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Reg. No. :

Code No. : 30314 E Sub. Code : JMPH 63

B.Sc. (CBCS) DEGREE EXAMINATION,
APRIL 2020.

Sixth Semester

Physics – Main

QUANTUM MECHANICS

(For those who joined in July 2016 only)

Time : Three hours

Maximum : 75 marks

PART A — ($10 \times 1 = 10$ marks)

Answer ALL questions.

Choose the correct answer :

1. According to Wien's displacement law λ_m is _____ to absolute temperature.
 - (a) equal
 - (b) directly proportional
 - (c) inversely proportional
 - (d) none

2. When the angle of scattering is 180 degree, the Compton shift $d\lambda$ is = _____.
- (a) $\frac{2h}{m_o c^2}$ (b) $\frac{2h}{m_o c}$
- (c) $\frac{2h^2}{m_o c}$ (d) none
3. The de Broglie wavelength of an electron accelerated by a potential V is, $\lambda =$
- (a) $\frac{h}{\sqrt{2m_o eV}}$ (b) $\frac{h}{\sqrt{m_o eV}}$
- (c) $\frac{he}{\sqrt{2m_o V}}$ (d) none
4. If k is the propagation constant, the momentum p of a particle is given by _____.
- (a) $\frac{\hbar}{k}$ (b) $\frac{k}{\hbar}$
- (c) $\hbar k$ (d) none
5. If the uncertainty in locating the position of the particle is its deBroglie wavelength, the uncertainty in locating the momentum p is _____.
- (a) $p \geq 2\pi$ (b) $p \geq 4\pi$
- (c) $p \geq 6\pi$ (d) none

6. The value of Planck's constant is _____.
- (a) 6.626×10^{-14} JS (b) 6.626×10^{34} JS
 (c) 6.626×10^{-34} JS (d) none
7. The value of the commutation bracket $[x, p_x] =$
- (a) 0 (b) 1
 (c) $i\hbar$ (d) $-i\hbar$
8. The potential energy of a free particle in a time independent Schrodinger equation is _____.
- (a) V (b) 0
 (c) 2V (d) none
9. The energy of a particle in a 1-D box is _____.
- (a) $\frac{8n^2h^2}{ma^2}$ (b) $\frac{n^2h^2}{8ma^2}$
 (c) $\frac{\pi^2h^2}{8ma^2}$ (d) none
10. For a particle encountering a potential barrier, the sum of the reflection and transmission coefficients is always _____.
- (a) 1 (b) infinity
 (c) 0 (d) none

PART B — ($5 \times 5 = 25$ marks)

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

Answer should not exceed 250 words.

11. (a) What are the observations of black body radiation?

Or

- (b) State and explain Rayleigh – Jeans law.

12. (a) Derive the expression for the deBroglie wavelength of a charged particle accelerated by a potential V .

Or

- (b) Calculate the deBroglie wavelength of electron accelerated by a voltage of 100V.

13. (a) Explain the Heisenberg uncertainty relation between energy and time.

Or

- (b) What are the consequences of Heisenberg uncertainty principle?

14. (a) What are the properties of wave function?

Or

- (b) Write short note on operators in quantum mechanics.

15. (a) Explain Tunnel effect through a rectangular barrier.

Or

- (b) Write short notes on free states.

PART C — ($5 \times 8 = 40$ marks)

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

Answer should not exceed 600 words.

16. (a) Define photo electric effect. Give the Einsteins explanation for photoelectric effect.

Or

- (b) State Compton effect. Derive the formula for shift in wave length during Compton Scattering.

17. (a) Discuss the relation between deBroglie wave and phase velocity.

Or

- (b) Describe Davison and Germer's experiment on electron diffraction.

18. (a) State and prove Heisenberg Uncertainty principle.

Or

- (b) Illustrate Heisenberg uncertainty principle by Thought experiment.

19. (a) State and explain Ehrenfest Theorem.

Or

(b) Discuss in detail about

(i) momentum wave function

(ii) momentum eigen function

20. (a) Explain the emission of alpha particles from a radioactive element.

Or

(b) Discuss in detail about 1-D simple harmonic oscillator in quantum mechanics.

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