K17U 2324

Reg. No. : .....

Name : .....

V Semester B.Sc. Degree (CCSS – Sup./Imp.)
Examination, November 2017
CORE COURSE IN PHYSICS
5B10 PHY : Atomic, Nuclear and Particle Physics
(2012 and 2013 Admissions)

Time : 3 Hours

Total Weightage : 30

SECTION – A

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

1. i) The mass density of a nucleus varies with mass number A as
   1) A^2 2) A 3) A^{-1} 4) A^0
   ii) Maxwell – Boltzmann statistics is applicable to particles of
   1) Spin half 2) Integral spin 3) Any spin 4) Zero spin
   iii) Omega hyperon is made up of
   1) uuu 2) u + $\acute{d}$ 3) u + $\acute{s}$ 4) d + $\acute{u}$
   iv) The energy of nuclear electrons is of the order of
   1) 2 – 3 MeV 2) >20MeV 3) 1eV 4) None

2. i) The spin of neutrino is
   1) $\frac{1}{2}\hbar$ 2) $-\frac{1}{2}\hbar$ 3) 0 4) $-\hbar$
   ii) The phenomenon of radioactive decay was discovered by
   1) Marie Curie 2) Rutherford
   3) Becquerel 4) None of above
   iii) The system of fermions are described by _____ wave function.
   1) Symmetric
   2) Anti symmetric
   3) Both symmetric and anti symmetric
   4) None

P.T.O.

iv) Which one is the prediction of shell model ?
   1) Spins of nuclear ground states
   2) Stability of closed shell nuclei
   3) Magnetic moments of nuclei
   4) All of the above **(2×1=2)**

SECTION – B

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

3. What is beta decay ? Give an example.
4. State Pauli's Exclusion Principle.
5. Write the condition for the orbital stability in Bohr atomic model.
6. Why cadmium is widely used in control rods for nuclear reactors ?
7. How will you distinguish between neutrino and antineutrino ?
8. Why is the binding energy curve steep for lighter nuclei and falling off slowly for the heavy nuclei ?
9. 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 ?
10. Give any four properties of nuclear force. **(6×1=6)**

SECTION – C

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

11. Distinguish between BE statistics and FD statistics.
12. The half-life of Radon nuclei is 3.82 days. How long does it take for 60 percent of a sample of Radon to decay ?
13. What is nuclear reactor ? What are the uses of nuclear reactor ?
14. An excited hydrogen atom emits at 1025.5 $\mathring{A}$ photon in returning to the ground state. What was the quantum number of the excited state ?

15. Explain the concept of correspondence principle.
16. Obtain the Rayleigh jeans formula.
17. Check whether the given reaction is possible or not :
   a) $K^+ \rightarrow \Pi^+ + \Pi^+ + \Pi^-$
   b) $K^- + p \rightarrow \Sigma^+ + \Pi^-$
18. What are the factors on which binding energy of a nucleus depend according to liquid drop model ? Briefly describe each.
19. Derive an expression for total energy of the electron in a H atom according to Rutherford model.
20. The term symbol of the ground state is $3^2S_{1/2}$ and that of its first excited state is $3^2P_{1/2}$. List the possible quantum numbers n, l, j and m_j, of the outer electron in each case.
21. Explain the proton-proton cycle reaction with an example.
22. What is tokamak ? **(9×2=18)**

SECTION – D

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

23. Give an account on the various quantum numbers associated with elementary particles.
24. Give salient features of nuclear shell model and give its success and failures. **(1×4=4)**

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