M.Sc. Physics 2017

Q1. If N atoms of a gas is mixed with N atoms of the same gas, the entropy of mixing of the gases in thermodynamics is

(a) $2kN\ln 2$ (b) $kN\ln 2$ (c) zero (d) $\ln 2$

Where k is Baltzamann constant?

Q2. The heat involved in going reversibly between two states can be made integrable when multiplied with an integrating factor

(a) $\frac{1}{V}$ (b) T (c) $\frac{1}{T}$ (d) S

Q3. In an isothermal expansion of $10\,gm$ of nitrogen, its volume becomes 4 times of initial volume. The change in entropy of nitrogen if molecular weight of nitrogen $= 28$ and for $1\,gm-mole$ gas, gas constant $R = 8.3\,J/mole-K$, is

(a) $4.1\,joule/K$ (b) $41\,joule/K$ (c) $4.1 erg/K$ (d) $4.1 cal/K$

Q4. The function which remains constant if the thermodynamic process is carried out isobarically and isothermally is called

(a) Internal energy (b) Gibbs' function

(c) Helmholtz function (d) Enhalpy

Q5. Which of the following gives volume, V ?

(a) $\left(\frac{\partial G}{\partial P}\right)_T$ (b) $\left(\frac{\partial U}{\partial V}\right)_X$ (c) $-\left(\frac{\partial G}{\partial T}\right)_P$ (d) $\left(\frac{\partial U}{\partial S}\right)_T$

Where the symbols have their usual meanings.

Q6. Fermi level represents the energy level with probability of its occupation of

(a) 0% (b) 25% (c) 50% (d) 100%

Q7. The steady state conditions in diffusion are governed by

(a) Fick's second law (b) Fick's first law

(c) Both (1) and (2) (d) Maxwell-Boltzmann's law

Q8. The electronic polarizability, α_c of a monatomic gas atom, if r is the radius of orbit of electron, is

(a) $4\pi\varepsilon_0$ (b) $4\pi\varepsilon_0 r$ (c) $4\pi\varepsilon_0 r^3$ (d) $4\pi\varepsilon_0 r^2$

Q9. With increase in temperature, the orientational polarization in general

(a) Decreases (b) Increases

(c) Remains same (d) None of these

Q10. The probability of occupation of an energy level E, when $E - EF = KT$, is given by

(a) 0.73 (b) 0.63 (c) 0.5 (d) 0.27

Q11. The frequency associated with 20 mm wavelength microwaves is

(a) 100 MHz (b) 400 MHz (c) $73\,MHz$ (d) $15\,GHz$

Q12. Total current density, $\bar{J}$, equals

(a) Sum of current density due to free charge carriers and displacement current density

(b) Current density due to free charge carriers only

(c) Displacement current density only

(d) None of these

Q13. The capacitance of two concentric metal shells, with radii a and b is

(a) $\frac{Q}{4\pi\varepsilon_0}\left(\frac{1}{a}-\frac{1}{b}\right)$ (b) $4\pi\varepsilon_0\frac{ab}{(b-a)}$

(c) $\frac{1}{4\pi\varepsilon_0}\frac{ab}{(b-a)}$ (d) $4\pi\varepsilon_0 Q\left(\frac{1}{a}-\frac{1}{b}\right)$

Q14. For glass-air interface ($ng = 1.5$ and $na = 1$) for normal incidence, the reflection coefficient is

(a) 0.2 (b) 0.04 (c) 0.98 (d) 0.96

Q15. The total energy density associated with an electromagnetic wave in free space is

(a) $\frac{1}{2}\varepsilon_0 E_{rms}^2$ (b) $\varepsilon_0 E_{rms}^2$ (c) $2\varepsilon_0 E_{rms}^2$ (d) None of these

Where E_{rms} is the rms value of electric field associated with the electromagnetic wave?

