Entrance Examination, February-2012

M.Sc. (PHYSICS)

Marks: 75 **Time: 2.00 hrs**

Note: 1. Section A consists of 25 objective type questions of one mark each. There is negative marking of 0.33 marks for every wrong answer.

2. Section B consists of 50 objective type questions of one mark each. There is no negative marking in this section.

SECTION A

Q1. If two sides of a triangle are represented by $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{b} = 2\hat{j} + 3\hat{k}$, then the third side is represented by

(A) $\hat{i} - 3\hat{j} + 2\hat{k}$ (B) $\hat{i} + 3\hat{j} + 2\hat{k}$ (C) $-\hat{i} + \hat{j} - 2\hat{k}$ (D) $-\hat{i} + \hat{j} + 2\hat{k}$

Q2. If the electric field due to a point charge Q is expressed as $\vec{E} = \frac{Q}{4\pi\varepsilon_0}\frac{\hat{r}}{r^2}$, then the divergence of this field is

(A) $\frac{3Q}{4\pi\varepsilon_0 r^2}$ (B) $\frac{2Q}{4\pi\varepsilon_0 r}$ (C) 0 (D) $\frac{3Q}{4\pi\varepsilon_0 r}$

Q3. Which one of the following statements is true for the matrix given below?

$$A = \begin{pmatrix} 0 & 1 \\ -1 & i \end{pmatrix}$$

(A) A is symmetric (B) A is Hermitian

(C) A is anti-symmetric (D) A is skew-Hermitian

Q4. Complete solution of the differential equation

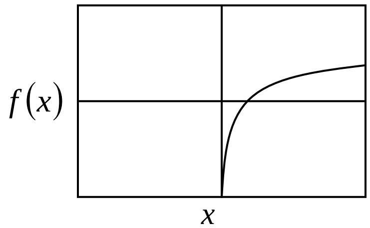
$$\frac{d^2y}{dx^2} - 7\frac{dy}{dx} + 6y = e^{2x}$$

is given by (where c_1 and c_2 are arbitrary constants)

(A) $c_1e^x + c_2e^{3x} - e^{2x}$ (B) $c_1e^x + c_2e^{6x} - e^{2x}$

(C) $c_1e^x + c_2e^{6x} - \frac{1}{4}e^{2x}$ (D) $c_1e^x + c_2e^{3x} - \frac{1}{4}e^{2x}$

Q5. A function $f(x)$ varies x, as shown in the figure. Which of the following represents $f(x)$?



(A) $\log_{10}(1+x)$ (B) $-\dfrac{1}{e^x-1}$ (C) $\dfrac{1-x}{x}$ (D) $\log_{10} x$

Q6. If rigid body with N particles is constrained to be fixed at a single point, then the number of degrees of freedom is

(A) 3 (B) 6 (C) N (D) 0

Q7. If a particle of mass m moves under the influence of a force obeying

$$m\frac{d\vec{v}}{dt}=\frac{\vec{r}\times\vec{v}}{|\vec{r}|^3},$$

then the rate of change of kinetic energy is

(A) positive (B) negative

(C) zero (D) can be positive or negative

Q8. The trajectory of a particle moving under the influence of an attractive, inverse square law force, could be

(A) Elliptic (B) Parabolic

(C) Hyperbolic (D) Any of the above

Q9. An astronaut moves in a spaceship travelling at a speed of $0.8c$ (c is the speed of light). If the astronaut observes a photon approaching the ship from space, then the speed of this photon with respect to the observer is

(A) $1.8c$ (B) c (C) $0.2c$ (D) $0.9c$

Q10. A certain weight of liquid has a volume of 100 cc at 0^oC. If the volume expansion coefficient of the liquid is $0.00112/^oC$, then its volume at 50^oC is approximately

(A) 106 cc (B) 6 cc (C) 94 cc (D) 11 cc

Q11. A string under tension T_1 vibrates at a natural frequency, f_1. If the tension of the string is increased to T_2, then the natural frequency at which the string now vibrates is

(A) $f_1\sqrt{\frac{T_2}{T_1}}$ (B) $f_1\sqrt{\frac{T_1}{T_2}}$

(C) $f_1\frac{T_1}{T_2}$ (D) $f_1\frac{T_2}{T_1}$

Q12. According to the kinetic theory of gases, the root-mean-square speed of gas molecules in a monoatomic ideal gas at a temperature T is

