

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2008-09)

SUBJECT CODE : PH/MC/NP64

B.Sc. DEGREE EXAMINATION APRIL 2011
BRANCH III - PHYSICS
SIXTH SEMESTER

REG. No. _____

COURSE : MAJOR – CORE
PAPER : NUCLEAR PHYSICS
TIME : 30 MINS.

MAX. MARKS : 30

SECTION – A

TO BE ANSWERED IN THE QUESTION PAPER ITSELF:

ANSWER ALL QUESTIONS:

I. CHOOSE THE CORRECT ANSWER:

- The size of atomic nucleus is
(a) 10^{-10} m (b) 10^{-12} m (c) 10^{-14} m (d) 10^{-17} m.
- Nuclear forces are
(a) Spin dependent (b) Spin independent
(c) Charge dependent (d) Internucleon distance dependent
- The nuclear fission was explained by
(a) Liquid drop model (b) Shell model
(c) Collective model (d) Radioactive model
- Bi^{10} has half life of 5 days. The time taken for seven eighths of sample to decay is
(a) 3.4 days (b) 10 days (c) 15 days (d) 20 days
- The range of α – particles depend on energy E according to relation
(a) $R \propto E$ (b) $R \propto E^{1/2}$ (c) $R \propto E^2$ (d) $R \propto E^{3/2}$
- A neutrino is emitted in
(a) α -decay (b) β -decay (c) γ -decay (d) All the above three processes
- γ –Ray emission is associated with
(a) Atomic energy states (b) Nuclear energy states
(c) Both (a) and (b) (d) None of these
- Cyclotron is used to accelerate protons upto energy of the order of
(a) KeV (b) MeV (c) BeV (d) few eV
- Emulsion detectors are used to determine the rest mass of
(a) Pions (b) α -particles (c) γ –rays (d) None of these

10. In the nuclear reaction ${}_6\text{C}^{12}(\text{d},\text{x}){}_7\text{N}^{13}$, the particle x is
 (a) α -particle (b) proton (c) neutron (d) gamma-photon
11. The fission of ${}_{92}\text{U}^{235}$ is caused by
 (a) α -particles (b) β -particles (c) fast neutrons (d) slow neutrons
12. In a working nuclear reactor, cadmium rods are used to
 (a) speed up neutrons (b) slow down neutrons
 (c) absorb some neutrons (d) absorb all neutrons.
13. Nuclear particles are bound in nucleus by
 (a) gravitational forces (b) mesonic forces
 (c) electrostatic forces (d) electromagnetic forces
14. Which of the following are fermions ?
 (a) neutrino (b) μ -meson (c) μ & π mesons (d) electrons
15. Quadrupole moment is exhibited by
 (a) spherical nuclei (b) ellipsoidal nuclei (c) both (a) & (b) (d) neither (a) nor (b)

II. STATE IF TRUE OR FALSE:

16. Isotopes are elements having same chemical properties and differ only in mass
17. The rest mass of neutrino is 931MeV
18. Cyclotron is used to accelerate only electrons
19. The fission of ${}_{92}\text{U}^{235}$ nucleus releases 200 MeV of energy
20. Photons obey Bose – Einstein statistics.

III. FILL IN THE BLANKS:

21. The value of nuclear density is -----.
22. The activity of a radioactive substance is measured in terms of ----
23. The basic principle of G.M.counter is-----.
24. The four factor formul is -----.
25. u quark has electric charge -----

IV. ANSWER IN ONE OR TWO SENTENCES:

26. Define binding energy.

27. Define half –life period of a radioactive substance..

28. What is the main drawback of nuclear emulsion technique?

29. Define Q value of a nuclear reaction

30. Mention any two applications of NMR.



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SECTION - B

ANSWER ANY FIVE QUESTIONS: (5X 5 = 25)

1. Calculate the binding energy of an alpha particle and express the result in both MeV and joules. ($m_n = 1.008665 \text{ amu}$, $m_p = 1.007276 \text{ amu}$)
2. Calculate the time required for 10% of a sample of thorium to disintegrate. Assume the half life of thorium to be 1.4×10^{10} years.
3. Deuterons in a cyclotron describe a circle of radius 0.32m just before emerging from the Dees. The frequency of the applied e.m.f is 10MHz. Find the flux density of the magnetic field and velocity of deuterons emerging out of the cyclotron. Mass of deuterium $+3.32 \times 10^{-27} \text{ kg}$; $e = 1.6 \times 10^{-19} \text{ C}$.
4. Explain Q value of a reaction. How is it related to threshold energy of a particle?.
5. What is thermonuclear reaction? Explain Carbon – Nitrogen Cycle..
6. Explain the basic principle of NQR.
7. Explain the meaning of elementary particles. Give a brief account of the discovery and properties of any two important elementary particles.

SECTION - C

ANSWER ANY THREE QUESTIONS (3 X 15 = 45)

8. Describe liquid drop model of nucleus.
9. Give an account of experiments to determine the range and energy of α particles.
10. Describe the construction and action of a cyclotron. Discuss its limitations.
11. Describe the construction and working of a nuclear reactor. When is the reactor said to be critical?
12. Describe the classification of elementary particles.

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