Q16. Electric flux associated with a small surface area $d\bar{s}$ in an electric field $\bar{E}$ is given by

(a) $\vec{E}\cdot d\bar{s}$ (b) $\varepsilon_0\bar{E}\cdot d\vec{s}$ (c) $\oint_S \vec{E}\cdot d\vec{s}$ (d) $\bar{E}\times d\bar{s}$

Q17. If a Gaussian surface encloses no charge, which of the following is true for a point inside it

(a) Electric field must be zero (b) Electric potential is zero

(c) Electric field and potential are zero (d) None of these

Q18. Energy is not transferred by

(a) Transverse progressive wave (b) Longitudinal progressive wave

(c) Stationary wave (d) Electromagnetic wave

Q19. The relation between permeability and susceptibility in $C.G.S.$ system is

(a) $\mu = \mu_0(1+\chi)$ (b) $\mu = 1+4\pi\chi$

(c) $\mu = \frac{\mu_0}{4\pi}(1+\chi)$ (d) $\mu = 1+\chi$

Q20. Lorentz unit is

(a) $\frac{eB}{4\pi mc}$ (b) $\frac{eB}{4\pi m}$ (c) $\frac{eB}{4\pi hmc}$ (d) $\frac{eB}{4\pi h}$

Q21. The unit of magnetic moment is

(a) erg-gauss (b) $\text{erg}^{-1}\,\text{gauss}^{-1}$

(c) $m-$gauss (d) Bohr magneton

Q22. Very low temperatures can be produced by

(a) Adiabatic demagnetisation of a paramagnetic salt

(b) Adiabatic magnetisation of a paramagnetic salt

(c) Isothermal magnetisation of diamagnetic salt

(d) Isothermal demagnetisation of diamagnetic salt

Q23. The SI unit of $\vec{B}$ is

(a) Tesla (b) Gauss

(c) Tesla mt Amp^2 (d) $\text{Amp}-\text{mt}^2$

Q24. A solenoid having a resistance of 5Ω and self inductance of 4 Henry, is connected to a battery of emf $10\,volt$ and negligible resistance. After how long current will become $1A$ in it?

(a) 1.1 Sec (b) 10.55 Sec (c) 2 Sec (d) 2.2 Sec

Q25. An $L-C-R$ circuit will oscillate if

(a) $R > LC$ (b) $R < \sqrt{\frac{L}{C}}$ (c) $R > \sqrt{\frac{L}{C}}$ (d) $R = \frac{L}{C}$

Q26. The lag angle between the current and applied emf in a series LR circuit is given by

(a) $\tan^{-1}\frac{1}{WLR}$ (b) $\tan^{-1}\frac{WL}{R}$ (c) $\tan^{-1}WLR$ (d) $\tan^{-1}(R)$

Q27. The quality factor of a series $L-C-R$ circuit is given by

(a) $\frac{1}{WLR}$ (b) WCR (c) $\frac{WL}{R}$ (d) WLR

Q28. For a good conductor, the spin depth varies as

(a) Inversely as angular frequency ω (b) Directly as ω

(c) Inversely as $\sqrt{\omega}$ (d) Directly as $\sqrt{\omega}$

Q29. The dielectric constant, ε of water is 80. This does not justify its refractive index $n = 1.33$, violating the expression $n^2 = \varepsilon$. This is because,

(a) The water molecule has no permanent dipole moment

(b) The boiling point of water is $100^0 C$

(c) The two quantities are measured at different frequencies

(d) Water is transparent to visible light

Q30. Propagation of electromagnetic waves in a medium with frequency dependence phase velocity is called

(a) Reflection (b) Refraction

(c) Polarization (d) Dispersion

Q31. If σ be conductivity and ε, permittivity of a medium with sinusoidal time varying electric field E of angular frequency, ω, then the ratio of displacement current density to the conduction current density will be

(a) $\frac{\sigma}{E\varepsilon}$ (b) $\frac{\omega\varepsilon}{\sigma}$ (c) $\frac{\sigma}{\omega\varepsilon}$ (d) $\frac{E\varepsilon}{\omega}$

Q32. For sinusoidally varying electric field, the conduction current and the displacement current differ in phase by

(a) 180 degree (b) zero degree (c) 90 degree (d) 45 degree

Q33. A bubbled (input inverted) ORgate is equivalent to

(a) NOR gate (b) NAND gate (c) NOT gate (d) XNOR gate

Q34. The most suitable gate for comparing two bits is

(a) AND (b) OR (c) NAND (d) X-OR

Q35. Which of the following gates cannot be used as an inverter?