(A) $\sqrt{\langle v\rangle^2}=\sqrt{\frac{k_BT}{m}}$ (B) $\sqrt{\langle v\rangle^2}=\sqrt{\frac{k_BT}{2m}}$

(C) $\sqrt{\langle v\rangle^2}=\sqrt{\frac{3k_BT}{m}}$ (D) $\sqrt{\langle v\rangle^2}=\sqrt{\frac{k_BT}{3m}}$

Q13. If 1 gm of ice at $0^{\circ}C$ is melted and converted into water at the same temperature, then the change in entropy is, (assuming heat of fusion = 79.7 cal/g)

(A) 0.29 cal/K (B) 0 cal/K (C) -79.7 cal/K (D) -0.29 cal/K

Q14. If a system is in equilibrium with entropy S at constant T and N, then the variation of entropy with volume $\left(\frac{\partial S}{\partial V}\right)_{T,N}$ is given by

(A) $-\left(\frac{\partial S}{\partial P}\right)_{T,N}$ (B) $\left(\frac{\partial P}{\partial T}\right)_{V,N}$

(C) $\left(\frac{\partial V}{\partial T}\right)_{P,N}$ (D) $\left(\frac{\partial T}{\partial P}\right)_{S,N}$

Q15. Which one of the following equations does not represent a travelling wave?

(A) $y=f(x-vt)$ (B) $y=f\left(x^2-v^2t^2\right)$

(C) $y=y_{\max}\sin k(x+vt)$ (D) $y=y_{\max}\exp[i(x-vt)]$

Q16. The light (L) and sound (S) arising from an explosion on the sea surface were recorded by an observer in a submarine located at 1 km below the sea surface at time periods t_{sub}^{L} and t_{sub}^{S} respectively. The same event was also recorded by an observer in a helicopter, at 1 km above the sea surface, at times t_{hel}^{L}, and t_{hel}^{S} respectively. Assuming that both the observers are at rest with respect to the event, which one of the following is true?

(A) $t_{sub}^{L} > t_{hel}^{L}; t_{sub}^{S} > t_{hel}^{S}$ (B) $t_{sub}^{L} > t_{hel}^{L}; t_{sub}^{S} < t_{hel}^{S}$

(C) $t_{sub}^{L} < t_{hel}^{L}; t_{sub}^{S} > t_{hel}^{S}$ (D) $t_{sub}^{L} < t_{hel}^{L}; t_{sub}^{S} < t_{hel}^{S}$

Q17. When the current flowing in a primary coil of a transformer increases from zero to 5A in a time of 0.01 sec, the induced emf in the secondary coil was found to be 1500 V. Then the mutual induction between the two coils is

(A) 0.3 H (B) 3 H (C) 30 H (D) 300 H

Q18. If a charge '$-q$' is moving initially with a velocity of $\vec{v} = v\hat{z}$, parallel to a uniform magnetic field, $\vec{B} = B\hat{z}$, the charge will then

(A) accelerate along $+\hat{z}$

(B) oscillate back and forth around $\hat{z}$

(C) continue along $\hat{z}$ with the same speed v

(D) move in a plane perpendicular to $\hat{z}$ along the circular path.

Q19. A filament, assumed to be a black body, is emitting radiation at a temperature T. If the power to the filament is doubled then the temperature will

(A) increase by $2^{\frac{1}{4}}$ (B) increase by $2^{\frac{1}{2}}$

(C) increase by 2 (D) increase by 4

Q20. If a particle of mass M at rest explodes into two parts of masses m_1 and m_2, then the ratio of their de Broglie wavelength is

(A) $\frac{m_1}{m_2}$ (B) $\frac{m_2}{m_1}$ (C) $\frac{2M}{m_1 + m_2}$ (D) 1

Q21. If an electron and a proton are moving with the same kinetic energy along the same direction, when they pass through a uniform magnetic field perpendicular to the direction of their motion, which one of the following statements regarding the radii of the trajectories of these two particles in the region of the magnetic field is true?

(A) they are the same.

(B) radius is greater for the electron since it has a higher velocity.

(C) radius is greater for the proton since it has a higher mass.

(D) radius is lower for the proton since it has the higher mass.

