PHYSICS

41. A ball is dropped from the top of a building. The ball takes 0.5 s to pass the 3 m length of a window some distance from the top of the building. If the velocities of the ball at the top and at the bottom of the window are v_T and v_B respectively, then

(a) $v_T + v_b = 12\,\text{ms}^{-1}$ (b) $v_T - v_B = 4.9\ \text{ms}^{-1}$ (c) $v_B v_T = 1\ \text{ms}^{-1}$ (d) $\frac{v_B}{v_T} = 1\ \text{ms}^{-1}$

42. $(\vec{A}.\vec{B})^2 + |\vec{A} \times \vec{B}|^2 =$

(a) zero (b) A^2B^2 (c) AB (d) $\sqrt{AB}$

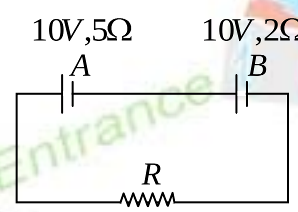
43. A uniformly tapered vessel of height h whose lower and upper radii are r and R respectively *is* completely filled with a liquid of density ρ. The force that acts on the base of the vessel due to the liquid is

(a) $\pi R^2 h\rho g$ (b) $\pi r^2 h\rho g$ (c) $\pi\left(\frac{R+r}{2}\right)^2 h\rho g$ (d) $\frac{1}{3}\pi(R^2 - r^2)h\rho g$

44. The ratio of the K.E. and P.E. possessed by a body executing SHM when it is at a distance of $\frac{1}{n}$ of its amplitude from the mean position is

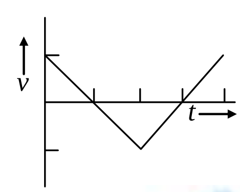
(a) n^2 (b) $\frac{1}{n^2}$ (c) $n^2 + 1$ (d) $n^2 - 1$

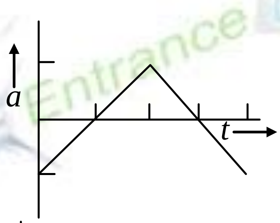
45. In the circuit shown in the figure, cells A and B have emf $10V$ each and the internal resistance is 5Ω and 2Ω respectively. For what value of R will the potential difference across cell A be zero?

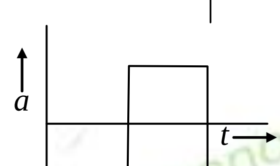


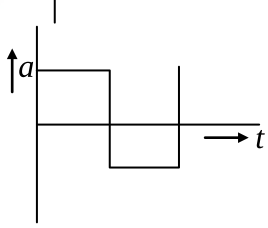
(a) zero (b) 1 ohm
(c) 2 ohm (d) 3 ohm

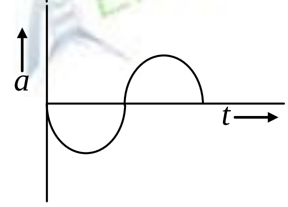
46. The graph given shows the velocity v versus time t for a body. Which of the following graphs shown represents the corresponding acceleration versus time graphs?



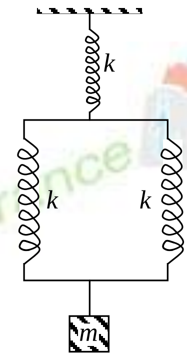
(a) 

(b) 

(c) 

(d) 

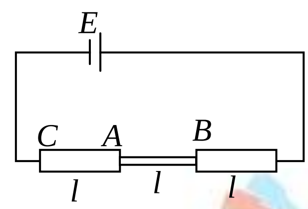
47. The time period of oscillation of the mass shown in the figure is



(a) $2\pi\sqrt{\frac{m}{3k}}$ (b) $2\pi\sqrt{\frac{3m}{2k}}$

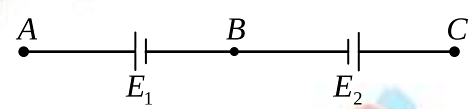
(c) $2\pi\sqrt{\frac{2m}{3k}}$ (d) $2\pi\sqrt{\frac{3k}{m}}$

