

# Ph. D Entrance Test - Jan 21 (Physics)

- An electron at rest is accelerated through a potential difference of 100 V. What is its final kinetic energy?
  - $1.6 \times 10^{-17}$  J
  - 100J
  - $1.6 \times 10^{-17}$  eV
  - None of these
- X-rays are known to be electromagnetic radiations, so the X-ray photon has
  - Electric charge
  - magnetic moment
  - both electric charge and magnetic moment
  - Neither electric charge nor magnetic moment
- On which of the following levels of hydrogen the spin orbit interaction has no effect?
  - S-level
  - p-level
  - d-level
  - f-level
- The product of uncertainty in measurement of position  $x$  and time  $t$  is given by
  - $\Delta x \cdot \Delta t \geq h/2\pi$
  - $\Delta x \cdot \Delta t = 0$
  - $\Delta x \cdot \Delta t \geq h/4\pi$
  - $\Delta x \cdot \Delta t = h/4\pi$
- The matter wave associated with a moving particle is usually
  - A finite monochromatic wave travelling with a velocity less than that of light
  - An infinite monochromatic wave travelling with a velocity less than that of light
  - An infinite monochromatic wave travelling with a velocity equal to that of light
  - A wave packet having group velocity equal to that of the moving particle
- The uncertainty in the location of a particle is equal to its de-broglie wavelength, then the uncertainty in the velocity of particle will be equal to
  - its velocity
  - half of its velocity
  - twice its velocity
  - four times its velocity
- Which of the following wave functions represents a free particle moving along positive  $x$ -axis?
  - $\sin(kx - \omega t)$
  - $\cos(kx - \omega t)$
  - $e^{i(kx - \omega t)}$
  - $e^{-i(kx - \omega t)}$
- In which of the process, the internal energy of the system remain constant...
  - adiabatic
  - isochoric
  - isobaric
  - isothermal
- For cubic lattice, the plane  $(h, k, l)$  and the direction having the same miller indices  $[h k l]$

are:

- a) parallel to each other
  - b) Oblique to each other
  - c) perpendicular to each other
  - d) totally unrelated
10. The highest melting point is found in crystalline solids having
- a) ionic bonds
  - b) covalent bonds
  - c) metallic bonds
  - d) Vander waals bonds
11. Lattice vibrations are
- a) Transverse only
  - b) longitudinal
  - c) both longitudinal and transverse
  - d) yet not fully known
12. Quantum mechanically, the energy of a system at zero Kelvin is
- a) Non-zero
  - b) positive
  - c) negative
  - d) zero
13. The electronic contribution to the heat capacity of a metallic solid is
- a) About 10%
  - b) about 80%
  - c) less than 5%
  - d) less than 1%
14. Forbidden energy gap in solids is because of
- a) the standing wave solution for the electrons wave function at the boundaries of different Brillouin zones
  - b) electrons treated as free particles in a solid
  - c) inner atomic cores taking no active part
  - d) a mathematical manipulation of Schrodinger wave equation
15. Intrinsic concentration of charge carriers in a semiconductor varies as
- a)  $T$
  - b)  $T^2$
  - c)  $T^{3/2}$
  - d)  $1/T$
16. One of the effects of negative feedback in amplifier is to
- a) Increase the noise
  - b) increase the harmonic distortion
  - c) decrease the harmonic distortion
  - d) none of these
17. The voltage gain of an amplifier is 100. On applying negative feedback with  $\beta = 0.03$ , its gain will reduce to
- a) 70
  - b) 25
  - c) 99.97

- d) 3
18. Lissajous pattern obtained on a CRO can be used to determine
- Phase shift
  - amplitude distortion
  - voltage amplitude
  - none of these
19. The value of  $\overline{A \cdot (\vec{A} \times \vec{B})}$
- A
  - B
  - 1
  - none of these
20. The function  $\overline{\nabla \cdot \vec{A}}$  with positive value represents
- Total flux of  $\vec{A}$  over any arbitrary closed surface
  - The outward flux density at a point
  - The inward flux density at point
  - None of these
21. A vertical electric field of magnitude  $4.9 \times 10^5$  N/C just prevents a water droplet of charge  $q$  and mass 0.1gm from falling. The charge  $q$  on the droplet is
- 0
  - $2 \times 10^{-9}$  C
  - $2 \times 10^5$  C
  - $2 \times 10^1$  C
22. 12J of work has to be done against an electric field to take a charge of 0.01C from A to B. then potential difference between A and B is
- 0.12V
  - 0V
  - 600V
  - 1200V
23. When no current passes through a conductor then
- Free electrons do not move
  - The average speed of free electrons over large period of time is zero
  - The average speed of free electrons over large period of time is zero
  - The average speed of free electrons is proportional to square root of temperature
24. Spin and parity of  ${}^9_4\text{Be}$  nucleus, as predicted by shell model, are respectively
- $3/2$  and odd
  - $1/2$  odd
  - $3/2$  and even
  - $1/2$  and even
25. The degeneracy of spectral term  ${}^3F$  is
- 7

