

D 70985

(Pages : 2)

Name.....

Reg. No.....

THIRD SEMESTER M.Sc. DEGREE (REGULAR) EXAMINATION
NOVEMBER 2019

Physics

PHY 3C 10—NUCLEAR AND PARTICLE PHYSICS

(2017 Admissions)

Time : Three Hours

Maximum : 36 Weightage

Section A

Answer all questions.

Each question carries 1 weightage.

1. What are the limits on the phase shifts for an elastic scattering and a nuclear reaction process ?
2. What are singlet and triplet potentials ?
3. Express the Gell-mann-Nishijima formula.
4. Explain the origin of stellar energy.
5. What are baryon and lepton conservation laws ?
6. Give the Gamow Teller selection rules for beta decay.
7. How does binding energy of the odd-odd differ from the even-even nuclei.
8. What is the principle of Ionization chamber ?
9. What are the assumptions on which shell model is based ?
10. What is Solar Fusion ?
11. Explain the concept of charge conjugation.
12. What do you mean by pair production and annihilation of matter ?

(12 × 1 = 12 weightage)

Section B

Answer any two questions.

Each question carries 6 weightage.

13. With necessary theory explain in detail the low energy n-p scattering and obtain the expression for cross-section.
14. Give the main assumptions of liquid drop model of the nucleus. Obtain the expression for the binding energy of a nucleus based on liquid drop model. State the semi-empirical formula of Weizacker.

Turn over

15. Give an account of :

(i) Semiconductor detector.

(ii) Discuss the working of a scintillation detector.

16. What are Quarks ? Outline the basic properties of quarks. Explain the quark model of baryons.

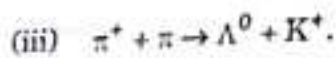
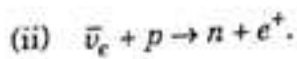
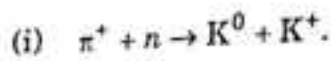
(2 × 6 = 12 weightage)

Section C

Answer any four questions.

Each question carries 3 weightage.

17. Some nuclear reactions involving elementary particles is given below. Among them which reaction are possible ?



18. It is required to operate a proportional counter with a maximum radial field of 10^6 Vm^{-1} . What is the applied voltage required if the radii of the wire and tube are 0.01 cm and 1 cm respectively

19. A radioactive substance has a half life period of 30 days. Calculate the time taken for $\frac{3}{4}$ original numbers of atoms to disintegrate

20. Calculate the binding energy and average binding energy per nucleon of ${}_{15}\text{P}^{31}$ of mass

$${}_{15}\text{P}^{31} = 30.9737634.$$

21. The activity of certain radio nuclide decreases to 15% of its original value in 10 days. Find its half life.

22. Show that for a most stable isobar of a nucleus having odd mass number A, the atomic number Z

Z is given by,
$$\left[\frac{A}{0.015A^{\frac{2}{3}} + 2} \right]$$
 the constants in the semiempirical mass formula $a_3 = 0.58 \text{ Mev}$,
 $a_4 = 19.3 \text{ Mev}$.

(4 × 3 = 12 weightage)