Q22. The part of the output characteristics of an $n-p-n$ transistor, which is used while operating it as an amplifier is the

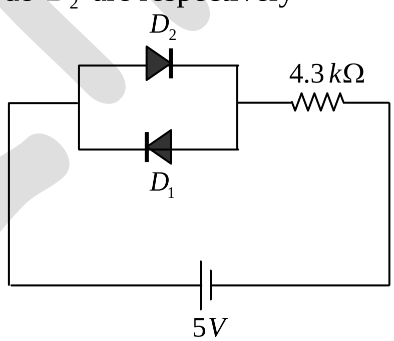
(A) saturation region.

(B) active region.

(C) cut-off region.

(D) break down region.

Q23. Diodes D_1 and D_2 shown in the circuit are silicon diodes. The voltage drop across the diode D_2 and the power dissipated by the diode D_2 are respectively



(A) 0.7 V and 0 W

(B) 5.0 V and 0 W

(C) 0.7 V and 0.7 W

(D) 5.0 V and 5 W

Q24. A source produces sound of constant frequency at 10 kHz. If a person moves away from this source at twice the speed of sound, then the

(A) frequency of sound sensed by the person is larger than 10 kHz.

(B) frequency of sound sensed by the person is smaller than 10 kHz.

(C) frequency of sound sensed by the person is equal to 10 kHz.

(D) person does not hear any sound.

Q25. If a ray of light is travelling from a denser medium (glass) to air, and the refractive index (n) of the denser medium is 1.5, then the Brewster angle is

(A) 56° (B) 34° (C) 65° (D) 25°

SECTION - B

Q26. A unit vector normal to the surface $z = x^2 + y^2$ at the point (1, 2, 5) is given by

(A) $\pm\frac{\hat{i}+2\hat{j}-\hat{k}}{\sqrt{6}}$ (B) $\pm\frac{2\hat{i}+2\hat{j}-2\hat{k}}{\sqrt{12}}$

(C) $\pm\frac{2\hat{i}+4\hat{j}-\hat{k}}{\sqrt{21}}$ (D) $\pm\frac{2\hat{i}+4\hat{j}-2\hat{k}}{\sqrt{24}}$

Q27. Which of the following cannot possibly be the eigenvalues of a real 3×3 matrix?

(A) $1, 1, -1$ (B) $1, 1+i, 1-i$

(C) $1, 0, -1$ (D) $-1, 1+i, -1+i$

Q28. Two independent solutions of the differential equation

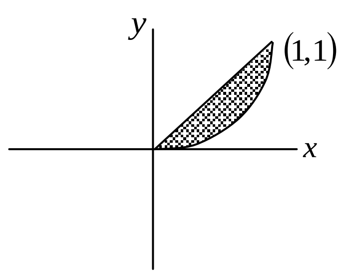
$$\frac{d^2y}{dx^2}+3\frac{dy}{dx}+2y=0$$

may be chosen to be

(A) $e^{-2x}+e^{-x},\ 2\left(e^{-2x}-e^{-x}\right)$ (B) $e^{-2x}+e^{-x},\ 2\left(e^{-2x}+e^{-x}\right)$

(C) $e^{-2x}+e^{-x},\ x\left(e^{-2x}-e^{-x}\right)$ (D) $e^{-2x},\ e^{x}$

Q29. The area of the shaded region between the straight line and parabola as shown in the figure is given by



(A) $\int_0^1 dy\int_{x^2}^{x} dx$ (B) $\int_0^1 dx\int_{x^2}^{x} dy$ (C) $\int_0^1 dx\int_0^{x} dy$ (D) $\int_0^1 dy\int_0^{x^2} dx$

Q30. Given $\left(\frac{1-i}{1+i}\right)^{100} = a+ib,$ the values of a and b are

(A) $a=2, b=-1$ (B) $a=0, b=0$

(C) $a=0, b=1$ (D) $a=-1, b=2$

Q31. If one person speaks the truth in 70% of the cases and another in 80% of the cases, then the probability that they will contradict each other in describing a single event is