- b) 9
- c) 15
- d) 21

26. The main current crossing the collector junction in a normally biased NPN transistor is

- a) a diffusion current
- b) a drift current
- c) a hole current
- d) equal to the base current

27. Current through an inductor follows (when circuit is closed)

- (a) a linear growth
- (b) a linear decay
- (c) an exponential growth
- (d) an exponential decay

28. The velocity of the plane wave  $e^{j(\omega t - \beta x)}$  is

- (a)  $\frac{2\omega}{\beta}$
- (b)  $\frac{\omega}{2\beta}$
- (c)  $\frac{\omega^2}{\beta^2}$
- (d)  $\frac{\omega}{\beta}$

29.  $\nabla \cdot \vec{D} = \rho$

is based on

- (a) Ampere's law
- (b) Faraday's law
- (c) Ohm's law
- (d) Gauss's law

30. Permeability is magnetic phenomenon and is analogous to which one of the following in electric phenomenon ?

- (a) Inductance
- (b) Current Density
- (c) Conductivity
- (d) Resistance

31. The de-Broglie wavelength of an electron accelerated to a potential difference of V volts is

- (a)  $\sqrt{\frac{150}{V}}$
- (b)  $\frac{h}{\sqrt{2mE}}$
- (c)  $\frac{h}{\sqrt{2m \cdot e \cdot V}}$
- (d)  $\frac{12.26}{\sqrt{V}}$

32. The acceptable wave function,  $\psi$  must fulfill the requirements that

- (a) it must be finite, single valued and continuous
- (b) it must be normalizable
- (c) the integral of  $|\psi|^2 \cdot d\tau$  over the whole space must be unity
- (d) all of these

33. A network contains linear resistors and ideal voltage sources. If the value of all resistors are doubled, then the voltage across each resistor is

- (a) Halved
- (b) Doubled
- (c) Increased by 4 times
- (d) No Change

34. A vessel contains an ideal monatomic gas, which expands at constant pressure when heat,  $Q$  is supplied to it. Then work done in the expansion is

- (a)  $Q$
- (b)  $3/5 Q$
- (c)  $2/5 Q$
- (d)  $2/3 Q$

35. Moseley's law relates

- (a) wavelength and intensity of X-rays
- (b) frequency and voltage applied
- (c) frequency and atomic number
- (d) wavelength and angle of scattering

36. The minimum energy required for the pair production is

- (a) 2.024 MeV
- (b) 1.012 MeV
- (c) 0.511 MeV
- (d) 4.048 MeV

37. Which of the following elementary particle is a lepton?

- (a) Photon
- (b)  $\mu$ -meson
- (c)  $\pi$ -meson
- (d) Proton

38. The MOSFET switch in its on-state may be considered equivalent to

- (a) resistor
- (b) inductor
- (c) capacitor
- (d) battery

39. The built-in potential (diffusion potential) in a p-n junction

- (a) Is equal to the difference in the fermi level of two sides
- (b) Increases with increase in doping level of two sides
- (c) Increases with increase in temperature
- (d) All of these

40. Which of the following method is used for pumping in He-Ne laser

- (a) optical
- (b) x-ray
- (c) chemical
- (d) electrical discharge

### Answer Key of MRSU-Ph.D. Physics

Q. No.	Answer	Q. No.	Answer
1	a	21	b
2	d	22	d
3	a	23	d
4	a	24	a
5	d	25	d
6	a	26	b
7	c	27	c
8	d	28	d
9	c	29	d
10	a	30	c
11	c	31	a
12	b	32	d
13	d	33	d
14	a	34	c
15	c	35	c
16	c	36	b
17	b	37	b
18	a	38	c
19	d	39	d
20	b	40	d