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Name.....

Reg. No.....

SIXTH SEMESTER U.G. DEGREE EXAMINATION, MARCH 2023

(CBCSS—UG)

Physics/Applied Physics

PHY 6B 12/APH 6B 12—NUCLEAR PHYSICS AND PARTICLE PHYSICS

(2019 Admissions onwards)

Time : Two Hours

Maximum : 60 Marks

The symbols used in question paper have their usual meanings.

Section A (Short Answer Type)

*Answer **all** questions in two **or** three sentences.*

Each correct answer carries a maximum of 2 marks.

1. What are Isotopes ? Give an example.
2. Explain the electron capture process.
3. What do you mean by radiocarbon dating ?
4. Explain Lawson's criterion for fusion reactors.
5. Draw the schematic of a pressurized water nuclear reactor.
6. Draw the count rate versus applied voltage of a GM tube and indicate the different regions.
7. What are the basic requirements of a neutron counting system ?
8. Explain the working principle of an intersecting beam accelerator.
9. Compare the basic properties of particles and antiparticles. Give an example.
10. What is the strange behavior of kaons and hyperons ?
11. List the different quarks and their charges.
12. Give the essence of electroweak theory.

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Turn over



Section B (Paragraph/Problem Type)

(Answer all questions in a paragraph of about half a page to one page.)

Each correct answer carries a maximum of 5 marks.

13. The half-life of radon is 3.8 days. After how many days will only one twentieth of a radon sample be left over?
14. Draw the schematic of an ionization chamber and indicate the parts involved.
15. Using a suitable figure, explain the working principle of a linear accelerator.
16. Explain the advantage of a synchrocyclotron over a cyclotron.
17. Calculate the threshold kinetic energy for the reaction $p + {}^3_1\text{H}_2 \rightarrow {}^2_1\text{H}_1 + {}^2_1\text{H}_1$, if the proton is incident on ${}^3_1\text{H}$ at rest.
18. Find the Q value of the following decay $K^0 \rightarrow \pi^+ + \pi^-$.
19. Name the conservation law that would be violated in the following decay $p + p \rightarrow p + n + K^+$

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Section C (Essay Type)

Answer in about two pages, any one question.

Answer carries 10 marks.

20. Discuss the essential properties of an atomic nucleus: constituents, size, shape, mass and binding energy.
21. Explain the proton-proton and carbon cycles of nuclear fusion.

(1 × 10 = 10 marks)