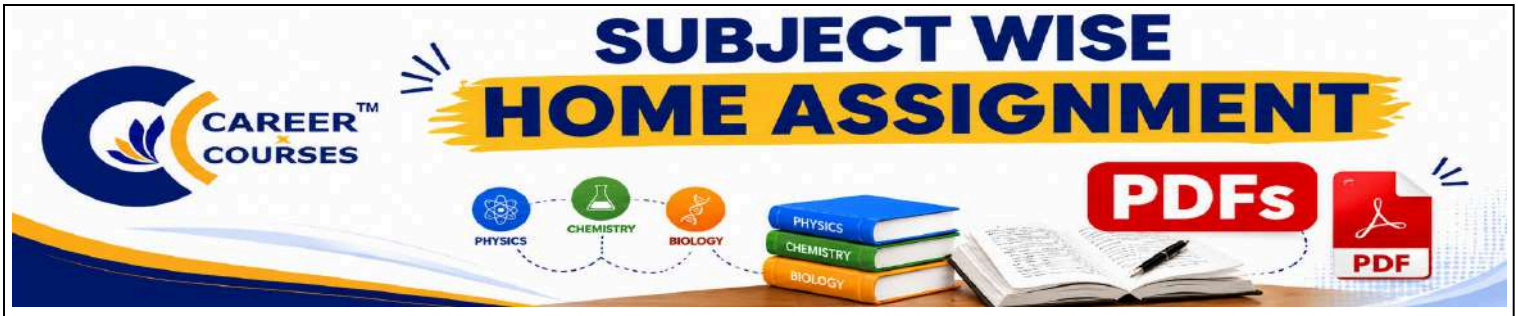


Career and Courses

Subjects : Physics | **JEE MAINS PHYSICS** | **Date** : 10-11-2026

Total Marks : 600 | **Hours** : 3 Hours

Physics - Section A (MCQ)

1. If ε_0 is the permittivity of free space and E is the electric field, then $\varepsilon_0 E^2$ has the dimensions is _____.

   A) $[\mathrm{M}^0\ \mathrm{L}^{-2}\mathrm{TA}]$ B) $[\mathrm{ML}^{-1}\ \mathrm{T}^{-2}]$ C) $[\mathrm{M}^{-1}\ \mathrm{L}^{-3}\ \mathrm{T}^4\ \mathrm{A}^2]$ D) $[\mathrm{ML}^2\ \mathrm{T}^{-2}]$

2. Match List$-I$ with List$-II$.

List$-I$	List$-II$
(a) Magnetic Induction	$(i)\ ML^2T^{-2}A^{-1}$
(b) Magnetic Flux	$(ii)\ M^0L^{-1}A$
(c) Magnetic Permeability	$(iii)\ MT^{-2}A^{-1}$
(d) Magnetization	$(iv)\ MLT^{-2}A^{-2}$

   Choose the most appropriate answer from the options given below:

   A) $(a)-(ii),(b)-(iv),(c)-(i),(d)-(iii)$ B) $(a)-(ii),(b)-(i),(c)-(iv),(d)-(iii)$

   C) $(a)-(iii),(b)-(ii),(c)-(iv),(d)-(i)$ D) $(a)-(iii),(b)-(i),(c)-(iv),(d)-(ii)$

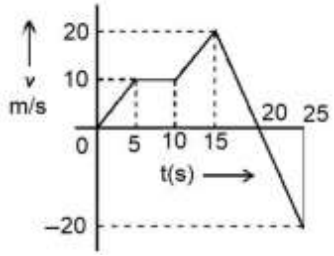
3. In a screw gauge the zero of main scale reference line coincides with the fifth division of the circular scale when two studs are in contact. There are 100 divisions in circular scale and pitch of screw gauge is 0.1 mm. When diameter of a sphere is measured, the reading of main scale is 5 mm and 50^{th} division of circular scale coincides with the reference line of main scale. The diameter of sphere is _____ mm.

   A) 5.045 B) 5.055 C) 5.450 D) 5.550

4. In finding out refractive index of glass slab the following observations were made through travelling microscope 50 vernier scale division $=49$MSD; 20 divisions on main scale in each cm For mark on paper
   $\mathrm{MSR} = 8.45\ \mathrm{cm}, \mathrm{VC} = 26$
   For mark on paper seen through slab
   $\mathrm{MSR} = 7.12\ \mathrm{cm}, \mathrm{VC} = 41$
   For powder particle on the top surface of the glass slab
   $\mathrm{MSR} = 4.05\ \mathrm{cm}, \mathrm{VC} = 1$
   (MSR = Main Scale Reading, VC = Vernier Coincidence)
   Refractive index of the glass slab is _____.

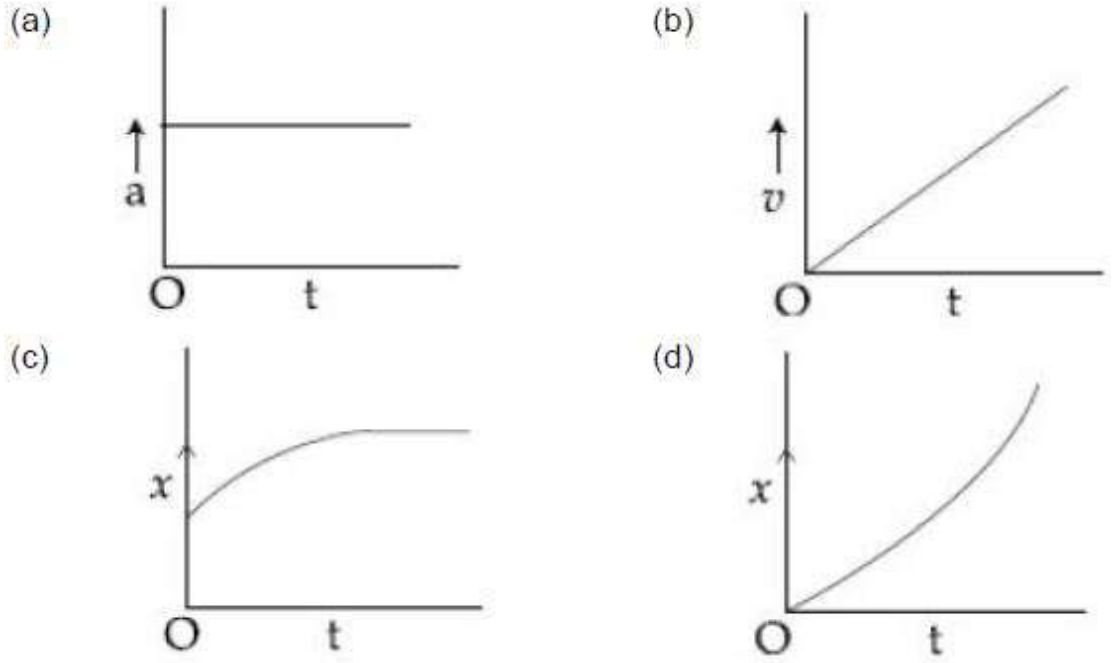
   A) 1.42 B) 1.52 C) 1.24 D) 1.35

5. From the v - t graph shown. the ratio of distance to displacement in $25\,s$ of motion



A) $\frac{3}{5}$ B) $\frac{1}{2}$ C) $\frac{5}{3}$ D) 1

6. A particle starts from origin O from rest and moves with a uniform acceleration along the positive $x-$ axis. Identify all figures that correctly represent the motion qualitatively. (a = acceleration, v = velocity, x = displacement, t = time)



A) a, b, c B) a C) b, c D) a, b, d

7. Water drops are falling from a nozzle of a shower onto the floor, from a height of $9.8\,m$. The drops fall at a regular interval of time. When the first drop strikes the floor, at that instant, the third drop begins to fall. Locate the position of second drop from the floor when the first drop strikes the floor. (In m)

A) 4.18 B) 2.94 C) 2.45 D) 7.35

8. A passenger train of length $60\,m$ travels at a speed of $80\,km/hr$. Another freight train of length $120\,m$ travels at a speed of $30\,km/hr$. The ratio of times taken by the passenger train to completely cross the freight train when:
(i) they are moving in the same direction, and
(ii) in the opposite directions is

A) 2.2 B) 2.5 C) 1.5 D) $\frac{25}{11}$

9. The angle between vector $\vec{Q}$ and the resultant of $(2\vec{\mathrm{Q}} + 2\vec{\mathrm{P}})$ and $(2\vec{\mathrm{Q}} - 2\vec{\mathrm{P}})$ is _____.