(a) NAND (b) AND (c) NOR (d) X-NOR

Q36. How many NOR gates are required to obtain AND operation?

(a) 2 (b) 3 (c) 4 (d)1

Q37. The velocity of an electron in first orbit of H atom is (approximately)

(a) C (b) $2.2\times10^{6}\ m/\sec$

(c) $5\times10^{7}\ m/\sec$ (d) $22\times10^{7}\ m/\sec$

Q38. For overlap interaction between nearest neighbours of the type, $\phi(r)=B\exp\left(\frac{-r}{\rho}\right)$, B and ρ are constants, the equilibrium spacing in terms of B and ρ is

(a) $\rho\log eB$ (b) $\frac{\rho}{B}$ (c) $\frac{B}{\rho}$ (d) ρB

Q39. If a charged particle charge q and mass m is accelerated through a potential difference of V volts, the de Broglie wavelength associated with the particle is

(a) $\frac{h}{\sqrt{2meV}}$ (b) $\frac{h}{\sqrt{2mqV}}$ (c) $\frac{h}{\sqrt{2qV}}$ (d) $\frac{h}{\sqrt{2mV}}$

Q40. Number of atoms in a unit cell in BCC lattice is

(a) 8 (b)1 (c) 2 (d) 4

Q41. Atomic packing factor for FCC lattice is approximately

(a) 34% (b) 52% (c) 68% (d) 74%

Q42. Nearest neighbour distance in a simple cubic lattice with lattice parameter a is

(a) $a\sqrt{\frac{3}{2}}$ (b) a (c) $\sqrt{2}a$ (d) $\sqrt{3}a$

Q43. For a simple cubic lattice, the ratio of density of points in (111) and (110) place is

(a) $\frac{2}{3}$ (b) $\frac{\sqrt{2}}{\sqrt{3}}$ (c) $\frac{9}{4}$ (d) $\frac{2}{5}$

Q44. If Fermi energy of electrons in a metal at some temperature T is $5.5eV$. The average electron energy at same temperature will be given by

(a) $33eV$ (b) $5.5eV$ (c) $3.3eV$ (d) zero eV

Q45. Which of the following characteristics does not necessarily apply to an op-amp?

(a) High gain (b) Low power

(c) High input impedance (d) Low output impedance

Q46. Common mode gain in a differential amplifier is

(a) Very high (b) Very low

(c) Always unit (d) Infinite

Q47. A certain non inverting amplifier has an R_i of $1k\Omega$ and an R_f of $100k\Omega$. The closed loop gain is

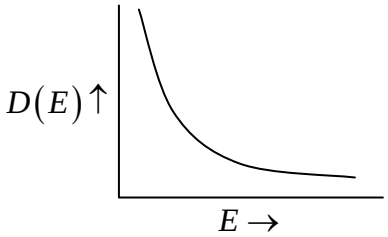
(a) 10^6 (b) 10^3 (c) 101 (d) 100

Q48. A phase-shift oscillator has

(a) Three RC circuits (b) Three LC circuits

(c) a T - type circuit (d) $a\pi$ - type circuit

Q49. The figure given below shows the density of electron states versus energy for a free electron gas in.



(a) Three-dimensions

(b) One-dimension

(c) Two-dimensions

(d) None of these

Q50. Specific impedance of free space is

(a) 377Ω (b) 500Ω (c) 50Ω (d) 100Ω

Q51. Zero-point is related to

(a) Quantization (b) Lasers

(c) Uncertainty (d) Duality

Q52. Stern-Gerlach experiment demonstrated

(a) Uncertainty principle (b) Quantization of angular momentum

(c) Duality (d) None of these

Q53. The distance between (100) planes in a simple cubic crystal with unit cell side a is

(a) a (b) $\frac{a}{\sqrt{2}}$ (c) $\frac{a}{\sqrt{3}}$ (d) $\frac{a}{2}$

Q54. The lenn value, T of a state is

(a) $\frac{E}{hc}$ (b) $-\frac{E}{hc}$ (c) $-\frac{E}{2\pi hc}$ (d) $-\frac{E}{2\pi hc}$

Q55. The spectral term value corresponding to the ionisation potential of Hg – atom is $84178.5\ cm$. The ionisation potential of Hg - atom is

(a) $15V$ (b) $10.4V$ (c) $13.6V$ (d) $1V$

Q56. Which of the following best describes the relation between orbital angular momentum and corresponding magnetic moment of electron in an atom?

