



QP CODE: S0100437



S0100437

Reg No :

Name :

BSc DEGREE (CBCS) EXAMINATION, MARCH 2020

Sixth Semester

Core course - PH6CRT11 - NUCLEAR, PARTICLE AND ASTROPHYSICS

B.Sc Physics Model I, B.Sc Physics Model II Computer Applications, B.Sc Physics Model III
Electronic Equipment Maintenance, B.Sc Physics Model II Applied Electronics

2017 Admission Onwards

1FDBE24C

Time: 3 Hours

Maximum Marks: 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. Explain nuclear spin magnetic moment.
2. What are the properties of nuclei on which liquid drop model is based?
3. Why nuclear shell model referred to as independent model ?
4. What is a linear accelerator?
5. Compare the velocities of α -particle, β -particle and γ - rays.
6. Which isotope is the parent element of Actinium series?
7. Write any two hazards of radiation.
8. Define Q value of a reaction.
9. What is east – west asymmetry of cosmic rays?
10. What are Baryons?
11. What is the charge of a strange quark?
12. What is meant by Photon diffusion time?

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. With the help of magnetic moment of nucleus, explain why electrons cannot exist inside the nucleus?





14. Calculate the energy required to remove the least tightly bound neutron from ${}_{20}\text{Ca}^{40}$, given the mass of ${}_{20}\text{Ca}^{40}$ is 39.962589 amu, the mass of ${}_{20}\text{Ca}^{39}$ is 38.970691 amu, and the neutron mass is 1.008665 amu.
15. An ionization chamber exposed to a beam of α particles registers a current of 3.5×10^{-13} A. On the average 25 alpha particles enter the chamber per second. Assuming that the production of an ion pair in the chamber involves the expenditure of 35 MeV of energy, calculate the energy of the alpha particles.
16. Explain Cyclotron.
17. In an archaeological expedition, charcoal from an ancient fire pit was excavated. The sample showed a ${}_{6}\text{C}^{14}$ activity of 11.3 counts per gram per minute. The absolute activity of ${}_{6}\text{C}^{14}$ is constant for all wood samples and is equal to 15.3 counts per gram per minute. Estimate the age of charcoal sample. Half life of ${}_{6}\text{C}^{14} = 5568$ years.
18. Draw the β – spectrum of any β – emitting isotope. Explain why the β – spectrum is continuous?
19. A reactor is developing energy at the rate of 32 mega watts. How many atoms of ${}_{92}\text{U}^{235}$ undergo fission per seconds? Assume that on the average, an energy of 200MeV is released per fission.
20. Which of the following reactions are forbidden? Explain the reason. (a) $\pi^{+} + n \rightarrow \pi^{-} + p$
(b) $\pi^{+} + n \rightarrow \Lambda^{0} + K^{+}$
21. Describe the various symmetry operations in particle physics.

(6×5=30)

Part C

Answer any **two** questions.

Each question carries **10** marks.

22. Explain Nuclear forces and Meson theory of Nuclear forces.
23. Explain the principle, construction and working of Wilson cloud chamber.
24. What is nuclear fusion? Explain nuclear fusion in stars and fusion reactors. Explain tokamak.
25. Define HR diagram. What are the uses? Sketch and explain HR diagram

(2×10=20)

