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K19U 2270

Reg. No. : .....

Name : .....

V Semester B.Sc. Degree (CBCSS- Reg./Sup./Imp.) Examination,  
November-2019

(2014 Admn. Onwards)

Core Course in Physics

5B 10 PHY: ATOMIC, NUCLEAR &amp; PARTICLE PHYSICS

Time : 3 Hours

Max. Marks : 40

*Write answers in English only.***SECTION - A**Answer **All** - Very short answer type - each question carries 1 mark.

(4×1=4)

1. What is the SI unit of radioactivity?
2. Which element is used to date the objects of biological origin?
3. ----- is the antiparticle of the electron.
4. When the spin of an element is  $\frac{1}{2}$  then we obtain ----- state.

**SECTION - B**Answer any **SEVEN** - short answer type - Each question carries **TWO** marks.

(7×2=14)

5. Write a note on spin-orbit coupling.
6. Write a note on atomic structures.
7. Explain the eightfold way of classification of hadrons.
8. What is Franck-Hertz experiment?
9. How emission and absorption spectral lines originate.

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10. Obtain the relationship between the cross section and beam intensity? Also find the relation between the surviving particles and slab thickness.
11. Give brief account of half-life of the radioactive element.
12. What are stable nuclei?
13. Explain the correction in the binding energy formula obtained using liquid drop model.
14. Brief account of Lasers.

### SECTION - C

Answer any **FOUR** - short essay/problem - Each question carries **THREE** marks. **(4×3=12)**

15. Find the possible values of the total angular - momentum quantum number  $J$  under LS coupling of two atomic electrons whose orbital quantum numbers are  $l_1=1$  and  $l_2=2$ .
16. Show that the following decays conserves the lepton numbers  $L_e$  and  $L_\mu$ 
  - a)  $\pi^- \rightarrow \mu^- + \bar{\nu}_\mu$
  - b)  $\mu^- \rightarrow e^- + \nu_\mu + \bar{\nu}_e$
  - c)  $\gamma \rightarrow e^- + e^+$
17. Experiments indicate that 13.6 eV is required to separate a hydrogen atom into a proton and an electron. i.e. its total energy is  $E = 13.6$  eV. Find the orbital radius and velocity of the electron in a hydrogen atom.
18. The atomic ratio between the uranium isotopes  $^{238}\text{U}$  and  $^{234}\text{U}$  in a mineral sample is found to be  $1.8 \times 10^4$ . The half life of  $^{234}\text{U}$  is  $T_{1/2}(^{234}\text{U}) = 2.5 \times 10^5$  y. Find the half-life of  $^{238}\text{U}$ .
19. The binding energy of the neon isotope  $^{20}\text{Ne}_{10}$  is 160.647 MeV. Find its atomic mass ( $m({}_1^4\text{H}) = 1.007825 u, m(n) = 1.008665$ ).



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20. Find the longest wavelength present in the Balmer series of hydrogen corresponding to the  $H_\alpha$  line.

**SECTION - D**

Answer any **TWO** - Long essay type - Each question carries **FIVE** marks.  
**(2×5=10)**

21. Write a note on electron spin.
  22. What is shell model?
  23. Write a note on Quarks.
  24. Explain nuclear fusion in stars.
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