(a) $\vec{p}_c = \frac{-2m}{e}\vec{\mu}$ (b) $\vec{p}_c = \frac{2m}{e}\vec{\mu}_c$ (c) $\vec{p}_c = \frac{2m}{\hbar}\vec{\mu}_c$ (d) $\dot{p}_c = \dot{\mu}_c$

Q57. If a well collimated beam of Cu is allowed to pass through non-homogeneous magnetic field in Stern-Gerlach experiment, we get

(a) One trace (b) Double trace

(c) No trace (d) None of these

Q58. For $^1S_0$ state

(a) $J = 1$ (b) $J = 0$ (c) $J = \frac{3}{2}$ (d) $J = \frac{5}{2}$

Q59. The magnitude of L, for a d-electron, in one-electron atomic system is

(a) 2 (b) $\sqrt{5}\hbar$ (c) $\sqrt{3}\hbar$ (d) $\sqrt{7}\hbar$

Q60. In alkali spectral series, when one goes towards higher value of n,

(a) Doublet separation increases (b) Doublet separation decreases

(c) Separations remains the same (d) (a) and (c)

Q61. The transition $n^2P \rightarrow 3\ ^2S_1\ n = 3,4,5...,$ in alkali atom gives

(a) Sharp series (b) Principal series

(c) Diffuse series (d) Fundaamental series

Q62. In the following lines of a doublet:

$$^2S_{1/2} \leftarrow {}^2P_{1/2}\ \ ^2S_{1/2} \leftarrow {}^2P_{3/2}$$

(a) 1st line is stronger

(b) 2nd line is stronger

(c) Both lies have the same intensity

(d) Intensity of 2nd line is half that of 1st

Q63. For the level $^3D_3$, the Lange's splitting factor g is

(a) $\frac{7}{3}$ (b) $\frac{5}{3}$ (c) $\frac{4}{3}$ (d) zero

Q64. In normal Zeeman effect, selection rule $\Delta M_L = 0$ gives

(a) π Components (b) σ Components

(c) Unpolarized components (d) γ-Components

Q65. If one state is occupied (or allowed) for one micro particle and is denied for other particles, the particles are

(a) Bosons (b) Fermions

(c) Phonon (d) Photons

Q66. The main component responsible for the fall of gain of an RC coupled amplifier in low frequency range is

(a) The active device itself (b) Coupling capacitance

(c) Load resistance (d) Junction capacitance

Q67. Compared to a CB amplifier, the CE amplifier has

(a) Lower input resistance (b) Higher output resistance

(c) Lower current amplification (d) Higher current amplification

Q68. $r^n\vec{r}$ is solenoidal for

(a) $n = 3$ (b) $n = -3$ (c) $n = 2$ (d) $n = -2$

Q69. If $I = \int_0^\infty e^{-au^2} du$, then

(a) $I = \sqrt{\frac{\pi}{a}}$ (b) $I = \frac{1}{2}\sqrt{\frac{\pi}{a}}$ (c) $I = \frac{3}{8}\sqrt{\frac{\pi}{a}}$ (d) $I = \sqrt{\frac{\pi}{2a}}$

Q70. The coefficient of t^n in the expansion of the function $e^{\frac{x}{2}\left(t-\frac{1}{t}\right)}$ is called

(a) The Legendre function

(b) The Bessel function of first kind of order n

(c) Laugurre function

(d) Hermite polynomial of order n

Q71. $H_{n-1}(x) + H_{n+1}(x)$ Equals (where terms have their usual meanings)

