M 7160

Reg. No. : ....

Name : ....

V Semester B.Sc. Degree (CCSS-Reg./Supple./Imp.)
Examination, November 2014
CORE COURSE IN PHYSICS
5B10 PHY : Atomic, Nuclear and Particle Physics
(2011 and Earlier Admissions)

Time : 3 Hours   Max. Weightage : 30

PART – A

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

1. i) Rutherford is a unit of

   a) Energy   b) Radioactivity

   c) Photoelectric current   d) Magnetic field

   ii) In Bohr atom the ratio between the period of revolution of an electron in orbit if n = 1 to the period of revolution of the electron in the orbit n = 2 is

   a) 1 : 2   b) 2 : 1

   c) 1 : 4   d) 1 : 8

   iii) The absorption coefficient of X rays for a given wavelength is larger for

   a) Lithium   b) Lead

   c) Aluminium   d) Copper

   iv) Radioactivity is a

   a) Spontaneous process

   b) Irreversible process

   a) Self disintegration process

   d) All of the above

P.T.O.

2. i) Neutron was discovered by
   a) Rutherford   b) Chadwick
   c) Milikan   d) None of the above

ii) The radius R of a nucleus changes with the nucleon number A of nucleus as
   a) $R \propto A^{2/3}$ b) $R \propto A^{1/3}$
   c) $R \propto A^{0}$ d) $R \propto A$

iii) α-particle emitted during various radioactive process have same
   a) Speed   b) Momentum
   c) K.E.   d) Specific charge

iv) The rust mass of an antineutrino is
   a) 1   b) 0
   c) 02   d) None of these   (2×1=2)

PART – B

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

3. What is correspondence principle ?

4. Distinguish between symmetric and antisymmetric wave function.

5. What is Paulis exclusion principle ?

6. What is nuclear binding energy ?

7. Define decay constant and half life.

8. What is the significance of liquid drop model ?

9. Explain the mechanism of energy production in stars.

10. What are elementary particles ?   (6×1=6)

PART – C

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

11. Distinguish between spontaneous and stimulated emission processes.

12. Calculate:
    i) Ionisation potential
    ii) First excitation potential of the hydrogen atom taking h = 6.62×10⁻³⁴ JS.

13. Show that the velocity of the electron in the first Bohr orbit is $\frac{1}{137}$ C, where C is the velocity of light.

14. Explain the main features of the nuclear shell model. What are magic numbers ?

15. Discuss why the nucleus is supposed to consist of protons and neutrons and not electrons.

16. What are the laws of radioactive disintegration ?

17. Calculate the time required for 10% of a sample of thorium to disintegrate. Assume the half life of thorium to be 1.4×10^{10} years.

18. Discuss the biological effect of nuclear radiation.

19. Distinguish between nuclear fission and fusion.

20. Give an account of the discovery and properties of transuranic elements.

21. Give a brief account of energy levels and spectra of an atom.

22. Discuss the four type interaction between elementary particles.   (9×2=18)

PART – D

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

23. Explain the phenomenon of large angle scattering of α-particles and derive the Rutherford formula for it. Describe how size of the nucleus and nuclear models have been obtained from the scattering phenomenon.

24. Deduce the expression for Larmor frequency for protons placed in a magnetic field.   (1×4=4)

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