



Date: 08-04-2019
Time: 09:00-12:00

Dept. No.

Max. : 100 Marks

PART A

Answer ALL questions:

(10 x 2 = 20)

1. An α -particle of energy 3 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. Calculate the BE and BE/A of ${}_{28}\text{Ni}^{64} = 63.927958\text{u}$. Given $M_n = 1.008665\text{u}$ and $M_H = 1.007825\text{u}$.
4. List down the types of reactions based on the type of the bombarding particle.
5. Describe continuum, leading to the collapse of sharp resonances in compound nuclei.
6. Describe spallation reaction with an example.
7. Give any 4 properties of an ideal reactor coolant.
8. Describe pion condensation.
9. What are leptons? Name any two leptons and their antiparticles.
10. Give the quark composition of an antiproton.

PART B

Answer Any Four questions:

(4 x 7.5 = 30)

11. Give an account of the electric quadrupole moment of nuclei.
12. Obtain Levy's formula for atomic mass determination.
13. Derive the four factor formula for controlled chain reactions.
14. Discuss the Fermi and Gamow-Teller selection rules for beta transitions.
15. Discuss the invariance of combined (CP) inversion in nature with a suitable example.
16. Bring out the analogies between the nucleus and the liquid drop.

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. Derive the semi-empirical mass formula proposed by Weizsacker giving adequate explanation to each energy term.
19. Obtain the Breit-Wigner resonance formula for $l=0$ in a compound nucleus.
20. Discuss the energy spectrum of beta decay and outline the Fermi's theory.
21. Elucidate the principle of CPT invariance in elementary particles.
22. Elucidate the shell model and write a note on the significance of magic numbers.

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