48. A cell of emf E with zero internal resistance is connected to a wire whose cross-section is variable. The wire has three sections of equal length. The middle section has a radius a whereas the radius of the other two sections is $2a$. The ratio of the potential difference across the section AB to the potential difference across the section CA is



(a) 5 (b) 4 (c) $\frac{1}{2}$ (d) $\frac{1}{4}$

49. Two cells of emfs E_1 and $E_2 (E_1 > E_2)$ are connected as shown in the figure. When a potentiometer is connected between A and B, the balancing length of the potentiometer wire is 300 cm. On connecting the same potentiometer between A and C, the balancing length is 100 cm. The ratio $\frac{E_1}{E_2}$ is



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

50. The earth's magnetic field at a certain place has a horizontal component 0.3 gauss and the total strength 0.5 gauss. The angle of dip is

(a) $\tan^{-1}\frac{3}{4}$ (b) $\sin^{-1}\frac{3}{4}$ (c) $\tan^{-1}\frac{4}{3}$ (d) $\sin^{-1}\frac{3}{5}$

51. An electron of mass m when accelerated through a potential difference V has de Broglie wavelength λ. The de Broglie wavelength associated with a proton of mass M accelerated through the same potential difference will be

(a) $\lambda\frac{m}{M}$ (b) $\lambda\sqrt{\frac{m}{M}}$ (c) $\lambda\frac{M}{m}$ (d) $\lambda\sqrt{\frac{M}{m}}$

52. A sample of radioactive element has a mass of 10 g at an instant $t = 0$. The approximate mass of this element in the sample after two mean lives is

(a) 1.35 g (b) 2.50 g (c) 3.70 g (d) 6.30 g

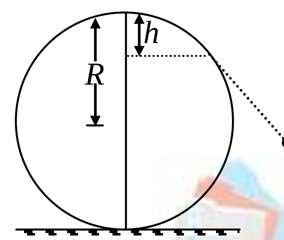
53. When the voltage drop across a PN junction diode is increased from 0.65 V to 0.70 V, the change in the diode current is 5 mA. The dynamic resistance of diode is

(a) 10Ω (b) 20Ω (c) 50Ω (d) 80Ω

54. A uniform chain of length L and mass M overhangs a horizontal table with its two third part lying on the table. The friction coefficient between the table and the chain is μ. The work done by the friction during the period the chain slips off the table will be

(a) $-\frac{1}{4}\mu MgL$ (b) $-\frac{2}{9}\mu MgL$ (c) $-\frac{4}{9}\mu MgL$ (d) $-\frac{6}{7}\mu MgL$

55. A particle initially at rest at the highest point of a smooth vertical circle is slightly displaced. It will leave the circle at a vertical distance h below the highest point. Then



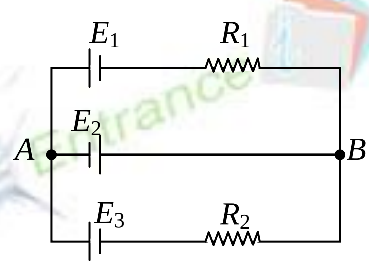
(a) $h = R$ (b) $h = 2R$

(c) $h = \frac{R}{2}$ (d) $h = \frac{R}{3}$

56. A block of mass 2 kg is placed on a crate of mass 6 kg. The crate is kept on a smooth surface. The block is given some velocity such that block moves a distance of 4m over the crate. The distance moved by the crate and centre of mass of the system is respectively.

