

18P311

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Name.....

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, NOVEMBER 2019

(Regular/Supplementary/Improvement)

(CUCSS-PG)

(Physics)

CC17P PHY3 C10 - NUCLEAR AND PARTICLE PHYSICS

(2017 Admission onwards)

Time: Three Hours

Maximum: 36 Weightage

PART A

Answer *all* questions. Each question carries 1 weightage.

1. There are no diproton and dineutron bound states in nature. Why?
2. Explain Yukawa's exchange force model of nuclear forces.
3. What is internal conversion? Define conversion co-efficient.
4. What is Fermi-Kurie Plot? Explain its significance in Fermi's Theory.
5. List any four evidences for the existence of magic numbers.
6. Explain Compound nuclear reaction in terms of liquid drop model.
7. What are thermal neutrons? Explain their role in Nuclear fission.
8. Explain characteristics of a gas detector.
9. Distinguish between a single channel analyser and multichannel analysers.
10. Write a short note on Ge (Li) and Si (Li) detectors.
11. Explain Wu's experiment on non-conservation of parity in particle interactions.
12. What is isospin quantum number? Give the isospin quantum numbers associated with nucleons.

(12 x 1 = 12 Weightage)

PART B

Answer any *two* questions. Each question carries 6 weightage.

13. Discuss the partial wave analysis of low energy neutron scattering and derive the cross section in terms of the phase shift. Explain the physical significance of scattering length.
14. Discuss Nuclear shell Model. Explain how the inclusion of spin orbit coupling in shell model helped in clarifying the shell structure of nucleus.
15. Explain the classical and quantum theories of gamma - transitions. What are the relevant selection rules involved in gamma \square -decay?

16. Describe the eight fold way and show how the octet and decuplet of particles can be formed. Explain quark theory as evolved from Eight fold way model.

(2 x 6 = 12 Weightage)

PART C

Answer any *four* questions. Each question carries 3 weightage.

17. Using semi empirical mass formula, derive the expression for the most stable nucleus in a given set of isobaric nuclei.
18. Find the ground state Spin, Parity, Magnetic dipole and electric quadrupole moments of $^{17}_8\text{O}$ and $^{33}_{16}\text{S}$
19. State the relevant selection rules for beta decays. A given nucleus decays first by beta decay from its 2+ ground state to the 2- excited state of the daughter nucleus using the appropriate selection rules, identify the type of beta transition (Fermi or G-T).
20. A Geiger Muller tube with a cathode 5 cm in diameter and a wire diameter of 0.012 cm is filled with Argon to a pressure such that the mean free path is 7.8×10^{-4} cm. Calculate the value of voltage that must be applied to just produce an avalanche.
21. Calculate the threshold energy of the incident alpha particle in the reaction.



22. Analyze the following reactions according to their quark content. In each case state whether the reaction is possible or not.
- a) $\Omega^- \rightarrow \lambda^0 + K^- + p$
- b) $\Xi^- \rightarrow \lambda^0 + \pi^-$
- c) $K^+ \rightarrow \pi^0 + \pi^+$

(4 x 3 = 12 Weightage)
