

C 80035

(Pages : 3)

Name.....47.....

Reg. No.....

SIXTH SEMESTER B.Sc. DEGREE EXAMINATION, MARCH/APRIL 2015

(U.G.-CCSS)

Core Course—Physics

PH 6B 18—NUCLEAR PHYSICS, PARTICLE PHYSICS AND ASTROPHYSICS

Time : Three Hours

Maximum : 30 Weightage

Section I

Answer all questions.

Each question carries $\frac{1}{4}$ weightage.

1. Radioactivity is :
 - (a) Irreversible process.
 - (b) Self disintegration process.
 - (c) S Pontaneous.
 - (d) All of the above.
2. Nuclear forces :
 - (a) Obey the inverse square law of distance.
 - (b) Obey the inverse third power law of distance.
 - (c) Are strong short range forces.
 - (d) Are weak short range forces.
3. The phenomenon of pair production is :
 - (a) Production of an electron and a positron from γ -rays.
 - (b) Ejection of a proton and neutron from nucleus.
 - (c) Ejection of proton and electron from a nucleus.
 - (d) Creation of neutrino and antineutrino.
4. Fusion reactions take place at a high temperature because :
 - (a) Atoms are ionized at high temperature.
 - (b) Kinetic energy is high enough to overcome repulsion between nuclei.
 - (c) Nuclei break up at high temperatures.
 - (d) None of the above.
5. When Boron (${}^5\text{B}^{10}$) is bomharded by a neutron α particles are emitted ? The resulting nucleus has a mass number :
 - (a) 7.
 - (b) 6.
 - (c) 11.
 - (d) 9.

Turn over

6. The critical mass of fissionable Uranium 235 can be reduced by :
- Adding impurities.
 - Heating the material.
 - Surrounding it by neutron reflecting material.
 - Surrounding it by neutron absorbing material.
7. Due to earth's magnetic field the charged cosmic ray particle :
- Require greater kinetic energy to reach the equator than pole.
 - Require less kinetic energy to reach the equator than pole.
 - Cannot reach the equator.
 - Cannot reach the poles.
8. Which one of the following is the best nuclear fuel ?
- Uranium 236.
 - Plutonium 236.
 - Neptunium 239.
 - Thorium 239.
9. Hyper charge is equal to :
- Sum of the strangeness and baryon numbers.
 - Product of strangeness and baryon numbers.
 - Product of Lepton and baryon numbers.
 - Sum of Lepton and strangeness.
10. Quantum chromodynamics deals with the theory of _____.
11. In a linear accelerator high energy particles are produced by using the principle of _____.
12. The graph obtained by plotting the luminosity of stars against the surface temperature is called the _____.

($12 \times \frac{1}{4} = 3$ weightage)

Section II

Answer all questions.

Each question carries 1 weightage.

13. Distinguish between Isotopes and isobars.
14. What is nuclear binding energy ? Give any one information that you get from the binding energy curve.
15. Explain the postulates of the liquid drop model.
- Give the fundamental laws of radioactivity.
 - Distinguish between exoergic reactions and endoergic reactions.
18. How does nuclear fusion reaction take place in the sun ?

19. State the law of conservations of Baryon numbers.
20. Give the principle of the working of an electron synchrotron.
21. What are black holes ?

(9 × 1 = 9 weightage)

Section III

*Answer any five questions.
Each question carries 2 weightage.*

22. Prove that electrons cannot exist inside the nucleus.
23. Give a brief account of the moron theory of nuclear forces.
24. Assuming the age of the earth to be 10^{10} years, what fraction of the original amount of V^{238} , still in existence on the earth ? (Half life of $U^{238} = 4.5 \times 10^9$ years).
25. Why are neutrons chosen as missiles in nuclear reaction ? Illustrate with an example.
26. Write a note on cosmic ray showers.
27. Give an account of coloured quarks. What are gluons ?
28. Explain what you understand by the colour index of a star ? Mention *one* significance.

(5 × 2 = 10 weightage)

Section IV

*Answer any two questions.
Each question carries 4 weightage.*

29. What is a nuclear reaction ? Using the concept of center-of-mass Co-ordinate system, derive an expression for the kinetic energy in CM system. Define Q value of nuclear reaction.
30. Describe the construction and working of a Betatron.
31. What is the magic about the magic numbers ? Explain how the shell model of the nucleus accounts for the existence of magic numbers.

(2 × 4 = 8 weightage)