(a) $\frac{2n}{x} H_n(x)$ (b) $2nH_n(x)$ (c) $2H_n^r(x)$ (d) $H_{n+2}(x)$

Q72. Transpose conjugate of two matrices A and B i.e., $(AB)'$ equals

(a) A^+B^+ (b) B^+A^+ (c) $B'A'$ (d) AB

Q73. The product of a singular matrix with its ad joint gives

(a) a unitary matrix (b) a null matrix

(c) a diagonal matrix (d) None of these

Q74. The generalised momenta is defined by

(a) $p_i = \frac{\partial L}{\partial q_i}$ (b) $p_i = \frac{\partial H}{\partial q_i}$ (c) $p_i = \frac{\partial L}{\partial q_j}$ (d) $p_i = \frac{\partial H}{\partial q_j}$

Q75. If $\delta(x)$ is delta function then

(a) $x\delta(x) = x$ (b) $x\delta x = \delta x$

(c) $x\delta(x) = 0$ (d) $\delta(x) = \infty$

Q76. $1m$ Curie is equal to

(a) 3.7×10^7 disintegrations/sec (b) 3.7×10^{10} disintegrations/sec

(c) 10^6 disintegrations/sec (d) 10^3 disintegrations/sec

Q77. Nuclei with even mass numbers have

(a) Zero or integral spin (b) Half integral spin

(c) Imaginary spin (d) None of these

Q78. In Mosley's law, $\sqrt{v} = a(z-b)$, the screening constant b for K series is

(a) 1 (b) 7.4 (c) 19.6 (d) 2.7

Q79. For crystals, having two atoms per primitive cell, square of angular frequency of lattice vibration is given by $\omega^2 = \frac{C/2}{M_1 + M_2} K^2 a^2$ corresponds to

(a) Optical branch

(b) Acoustical branch

(c) To both acoustical and optical branches

(d) Band gap

Q80. The wave vector associated with free electrons at Fermi surface has magnitudes

(a) $\left(\frac{2mE_F}{\hbar^2}\right)^{1/2}$ (b) $\frac{2mE_F}{\hbar^2}$ (c) $\left(\frac{2m}{\hbar^2}\right)^{\frac{1}{2}}$ (d) $\left(\frac{2mE_F}{\hbar^2}\right)^{\frac{3}{2}}$

Q81. The total forward electric current, including the effects of both holes and electrons, in $p-n$ junction is given by

(a) $I = I_0\left(e^{\frac{eV}{KT}} - 1\right)$ (b) $I = I_0\left(e^{\frac{-eV}{KT}} - 1\right)$

(c) $I = I_0$ (d) $I = I_0 e^{\frac{eV}{KT}}$

Where the terms have their usual meaning.

Q82. Compton wavelength $\frac{h}{m_0 e}$ equals

(a) $0.024\,\overset{0}{A}$ (b) $0.012\,\overset{0}{A}$ (c) 2.4 nm (d) 2.4×10^{-11} m

Q83. According to free electron theory of meals, potential experienced by electrons inside the metal is

(a) A constant large potential (b) A variable potential

(c) Zero potential (d) Periodic potential

Q84. Energy equivalent to rest mass of electron is

(a) 1.02 MeV (b) 0.51MeV (c) 1.53MeV (d) 0.51keV

Q85. A particle is moving with 90% of the velocity of light. Ratio of its relativistic mass with its rest mass is

(a) 2.29 (b) 3.00 (c) 5.00 (d) 2.00

Q86. In a solenoid, magnetic field is maximum at

(a) Its centre (b) Ends

(c) Away from it (d) None of these

Q87. Two interfering coherent waves have amplitudes in the ratio 2:1. The ratio of maximum to minimum intensity is

