22. Describe the principle and working of a pocket dosimeter and mention its applications in radiation monitoring. [U][CO4]
23. Explain the principles of radiation protection based on Time, Distance and Shielding. Explain the concept of Half-Value Layer (HVL). [U][CO4]
24. Derive the radioactive decay law and obtain the relation between decay constant and half-life. [A][CO5]
25. Explain successive disintegration and distinguish between ideal, transient and permanent radioactive equilibrium. [U][CO5]

$$6 \times 5 = 30$$