

(6 pages)

OCTOBER 2011

P/ID 40010/PPHK

Time : Three hours

Maximum : 100 marks

PART A — (10 × 2 = 20 marks)

Answer ALL questions.

All questions carry equal marks.

1. What are isotopes and isotones?
2. Write a short note on Mass parabola.
3. Explain why di-proton or di-neutron does not exist.
4. What are three forms of Beta decay?.
5. Explain why it is not possible to have a $0^+ \rightarrow 0^+$ in γ - transition.
6. Calculate the Q-value for the Beta decay of $^{108}\text{Ag} \rightarrow ^{108}\text{Cd} + \beta^- + \bar{\nu}_e$.
7. Write a note on helicity of neutrino.

8. What you mean by pair production?
9. Explain Isospin.
10. What is meant by charm?

PART B — (5 × 6 = 30 marks)

Answer ALL questions.

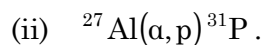
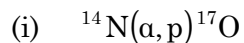
All questions carry equal marks.

11. (a) Write a note on salient features of nuclear forces.

Or

- (b) Discuss the effective range theory of n-p scattering.

12. (a) Expand the following reactions and determine the Q-value.



Or

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(b) Prove that the nuclear absorption cross-section varies inversely proportional to the velocity of the incident neutron for low energy neutrons.

13. (a) Discuss the salient features of Nuclear Shell Model. Predict ground state J^π of ^{15}N .

Or

(b) Describe the expression for nuclear magnetic moments based on Schmidt model.

14. (a) What is the Fermi-Kurie plot and determine the mass of the neutrino by using Fermi-Kurie plot.

Or

(b) Determine the multipolarities in gamma decay using angular correlation techniques.

15. (a) What are fermions and Bosons? Discuss the classification of Fermions and Bosons.

Or

(b) What are hadrons? Discuss their SU(3) classifications.

PART C — (5 × 10 = 50 marks)

Answer ALL questions.

All questions carry equal marks.

16. (a) With a square well potential, derive an expression for the binding energy of a deuteron, as a function of the depth and width of the potential.

Or

- (b) Describe the basic ideas in Yukawa's meson exchange theory of nuclear forces. From the Yukawa theory form, If a nucleon emits a Virtual pions of rest mass $270 m_e$, estimate the range of nuclear force.

17. (a) (i) Prove that the nuclear absorption cross-section varies inversely proportional to the velocity of the incident neutron for low energy neutrons.
- (ii) Discuss briefly the various types of the direct reactions with suitable examples.

Or

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- (b) Describe the Breit-Wigner dispersion formula for σ_r (the reaction cross section) and σ_s (the scattering cross section) for spinless neutrons.
18. (a) Discuss the Bohr-Wheeler theory of fission and find the condition for spontaneous fission. Obtain the expression for activation energy for initiating fission with suitable examples.

Or

- (b) (i) Explain how the L.S interaction helps us to reproduce the magic number in Shell model?
- (ii) Discuss the salient features of the collective model.
19. (a) Discuss Fermi's theory of beta decay and explain the continuous beta spectrum.

Or

- (b) (i) What are the selection rules for gamma decay? Illustrate with examples.
- (ii) Write note on Internal conversion and nuclear Isomerism.

20. (a) What is CP invariance? Combined operation of charge and space or simultaneous reversal of charge and position coordinate on the particle.

Or

- (b) (i) Discuss Weak Interactions in detail. Illustrate with examples.
- (ii) Determine the charges of the u and d quarks from the quark structure of a neutron and a proton.
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