

E 6167



Reg. No.....

Name.....

B.Sc. DEGREE (C.B.C.S.S.) EXAMINATION, SEPTEMBER 2024

Sixth Semester

Core Course—NUCLEAR AND PARTICLE PHYSICS

(Common for Model I B.Sc. Physics, Model II B.Sc. Physics EEM and B.Sc. Physics Instrumentation)

[Prior to 2013 Admissions]

Time : Three Hours

Maximum Weight : 25

Part A

*Answer all questions.
Weight 1 for each bunch.*

BUNCH I

1. The nuclides with identical proton numbers are called as _____.
2. The total angular momentum of the nucleus is called _____.
3. Radioactivity is confined almost entirely to the elements _____ to _____ in the periodic table.
4. Gamow's theory of alpha decay depends on _____.

BUNCH II

5. The first antiparticle found was the _____.
6. The transuranic elements are the chemical elements with atomic numbers greater than _____.
7. In pair production, two gamma rays with energy greater than _____ MeV can come together to create a positron and an electron.
8. Materials consisting of atoms of _____ atomic mass are used as moderators.

BUNCH III

9. A meson have _____ quarks.
10. Packing fraction is positive for mass number _____.

Turn over





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11. Electron emitted during internal conversion has _____ spectrum.
12. The intensity of the cosmic rays are maximum at _____.

BUNCH IV

13. Fermi's neutrino theory is for _____.
14. _____ is emitted in a beta decay.
15. The scientist who predicted meson theory of nuclear forces is _____.
16. The permissible dose of radiation for an individual working 40 hours per week is _____.

(4 × 1 = 4)

Part B

*Answer any **five** questions.*

Weight 1 each.

17. What are thermal neutrons ?
18. Discuss nuclear density.
19. Describe two important differences between the gamma emission and beta emission.
20. Explain the law of radioactive decay.
21. What is Quark ? Explain.
22. What are secondary cosmic rays ?
23. Explain the Q-value of a nuclear reactor.
24. What is carbon dating ? Give two examples.

(5 × 1 = 5)

Part C

*Answer any **four** questions.*

Weight 2 for each.

25. Describe Bainbridge mass spectrograph.
26. A Geiger-Muller counter shows a count rate of 5750 counts per minute at some instant. After 5 minutes, it shows a count rate of 2700 counts per minute. Find the half-life of the substance giving the counts.





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27. Determine the atomic mass of $^{10}\text{Ne}_{20}$ if the binding energy of neon is 160.647 MeV.
28. Explain the Tokamak nuclear waste disposal scheme.
29. Briefly explain the energy production in stars by nuclear fusion.
30. State and explain the Geiger-Nuttal law.

(4 × 2 = 8)

Part D

Answer any two questions.

Weight 4 for each.

31. What are ionization detectors? With neat diagram describe the construction and working principle of G.M. counter. What is the meaning and significance of quenching in G.M. counter?
32. What is β -decay? Explain the different types of β -decay and characteristics of β -spectra. Also explain the neutrino theory of beta decay.
33. Describe liquid drop model of nucleus. How can the semi-empirical mass formula be derived from it? Mention the merits and demerits of this formula.

(2 × 4 = 8)

