



K17U 2323

Reg. No. : .....

Name : .....

V Semester B.Sc. Degree (CCSS – Sup./Imp.)

Examination, November 2017

(2011 &amp; Earlier Admissions)

Core Course in Physics

5B10PHY : ATOMIC, NUCLEAR AND PARTICLE PHYSICS

Time : 3 Hours

Total Weightage : 30

## SECTION – A

Choose the correct answer. Each bunch carries a weightage of 1.

1. i) The electron energy is proportional to  
a)  $r$                       b)  $r^n$                       c)  $-(1/r)$                       d)  $-(1/r^n)$
- ii) Particles with symmetric wavefunctions are referred to as  
a) Bosons                      b) Fermions                      c) Quarks                      d) Leptons
- iii) The nuclear radii is proportional to  
a)  $A^{1/2}$                       b)  $A$                       c)  $A^{1/3}$                       d)  $A^{1/5}$
- iv) Quarks show which type of interaction?  
a) strong                      b) electromagnetic  
c) weak                      d) gravitational
2. i) Hadron families having same masses but different charges are termed as  
a) singlets                      b) triplets                      c) multiplets                      d) doublets
- ii) The total energy evolved from the sun is  
a)  $4 \times 10^{-12} \text{ J}$                       b)  $4 \times 10^{-10} \text{ J}$                       c)  $4 \text{ J}$                       d)  $24.7 \text{ J}$
- iii) The surface energy of a nucleus is given by  
a)  $-aA^{2/3}$                       b)  $-aA$                       c)  $-aA^{1/3}$                       d)  $-A$
- iv) Orbital angular momentum can acquire values  
a)  $\sqrt{L(L+1)} \hbar$                       b)  $l \hbar$                       c)  $m \hbar$                       d)  $\sum L_i$                       (2×1=2)



## SECTION – B

Answer **any six** questions. **Each** carries a weightage of 1.

3. Find the wavelength of the spectral line that corresponds to a transition in hydrogen from the  $n = 6$  state to the  $n = 3$  state.
4. State the two basic principles that determines the structure of atoms with more than one electron.
5. What is an isotope ? Name any 2 isotope of hydrogen.
6. What are magic numbers ?
7. What is half life of radioactive elements ?
8. Derive an expression for the cross-section when an energetic particle collides with a stationary target nuclei.
9. Which are the four fundamental forces ?
10. What do you mean by hadrons ? (6×1=6)

## SECTION – C

Answer **any nine** questions. **Each** carries a weightage of **two**.

11. Explain the Rutherford scattering experiment with diagram.
12. Explain about the spontaneous and stimulated emission processes.
13. Derive the total energy of an electron in a hydrogen atom.
14. Give a brief account on periodic table.
15. Explain LS coupling.
16. Calculate the atomic number of the element which has a  $K_{\alpha}$  X-ray line of wavelength 0.141 nm.
17. Explain about X-ray spectra.
18. What is binding energy of nucleus ? Explain with an example.
19. Distinguish between the nuclear fission and nuclear fusion processes.
20. What are the various radiation hazards ?
21. Explain Baryon and Lepton numbers.
22. What is the eight-fold way of classifying the hadrons. (9×2=18)

## SECTION – D

Answer **any one** question. **Each** carries a weightage of 4.

23. Explain the liquid drop model.
24. Describe about the radioactive decay process. (1×4=4)