



Reg. No. : SP16CPHR16

K18U 1490

Name : Jithuesh

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. 21.21

(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.



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- 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? $-1.9377 \times 10^{-18} \text{ J}$
- 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 ? 2.469×10^{23} 45025
- 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. (27) 2621
- ✓ 19. a) Find the energy difference between the spin-up and spin-down states of a proton in a magnetic field of $B = 1 \text{ T}$. $2.8209 \times 10^{-8} \text{ J}$
b) What is the Larmor frequency of a proton in this field? $4.2573 \times 10^6 \text{ Hz}$
- 20. Find the minimum kinetic energy in the laboratory system need by an alpha particle to cause the reaction $^{14}\text{N}(\alpha, p)^{17}\text{O}$. 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)