A) 0° B) $\tan^{-1}\frac{(2\vec{\mathrm{Q}}-2\vec{\mathrm{P}})}{2\vec{\mathrm{Q}}+2\vec{\mathrm{P}}}$ C) $\tan^{-1}\left(\frac{P}{Q}\right)$ D) $\tan^{-1}\left(\frac{2Q}{P}\right)$

10. Statement I :Two forces $(\vec{P} + \vec{Q})$ and $(\vec{P} - \vec{Q})$ where $\vec{P} \perp \vec{Q}$, when act at an angle θ_1 to each other, the magnitude of their resultant is $\sqrt{3\,(P^2+Q^2)}$, when they act at an angle θ_2, the magnitude of their resultant becomes $\sqrt{2\,(P^2+Q^2)}$. This is possible only when $\theta_1 < \theta_2$.
Statement II : In the situation given above. $\theta_1 = 60^\circ$ and $\theta_2 = 90^\circ$ In the light of the above statements, choose the most appropriate answer from the options given below

A) Statement$-I$ is false but Statement$-II$ is true

B) Both Statement$-I$ and Statement$-II$ are true

C) Statement$-I$ is true but Statement$-II$ is false

D) Both Statement$-I$ and Statement$-II$ are false.

11. Which of the following relations is true for two unit vectors $\hat{A}$ and $\hat{B}$ making an angle θ to each other?

A) $|\hat{A}+\hat{B}| = |\hat{A}-\hat{B}| \tan\frac{\theta}{2}$

B) $|\hat{A}-\hat{B}| = |\hat{A}+\hat{B}| \tan\frac{\theta}{2}$

C) $|\hat{A}+\hat{B}| = |\hat{A}-\hat{B}| \cos\frac{\theta}{2}$

D) $|\overrightarrow{A}-\hat{B}| = |\overrightarrow{A}+\hat{B}| \cos\frac{\theta}{2}$

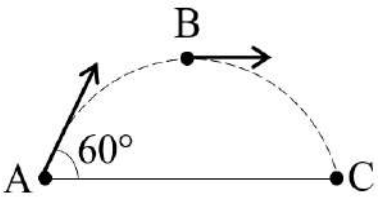
12. $\vec{A}$ is a vector quantity such that $|\vec{A}|$ = nonzero constant. Which of the following expressions is true for $\vec{A}$?

A) $\overrightarrow{A} \cdot \overrightarrow{A} = 0$ B) $\overrightarrow{A} \times \overrightarrow{A} < 0$ C) $\overrightarrow{A} \times \overrightarrow{A} = 0$ D) $\overrightarrow{A} \times \overrightarrow{A} > 0$

13. At time $t = 0$ a particle starts travelling from a height $7\,\hat{z}cm$ in a plane keeping z coordinate constant. At any instant of time it's position along the x and y directions are defined as $3\,t$ and $5\,t^3$ respectively. At $t = 1\,s$ acceleration of the particle will be.

A) $-30\,y$ B) $30\,y$ C) $3x + 15y$ D) $3x + 15y + 7\hat{z}$

14. An object is projected with kinetic energy K from a point A at an angle 60° with the horizontal. The ratio of the difference in kinetic energies points B and C to that at point A (see figure), in the absence of air friction is :



A) 1 : 2 B) 2 : 3 C) 1 : 4 D) 3 : 4

15. A ball projected from ground at an angle of 45^o just clears a wall in front. If point of projection is $4\,m$ from the foot of wall and ball strikes the ground at a distance of $6\,m$ on the other side of the wall, the height of the wall is ..... m

A) 4.4 B) 2.4 C) 3.6 D) 1.6

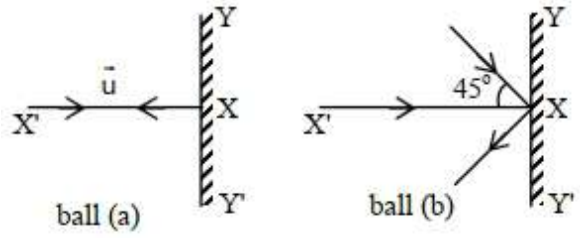
16. A particle moving in a circle of radius R with uniform speed takes time T to complete one revolution. If this particle is projected with the same speed at an angle θ to the horizontal, the maximum height attained by it is equal to $4R$. The angle of projection θ is then given by _____.

A) $\sin^{-1}\left[\frac{2gT^2}{\pi^2 R}\right]^{\frac{1}{2}}$ B) $\sin^{-1}\left[\frac{\pi^2 R}{2gT^2}\right]^{\frac{1}{2}}$ C) $\cos^{-1}\left[\frac{2gT^2}{\pi^2 R}\right]^{\frac{1}{2}}$ D) $\cos^{-1}\left[\frac{\pi R}{2gT^2}\right]^{\frac{1}{2}}$

17. A particle of mass m is acted upon by a force F given by the empirical law $F = \frac{R}{t^2}\,v(t)$. If this law is to be tested experimentally by observing the motion starting from rest, the best way is to plot

A) $log\,v(t)$ against $\frac{1}{t}$ B) $v(t)$ against t^2 C) $log\,v(t)$ against $\frac{1}{t^2}$ D) $v(t)$ against t

18. Two billiard balls of equal mass $30\,g$ strike a rigid wall with same speed of $108\,kmph$ (as shown) but at different angles. If the balls get reflected with the same speed then the ratio of the magnitude of impulses imparted to ball $'a'$ and ball $'b'$ by the wall along $'X'$ direction is :



A) $1:1$ B) $\sqrt{2}:1$ C) $1:\sqrt{2}$ D) $2:1$

19. Two bodies of mass 4 g and 25 g are moving with equal kinetic energies. The ratio of magnitude of their linear momentum is :

A) $3:5$ B) $5:4$ C) $2:5$ D) $4:5$

20. A block of mass $5\,kg$ is placed at rest on a table of rough surface. Now, if a force of $30\,N$ is applied in the direction parallel to surface of the table, the block slides through a distance of $50\,m$ in an interval of time $10\,s$. Coefficient of kinetic friction is (given, $g = 10\,ms^{-2}$)

A) 0.60 B) 0.75 C) 0.50 D) 0.25

21. A block of mass M slides down on a rough inclined plane with constant velocity. The angle made by the incline plane with horizontal is θ. The magnitude of the contact force will be.

A) Mg B) $Mg\cos\theta$ C) $\sqrt{Mg\sin\theta + Mg\cos\theta}$ D) $Mg\sin\theta\sqrt{1+\mu}$

22. A train is moving with a speed of 12 m/s on rails which are 1.5 m apart. To negotiate a curve radius 400 m, the height by which the outer rail should be raised with respect to the inner rail is (Given, $g = 10$ m/s^2) :

A) 6.0 cm B) 5.4 cm C) 4.8 cm D) 4.2 cm

23. A body of mass 1 kg moves along a straight line with a velocity $v = 2x^2$. The work done by the body during displacement from $x = 0$ to 5 m is _____ J.

A) 0 B) 250 C) 1250 D) 1000

24. An object of mass 1000 g experiences a time dependent force $\vec{F} = \left(2t\hat{i} + 3t^2\hat{j}\right) N$. The power generated by the force at time t is :

A) $\left(2t^2 + 3t^3\right) W$ B) $\left(2t^2 + 18t^3\right) W$ C) $\left(3t^3 + 5t^5\right) W$ D) $\left(2t^3 + 3t^5\right) W$

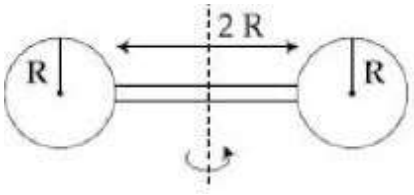
25. An object is dropped from a height h from the ground. Every time it hits the ground it looses 50% of its kinetic energy. The total distance covered as $t \to \infty$ is

A) $3\,h$ B) ∞ C) $\frac{5}{3}\,h$ D) $\frac{8}{3}\,h$

26. Consider a circular disc of radius 20 cm with centre located at the origin. A circular hole of radius 5 cm is cut from this disc in such a way that the edge of the hole touches the edge of the disc. The distance of centre of mass of residual or remaining disc from the origin will be _____.

A) 2.0 cm B) 1.5 cm C) 1.0 cm D) 0.5 cm

27. Two identical spherical balls of mass M and radius R each are stuck on two ends of a rod of length $2R$ and mass M (see figure). The moment of inertia of the system about the axis passing perpendicularly through the centre of the rod is



A) $\frac{137}{15}MR^2$ B) $\frac{17}{15}MR^2$ C) $\frac{209}{15}MR^2$ D) $\frac{152}{15}MR^2$

28. Two coaxial discs, having moments of inertia I_1 and $\frac{I_1}{2}$ are a rotating with respectively angular velocities ω_1 and $\frac{\omega_1}{2}$, about their common axes. They are brought in contact with each other and thereafter they rotate with a common angular velocity. If E_f and E_i are the final and initial total energies, then $(E_f - E_i)$ is

A) $\frac{I_1\omega_1^2}{6}$ B) $\frac{3}{8}I_1\omega_1^2$ C) $-\frac{I_1\omega_1^2}{12}$ D) $-\frac{I_1\omega_1^2}{24}$

29. The acceleration due to gravity on the surface of earth is g. If the diameter of earth reduces to half of its original value and mass remains constant, then acceleration due to gravity on the surface of earth would be :

A) $g/4$ B) $2\ \mathrm{g}$ C) $g/2$ D) $4\ \mathrm{g}$

30. An astronaut takes a ball of mass m from earth to space. He throws the ball into a circular orbit about earth at an altitude of $318.5\ \mathrm{km}$. From earth's surface to the orbit, the change in total mechanical energy of the ball is $x\frac{\mathrm{GM_e\ m}}{21R_e}$. The value of x is _____. (take $R_\mathrm{e} = 6370\ \mathrm{km}$)

A) 11 B) 9 C) 12 D) 10

31. A light planet is revolving around a massive star in a circular orbit of radius R with a period of revolution T. If the force of attraction between planet and star is proportional to $\mathrm{R}^{-3/2}$ then choose the correct option.

