

Code No. : 10307 E Sub. Code : AMPH 61

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2023.

Sixth Semester

Physics – Core

QUANTUM MECHANICS

(For those who joined in July 2020 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Bohr model of atom is contradicted by _____.
- (a) Pauli's exclusion principle
 (b) Planck quantum theory
 (c) Heisenberg uncertainty principle
 (d) All of these

2. A black surface absorbs _____ as compared to a white surface, under identical conditions.
- (a) Same heat (b) Negligible heat
 (c) More heat (d) Lesser heat
3. Which of the following is the correct expression for the group velocity?
- (a) $v\lambda$ (b) $d\omega/dv$
 (c) dE/dh (d) dE/hdk
4. The energy of the particle is proportional to
- (a) n (b) n^{-1}
 (c) n^2 (d) n^3
5. The uncertainty principle applies to
- (a) Macroscopic particles
 (b) Microscopic particles
 (c) Gases
 (d) None of the above
6. Uncertainty principle can be easily understood with the help of
- (a) Dalton's effect (b) Compton's effect
 (c) Electrons effect (d) Rhombic effect

Page 2 Code No. : 10307 E

7. A schrodinger equation is a _____ form of equation.
- (a) Linear
 (b) Partial differential
 (c) Non linear
 (d) None of the above
8. The ground state energy of an electron confined to a box 1 Å wide is
- (a) 6.016×10^{-20} (b) 2.016×10^{-18}
 (c) 5.02×10^{-18} (d) 6.016×10^{-18}
9. The oscillatory solution is physically
- (a) Acceptable
 (b) Divergent
 (c) Not acceptable
 (d) None of these
10. For a particle inside a box, the potential is maximum at $X =$
- (a) L (b) 2L
 (c) L/2 (d) 3L

Page 3 Code No. : 10307 E

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 250 words.

11. (a) What is meant by black body radiation? Describe the photo electric effect.
- Or
- (b) Explain in details about the Plank's quantum theory.
12. (a) Describe the De Broglie hypothesis for matter waves.
- Or
- (b) Write short notes on phase and group velocity.
13. (a) Explain the elementary proof of Heisenberg's uncertainty relation.
- Or
- (b) Explain in elementary proof of the Heisenberg's uncertainty relation between energy and time.

Page 4 Code No. : 10307 E

[P.T.O.]

14. (a) What are the physical interpretation of the wave function ψ ?

Or

- (b) What are the postulates of quantum mechanics?
15. (a) Explain the particle in a one dimensional box.

Or

- (b) What is Schrödinger wave equation for particle in a rectangular three dimensional box?

PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

Each answer should not exceed 600 words.

16. (a) Discuss about the Bohr's quantization of angular momentum and its application to the hydrogen atom.

Or

- (b) Discuss about the failure of classical physics and to explain energy distribution in the spectrum of a black body.

17. (a) State and explain wave particle duality.

Or

- (b) Explain the interference of electrons.

Page 5 Code No. : 10307 E

18. (a) Explain the illustration of Heisenberg's uncertainty principle by thought experiments.

Or

- (b) State Uncertainty principle and describe the consequences of the uncertainty relation.

19. (a) Derive the expression for Schrödinger's one dimensional time-dependent wave equation.

Or

- (b) Describe the Eigen value and Eigen value equation.

20. (a) Explain in detail about simple harmonic oscillator.

Or

- (b) Explain in detail about Reflection at a sleep potential and the transmission across a potential barrier.

Page 6 Code No. : 10307 E