(A) 0.36 (B) 0.38 (C) 0.40 (D) 0.42

Q32. The straight line $x+y=k$ touches the parabola $y=x-x^2$, if k is chosen as

(A) $k=0$ (B) $k=-1$

(C) $k=+1$ (D) $k=$ any integer

Q33. The power series $\sum_{n=1}^{\infty} nx^{n-1}$ converges for

(A) $-1<x<1$ (B) $-1\le x\le 1$ (C) $-1<x\le 1$ (D) $-1\le x<1$

Q34. $\lim_{x\to 0}\left(\frac{1}{x^2}-\frac{1}{\sin^2 x}\right)$ is given by

(A) 0 (B) $\frac{1}{3}$ (C) $-\frac{1}{3}$ (D) $-\frac{2}{3}$

Q35. The inverse of the function $y=\frac{10^x-10^{-x}}{10^x+10^{-x}}$ is

(A) $\log_{10}(2-x)$ (B) $\frac{1}{2}\log_{10}\frac{1+x}{1-x}$ (C) $\frac{1}{2}\log_{10}(2x-1)$ (D) $\frac{1}{4}\log\frac{2x}{2-x}$

Q36. A satellite of mass M, launched into a circular orbit of radius R, has a time period T. If a second satellite of mass $0.75M$ is launched into an orbit of radius $\frac{4}{3}R$, the time period of the second satellite will be given by

(A) T (B) $0.65T$ (C) $0.75T$ (D) $1.54T$

Q37. A block of mass m rests on a frictionless horizontal table and is connected to two fixed posts by springs having spring constants k and $2k$. If the block is displaced from its equilibrium position, the angular frequency of vibrations is given by

(A) $\sqrt{\frac{3k}{m}}$ (B) $\sqrt{\frac{k}{m}}$ (C) $\sqrt{\frac{k}{3m}}$ (D) $\sqrt{\frac{3k}{2m}}$

Q38. A particle of mass m moves in a circle of radius a under the action of a central force whose potential is $V(r) = kmr^3 (k > 0)$. The energy of the particle given by

(A) $\frac{3}{2}mka^3$ (B) $\frac{3}{2}mka^2$ (C) $\frac{1}{2}mka^3$ (D) $\frac{1}{2}mka^2$

Q39. The mutual potential energy V of two particles depends on their mutual distance r, as

$$V(r) = \frac{a}{r^2} - \frac{b}{r}; a > 0, b > 0$$

If the particles are in static equilibrium, then the separation is given by

(A) $\frac{2a}{b}$ (B) $\frac{2b}{a}$ (C) $\frac{a}{b}$ (D) $\frac{b}{a}$

Q40. If a body of uniform cross-sectional area A and mass density ρ floats in a liquid of density $\rho_0 (\rho < \rho_0)$ and at equilibrium displaces a volume V of the liquid, then the time period of small oscillations about the equilibrium position is

(A) $T = \frac{1}{2\pi}\sqrt{\frac{V}{g\rho}}$ (B) $T = 2\pi(\rho - \rho_0)g\sqrt{\frac{V}{A}}$

(C) $T = \sqrt{\frac{gA}{V}}\frac{1}{(\rho - \rho_0)}$ (D) $T = 2\pi\sqrt{\frac{V}{gA}}$

Q41. A particle of mass m, carrying a charge $+q$ hangs at rest from a spring of stiffness k. If a charge $-q$ is brought and held directly below $+q$ at a distance of d, then the change in length of the spring, Δz, in its new equilibrium state is proportional to

(A) d (B) $\frac{q^2}{d}\sqrt{\frac{k}{m}}$ (C) $\frac{q^2}{kd}$ (D) $\sqrt{\frac{kq^2}{md}}$

Q42. For which of the following force fields the potential energy is **not** defined?

(A) $F_x = 2yz(1-6xyz), F_y = 2xz(1-6xyz), F_z = 2xy(1-6xyz)$

(B) $F_x = y^2 + z^2 + 2(xy - yz + zx), F_y = z^2 + x^2 + 2(xy + yz + zx), F_z = x^2 + y^2 + 2(xy + yz + zx)$

(C) $F_x = 2x^2yz,\ F_y = 2xy^2z, F_z = 2xyz^2$

(D) $F_x = x/(x^2+y^2+z^2),\ F_y = y/(x^2+y^2+z^2), F_z = z/(x^2+y^2+z^2)$

Q43. A uniform hollow cylinder of mass M and radius R, rolls from rest down an inclined plane through a distance L. If the plane makes an angle of 30° with horizontal, then the rotational kinetic energy of the cylinder when it reaches the bottom of the inclined plane is