A) $\mathrm{T}^2 \propto \mathrm{R}^{5/2}$ B) $T^2 \propto R^{7/2}$ C) $T^2 \propto R^{3/2}$ D) $T^2 \propto R^3$

32. A man grows into a giant such that his linear dimensions increase by a factor of 9. Assuming that his density remains same, the stress in the leg will change by a factor of

A) 9 B) $\frac{1}{9}$ C) 81 D) $\frac{1}{81}$

33. Young's moduli of the material of wires A and B are in the ratio of $1:4$, while its area of cross sections are in the ratio of $1:3$. If the same amount of load is applied to both the wires, the amount of elongation produced in the wires A and B will be in the ratio of
[Assume length of wires A and B are same]

A) 36 : 1 B) 12 : 1 C) 1 : 36 D) 1 : 12

34. The force required to stretch a wire of crosssection $1cm^2$ to double its length will be ..... $\times 10^7\ N$
(Given Yong's modulus of the wire $= 2 \times 10^{11}\ N/m^2$)

A) 1 B) 1.5 C) 2 D) 2.5

35. A 400 g solid cube having an edge of length 10 cm floats in water. How much volume of the cube is outside the water ?
(Given : density of water $= 1000\ \mathrm{kg\ m^{-3}}$)

A) $1400\ \mathrm{cm^3}$ B) $600\ \mathrm{cm^3}$ C) $4000\ \mathrm{cm^3}$ D) $400\ \mathrm{cm^3}$

36. A fluid is flowing through a horizontal pipe of varying cross-section, with speed $v\ ms^{-1}$ at a point where the pressure is P Pascal. At another point where pressure is $\frac{P}{2}$ Pascal its speed is $V\ ms^{-1}$. If the density of the fluid is $\rho\, kg\, m^{-3}$ and the flow is streamline, then V is equal to

A) $\sqrt{\frac{P}{2\rho}+v^2}$ B) $\sqrt{\frac{P}{\rho}+v^2}$ C) $\sqrt{\frac{2P}{\rho}+v^2}$ D) $\sqrt{\frac{P}{\rho}+v}$

37. A spherical body of radius r and density σ falls freely through a viscous liquid having density ρ and viscosity η and attains a terminal velocity v_0. Estimated maximum error in the quantity η is : (Ignore errors associated with σ, ρ and g , gravitational acceleration)

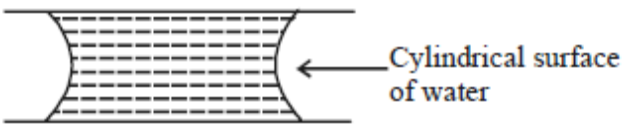
A) $2\frac{\Delta r}{r} - \frac{\Delta v_0}{v_0}$ B) $\frac{2\Delta r}{r} + \frac{\Delta v_0}{v_0}$

C) $2\left[\frac{\Delta r}{r} + \frac{\Delta v_0}{v_0}\right]$ D) $2\left[\frac{\Delta r}{r} - \frac{\Delta v_0}{v_0}\right]$

38. If 1000 droplets of water of surface tension $0.07\ N/m$. having same radius $1\ mm$ each, combine to from a single drop. In the process the released surface energy is $\left(\text{ Take } \pi = \frac{22}{7}\right)$

A) $7.92 \times 10^{-6}\ J$ B) $7.92 \times 10^{-4}\ J$ C) $9.68 \times 10^{-4}\ J$ D) $8.8 \times 10^{-5}\ J$

39. If two glass plates have water between them and are separated by very small distance (see figure), it is very difficult to pull them apart. It is because the water in between forms cylindrical surface on the side that gives rise to lower pressure in the water in comparison to atmosphere. If the radius of the cylindrical surface is R and surface tension of water is T then the pressure in water between the plates is lower by



A) $\frac{T}{R}$ B) $\frac{4T}{R}$ C) $\frac{T}{4R}$ D) $\frac{2T}{R}$

40. The ratio of surface tensions of mercury and water is given to be 7.5 while the ratio of their densities is 13.6. Their contact angles, with glass, are close to 135^o and 0^o, respectively. It is observed that mercury gets depressed by an amount h in a capillary tube of radius r_1, while water rises by the same amount h in a capillary tube of radius r_2. The ratio, (r_1/r_2), is then close to

A) $3/5$ B) $4/5$ C) $2/3$ D) $2/5$

41. A solid metallic cube having total surface area 24 m^2 is uniformly heated. If its temperature is increased by $10\,^{\circ}C$, calculate the increase in volume of the cube (Given : $\alpha = 5.0 \times 10^{-4\circ}C^{-1}$)

A) $2.4 \times 10^6 cm^3$ B) $1.2 \times 10^5 cm^3$ C) $6.0 \times 10^4 cm^3$ D) $4.8 \times 10^5 cm^3$

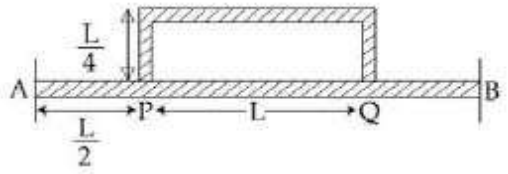
42. When the temperature of a metal wire is increased from 0° C to 10° C, its length increases by 0.02%. The percentage change in its mass density will be closest to:

A) 0.008 B) 0.06 C) 0.8 D) 2.3

43. The specific heat of water $= 4200\ J\ kg^{-1}\ K^{-1}$ and the latent heat of ice $= 3.4 \times 10^5\ J\ kg^{-1}$. 100 grams of ice at $0^{\circ}C$ is placed in 200 g of water at $25^{\circ}C$. The amount of ice that will melt as the temperature of water reaches $0^{\circ}C$ is close to (in $grams$)

A) 61.7 B) 63.8 C) 69.3 D) 64.6

44. Temperature difference of $120\,^oC$ is maintained between two ends of a uniform rod AB of length $2L$. Another bent rod PQ, of same cross-section as AB and length $\frac{3L}{2}$, is connected across AB (See figure). In steady state, temperature difference between P and Q will be close to **.....** ^oC



A) 45 B) 75 C) 60 D) 35

45. A hot body, obeying Newton's law of cooling is cooling down from its peak value $80\,^oC$ to an ambient temperature of $30\,^oC$. It takes 5 $minutes$ in cooling down from $80\,^oC$ to $40\,^oC$. ..... min . will it take to cool down from $62\,^oC$ to $32\,^oC$? (Given $ln\,2 = 0.693, ln\,5 = 1.609$)

A) 3.75 B) 8.6 C) 9.6 D) 6.5

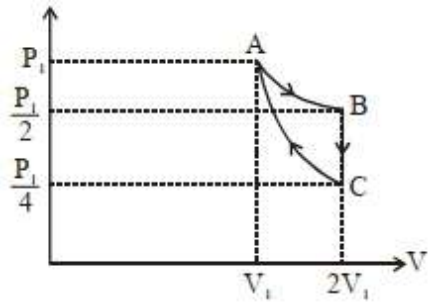
46. A bowl filled with very hot soup cools from 98° C to 86° C in 2 minutes when the room temperature is 22° C. ..... $minutes$ long it will take to cool from 75° C to 69° C ?

A) 2 B) 1.4 C) 0.5 D) 1

47. During an adiabatic process, if the pressure of a gas is found to be proportional to the cube of its absolute temperature, then the ratio of $\frac{C_p}{C_V}$ for the gas is _____.

A) $\frac{5}{3}$ B) $\frac{9}{7}$ C) $\frac{3}{2}$ D) $\frac{7}{5}$

48. If one mole of an ideal gas at (P_1, V_1) is allowed to expand reversibly and isothermally (A to B) its pressure is reduced to one-half of the original pressure (see $figure$). This is followed by a constant volume cooling till its pressure is reduced to one-fourth of the initial value $(B \to C)$. Then it is restored to its initial state by a reversible adiabatic compression (C to A). The net workdone by the gas is equal to ..... .



