

STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2015-16 and thereafter)

SUBJECT CODE :15PH/MC/NP64

B.Sc. DEGREE EXAMINATION APRIL 2019
BRANCH III - PHYSICS
SIXTH SEMESTER

COURSE : MAJOR – CORE
PAPER : NUCLEAR AND PARTICLE PHYSICS
TIME : 3 HOURS. MAX. MARKS :100

SECTION – A

ANSWER ALL QUESTIONS: (30X1=30)

I. CHOOSE THE CORRECT ANSWER:

- The mass defect of an atom divided by its mass number is known as _____
 - Packing fraction
 - Nuclear density
 - Nuclear radius
 - Meson theory
- The nuclear density will be in the order of _____
 - 10^{15}kg/m^3
 - 10^{17}kg/m^3
 - 10^{-15}kg/m^3
 - 10^{-17}kg/m^3
- The interaction between nucleons is accomplished by the exchange of _____
 - π - Meson
 - Boson
 - Positron
 - Lepton
- _____ is defined as the quantity of a radioactive substance which gives 3.70×10^{10} disintegration per second
 - Micro curie
 - Milli curie
 - Curie
 - Rutherford
- The probability of leakage of an alpha particle through the barrier is called _____
 - Disintegration
 - Tunnel effect
 - Fusion
 - Fission
- _____ are not affected by electric and magnetic fields
 - Alpha ray
 - Beta ray
 - Gamma ray
 - Neutrino
- The ratio of the observed counts/sec to the number of ionizing particles entering the counter per second in Geiger-Muller counter is called _____ of the counter.
 - Efficiency
 - Impulse
 - Plateau
 - Tension
- The energy of the particle is converted to _____ is the basis of scintillation counter.
 - Mass
 - Light
 - Charge
 - Density

9. The ions travel with constant _____ in the field-free space inside the drift tubes in the linear accelerator.
 - a. Charge
 - b. Density
 - c. Velocity
 - d. Accelerator
10. The radioactive nitrogen decays into a stable isotope of _____ with the emission of a positron.
 - a. Carbon
 - b. Helium
 - c. Radium
 - d. Chromium
11. When lithium is bombarded by protons it breaks up into two _____.
 - a. Beta particle
 - b. Neutron
 - c. Alpha particle
 - d. Hydrogen
12. Greater energy per unit mass is obtained from a _____ than from a nuclear fission bomb.
 - a. Transmutation
 - b. Hydrogen bomb
 - c. Cooling system
 - d. Moderator
13. Hyperon is a special class of
 - a. Leptons
 - b. Mesons
 - c. Baryons
 - d. Electrons
14. _____ were produced by bombarding protons in a target with 6-Gev proton
 - a. Neutron
 - b. Antineutron
 - c. Antiproton
 - d. Neutrino
15. The strong nuclear interaction is independent of the _____.
 - a. Mass
 - b. Density
 - c. Electric charge
 - d. Nuclear volume

II.FILL IN THE BLANKS:

16. The density of the liquid drop is _____ of its volume.
17. The range of the alpha particle depends on _____ of the alpha particle.
18. The proton synchrotron provides energy of the order of _____ to protons.
19. Number of atoms in 1kg uranium is _____
20. Anti-hydrogen would have a spectrum similar to that of _____

III.STATE WHETHER TRUE OR FALSE:

21. The charge of the nucleus is due to the neutrons contained in it.
22. According to Fermi neutrino theory a beta particle and a neutrino are created in the nucleus.
23. In nuclear emulsion, the thickness is smaller than that of optical emulsion.
24. Most of the mass of natural uranium consists of U^{238} .
25. Parity relates to the symmetry of the wave function that represents the system in elementary particles.

IV.ANSWER BRIEFLY:

26. List the three types of attractive forces inside the nucleus.
27. What is called tunnel effect?
28. What is the reason for the execution of circular path of ion in cyclotron?
29. What is known as nuclear fission?
30. What is the range and characteristic time of weak interaction?

SECTION – B**ANSWER ANY FIVE QUESTIONS:****(5X 5 = 25)**

31. The wire in a GM counter collects 10^{10} electrons per discharge. If the count rate is 1000/min, Calculate the average current in the circuit. (Charge on electron is 1.6×10^{-19} C).
32. Explain the liquid drop model of nucleus.
33. The half life period of radium is 1590 years. In how many years will 1 gram of pure element a) lose one centigram b) be reduced to 1 centigram?
34. i) Calculate the weight in kg of 1 Curie of Rn B(Rn^{214}) from the half-life of 26.8 minutes
ii) Find the activity of 1 mg of radon.
35. In a linear accelerator proton accelerated thrice by a potential of 40 kV leaves a tube and enters an accelerating space of length 30 cm before entering the next tube. Calculate the frequency of the radio frequency voltage and the length of the tube entered by the proton.
36. A reactor is developing energy at the rate of 3000 kW. How many kg of U^{235} would be used in 1000 hrs of operation assuming that on an average energy of 200 MeV is released per fission?
37. Explain the fundamental interactions of nature.

SECTION - C**ANSWER ANY THREE QUESTIONS:****(3X15= 45)**

38. Explain the Meson theory of nuclear forces. ii) Discuss the weizacker semi empirical mass formula for binding energy of the nucleus.
39. Describe the Neutrino theory of beta decay. ii) Explain the K-electron capture.
40. Discuss the construction and working of cyclotron with necessary theory and give its limitations.
41. Explain the process of nuclear transmutations by α -particles, protons, deuterons and neutrons.
42. Describe the quark model of elementary particles.