(A) $\frac{mgL}{2}$ (B) mgL (C) $\frac{mgL}{4}$ (D) $\frac{mgL}{8}$

Q44. If S_1, S_2 and S_{12} denote the surface tensions of a liquid drop, its supporting liquid and the interface between them, respectively, then the liquid drop will spread over the surface of the supporting liquid when

(A) $S_1 + S_{12} = S_2$ (B) $S_2 > S_1 + S_{12}$

(C) $S_2 < S_1 + S_{12}$ (D) $S_1 + S_2 = S_{12}$

Q45. A solid block which is 2 m in side and having a thickness of 0.25 m is compressed across its thickness. If its Young's modulus is $20\times10^6\ \text{N}/\text{m}^2$ then the force required to compress the solid by 0.01 m in length across its thickness is

(A) 2×10^5 N (B) 8×10^5 N (C) 1×10^5 N (D) 12.5×10^5 N

Q46. Consider a long thin wire of cross sectional area A, with Young's modulus Y, tension T, mass per unit length M and density ρ. In such a system, which of the following statements regarding the speeds of transverse and longitudinal waves will be true?

(A) The speeds are equal if the fractional increase in its length is 1.

(B) The speeds are equal if the fractional increase in its length is 1/2.

(C) The speeds are equal if the fractional increase in its length is 2.

(D) The speeds can never be equal.

Q47. The surface tension, σ of a liquid of density δ, which rises to a height h in a capillary of a diameter D is

(A) $\pi\delta D^2hg$ (B) $\frac{1}{4}g\delta Dh$ (C) $\frac{1}{4}g\delta D^2h$ (D) $g\delta Dh$

Q48. If the equilibrium state of the vapour near and above the critical point is described by the Van der Waal equation of state $\left(p+\frac{a}{v^2}\right)(v-b)=RT$, where $v=V/n$ is the molar volume, which one of the following statements about the critical values of (molar) volume, pressure and temperature at the critical point is true?

(A) $\left.\frac{\partial p}{\partial v}\right|_{T=T_C}=0$

(B) $\left.\frac{\partial p}{\partial v}\right|_{T=T_C}=0;\quad \left.\frac{\partial^2 p}{\partial v^2}\right|_{T=T_C}>0$

(C) $\left.\frac{\partial p}{\partial v}\right|_{T=T_C}=0;\quad \left.\frac{\partial^2 p}{\partial v^2}\right|_{T=T_C}>0$

(D) $\left.\frac{\partial p}{\partial v}\right|_{T=T_C}=0;\quad \left.\frac{\partial^2 p}{\partial v^2}\right|_{T=T_C}=0$

Q49. If W is the work done on a system in a reversible process and ΔF is the change in its free energy, then

(A) $W>\Delta F$ (B) $W<\Delta F$ (C) $W=\Delta F$ (D) $W\neq\Delta F$

Q50. In an infinitesimal adiabatic process, the work done

(A) is a perfect differential

(B) is not a perfect differential

(C) is zero

(D) depends on the temperature

Q51. The outer surface of a brass sheet at 100°C is kept in contact with the outer surface of a steel sheet at 0°C. If the thickness and cross-sectional areas of both the sheets are equal and the ratio of their thermal conductivities is 2:1, then the temperature of the interface at equilibrium is

(A) 66.7°C (B) 50°C (C) 33°C (D) 100°C

Q52. A refrigerator is operated between two reservoirs maintained at 250 K and 300 K respectively. If its coefficient of performance is one-third that of a Carnot engine and it absorbs 500 J from the low temperature reservoir, then the heat lost to the high temperature reservoir is

(A) 800 J (B) 1500 J (C) 600 J (D) 155 J

Q53. If a metal rod is heated at one end and immersed in ice (at 0° C) at the other end, then the mass of ice that melts in a given time, t, is

(A) directly proportional to the length of the rod and inversely proportional to the area of cross-section.

(B) directly proportional to the area of cross-section and inversely proportional to thermal conductivity of the rod.

(C) directly proportional to both the length and thermal conductivity of the rod.

(D) directly proportional to the thermal conductivity of the rod and inversely proportional to its length.

Q54. Two waves are described by $y_1 = a\sin(4\pi t)$ and $y_2 = a\cos(4\pi t)$. The phase difference between these two waves is

(A) π (B) 0 (C) 2π (D) $\pi/2$

Q55. The fraction of kinetic energy in the total energy of a simple harmonic oscillator, when its displacement is half of its amplitude, is given by

(A) 0 (B) 0.5 (C) 1 (D) 0.75

Q56. Which one of the following statements about sound waves is true?