(a) 1 m, 0 m (b) 2 m, 0 m (c) 1 m, 1 m (d) $\frac{4}{3}$ m, 0 m

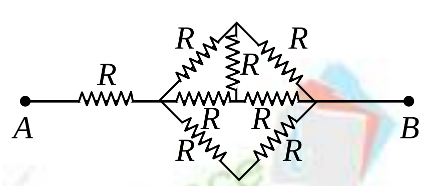
57. In the circuit shown, $E_1 = E_2 = E_3 = 2V$ and $R_1 = R_2 = 4\Omega$. The current flowing between points A and B through battery E_2 is



(a) zero (b) 2 A from A to B

(c) 2 A from B to A (d) none of the above

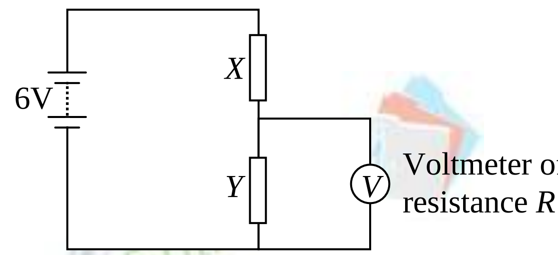
58. In the network of resistance shown in figure, the effective resistance between A and B is



(a) $\frac{5}{3}R$ (b) $\frac{8}{3}R$

(c) $5R$ (d) $8R$

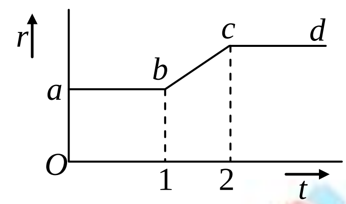
59. In the circuit shown in figure, The series combination of resistors X and Y, each of resistance R, are connected to a 6 V battery of negligible internal resistance. A voltmeter, also of resistance R, is connected across Y. The reading of the voltmeter is

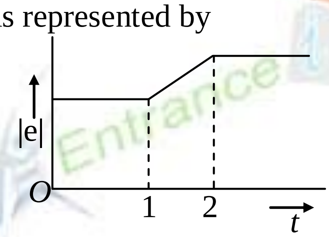


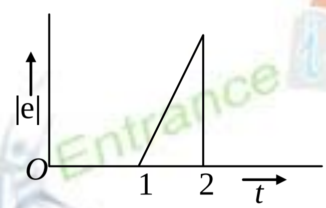
(a) zero (b) between zero and 3V

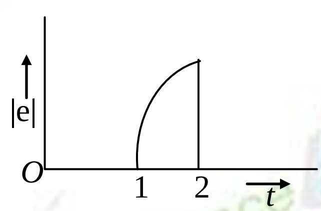
(c) 3 V (d) between 3 V and 6 V

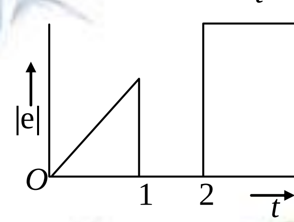
60. A flexible wire bent in the form of a circle is placed in a uniform magnetic field perpendicular to the plane of the coil. The radius of the coil changes as shown in figure. The graph of magnitude of induced emf in the coil is represented by



(a) 

(b) 

(c) 

(d) 

61. The power factor in an AC series L-R circuit is

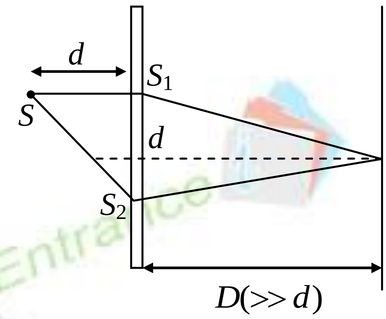
(a) $\sqrt{R^2+L^2\omega^2}$ (b) L/R

(c) $R\sqrt{R^2+L^2\omega^2}$ (d) $R/\sqrt{R^2+L^2\omega^2}$

62. A small square loop of wire of side l is placed inside a large square loop of wire of side $L(L>>l)$. The loops are coplanar and their centres coincide. The mutual inductance of the system is proportional to

(a) l/L (b) l^2/L (c) L/l (d) L^2/l

63. In YDSE, to obtain the central maximum at the centre, a mica sheet of refractive index 1.5 is introduced in front of a slit. Which of the following is correct?



