K18U 1490

V Semester B.Sc. Degree (CBCSS-Reg./Sup./Imp.)
Examination, November 2018
(2014 Admn. Onwards)
CORE COURSE IN PHYSICS
5B10PHY-Atomic, Nuclear & Particle Physics

Time : 3 Hours   Max. Marks : 40

Instruction : Write answers in English only.

SECTION – A

Answer **all** – Very short answer type – **Each** question carries **1** mark.

1. The de Broglie wavelength of an electron is given by _____

2. The amount of energy needed to remove an electron from an atom in its ground state is called as _____

3. The orbital angular-momentum vector of an electron can have _____ orientations in a magnetic field.

4. What are nucleons ?   (4×1=4)

SECTION – B

Answer **any seven** – Short answer type – **Each** question carries **two** marks.

5. State the four fundamental interactions with their range and relative strength.

6. Explain the Pauli's exclusion principle.

7. Write a note on the half-life and mean life of radioactive element.

8. Explain the binding energy of a nucleus.

9. What are symmetric and anti-symmetric wave functions ?

10. Explain the total angular momentum of an atom.

11. Discuss the radioactive series.

12. Write a note on nuclear decay.

13. Explain nuclear fission process.

14. Show that the total energy of an atom is inversely related to its radius. (7×2=14)

SECTION – C

Answer **any four** – Short essay/problem – **Each** question carries **three** marks.

15. An electron collides with a hydrogen atom in its ground state and excites it to a state of n = 3. How much energy was given to the hydrogen atom in this inelastic collision ?

16. Find the frequencies of revolution of electrons in n = 1 and n = 2 Bohr orbits. An electron typically spends about 10^{-8} s in an excited state before it drops to a lower state by emitting a photon. How many revolution does an electron in an n = 2 Bohr orbit make in 10^{-8} s ?

17. If atoms could contain electrons with principal quantum numbers up to and including n = 6, how many elements would there be ?

18. Find the atomic number of the element which emits K_α X-ray line of wavelength 0.180 nm.

19. a) Find the energy difference between the spin-up and spin-down states of a proton in a magnetic field of B = 1 T.

    b) What is the Larmor frequency of a proton in this field ?

20. Find the minimum kinetic energy in the laboratory system need by an alpha particle to cause the reaction $^{14}N(\alpha, p)^{17}O$. The masses of ^{14}N, ^4He, ^1H and ^{17}O are respectively 14.00307 u, 4.00260 u, 1.00783 u and 16.99913 u.

(4×3=12)

SECTION – D

Answer **any two** – Long essay type – **Each** question carries **five** marks.

21. Write an essay on explaining Stern-Gerlach experiment.

22. How X-rays are generated and explain the spectra obtained.

23. Explain He-Ne lasers.

24. What is correspondence principle ? (2×5=10)