A) $RT\left(\ln 2 - \frac{1}{2(\gamma-1)}\right)$ B) $-\frac{RT}{2(\gamma-1)}$ C) 0 D) $RT\ln 2$

49. Two ideal Carnot engines operate in cascade (all heat given up by one engine is used by the other engine to produce work) between temperatures, $\mathrm{T_1}$ and $\mathrm{T_2}$. The temperature of the hot reservoir of the first engine is $\mathrm{T_1}$ and the temperature of the cold reservoir of the second engine is $\mathrm{T_2}$.T is temperature of the sink of first engine which is also the source for the second engine. How is T related to $\mathrm{T_1}$ and $\mathrm{T_2}$, if both the engines perform equal amount of work?

A) $\mathrm{T} = \frac{2\mathrm{T_1T_2}}{\mathrm{T_1+T_2}}$ B) $\mathrm{T} = \sqrt{\mathrm{T_1T_2}}$ C) $\mathrm{T} = \frac{\mathrm{T_1+T_2}}{2}$ D) $T = 0$

50. When heat Q is supplied to a diatomic gas of rigid molecules at constant volume its temperature increases by ΔT. The heat required to produce the same change in temperature, at constant pressure is

A) $\frac{3}{2}Q$ B) $\frac{5}{3}Q$ C) $\frac{7}{5}Q$ D) $\frac{2}{3}Q$

51. What will be the effect on the root mean square velocity of oxygen molecules if the temperature is doubled and oxygen molecule dissociates into atomic oxygen?

A) The velocity of atomic oxygen remains same

B) The velocity of atomic oxygen doubles

C) The velocity of atomic oxygen becomes half

D) The velocity of atomic oxygen becomes four times

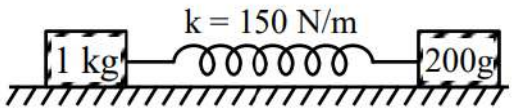
52. The mean free path and the average speed of oxygen molecules at 300 K and 1 atm are 3×10^{-7} m and 600 m/s respectively. Find the frequency of its collisions.

A) $2 \times 10^{10}/\mathrm{s}$ B) $9 \times 10^{5}/\mathrm{s}$ C) $2 \times 10^{9}/\mathrm{s}$ D) $5 \times 10^{8}/\mathrm{s}$

53. The kinetic energy and potential energy of a particle executing simple harmonic motion will be equal, when displacement (amplitude = a) is

A) $\frac{a}{2}$ B) $a\sqrt{2}$ C) $\frac{a}{\sqrt{2}}$ D) $\frac{a\sqrt{2}}{3}$

54. As shown in the figure, a spring is kept in a stretched position with some extension by holding the masses 1 kg and 0.2 kg with a separation more than spring natural length and are released. Assuming the horizontal surface to be frictionless, the angular frequency (in SI unit) of the system is :



A) 30 B) 27 C) 20 D) 5

55. The length of a seconds pendulum at a height $h = 2R$ from earth surface will be _____. (Given: $R =$ Radius of earth and acceleration due to gravity at the surface of earth $g = \pi^2\ m/s^{-2}$)

A) $\frac{2}{9}m$ B) $\frac{4}{9}m$ C) $\frac{8}{9}m$ D) $\frac{1}{9}m$

56. Assume that the displacement(s) of air is proportional to the pressure difference (Δp) created by a sound wave. Displacement(s) further depends on the speed of sound (v), density of air (ρ) and the frequency (f) If $\Delta p \approx 10\,Pa, v \approx 300\,m/s, p \approx 1\,kg/m^3$ and $f \approx 1000\,Hz$, then s will be the order of
(take multiplicative constant to be 1)

A) $10\,mm$ B) $\frac{3}{100}\,mm$ C) $1\,mm$ D) $\frac{1}{10}\,mm$

57. A string of length $1\,m$ and mass $5\,g$ is fixed at both ends. The tension in the string is $8.0\,N$. The string is set into vibration using an external vibrator of frequency $100\,Hz$. The separation between successive nodes on the string is close to .... cm

A) 10 B) 33.3 C) 16.6 D) 20.0

58. A train moves towards a stationary observer with speed $34\,m/s$. The train sounds a whistle and its frequency registered by the observer is f_1. If the speed of the train is reduced to $17\,m/s$, the frequency registered is f_2. If speed of sound is $340\,m/s$, then the ratio f_1/f_2 is

A) $18/17$ B) $19/18$ C) $20/19$ D) $21/20$

59. A particle of charge $-q$ and mass m moves in a circle of radius r around an infinitely long line charge of linear density $+\lambda$. Then time period will be given as _____.
(Consider k as Coulomb's constant)

A) $\mathrm{T}^2 = \frac{4\pi^2\,\mathrm{m}}{2\mathrm{k}\lambda\mathrm{q}}\mathrm{r}^3$ B) $T = 2\pi r\sqrt{\frac{m}{2k\lambda q}}$ C) $\mathrm{T} = \frac{1}{2\pi\mathrm{r}}\sqrt{\frac{\mathrm{m}}{2\mathrm{k}\lambda\mathrm{q}}}$ D) $\mathrm{T} = \frac{1}{2\pi}\sqrt{\frac{2\mathrm{k}\lambda\mathrm{q}}{\mathrm{m}}}$

60. A body of mass M and charge q is connected to a spring of spring constant k. It is oscillating along $x-$ direction about its equilibrium position, taken to be at $x = 0$, with an amplitude A. An electric field E is applied along the $x-$ direction. Which of the following statements is correct?

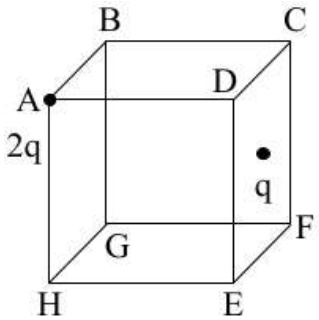
A) The total energy of the system is $\frac{1}{2}m\omega^2A^2 + \frac{1}{2}\frac{q^2E^2}{k}$

B) The new equilibrium position is at a distance: $\frac{2qE}{k}$ from $x = 0$

C) The new equilibrium position is at a distance: $\frac{qE}{2k}$ from $x = 0$

D) The total energy of the system is $\frac{1}{2}m\omega^2A^2 - \frac{1}{2}\frac{q^2E^2}{k}$

61. Two point charges $2q$ and q are placed at vertex A and centre of face CDEF of the cube as shown in figure. The electric flux passing through the cube is :

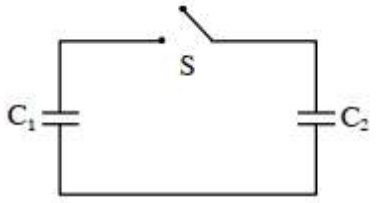


A) $\frac{3q}{\varepsilon_0}$ B) $\frac{q}{\varepsilon_0}$ C) $\frac{3q}{2\varepsilon_0}$ D) $\frac{3q}{4\varepsilon_0}$

62. Three small identical bubbles of water having same charge on each coalesce to form a bigger bubble. Then the ratio of the potentials on one initial bubble and that on the resultant bigger bubble is:

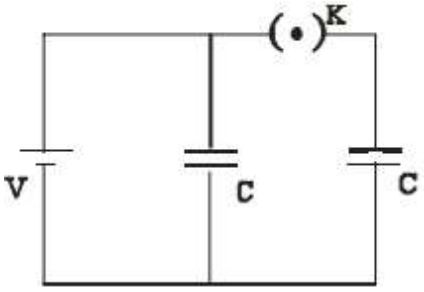
A) $1 : 3^{1/3}$ B) $1 : 2^{2/3}$ C) $3^{2/3} : 1$ D) $1 : 3^{2/3}$

63. Two capacitors having capacitance C_1 and C_2 respectively are connected as shown in figure. Initially, capacitor C_1 is charged to a potential difference V volt by a battery. The battery is then removed and the charged capacitor C_1 is now connected to uncharged capacitor C_2 by closing the switch S. The amount of charge on the capacitor C_2, after equilibrium is



A) $\frac{C_1C_2}{(C_1+C_2)}V$ B) $\frac{(C_1+C_2)}{C_1C_2}V$ C) $(C_1+C_2)\,V$ D) $(C_1-C_2)\,V$

64. A source of potential difference V is connected to the combination of two identical capacitors as shown in the figure. When key ' K ' is closed, the total energy stored across the combination is E_1. Now key ' K ' is opened and dielectric of dielectric constant 5 is introduced between the plates of the capacitors. The total energy stored across the combination is now E_2. The ratio E_1/E_2 will be :

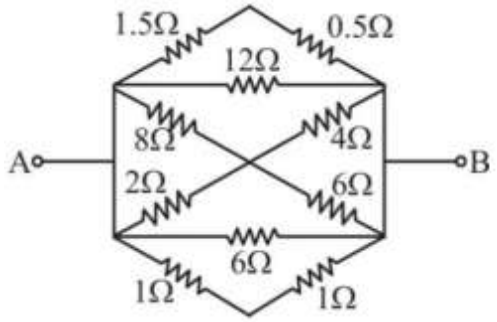


A) $\frac{1}{10}$ B) $\frac{2}{5}$ C) $\frac{5}{13}$ D) $\frac{5}{26}$

65. The resistance of a conductor at $15^{\circ}C$ is $16\,\Omega$ and at $100\,C$ is $20\,\Omega$. What will be the temperature coefficient of resistance of the conductor?