(a) the thickness of sheet is $2(\sqrt{2}-1)d$ in front of S_1

(b) the thickness of sheet is $(\sqrt{2}+1)d$ in front of S_2

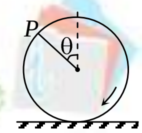
(c) the thickness of sheet is $(2\sqrt{2}d-1)$ in front of S_2

(d) the thickness of sheet is $(2\sqrt{2}-1)d$ in front of S_1

64. If the wavelength of photon emitted due to transition of electron from third orbit to first orbit in a hydrogen atom is λ, then the wavelength of photon emitted due to transition of electron from fourth orbit to second orbit will be

(a) $\frac{128}{27}\lambda$ (b) $\frac{25}{9}\lambda$ (c) $\frac{36}{7}\lambda$ (d) $\frac{125}{11}\lambda$

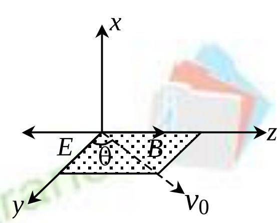
65. A wheel is rolling straight on ground without slipping. If the axis of the wheel has speed v, the instantaneous velocity of a point P on the rim, defined by angular θ, relative to the ground will be



(a) $v\cos\left(\frac{1}{2}\theta\right)$ (b) $2v\cos\left(\frac{1}{2}\theta\right)$

(c) $v(1+\sin\theta)$ (d) $v(1+\cos\theta)$

66. In a certain region uniform electric field E and magnetic field B are present in the opposite direction. At the instant $t = 0$, a particle of mass m carrying a charge q is given velocity v_0 at an angle θ, with the y-axis, in the yz plane. The time after which the speed of the particle would be minimum is equal to



(a) $\frac{mv_0}{qE}$ (b) $\frac{mv_0\sin\theta}{qE}$ (c) $\frac{mv_0\cos\theta}{qE}$ (d) $\frac{2\pi m}{qB}$

67. Point charges $+4q$, $-q$ and $+4q$ are kept on the x-axis at point $x = 0$, $x = a$ and $x = 2a$ respectively. Then

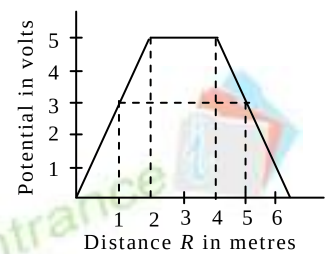
(a) only $-q$ is in stable equilibrium

(b) none of the charges are in equilibrium

(c) all the charges are in unstable equilibrium

(d) all the charges are in stable equilibrium

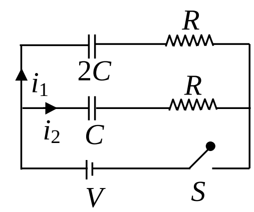
68. The variation of potential with distance R from a fixed point is as shown in the figure. The electric field at $R = 5$ m is



(a) 2.5 volt/m (b) – 2.5 volt/m

(c) $\frac{2}{5}$ volt/m (d) $-\frac{2}{5}$ volt/m

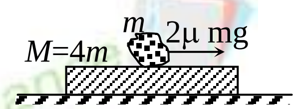
69. In the circuit shown in figure switch S is closed at time $t = 0$. Let i_1 and i_2 be the currents at any finite time t then the ratio $\frac{i_1}{i_2}$



(a) is constant (b) increases with time

(c) decreases with time (d) first increase and then decreases

70. A plate of mass M is placed on a horizontal frictionless surface as shown in the figure, and a body of mass m is placed on this plate. The coefficient of dynamic friction between this body and the plate is μ. If a force $2\mu mg$ is applied to the body of mass m along the horizontal, the acceleration of the plate will be



(a) $\frac{\mu g}{4}$ (b) μg (c) $\frac{\mu g}{5}$ (d) $\frac{2\mu g}{5}$

71. A particle is projected with velocity u at angle 60° with the vertical. The time after which its velocity vector becomes perpendicular to its initial velocity vector is

(a) $\frac{2u}{g}$ (b) $\frac{u}{g}$ (c) $\frac{u}{2g}$ (d) none of these.

