



LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION – PHYSICS

FOURTH SEMESTER – APRIL 2018

16PPH4MC02/PH4811/PH4808 – NUCLEAR PHYSICS

Date: 20-04-2018
Time: 01:00-04:00

Dept. No.

Max. : 100 Marks

PART – A

Answer **ALL** Questions.

(10 x 2 = 20)

1. An α -particle of energy 5 MeV is scattered through 180° by a Uranium nucleus. Calculate the distance between the nucleus and the α -particle.
2. Write a short note on charge independence of nuclear forces.
3. What are magic numbers? How are they correlated with nuclear stability?
4. Calculate the BE and BE/A of ${}_{28}\text{Ni}^{64} = 63.927958\text{u}$. Given $M_n = 1.008665\text{u}$ and $M_H = 1.007825\text{u}$.
5. List down types of reactions based on the type of the bombarding particle.
6. Describe continuum, leading to the collapse of sharp resonances in compound nuclei.
7. What are the 3 modes of β decay?
8. Write a note on parity violation in β decay.
9. What are leptons? Name any two leptons and their antiparticles.
10. Verify if charge is conserved in the following reaction: $\pi^+ + n \rightarrow K^0 + K^+$.

PART –B

Answer any **FOUR** Questions

(4 x 7.5 = 30)

11. List and explain the various exchange forces associated with nuclear interactions.
12. Bring out the analogies between the nucleus and the liquid drop.
13. Explain the formation of compound nucleus and describe its energy levels with relevant diagrams.
14. Discuss the Fermi and Gamow-Teller selection rules for beta transitions.
15. Discuss the quark model of nucleons and mesons.
16. Derive the Levy's formula for determination of atomic mass.

PART –C

Answer any **FOUR** Questions

(4 x 12.5 = 50)

17. Discuss with necessary theory, how the electron scattering experiments lead to the determination of the nuclear size.

18. Obtain an expression for nuclear mass using Weizsacker's semi-empirical formula.
19. Write a detailed note on the basic aspects of a nuclear reactor.
20. Explain the Gamow's theory of alpha decay.
21. Elucidate the principle of CPT invariance in elementary particles.
22. Derive the Breit-Wigner single level resonance formula for compound nuclei.

\$\$\$\$\$\$\$\$