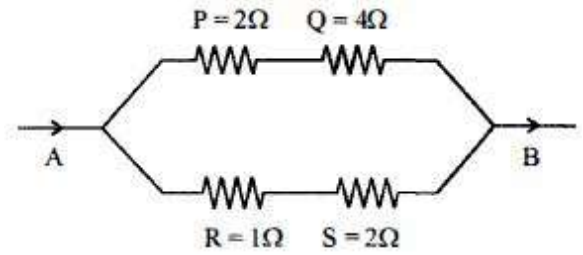
A) $0.033\,C^{-1}$ B) $0.010\,C^{-1}$ C) $0.042\,C^{-1}$ D) $0.003^{\circ}\,C^{-1}$

66. The equivalent resistance between A and B is .....



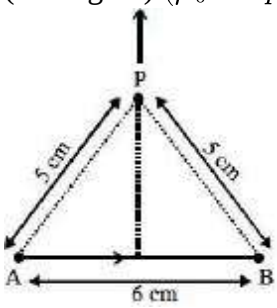
A) $\frac{2}{3}\Omega$ B) $\frac{1}{2}\Omega$ C) $\frac{3}{2}\Omega$ D) $\frac{1}{3}\Omega$

67. Which of the four resistances P, Q, R and S generate the greatest amount of heat when a current flows from A to B ?



A) Q B) S C) P D) R

68. Find the magnetic field at point P due to a straight line segment AB of length $6\,cm$ carrying a current of $5\,A$. (See figure) $(\mu_0 = 4p \times 10^{-7}\,N - A^{-2})$



A) $2.0 \times 10^{-5}\,T$ B) $3.0 \times 10^{-5}\,T$ C) $2.5 \times 10^{-5}\,T$ D) $1.5 \times 10^{-5}\,T$

69. Bob of a simple pendulum of length l is made of iron . The pendulum is oscillating over a horizontal coil carrying direct current. If the time period of the pendulum is T then

A) $T < 2\pi\sqrt{\frac{l}{g}}$ and damping is smaller than in air alone.

B) $T = 2\pi\sqrt{\frac{l}{g}}$ and damping is larger than in air alone.

C) $T > 2\pi\sqrt{\frac{l}{g}}$ and damping is smaller than in air alone.

D) $T < 2\pi\sqrt{\frac{l}{g}}$ and damping is larger than in air alone

70. A moving coil galvanometer allows a full scale current of $10^{-4}\,A$. A series resistance of $2\,M\,\Omega$ is required to convert the above galvanometer into a voltmeter of range $0 - 5\,V$. Therefore the value of shunt resistance required to convert the above galvanometer into a ammeter of range $0 - 10\,mA$ is....Ω

A) 200 B) 100 C) 10 D) None of these

71. Choose the correct option:

A) True dip is not mathematically related to apparent dip.

B) True dip is less than apparent dip.

C) True dip is always greater than the apparent dip.

D) True dip is always equal to apparent dip.

72. A paramagnetic substance in the form of a cube with sides $1\,cm$ has a magnetic dipole moment of 20×10^{-6} J/T when a magnetic intensity of $60 \times 10^3\,A/m$ is applied. Its magnetic susceptibility is

A) 3.3×10^{-2} B) 40.3×10^{-2} C) 2.3×10^{-2} D) 3.3×10^{-4}

73. Given below are two statements; one is labelled as Assertion A and the other is labelled as Reason R.
Assertion A : Electromagnets are made of soft iron.
Reason R : Soft iron has high permeability and low retentivity.
In the light of above, statements, choose the most appropriate answer from the options given below.

A) A is not correct but R is correct

B) Both A and R are correct and R is the correct explanation of A

C) Both A and R are correct but R is NOT the correct explanation of A

D) A is correct but R is not correct

74. A 30 cm long solenoid has 10 turns per cm and area of 5 cm^2. The current through the solenoid coil varies from 2 A to 4 A in 3.14 s. The e.m.f. induced in the coil is $\alpha \times 10^{-5}$ V. The value α is _____.

A) 60 B) 12 C) 120 D) 34

75. A metal rod of length L rotates about one end at origin with a uniform angular velocity ω. The magnetic field radially falls off as $B(r) = B_0 e^{-\lambda r}$; λ being a positive constant. The emf induced (neglecting the centripetal force on electrons in the rod) is :

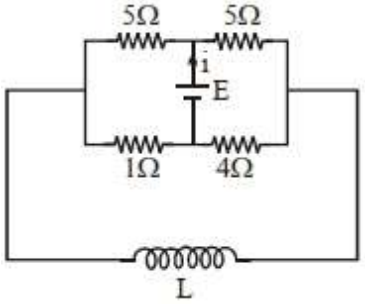
A) $B_0\omega\left[\frac{1}{\lambda^2}-e^{-\lambda L}\left(\frac{1}{\lambda^2}+\frac{L}{\lambda}\right)\right]$

B) $B_0\omega\left[\frac{1}{\lambda^2}+e^{-\lambda L}\left(\frac{1}{\lambda^2}+\frac{L}{\lambda}\right)\right]$

C) $B_0\omega\left[\frac{4}{\lambda^2}-e^{-2\lambda L}\left(\frac{1}{\lambda^2}+\frac{2L}{\lambda}\right)\right]$

D) $B_0\omega\left[\frac{3}{\lambda^2}-e^{-3\lambda L}\left(\frac{3}{\lambda^2}+\frac{L}{\lambda}\right)\right]$

76. The current (i) at time $t=0$ and $t=\infty$ respectively for the given circuit is

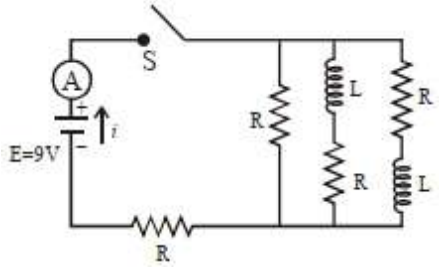


A) $\frac{18E}{55}, \frac{5E}{18}$ B) $\frac{10E}{33}, \frac{5E}{18}$ C) $\frac{5E}{18}, \frac{18E}{55}$ D) $\frac{5E}{18}, \frac{10E}{33}$

77. An alternating current is represented by the equation, $i=100\sqrt{2}\sin(100\pi t)$ ampere. The RMS value of current and the frequency of the given alternating current are _____.

A) $100\sqrt{2}$ A, 100 Hz B) $\frac{100}{\sqrt{2}}$ A, 100 Hz C) 100 A, 50 Hz D) $50\sqrt{2}$ A, 50 Hz

78. Figure shows a circuit that contains four identical resistors with resistance $R=2.0\ \Omega$, two identical inductors with inductance $L=2.0\,mH$ and an ideal battery with $emfE=9\,V$. The current $'i'$ just after the switch $'S'$ is closed will be .... A



A) 2.25 B) 3.0 C) 3.37 D) 9.0

79. An AC voltage $V=20\sin 200\pi t$ is applied to a series LCR circuit which drives a current $I=10\sin\left(200\pi t+\frac{\pi}{3}\right)$. The average power dissipated is _____.

A) 21.6 W B) 200 W C) 173.2 W D) 50 W

80. If the magnetic field in a plane electromagnetic wave is given by
$\overrightarrow{B}=3\times10^{-8}\sin\left(1.6\times10^{3}x+48\times10^{10}t\right)\hat{j}\ T$
then what will be expression for electric field?