(A) sound waves cannot be polarized.

(B) sound waves can only be circularly polarized.

(C) sound waves can only be plane polarized.

(D) sound waves can be plane polarized or circularly polarized.

Q57. If surface waves in a lake have a phase velocity given by $v = a\sqrt{\lambda/2\pi}$, where a is constant, then their group velocity is

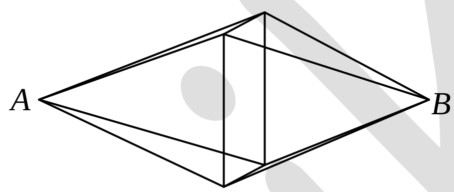
(A) v (B) $2v$ (C) $\frac{v}{2}$ (D) $\frac{v}{a}$

Q58. If a dipole $\vec{p}$ situated at the region $(0,0,0)$ is pointing in the $+z$-direction, then the force on a point charge q at $(a,0,0)$ is

(A) $F = \frac{2pq}{4\pi\varepsilon_0 a^3}\hat{z}$ (B) $F = \frac{-2pq}{4\pi\varepsilon_0 a^3}\hat{z}$

(C) $F = -\frac{pq}{4\pi\varepsilon_0 a^3}\hat{z}$ (D) zero

Q59. Wires of equal resistance 10Ω are joined together in the form of two pyramids with a common base, as shown in the figure. If current enters through A and leaves through B, then the resistance between the two points A and B is



(A) 5Ω (B) 10Ω (C) 20Ω (D) 40Ω

Q60. The resonance frequency of an LCR circuit was found to be 1200 Hz. If another capacitor of equal value is connected in parallel to the existing one in the circuit, then the new resonance frequency is

(A) 2400 Hz (B) 1697 Hz (C) 849 Hz (D) 600 Hz

Q61. If a 2 MeV alpha particle $\left({}_2He^4\right)$ incident on ${}_{47}Ag^{107}$ nucleus is scattered at 90°, then the impact parameter is $\left(e^2/4\pi\varepsilon_0 = 1.44\,\text{MeV fm}\right)$

(A) 3.38×10^{-15} m (B) 47×10^{-5} m

(C) 6.78×10^{-5} m (D) 0 m

Q62. The electron in a Hydrogen atom in its ground state gets elevated to the highest permissible excited state, by absorbing energy equal to 12.1 eV. The change in the angular momentum of the electron is

(A) $\frac{h}{\pi}$ (B) $\frac{2h}{\pi}$ (C) $\frac{3h}{\pi}$ (D) $\frac{h}{2\pi}$

Q63. Photons with energies $p\omega$ and $q\omega$ are incident one after another on a metal having work function ω, where p and q are integers. The ratio of respective maximum velocities is

(A) $\sqrt{\frac{p}{q}}$ (B) $\sqrt{\frac{q}{p}}$ (C) $\sqrt{\frac{p-1}{q-1}}$ (D) $\sqrt{\frac{q-1}{p-1}}$

Q64. Separate Compton effect experiments are carried out using visible light and X-rays. If the scattered radiation is observed at the same scattering angle, then

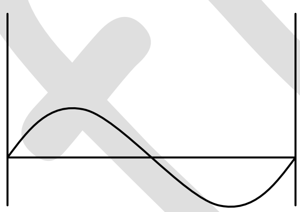
(A) the X-rays have greater shift in wavelength and greater change in photon energy.

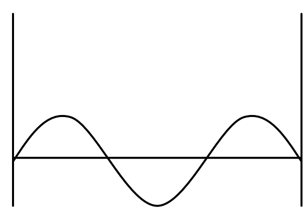
(B) the two radiations have the same shift in wavelength and X-rays have a greater change in photon energy.

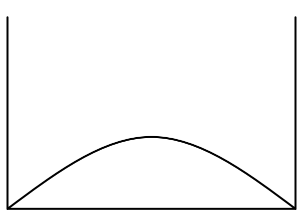
(C) the two radiations have the same shift in wavelength and visible light has greater change in photon energy

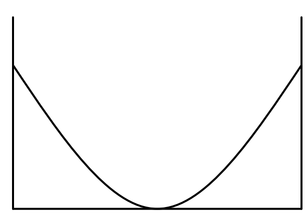
(D) the two radiations have the same shift in wavelength and the same change in photon energy.

