

D 52341

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Name.....

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, DECEMBER 2018

(CUCSS—PG)

Physics

PHY 3C 10—NUCLEAR AND PARTICLE PHYSICS

(2017 Syllabus Year)

Time : Three Hours

Maximum : 36 Weightage

Section A

Answer **all** questions.

Each question carries 1 weightage.

1. What is the CP violation in particle physics ?
2. Why are even-even nuclei are most stable ?
3. What are the advantages of semiconductor detector ?
4. Why is β -ray spectrum being continuous ?
5. What are the similarities between a nucleus and liquid drop ?
6. What is the importance of asymmetric term in semiempirical mass formula ?
7. How does the np and pp scattering cross section compare ?
8. What is internal conversion process ?
9. What is difference between π -mesons and K-mesons ?
10. What is a quarks ? Are they colored ?
11. Give short note on the general features of a nuclear fission reactor ?
12. Give the properties of a good quality photomultiplier tube.

(12 \times 1 = 12 weightage)

Section B

Answer any **two** questions.

Each question carries 6 weightage.

13. Describe the effective range theory of p - p scattering.
14. Write an essay on the nuclear fusion reaction undergoing at the interior of the sun. What are the various fusion reactors and describe in detail about any *two* fusion reactors ?

Turn over

15. Explain the working of Proportional and GM counters.
16. Explain in detail about charge conjugation, parity and time reversal and the combination of them with suitable examples.

(2 × 6 = 12 weightage)

Section C

Answer any four of the following questions.
Each question carries 3 weightage.

17. The maximum energy of β - particles from ${}_{15}^{32}\text{P}$ is 1.71 MeV. What magnetic field perpendicular to the beam of β - particles from ${}_{15}^{32}\text{P}$ would bend it to give a radius of 100 mm. ? Given

$$m = m_0 \left(1 - \frac{v^2}{c^2} \right)^{-\frac{1}{2}}$$

18. If the energy of the α -particle emitted by ${}^{231}\text{Au}$ is 5.48 MeV, find the closest distance it can approach a Au nucleus.
19. Using the liquid drop model, find the most stable isobars for $A = 118$.
20. An α -particle of energy 5.48 MeV is completely stopped in an ionization chamber. What is the pulse height in an external resistance of 1 M Ω ? Energy required to produce an ion pair is 35 eV and the capacitance of the chamber is 50 pF.
21. Calculate the height of the potential barrier faced by an α -particle inside the ${}_{88}^{226}\text{Ra}$ nucleus.
22. Determine whether the following reactions are allowed or forbidden :

(a) $p + p \rightarrow K^+ + \Sigma^+$

(b) $\bar{\nu}_e + p \rightarrow n + \mu^+$

(c) $p + \pi^- \rightarrow \Sigma^0 + \eta^0$

(4 × 3 = 12 weightage)