A) $\overrightarrow{E}=\left(9\sin\left(1.6\times10^{3}x+48\times10^{10}t\right)\hat{k}\ V/m\right)$

B) $\overrightarrow{E}=\left(3\times10^{-8}\sin\left(1.6\times10^{3}x+48\times10^{10}t\right)\right)\hat{i}\ V/m\Big)$

C) $\overrightarrow{E}=\left(60\sin\left(1.6\times10^{3}x+48\times10^{10}t\right)\hat{k}\ V/m\right)$

D) $\overrightarrow{E}=\left(3\times10^{-8}\sin\left(1.6\times10^{3}x+48\times10^{10}t\right)\hat{j}\ V/m\right)$

81. A plane electromagnetic wave propagates along the $+x$ direction in free space. The components of the electric field, $\vec{E}$ and magnetic field, $\vec{B}$ vectors associated with the wave in Cartesian frame are

A) $E_x,\ B_y$ B) $E_y,\ B_z$ C) $E_z,\ B_y$ D) $E_y,\ B_x$

82. Which is the correct ascending order of wavelengths?

A) $\lambda_{\text{visible}} < \lambda_{X\text{-ray}} < \lambda_{\text{gamma-ray}} < \lambda_{\text{microwave}}$

B) $\lambda_{\text{gamma-ray}} < \lambda_{X\text{-ray}} < \lambda_{\text{visible}} < \lambda_{\text{microwave}}$

C) $\lambda_{\text{X-ray}} < \lambda_{\text{gamma-ray}} < \lambda_{\text{visisible}} < \lambda_{\text{microwave}}$

D) $\lambda_{\text{microwave}} < \lambda_{\text{visible}} < \lambda_{\text{gamma-ray}} < \lambda_{\text{X-ray}}$

83. A $2\ meter$ long scale with least count of $0.2\ cm$ is used to measure the locations of objects on an optical bench. While measuring the focal length of a convex lens, the object pin and the convex lens are placed at $80\ cm$ mark and $1\ m$ mark, respectively. The image of the object pin on the other side of lens coincides with image pin that is kept at $180\ cm$ mark. The $\%$ error in the estimation of focal length is

A) 1.02 B) 0.85 C) 1.70 D) 0.51

84. A diverging lens with magnitude of focal length $25\ cm$ is placed at a distance of $15\ cm$ from a converging lens of magnitude of focal length $20\ cm$. A beam of parallel light falls on the diverging lens. The final image formed is

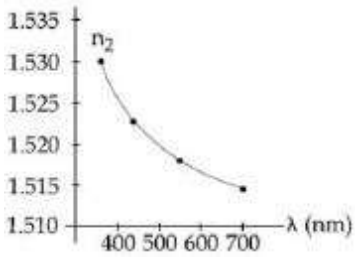
A) real and at a distance of $40\ cm$ from the divergent lens

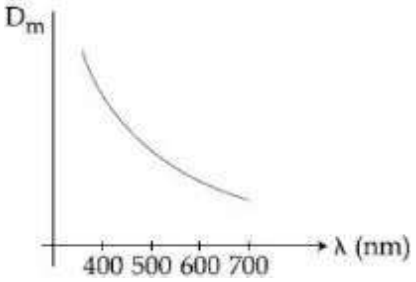
B) real and at a distance of $40\ cm$ from convergent lens

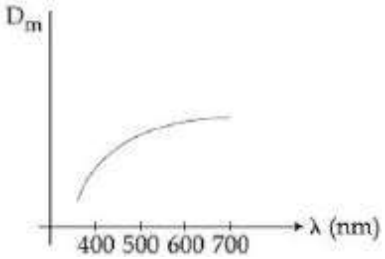
C) virtual and at a distance of $40\ cm$ from convergent lens.

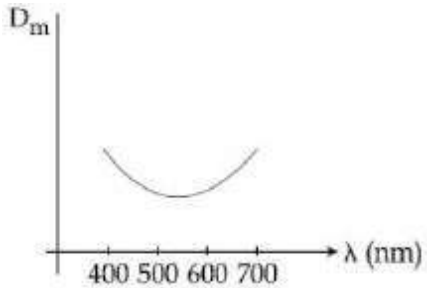
D) real and at a distance of $6\ cm$ from the convergent lens

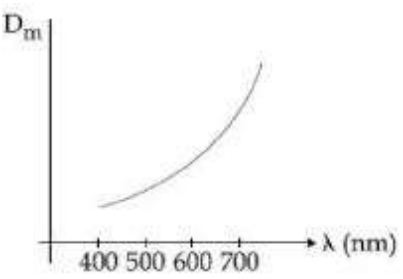
85. The variation of refractive index of a crown glass thin prism with wavelength of the incident light is shown. Which of the following, graph is the correct one, if D_m is the angle of minimum deviation?



A) 

B) 

C) 

D) 

86. In Young's double slit experiment, the fringe width of the interference pattern produced on the screen is $2.4\ \mu$ m. If the experiment is carried out in another medium having refractive index 1.2, the fringe width will be _____ μm.

A) 1.2 B) 2 C) 2.4 D) 2.88

87. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion-(A) : If Young's double slit experiment is performed in an optically denser medium than air, then the consecutive fringes come closer.
Reason-(R) : The speed of light reduces in an optically denser medium than air while its frequency does not change.
In the light of the above statements, choose the most appropriate answer from the options given below :

A) Both $(\mathbf{A})$ and $(\mathbf{R})$ are true but $(\mathbf{R})$ is not the correct explanation of $(\mathbf{A})$

B) Both $(\mathbf{A})$ and $(\mathbf{R})$ are true and $(\mathbf{R})$ is the correct explanation of $(\mathbf{A})$

C) (A) is true but (R) is false

D) (A) is false but (R) is true

88. An unpolarized light of certain intensity passes through a combination of two polarizers whose transmission axes are at $30\,^\circ$ and $90\,^\circ$, respectively, with respect to the horizontal axis. A third polarizer with its transmission axis at 60° with the horizontal axis is placed between the two existing polarizers. The ratio of the output intensities with and without the third polarizer is _____.

A) $3/4$ B) $4/3$ C) $9/4$ D) $4/9$

89. The kinetic energy of emitted electron is E when the light incident on the metal has wavelength λ. To double the kinetic energy, the incident light must have wavelength.

A) $\frac{hc}{E\lambda - hc}$ B) $\frac{hc\lambda}{E\lambda + hc}$ C) $\frac{h\lambda}{E\lambda + hc}$ D) $\frac{hc\lambda}{E\lambda - hc}$

90. A moving proton and electron have the same deBroglie wavelength. If K and P denote the $KE.$ and momentum respectively. Then choose the correct option :

A) $K_p < K_q$ and $P_p = P_e$ B) $K_p = K_q$ and $P_p = P_e$ C) $K_p < K_q$ and $P_p < P_e$ D) $K_p > K_a$ and $P_p = P_e$

91. When a light of a given wavelength falls on a metallic surface the stopping potential for photoelectrons is 3.2 V . If a second light having wavelength twice of first light is used, the stopping potential drops to 0.7 V . The wavelength of first light is _____ m .
$\left(h = 6.63 \times 10^{-34} J.s, e = 1.6 \times 10^{-19} C, c = 3 \times 10^8 m/s\right)$

A) 2.9×10^{-8} B) 2.2×10^{-8} C) 3.1×10^{-7} D) 2.5×10^{-7}

92. Hydrogen $({}_1H^1)$, Deuterium $({}_1H^2)$,singly ionised Helium $({}_2He^4)^+$ and doubly ionised lithium $({}^6_3Li)^{++}$, all have one electron around the nucleus. Consider an electron transition from $n = 2$ to $n = 1$. If the wavelengths of emitted radiation are $\lambda_1, \lambda_2, \lambda_3$ and λ_4 respectively then approximately which one of the following is correct?

A) $\lambda_1 = 2\lambda_2 = 2\lambda_3 = \lambda_4$ B) $\lambda_1 = \lambda_2 = 4\lambda_3 = 9\lambda_4$ C) $\lambda_1 = 2\lambda_2 = 3\lambda_3 = 4\lambda_4$ D) $4\lambda_1 = 2\lambda_2 = 2\lambda_3 = \lambda_4$

93. The wavelength of the photon emitted by a hydrogen atom when an electron makes a transition from $n = 2$ to $n = 1$ state is ..... $nm.$

A) 194.8 B) 913.3 C) 490.7 D) 121.8

94. If the series limit frequency of the Lyman series is v_L, then the series limit frequency of the P-fund series is

A) $16\ v_L$ B) $\frac{v_L}{16}$ C) $\frac{v_L}{25}$ D) $25\ v_L$

95. An atom ${}^8_3X$ is bombarded by shower of fundamental particles and in 10 s this atom absorbed 10 electrons, 10 protons and 9 neutrons. The percentage growth in the surface area of the nucleons is recorded by :

A) 250% B) 150% C) 225% D) 900%

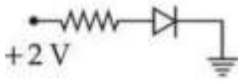
96. In a nuclear fission reaction of an isotope of mass M, three similar daughter nucler of same mass are formed. The speed of a daughter nuclei in terms of mass defect ΔM will be _____.

