



M 7337



Reg. No. :

Name :

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

Examination, November 2014

(2012 Admission)

CORE COURSE IN PHYSICS

5B10 PHY : Atomic, Nuclear and Particle Physics

Time : 3 Hours

Max. Weightage : 30

SECTION – A

Answer all questions. Each bunch carries 1 W.

- The minimum energy required to ionize hydrogen atom from its ground state is above
a) 13.6 eV b) 1.36 eV c) 136 eV d) 3.4 eV
- The kinetic energy of an electron in atom is
a) equal to the PE b) Half of PE c) Twice its PE d) Thrice its PE
- The non conservation of orbital angular momentum of the electron in an atom is due to
a) Spin orbit interaction
b) Spin-Spin interaction
c) Electrostatic interaction between electrons
d) Electrostatic interaction between electrons and nucleus
- The multiplicity of the state $2D_{3/2}$ is given by
a) 1 b) 2 c) 3 d) 4
- The volume of a nucleus in an atom is proportional to
a) mass number b) proton number
c) neutron number d) electron number

P.T.O.



6. Nuclear forces are
- | | |
|---------------------------------|---------------------------------|
| a) Short range attractive | b) Short range repulsive forces |
| c) Long range attractive forces | d) Long range repulsive forces |
7. Photoelectric absorption takes place when a sufficiently energetic photon interacts with
- | | |
|------------------|--------------------------------|
| a) Free electron | b) Electron of outermost shell |
| c) Nucleus | d) K shell electron |
8. When an electron and positron annihilate
- | | |
|----------------------------|-----------------------------|
| a) Nothing is created | b) One photon is created |
| c) Two photons are created | d) Two neutrons are created |
- (2×1=2 W)**

SECTION – B

Answer **any six**. Each question carries **1** weightage :

9. Explain the salient features of Rutherford scattering.
10. What is meant by stimulated emission process ?
11. What is a wave function ? Is it a physical reality ?
12. Briefly mention the nuclear properties.
13. What is radioactive equilibrium ?
14. What are baryons ? Give its property.
15. Distinguish between Fermions and Bosons.
16. What is black body radiation ? Give an example of a black body. **(6×1=6 W)**

SECTION – C

Answer **any nine**. Each question carries **2** weightage.

17. Explain the statement of Bohrs Correspondence principle. Give its significance and give an example of this principle.
18. What is Rydberg constant ? Calculate the wavelength of H_{α} and H_{β} lines of the hydrogen spectrum in the visible region.



19. Explain the idea of electron spin. Find the equatorial velocity of an electron assuming that it is a uniform sphere of radius $5 \times 10^{-7} \text{ m}$. Mass of electron = $9.1 \times 10^{-31} \text{ kg}$.
20. Explain atomic shells and sub shells of electrons.
21. What is Binding energy ? Find the energy release if two ${}^1_1\text{H}^2$ nuclei fuse together to form ${}^2_2\text{He}^4$ nucleus. The BE per nucleon of ${}^1_1\text{H}^2$ is 1.1MeV and of ${}^2_2\text{He}^4$ is 7.0MeV.
22. How does the liquid drop model explain the binding curve ?
23. What is radioactive decay ? What are the features of radioactivity that are different from classical physics ?
24. Define half life of a radioactive element. The half life of radon is 3.82 days. How long does it take for 60% of a sample of radon to decay ?
25. Explain compound nucleus reactions.
26. What are Leptons ? Explain the decay schemes of a pion and a muon.
27. What is equipartition of energy ? Find the rms speed of oxygen molecular mass of oxygen = $5.31 \times 10^{-26} \text{ kg}$.
28. Explain the Planck radiation law. Give its significance. **(9×2=18 W)**

SECTION – D

Answer **any one** question (Weightage **4**) :

29. What are the assumptions of the nuclear shell mode ? How is the magicity of magic numbers accounted using the shell model ?
30. What are the postulates of the Bohr atom model ? Derive an expression for the energy of the hydrogen atom in the n^{th} orbit. What is the significance of the negative sign in the energy term ? **(1×4=4 W)**