K18U 0134

Reg. No. : .....

Name : .....

VI Semester B.Sc. Degree (CBCSS – Reg./Supple./Imp.) Examination, May 2018

Core Course in Physics

6B13 PHY : QUANTUM MECHANICS

(2014 Admn. Onwards)

Time : 3 Hours Max. Marks : 40

SECTION – A

Answer **all** – very short answer type – **each** question carries **1** mark.

1. The Wilson-Sommerfield quantization rule is _____
2. Write down the de Broglie relation.
3. The photoelectric effect establishes that light travels in the form of _____
4. Zeeman effect is the confirmation of _____ **(1×4=4)**

SECTION – B

Answer **any seven** – short answer type – **each** question carries **two** marks.

5. List out the basic experimental results of the photoelectric phenomena.
6. Explain the assumptions of Planck with regard to cavity radiation.
7. Illustrate the uncertainty principle on the basis of single slit experiment.
8. What are stationary states ?
9. Outline the various admissibility conditions on the wavefunction of a system.
10. What is meant by expectation value of a dynamical variable ?
11. A particle confined in a box must have a certain minimum energy called zero point energy. Comment.

P.T.O.

12. Explain Zeeman effect.

13. Explain the magnetic quantum number of an atom.

14. What does tunnelling mean ? **(2×7=14)**

SECTION – C

Answer **any four** – short essay/problem – **each** question carries **three** marks.

15. From a sodium surface, light of wavelength 3125 Å and 3650 Å causes emission of electrons whose maximum kinetic energy is 2.128eV and 1.595 eV, respectively. Estimate Planck's constant and work function of sodium.

16. The average lifetime of an excited atomic state is 10^{-8}s. If the spectral line associated with the delay of this state is 6000 Å, estimate the width of the line.

17. Explain how barrier tunnelling accounts for α – decay by certain nuclei.

18. Electrons with energies of 1.0 eV and 2.0 eV are incident on a barrier 10.0 eV high and 0.50 nm wide.
    a) Find their respective transmission probabilities.
    b) How are these affected if the barrier is doubled in width ?

19. Verify that the average value of 1/r for a 1s electron in the hydrogen atom is $1/a_0$. Given $\psi = \frac{1}{\sqrt{\pi a_0^3}} e^{-r/a_0}$.

20. Discuss Stern-Gerlach experiment. **(3×4=12)**

SECTION – D

Answer **any two** – long essay type – **each** question carries **five** marks.

21. What is Compton effect ? How does Compton effect provide a conclusive evidence of the particle properties of radiation ?

22. State and explain the postulates of quantum mechanics.

23. A particle is trapped in a square well potential of finite depth. Show that the particles have a nonzero probability of being found outside the well even if its energy is less than the height of the barriers.

24. Obtain Schrödinger equation for the hydrogen atom in spherical polar coordinates. **(5×2=10)**

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