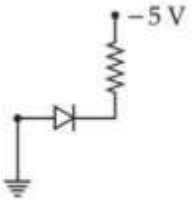
A) $\sqrt{\frac{2c\Delta M}{M}}$ B) $\frac{\Delta Mc^2}{3}$ C) $c\sqrt{\frac{2\Delta M}{M}}$ D) $c\sqrt{\frac{3\Delta M}{M}}$

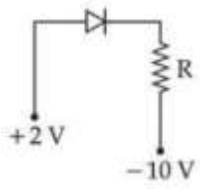
97. Some nuclei of a radioactive material are undergoing radioactive decay. The time gap between the instances when a quarter of the nuclei have decayed and when half of the nuclei have decayed is given as:
(where λ is the decay constant)

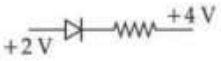
A) $\frac{2\ln 2}{\lambda}$ B) $\frac{1}{2}\frac{\ln 2}{\lambda}$ C) $\frac{\ln\frac{3}{2}}{\lambda}$ D) $\frac{\ln 2}{\lambda}$

98. Which of the following circuits is reverse - biased?

A) 

B) 

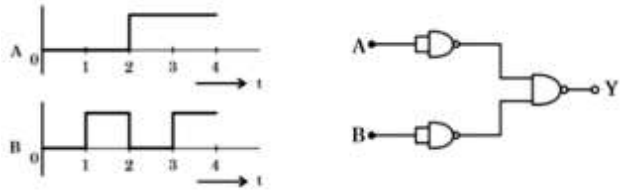
C) 

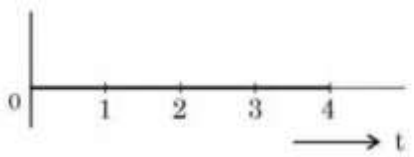
D) 

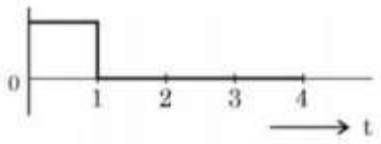
99. An experiment is performed to determine the $I-V$ characteristics of a Zener diode, which has a protective resistance of $R=100\,\Omega$, and a maximum power of dissipation rating of $1\,W$ .The minimum voltage range of the DC source in the circuit is

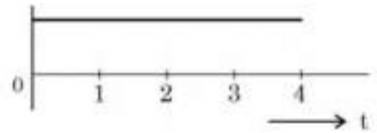
A) $0-5\ V$ B) $0-24\ V$ C) $0-12\ V$ D) $0-8\ V$

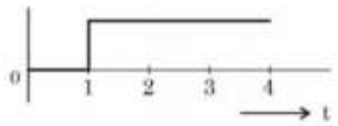
100. For the logic circuit shown, the output waveform at Y is



A) 

B) 

C) 

D) 

Physics - Section B (Numeric)

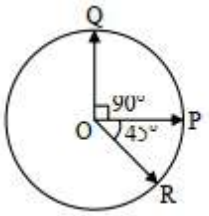
101. A sliver wire has mass $(0.6\pm0.006)\ g$, radius $(0.5\pm0.005)\ mm$ and length $(4\pm0.04)\ cm$. The maximum percentage error in the measurement of its density will be ..... $\%$

102. In a vernier callipers, each cm on the main scale is divided into 20 equal parts. If tenth vernier scale division coincides with nineth main scale division. Then the value of vernier constant will be ... $\times 10^{-2}\ mm$

103. A car is moving with speed of $150\,km/h$ and after applying the brake it will move $27\,m$ before it stops. If the same car is moving with a speed of one third the reported speed then it will stop after travelling ....m distance.

104. A ball is thrown vertically upwards with a velocity of $19.6\,ms^{-1}$ from the top of a tower. The ball strikes the ground after $6\ s$. The height from the ground up to which the ball can rise will be $\left(\frac{k}{5}\right)m$. The value of k is ..... (use $g=9.8\,m/s^2$)

105. Three vectors $\overrightarrow{OP}, \overrightarrow{OQ}$ and $\overrightarrow{OR}$ each of magnitude A are acting as shown in figure. The resultant of the three vectors is $A\sqrt{x}$. The value of x is _____.



106. If $\overrightarrow{P} = 3\hat{i} + \sqrt{3}\hat{j} + 2\hat{k}$ and $\overrightarrow{Q} = 4\hat{i} + \sqrt{3}\hat{j} + 2.5\hat{k}$ then, The unit vector in the direction of $\overrightarrow{P} \times \overrightarrow{Q}$ is $\frac{1}{x}(\sqrt{3}\hat{i} + \hat{j} - 2\sqrt{3}\hat{k})$. The value of x is

107. A person is swimming with a speed of $10\ m/s$ s at an angle of 120° with the flow and reaches to a point directly opposite on the other side of the river. The speed of the flow is $'x'\ m/s$. The value of $'x'$ to the nearest integer is .....

108. The maximum height reached by a projectile is 64 m. If the initial velocity is halved, the new maximum height of the projectile is _____ m.

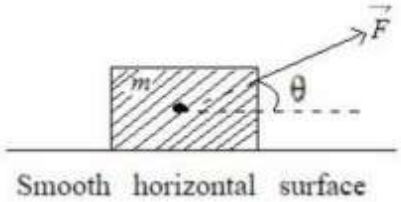
109. A force on an object of mass $100\ g$ is $(10\hat{i} + 5\hat{j})N$. The position of that object at $t = 2s$ is $(a\hat{i} + b\hat{j})m$ after starting from rest. The value of $\frac{a}{b}$ will be.....

110. A man of $60\ kg$ is running on the road and suddenly jumps into a stationary trolly car of mass $120\ kg$. Then. the trolly car starts moving with velocity $2\ ms^{-1}$. The velocity of the running man was _____ms^{-1}. when he jumps into the car

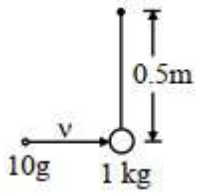
111. A coin placed on a rotating table just slips when it is placed at a distance of $1\ cm$ from the center. If the angular velocity of the table in halved, it will just slip when placed at a distance of from the centre ..... cm

112. A curved in a level road has a radius $75\ m$. The maximum speed of a car turning this curved road can be $30\ m/s$ without skidding. If radius of curved road is changed to $48\ m$ and the coefficient of friction between the tyres and the road remains same, then maximum allowed speed would be .....m/s.

113. An object of mass ' m ' initially at rest on a smooth horizontal plane starts moving under the action of force $F = 2N$. In the process of its linear motion, the angle θ (as shown in figure) between the direction of force and horizontal varies as $\theta = kx$, where k is a constant and x is the distance covered by the object from its initial position. The expression of kinetic energy of the object will be $E = \frac{n}{k}\sin\theta$. The value of n is .....

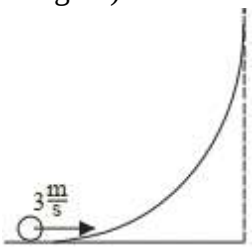


114. A bullet of $10\ g$, moving with velocity v, collides head-on with the stationary bob of a pendulum and recoils with velocity $100\ m/s$. The length of the pendulum is $0.5\ m$ and mass of the bob is $1\ kg$. The minimum value of $v = ...m/s$ so that the pendulum describes a circle. (Assume the string to be inextensible and $g = 10\ m/s^2$)



115. A uniform thin bar of mass $6\,kg$ and length $2.4\,meter$ is bent to make an equilateral hexagon. The moment of inertia about an axis passing through the centre of mass and perpendicular to the plane of hexagon is ..... $\times 10^{-1}\,kgm^2$

116. A hollow spherical ball of uniform density rolls up a curved surface with an initial velocity $3\,m/s$ (as shown in figure). Maximum height with respect to the initial position covered by it will be .....cm.

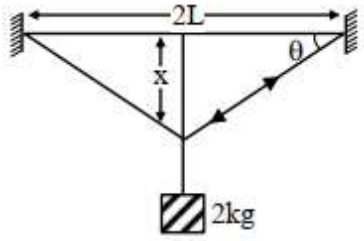


117. Assume there are two identical simple pendulum Clocks-1 is placed on the earth and Clock-2 is placed on a space station located at a height h above the earth surface. Clock-1 and Clock-2 operate at time periods $4\ s$ and $6\ s$ respectively. Then the value of h is ....km (consider radius of earth $R_E = 6400\,km$ and g on earth $10\,m/s^2$)

118. Two satellites S_1 and S_2 are revolving in circular orbits around a planet with radius $R_1 = 3200\,km$ and $R_2 = 800\,km$ respectively. The ratio of speed of satellite S_1 to the speed of satellite S_2 in their respective orbits would be $\frac{1}{x}$ where $x =$

119. The density and breaking stress of a wire are $6\times\ 10^4\ \mathrm{kg/m^3}$ and $1.2\ \times 10^8\ \mathrm{N/m^2}$ respectively. The wire is suspended from a rigid support on a planet where acceleration due to gravity is $\frac{1^{\mathrm{rd}}}{3}$ of the value on the surface of earth. The maximum length of the wire with breaking is _____ m (take, $\mathrm{g = 10\ m/s^2}$)

120. A wire of cross sectional area A, modulus of elasticity $2 \times 10^{11}\mathrm{Nm^{-2}}$ and length 2 m is stretched between two vertical rigid supports. When a mass of 2 kg is suspended at the middle it sags lower from its original position making angle $\theta = \frac{1}{100}$ radian on the points of support. The value of A is _____ $\times 10^{-4}$ $\mathrm{m^2}$ (consider $\mathrm{x < L}$).
(given: $\mathrm{g = 10\ m/s^2}$)



121. A liquid of density $750\ kgm^{-3}$ flows smoothly through a horizontal pipe that tapers in crosssectional area from $A_1 = 1.2 \times 10^{-2}\,m^2$ to $A_2 = \frac{A_1}{2}$. The pressure difference between the wide and narrow sections of the pipe is $4500\,Pa$. The rate of flow of liquid is_____$\times 10^{-3}\,m^3s^{-1}$

122. Sixty four rain drops of radius 1 mm each falling down with a terminal velocity of $10cm/s$ coalesce to form a bigger drop. The terminal velocity of bigger drop is _____ cm/s.