Q65. Which of the following represents the first excited state wave function of a massive particle confined to move in a one-dimensional box of length L (the x-axis represents the space co-ordinate and the y-axis represents the shape of the wave-function, in each figure).

(A)


(B)


(C)


(D)


Q66. When a beam of 100 eV electrons is incident on a crystal at an angle 30°, a first order Bragg reflection occurs, then the lattice spacing is

(A) 13.2×10^{-15} m (B) 13.2×10^{-13} m

(C) 14.2×10^{-14} m (D) 1.32×10^{-15} m

Q67. If a particle of mass 1.67×10^{-27} kg is confined to move in a box of length 10^{-14} m and infinite depth, the minimum kinetic energy of the particle would be

(A) 0.21 MeV (B) 0.33 MeV

(C) 0.21 MeV (D) 3.3 MeV

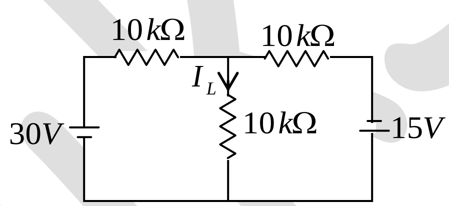
Q68. The current I_L flowing in the circuit is

(A) 1 mA

(B) 1.5 mA

(C) 0.5 mA

(D) 3 mA



Q69. If the binary number 01101010 is converted into the hexadecimal system, then it is written as

(A) 6AH (B) 106H (C) 610H (D) 2EH

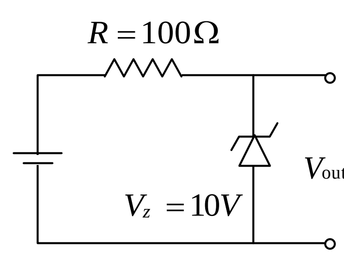
Q70. The minimum current required to achieve Zener action in the diode shown in the circuit is $0.5\,mA$ and the maximum power it can withstand is $1W$. The input voltage range over which this diode can regulate the output voltage is

(A) $9.95V-20V$

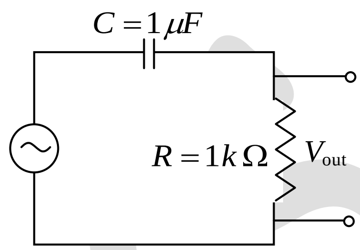
(B) $10V-100V$

(C) $10.05V-20V$

(D) $10.7V-20.7V$



Q71. A $1\mu F$ capacitor is connected in series with a $1k\Omega$ resistance and an AC source as shown in the figure. If V_1 is the magnitude of the output voltage when a $10kHz$ AC signal of certain amplitude is applied at the input and V_2 is the magnitude of the output voltage when a $1Hz$ AC signal of the same amplitude is applied, then the ratio of V_1 to V_2 is approximately



(A) $\frac{100}{2\pi}$

(B) $\frac{1000}{2\pi}$

(C) $\frac{2\pi}{100}$

(D) $\frac{2\pi}{1000}$

Q72. If light passes through a glass slab of 1cm thickness and refractive index 1.5 at an angle of 45^o with respect to the normal to the slab, then it deviates from the original path by

(A) 1cm (B) 1.06cm (C) 0.6cm (D) 0.53cm

Q73. The output of light from a laser source of $1mW$ power passing through two crossed polarizers is zero. If another polarizer is introduced between these two at an angle of 45^o with respect to the optic axis of one of them, the output power at the detector is

(A) $0mW$ (B) $0.5mW$ (C) $0.75mW$ (D) $0.25mW$

Q74. If the output from a $1V$ source is attenuated by $2dB$, then the measured voltage will be

(A) $0.5V$ (B) $0.1V$ (C) $0.01V$ (D) $0.001V$

Q75. If. the actual wavelength of light emitted from a luminous body is 6000Å, but is measured to be 6030Å, then its relative velocity with respect to the observer is

(A) $1\times10^6\ m/\sec$

(B) $1.5\times10^6\ m/\sec$

(C) $3\times10^6\ m/\sec$

(D) $6\times10^6\ m/\sec$