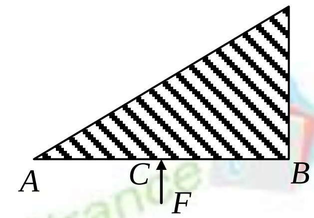
72. A wire of length l carrying a current i is bent first in form of an equilateral triangle, the magnetic field at the centre of triangle is B_1. The same wire is now bent in the form of a circle, the magnetic field at the centre is now B_2. Each of the coil is kept in a constant magnetic field with its plane perpendicular to magnetic field then τ_1 and τ_2 are torques acting on it respectively

(a) $B_1 > B_2$ (b) $B_2 > B_1$ (c) $\tau_1 > \tau_2$ (d) $\tau_2 > \tau_1$

73. A body of mass m is suspended from a massless spring of natural length l. It stretches the spring through a vertical distance y. The potential energy of the stretched spring is

(a) $mg(l + y)$ (b) $\frac{1}{2}mg(l + y)$ (c) $\frac{1}{2}mgy$ (d) mgy

74. A triangular plate of uniform thickness and density is made to rotate about an axis perpendicular to the plane of the paper (a) passing through A, (b) passing through B, by the application of the same force F, at C (mid-point of AB) as shown. Now



(a) angular acceleration in both the cases are same

(b) angular acceleration of case (a) is larger than that of case (b)

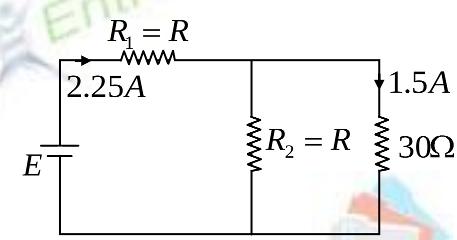
(c) angular acceleration for case (b) is larger than that of case (a)

(d) there would be no angular acceleration for case (a)

75. A satellite is launched into a circular orbit of radius R around the earth. A second satellite is launched into an orbit of radius $(1.01)R$. The period of the second satellite is larger than the first one by approximately

(a) 0.7% (b) 1% (c) 1.5% (d) 3%

76. In the circuit shown, the value of



(a) $R = 15\Omega$ (b) $R = 30\Omega$

(c) $E = 36V$ (d) $E = 180V$

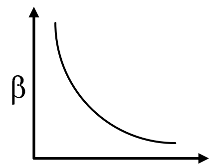
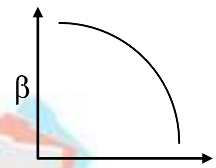
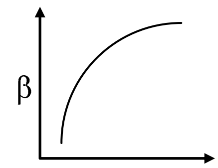
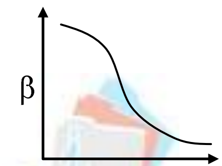
77. A short linear object of length b lies along the axis of a concave mirror of focal length f at a distance u from the pole of the mirror. The size of the image is equal to

(a) $b\left(\frac{u-f}{f}\right)^{1/2}$ (b) $b\left(\frac{f}{u-f}\right)^{1/2}$ (c) $b\left(\frac{u-f}{f}\right)$ (d) $b\left(\frac{f}{f-u}\right)^{2}$

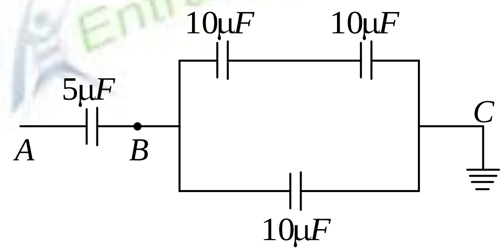
78. The distance between an object and a screen is 100 cm. A lens produces an image on the screen when placed at either of the two positions 40 cm apart. The power of the lens is nearly

(a) 3 D (b) 5 D (c) 7 D (d) 9 D

79. Which of the following graphs correctly represents the variation of $\beta = -\left(\frac{dV}{dP}\right)/V$ with P for an ideal gas at constant temperature?

(a)  (b)  (c)  (d) 

80. In the given circuit, if point C is connected to the Earth and a potential of +2000 V is given to the point A, then the potential at B will be



(a) 15000 V (b) 1000 V

(c) 500 V (d) 400 V