123. A soap bubble is blown to a diameter of 7 cm. $36960\mathrm{erg}$ of work is done in blowing it further. If surface tension of soap solution is $40\mathrm{dyne/cm}$ then the new radius is _____ cm. Take : $\left(\pi = \frac{22}{7}\right)$.

124. A liquid column of height 0.04 cm balances excess pressure of soap bubble of certain radius. If density of liquid is $8\ \times 10^3\ \mathrm{kg\ m^{-3}}$ and surface tension of soap solution is $0.28\mathrm{Nm^{-1}}$, then diameter of the soap bubble is _____ cm.
(if $g = 10\ \mathrm{ms^{-2}}$)

125. A unit scale is to be prepared whose length does not change with temperature and remains $20\ cm$, using a bimetallic strip made of brass and iron each of different length. The length of both components would change in such a way that difference between their lengths remains constant. If length of brass is $40\ cm$ and length of iron will be...cm
$\left(\alpha_{\text{iron}} = 1.2 \times 10^{-5} K^{-1} \text{ and } \alpha_{\text{brass}} = 1.8 \times 10^{-5} K^{-1}\right)$.

126. A geyser heats water flowing at a rate of $2.0 kg$ per minute from $30^{\circ}C$ to $70^{\circ}C$. If geyser operates on a gas burner, the rate of combustion of fuel will be ... $g\,\text{min}^{-1}$
[Heat of combustion $= 8 \times 10^3 Jg^{-1}$ Specific heat of water $= 4.2 Jg^{-1}\ {}^{\circ}C^{-1}$]

127. Two plates A and B have thermal conductivities $84\ Wm^{-1}\ K^{-1}$ and $126\ Wm^{-1}\ K^{-1}$ respectively. They have same surface area and same thickness. They are placed in contact along their surfaces. If the temperatures of the outer surfaces of A and B are kept at $100^{\circ}\ C$ and $0^{\circ}\ C$ respectively, then the temperature of the surface of contact in steady state is ..... $^{\circ}C$.

128. A body cools from $60^{\circ}C$ to $40^{\circ}C$ in 6 minutes. If, temperature of surroundings is $10^{\circ}C$. Then, after the next 6 minutes, its temperature will be ..... $^{\circ}C$.

129. A diatomic gas with rigid molecules does $10\ J$ of work when expanded at constant pressure. What would be the heat energy absorbed by the gas, in this process ..... J.

130. Work done by a Carnot engine operating between temperatures $127^{\circ}\ C$ and $27^{\circ}\ C$ is $2\ kJ$. The amount of heat transferred to the engine by the reservoir is ..... kJ

131. A cylinder of fixed capacity of $44.8\ litres$ contains helium gas at standard temperature and pressure. The amount of heat needed to raise the temperature of gas in the cylinder by $20.0^{\circ}C$ will be ..... J(Given gas constant $R = 8.3\ JK^{-1} - moI^{-1}$)

132. The rms speed of oxygen molecule in a vessel at particular temperature is $\left(1 + \frac{5}{x}\right)^{\frac{1}{2}} v$, where v is the average speed of the molecule. The value of x will be:(Take $\pi = \frac{22}{7}$)

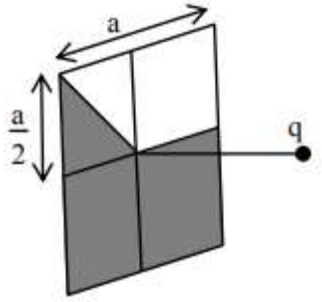
133. A particle performs simple harmonic motion with amplitude A. Its speed is increased to three times at an instant when its displacement is $\frac{2\,\text{A}}{3}$. The new amplitude of motion is $\frac{\text{nA}}{3}$. The value of n is____.

134. When the displacement of a simple harmonic oscillator is one third of its amplitude, the ratio of total energy to the kinetic energy is $\frac{x}{8}$, where $x =$ _____.

135. In an experiment to determine the velocity of sound in air at room temperature using a resonance is observed when the air column has a length of $20.0\ cm$ for a tuning fork of frequency $400\ Hz$ is used. The velocity of the sound at room temperature is $336\ ms^{-1}$. The third resonance is observed when the air column has a length of ..... cm

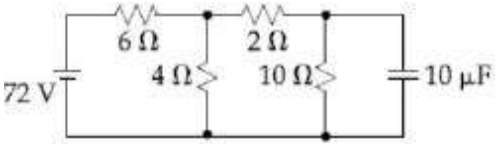
136. Two cars X and Y are approaching each other with velocities $36\ km/h$ and $72\ km/h$ respectively. The frequency of a whistle sound as emitted by a passenger in car X, heard by the passenger in car Y is $1320\ Hz$. If the velocity of sound in air is $340\ m/s$, the actual frequency of the whistle sound produced is ..... Hz.

137. A square loop of sides $a = 1\ \text{m}$ is held normally in front of a point charge $\text{q} = 1\text{C}$. The flux of the electric field through the shaded region is $\frac{5}{\text{p}} \times \frac{1}{\varepsilon_0} \frac{\text{Nm}^2}{\text{C}}$, where the value of p is _____.



138. A parallel plate capacitor has plate area $100\,m^2$ and plate separation of $10\,m$. The space between the plates is filled up to a thickness $5\ m$ with a material of dielectric constant of 10. The resultant capacitance of the system is $'x'\ pF$. The value of $\varepsilon_0 = 8.85 \times 10^{-12} F \cdot m^{-1}$ The value of $'x'$ to the nearest integer is.....

139. Determine the charge on the capacitor in the following circuit ..... μC

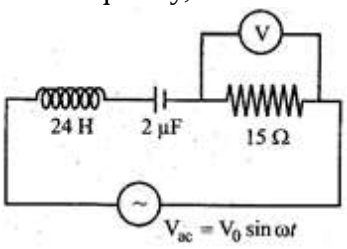


140. The number of turns of the coil of a moving coil galvanometer is increased in order to increase current sensitivity by 50%. The percentage change in voltage sensitivity of the galvanometer will be .....$\%$

141. A short bar magnet placed with its axis at 30° with an external field of 800 Gauss, experiences a torque of $0.016 N.m$. The work done in moving it from most stable to most unstable position is $\alpha \times 10^{-3} J$. The value of α is _____ .

142. A conducting circular loop is placed in a uniform magnetic field of $0.4\,T$ with its plane perpendicular to the field. Somehow, the radius of the loop starts expanding at a constant rate of $1\ mm/s$. The magnitude of induced emf in the loop at an instant when the radius of the loop is $2\,cm$ will be ..... μV.

143. An LCR circuit as shown in the figure is connected to a voltage source V_{ac} whose frequency can be varied. The frequency, at which the voltage across the resistor is maximum, is.....Hz



144. For the plane electromagnetic wave given by $\mathrm{E} = \mathrm{E}_0 \sin(\omega \mathrm{t} - \mathrm{kx})$ and $\mathrm{B} = \mathrm{B}_0 \sin(\omega \mathrm{t} - \mathrm{kx})$, the ratio of average electric energy density to average magnetic energy density is

145. Diameter of a plano-convex lens is $6\ cm$ and thickness at the centre is $3\ mm$. If the speed of light in the material of the lens is $2 \times 10^8 m/sec$, the focal length of the lens is.....cm

146. Two wavelengths λ_1 and λ_2 are used in Young's double slit experiment $\lambda_1 = 450\ \mathrm{nm}$ and $\lambda_2 = 650\ \mathrm{nm}$. The minimum order of fringe produced by λ_2 which overlaps with the fringe produced by λ_1 is n. The value of n is _____.

147. The surface of a metal is illuminated altemately with photons of energies $E_1 = 4\ eV$ and $E_2 = 2.5\ eV$ respectively. The ratio of maximum speeds of the photoelectrons emitted in the two cases is 2. The work function of the metal in (eV) is.....ev

148. The wavelength of the radiation emitted is λ_0 when an electron jumps from the second excited state to the first excited state of hydrogen atom. If the electron jumps from the third excited state to the second orbit of the hydrogen atom, the wavelength of the radiation emitted will be $\frac{20}{x}\lambda_0$. The value of x is .....

149. The activity of a radioactive sample falls from 700 s^{-1} to 500 s^{-1} in 30 min. Its half life is close to..... min

150.For the circuit shown below, calculate the value of I_z : (In mA)

