



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – PHYSICS

FOURTH SEMESTER – APRIL 2017

PH 4811/ PH 4808 - NUCLEAR PHYSICS

Date: 20-04-2017
09:00-12:00

Dept. No.

Max. : 100 Marks

PART – A

Answer ALL questions.

(10 x 2 = 20 marks)

1. Give the reasons for non-existence of electrons inside the nucleus.
2. Mention any two properties of the deuteron.
3. Find the BE and BE/A of ${}_{29}\text{Cu}^{64} = 63.929759$ u. Given $M_{\text{H}} = 1.008665\text{u}$ and 1.007825u .
4. What are magic numbers? How are they correlated with nuclear stability?
5. State any two striking similarities between the liquid drop and the nucleus.
6. Define level width in terms of the uncertainty principle.
7. Describe the safety precautions to be adopted in the design of a nuclear reactor.
8. Enlist the 3 modes of β decay.
9. Determine the strangeness number of a neutral kaon using the conservation of strangeness in the following reaction:
$$p^+ + p^+ \rightarrow p^+ + \Lambda^0 + K^+$$
10. Give the quark composition of a proton.

PART – B

Answer ANY FOUR questions.

(4 x 7.5 = 30 marks)

11. Obtain an expression for the nuclear magnetic dipole moment.
12. Derive the Levy's formula for determination of atomic masses.
13. Give an outline of the various types of nuclear reactions with examples.
14. Outline the salient features of the neutrino hypothesis.
15. Write a brief note on charge conjugation in elementary particles.
16. Explain the meson theory of nuclear exchange.

PART – C

Answer ANY FOUR questions.

(4 x 12.5 = 50 marks)

17. Describe the electron scattering method for determination of nuclear size.
18. Obtain an expression for nuclear mass using Weizsacker's semi-empirical formula.
19. Derive the Breit-Wigner single level resonance formula for compound nuclei.
20. Describe the important features of the Fermi's theory of beta decay and hence deduce the Fermi and Gamow-Teller selection rules for beta transition.
21. Discuss the classification of elementary particles and describe their conservation laws.
22. Explain the formation of compound nucleus and briefly describe its energy levels.