# UNIT-1: QUANTUM PHYSICS & SOLIDS

**(IMPORTANT OBJECTIVES FOR MID EXAMS)**

## MULTIPLE CHOICE QUESTIONS

1. Who among the following introduced the quantum theory of radiation?

   A) Newton  B) Stefan-Boltzmann  C) Rayleigh-Jeans  D) Planck

2. Who among the following discovered that electrons are emitted when ultraviolet radiation strikes a metal surface?

   A) Heinrich Hertz  B) Stefan-Boltzmann  C) Rayleigh-Jeans  D) Planck

3. Photoelectric current increases linearly with the increase in the intensity of --------

   A) Incident light  B) PotentialC) Frequency  D) Threshold frequency

4. The particle nature of matter waves is verified by ----------

   A) Photoelectric effect  B) Compton effect  C) Davisson & Germer experiment  D) A & B

5. Drude-Lorentz theory is also known as .....

   A) Band theory  B) Quantum free electron theory  C) Classical free electron theory  D) None

6. Visible light's wavelength range.....

   A) 0.4-0.7mm  B) 0.4-0.7μm  C) 0.4-0.7nm  D) 0.4-0.7cm

7. The wave nature of matter waves is verified by ----------

   A) Davisson & Germer experiment  B) G. P. Thomson's experiment

   C) Photoelectric effect  D) A & B

8. _____ theory states that electrons move with constant potential within a material.

   A) Classical free electron  B) de-Broglie's  C) Quantum  D) None

9. The wavelength associated with a particle of mass 'm' moving with velocity 'v' is given by

   λ = ----------

   A) h/mv  B) hv/m  C) mv/h  D) m/hv

10. Which among the following substances is used as a target in the Davisson & Germer experiment?

A) Na crystal B) NaCl crystal C) Mg crystal D) Al crystal

11. The probability of occupancy of Fermi level at any temperature other than 0 K is

A) 0 B) 1 C) ∞ D) 0.5

12. The wave function ψ must be

A) Normalized & finite B) Single-valued C) Continuous D) All of the above

13. The probability of finding a particle in a space is

A) 0 B) 1 C) 2 D) ½

14. A body at 1500 K emits maximum energy at a wavelength 20,000 Å. If the sun emits maximum energy at wavelength 5500 Å, what would be the temperature of the sun?

A) 5454.54 K B) 54.54 K C) 4545.45 K D) 45.45 K

15. Who among the following introduced the band theory?

A) Bloch B) Sommerfeld C) Kronig D) Drude-Lorentz

16. In the equation $\psi(x+a) = Q\,\psi(x)$, where Q is called as

A) Phase factor B) SR factor C) Wave factor D) Bloch factor

17. In the Kronig-Penney model, $P \rightarrow \infty$ is the special case of

A) Electrons trapped B) Free electrons C) Mobile electrons D) B & C

18. In the normalized wave function of a particle, the value of $A^2$ is

A) 2/L B) L C) 2 D) 4/L

19. In the Kronig-Penney model, $P \rightarrow 0$ is the special case of ----------

A) Electrons trapped B) Free electrons C) Mobile electrons D) B & C

20. In E-K curve, the range of second Brillouin zone is ----------

A) $-\pi/a$ to $+\pi/a$ B) $-\pi/a$ to $-2\pi/a$ and $+\pi/a$ to $+2\pi/a$

C) -2π/a to -3π/a and +2π/a to +3π/a  D) None

21. The value of h (reduced Planck's constant) is ----------

A) h/2π  B) h/4π  C) $h^2$  D) h/π

22. Which among the following is used to identify nature and understand the behavior of material?

A) E-k diagram  B) Kronig-Penney model  C) 1-D potential box  D) None

23. Quantum theory explains the ————————

A) Interference and diffraction  B) Polarization and black body radiation

C) Photo-electric effect and Compton effect  D) All the above

24. Fermi-Dirac distribution holds good for ————————————————

A) Distinguishable particles  B) Indistinguishable particles

C) Both (a) and (b)  D) None of the above

25. The wave function 'ψ' of moving particle

A) Is not an observable quantity  B) Does not direct physical meaning

C) Is a complex quantity  D) All the above

26. From laws of quantum mechanics, the energy possessed by a particle of mass 'm' trapped in a potential well of length 'L' is given by,

A) $(8mL^2) / (n^2\hbar^2)$  B) $(n^2L^2) / (8m\hbar^2)$  C) $(n^2\hbar^2) / (8mL^2)$  D) $(n^2m) / (8L\hbar^2)$

27. The Schrödinger's time-independent wave equation is $i\hbar\, \partial\psi/\partial t$ = _____

A) $(\hbar^2 / 2m)\, \nabla^2\psi + V\psi$  B) $-(\hbar^2 / 2m)\, \nabla^2\psi + V\psi$

C) $(\hbar^2 / 2m)\, \nabla^2\psi - V\psi$  D) $-(\hbar^2 / 2m)\, \nabla^2\psi - V\psi$

**KEY:**

1. D  2. A  3. A  4. D  5. C  6. B  7. D  8. A  9. A  10. A  11. D  12.D  13.B  14. A
15. A  16. A  17. A  18. A  19. D  20. B  21. A  22. B  23. D  24. B  25. D  26. C  27. B