(a) 9 :1 (b) 3:1 (c) 12:1 (d) 4:1

Q88. In Fresnel's biprism, coherent sources are formed due to

(a) Division of amplitude (b) Multiple reflection

(c) Division of wavefront (d) reflection

Q89. In colour photography

(a) Progressive wave-formation is used

(b) The formation of stationary waves is used

(c) Diffraction is used

(d) Reflection is used

Q90. In case of Newton's ring, central ring will be dark in

(a) Reflected system of light

(b) Transmitted system

(c) In reflected as well as transmitted system

(d) In case plano-covex lens is silvered

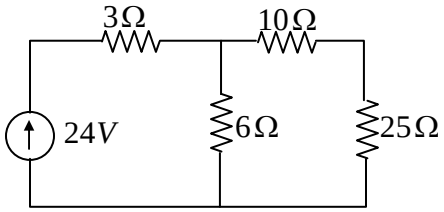
Q91. Diffraction of light can be exhibited by light with an obstacle having dimension of the order of

(a) 100 cm (b) 10 cm (c) 10^{-5} cm (d) 10 m

Q92. At polarising angles, reflected and refracted rays are

(a) Parallel (b) Antiparallel (c) at 90^{o} (d) at 45^{0}

Q93. The Thevenin equivalent voltage for the network shown is



(a) $24V$ (b) $12V$ (c) $16\,V$ (d) $8\,V$

Q94. A certain JFET has a $g_m = 4\,ms$. With an ac drain resistance of $1.5\,k\Omega$ the ideal voltage gain is

(a) 6×10^3 (b) 2.6 (c) 6 (d) 2.6×10^3

Q95. The wavelength associated with an electron accelerated through a potential difference $100\,V$ is

(a) 1.2 $\mathring{A}$ (b) 12.2 $\mathring{A}$ (c) 12 nm (d) 1.22 pm

Q96. The typical de Broglie wavelength of an electron in a metal at TK is

(a) $\lambda = \frac{1}{\sqrt{3mKT}}$ (b) $\lambda = \frac{h}{\sqrt{3mKT}}$ (c) $\lambda = \frac{hl2}{\sqrt{3mKT}}$ (d) $\lambda = \frac{h}{\sqrt{2mKT}}$

Q97. Slow neutrons are incident on a sample of Uranium containing both $^{235}_{92}U$ and $^{238}_{92}U$ isotopes, then

(a) Both isotopes will undergo fission and breakup

(b) Only $^{235}_{92}U$ atoms undergo fission

(c) Only $^{238}_{92}U$ atoms undergo fission

(d) None of the isotopes will break up

Q98. The half life of $^{218}P_0$ is 3 minute. What fraction of a 10 gm sample of $^{218}P_0$ will remain after 15 minutes?

(a) $\frac{1}{5}$ (b) $\frac{1}{25}$ (c) $\frac{1}{32}$ (d) $\frac{1}{64}$

Q99. Hard magnetic material is characterized by

(a) High coercive force and high residual magnetic induction

(b) Low coercive force and low residual magnetic induction

(c) Only low coercive force

(d) High coercive force and high residual magnetic induction

Q100. The density of carriers in a pure semiconductor is proportional to

(a) $\exp\left(\frac{-Eg}{KT}\right)$ (b) $\exp\left(\frac{-2Eg}{KT}\right)$ (c) $\exp\left(\frac{-Eg}{KT^2}\right)$ (d) $\exp\left(\frac{-Eg}{2KT}\right)$

Q101. Imperfection arising due to the displacement of an ion from a regular site to an interstitial site maintaining overall electrical neutrality of ionic crystal is called

(a) Frenkel imperfection (b) Schottky imperfection

(c) Point imperfection (d) Volume defect

Q102. Miller indices of the diagonal plane of a cube are

(a) (200) (b) (111) (c) (010) (d) (110)

Q103. If the load resistance of capacitor filtered full wave rectifier is reduced, the ripple voltage

(a) Increases (b) Decreases

(c) Is not affected (d) has a different frequency

Q104. If one of the diodes in bridge full wave rectifier opens, the output is

(a) $0V$

(b) One-fourth the amplitude of the input voltage

(c) A half-wave rectified voltage

(d) A $100\,Hz$ voltage

Q105. When operated in cut-off and saturation, the transistor acts like

(a) a linear amplifier (b) a switch

(c) a variable capacitor (d) a variable resistor

Q106. The low frequency response of an amplifier is determined in part by

(a) the voltage gain (b) the type of transistor

(c) the supply voltage (d) the coupling capacitors

Q107. If the rate of change of current in a current carrying coil is unity, then the induced emf is equal to

