

K17U 1710

Reg. No. : .....

Name : .....

V Semester B.Sc. Degree (CBCSS – Reg./Sup./Imp.)  
Examination, November 2017  
(2014 Admn. Onwards)  
**CORE COURSE IN PHYSICS**  
**5B10PHY : Atomic, Nuclear and Particle Physics**

Time : 3 Hours

Max. Marks : 40

SECTION – A

Answer **all** – very short answer type, each question carries **1** mark.

1. The magnitude  $S$  of the angular momentum due to electron spin in terms of the spin quantum number  $s$  is \_\_\_\_\_
2. The binding energy of the nucleus is equivalent to \_\_\_\_\_
3. The main source of solar energy is \_\_\_\_\_
4. Particles exchanged in gravitational interactions are \_\_\_\_\_. (4×1=4)

SECTION – B

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

5. What is the shortest wavelength present in the paschen series of the spectral lines ?
6. What is population inversion and optical pumping ?
7. Why does the spin of an electron play an important role in the structure of energy levels of a many electron atom but not in hydrogen atom ?
8. Explain the subshell capacities.
9. Define isotopes with example.

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10. What are the basic notions of tunnel theory of alpha decay ?
11. Compare the properties of radioactive rays.
12. Differentiate neutrinos and antineutrinos.
13. Why must the quarks in a hadron have different colors ?
14. What is larmor frequency ? Give an expression for it. (7×2=14)

### SECTION – C

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

15. Explain Franck-Hertz experiment.
16. Find the activity of 1 mg of radon whose atomic mass is 222u.  $T_{1/2} = 3.8$  days.
17. The boron isotope  $B^{10}$  captures neutrons in an  $(n, \alpha)$  reaction whose cross section for thermal neutrons is  $4 \times 10^3$  b. The density of  $B^{10}$  is  $2.2 \times 10^3$  kg/m<sup>3</sup>. What thickness of  $B^{10}$  is needed to absorb 99% of an incident beam of thermal neutrons ?
18. Write a short note on eight fold way model.
19. Which element has a  $K_{\alpha}$  x-ray line whose wavelength is 0.180 nm ?
20. Briefly explain the Stern -Gerlach experiment. (4×3=12)

### SECTION – D

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

21. Explain the postulates of a liquid drop model. Derive Weizsäcker mass formula.
22. Discuss X ray spectra in detail.
23. Explain the ultimate constituents of hadrons.
24. Give the Bohr theory of hydrogen atom leading to its energy levels and spectra. (2×5=10)