

D 71336

(Pages : 2)

Name.....

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE EXAMINATION, DECEMBER 2014

(CUCSS)

Physics

PHY 3C 10—NUCLEAR AND PARTICLE PHYSICS

(2012 Admission onwards)

Time : Three Hours

Maximum : 36 Weightage

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

1. What is mass defect and how will you correlate it with packing fraction ?
2. Write down semi-empirical mass formula and explain the different terms in it.
3. Explain Electric quadrupole moment of a nucleus.
4. What are the predictions of shell model ?
5. Explain how collective model explains nuclear vibrations.
6. Explain Kuril plot.
7. Define internal conversion coefficient and explain its significance.
8. Briefly explain the various conservation laws in nuclear reactions.
9. Explain the terms spontaneous fission and induced fission.
10. What is a thermonuclear reaction ? Illustrate it with an example.
11. Briefly explain Quark flavours and colours.
12. Write a note on quantum chromo dynamics.

(12 × 1 = 12 weightage)

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

13. Discuss the deuteron system in detail considering it as a rectangular square well potential and deduce an expression for the radius of the deuteron.
14. Derive an expression for the total magnetic moment of the nucleus and explain it with the help of Schmidt diagram.

Turn over

15. Using Fermi's theory of β -decay explain allowed and forbidden β -transitions.
 16. Discuss the various conservation laws in particle interaction.

(2 × 6 = 12 weightage)

Section C

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

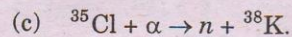
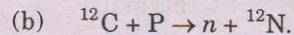
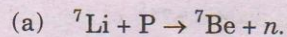
17. Compute the mass defects of :

(a) ^{32}S ; (b) ^{20}F ; (c) ^{238}U .

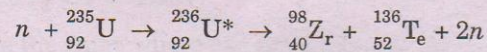
18. Determine the harmonic oscillator frequencies w appropriate to the nuclei ^{17}O and ^{60}Ni .

19. Prove that for $E_m \ll m_e c^2$, the mean kinetic energy of the 13-particle is equal to $E_m/3$.

20. For the following endoergic reactions, find the Q value and the threshold kinetic energy, assuming in each case that the lighter particle is incident on the heavier particle at rest.

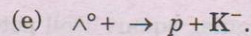
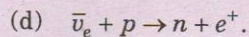
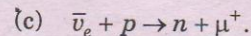
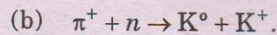
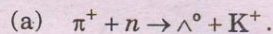


21. Consider a typical reaction during the neutron induced fission of $^{235}_{92}\text{U}$, namely



The following fission fragments are far from stability region and decay into stable end products $^{98}_{42}\text{Mo}$ and $^{136}_{52}\text{Xe}$ by successive emission of β -particles calculate total energy that will be released in this fission reaction.

22. Analyse the following decays or reactions for possible violation of the basic conservation laws :



(4 × 3 = 12 weightage)