(a) Coefficient of self induction (b) Magnetic flux linked with the coil

(c) number of turns in the coil (d) Thickness of the coil

Q108. The velocity of the ejected photoelectrons depends upon the

(a) Frequency of incident light (b) Intensity of incident light

(c) Both (a) and (b) (d) Neither (a) nor (2)

Q109. If the electron in a hydrogen atom jumps from an orbit with level $n_i = 3$ to an orbit with level $n_f = 2$, the emitted radiation has a wavelength given by

(a) $\lambda = \frac{36}{5R}$ (b) $\lambda = \frac{5R}{36}$

(c) $\lambda = \frac{6}{R}$ (d) $\lambda = \frac{R}{6}$

Where R is Rydberg constant.

Q110. Consider α-particle, β-particles and γ-rays, each having an energy of $0.5\,MeV$. In the increasing order of penetrating powers, the radiations are

(a) α, β, γ (b) α, γ, β (c) β, γ, α (d) γ, β, α

Q111. The wavelength of γ-rays is of the order of

(a) 10^{-7} metre (b) 10^{-10} metre (c) 10^{-12} metre (d) 10^{-8} metre

Q112. $\left[L^2, L_z\right]$ Equals

(a) $i\hbar L_x$ (b) $i\hbar L_y$ (c) zero (d) $\hbar L_z$

Q113. An electron falls from rest in a region with potential difference of $100V$. The deBroglie wavelength associated with electron will be nearly

(a) $12.3\,nm$ (b) $1.23\ nm$ (c) $123\,nm$ (d) $0.123\ nm$

Q114. An electron magnetic wave going through vacuum is described by

$E = E_0 \sin(kx - \omega t)$ And $B = B_0 \sin(kx - \omega t)$, then

(a) $E_0 K = B_0 \omega$ (b) $E_0 B_0 = \omega K$ (c) $E_0 \omega = B_0 K$ (d) $\frac{E_0}{B_0} = \frac{\omega}{K}$

Q115. The energy density of states of an electron in a one-dimensional potential well of infinitely high walls is (the symbols have their usual meaning)

(a) $\frac{L\sqrt{m}}{\pi\hbar\sqrt{2E}}$ (b) $\frac{L\,m}{\pi\hbar\sqrt{E}}$ (c) $\frac{L\,m}{\pi\hbar\sqrt{2E}}$ (d) $\frac{L\sqrt{m}}{2\pi\hbar E}$

Q116. The commutator $[x, px]$, where x and px are position and momentum operator respectively, is

(a) $2i\hbar px$ (b) $-i\hbar px$ (c) $2i\hbar xpx$ (d) $-2i\hbar xpx$

Q117. Value of $\left[f(x), px^2 \right]$ is

(a) $i\hbar$ (b) $i\hbar\frac{\partial f}{\partial x}$ (c) $i\hbar\frac{\partial f}{\partial px}$ (d) $n\,i\hbar$

Q118. The equation of states of a dilute gas at very high temperature is described by $\frac{pV}{K_B T} = 1 + \frac{B(T)}{V}$, where V is the volume per particle and $B(T)$ is a –ve quantity. One can conclude that this is a property of

(a) A van der Waals' gas (b) an ideal Fermi gas

(c) An ideal Bose gas (d) an ideal inert gas

Q119. Which of the following relations between the particle number density n and temperature T, must hold good for a gas consisting of non-interacting particles to be described by quantum statistics?

(a) $\frac{n}{T^{1/2}} << 1$ (b) $\frac{n}{T^{3/2}} << 1$

(c) $\frac{n}{T^{3/2}} >> 1$ (d) $\frac{n}{T^{1/2}}$ and $\frac{n}{T^{3/2}}$ can have any values

Q120. If the kinetic energy of a body is twice its rest mass energy, what will be the ratio of relativistic mass to the rest mass of the body

(a) 3 (b) 1 (c) $\frac{1}{2}$ (d) 2