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ELP

Educator Led Practice

SUBJECT: IIT-PHYSICS **COURSE: EXCEL (XII)** **ELP No.-49**

Note: (*) → Multiple Correct Type Question

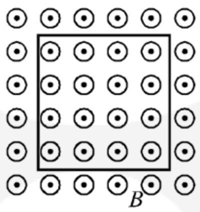
1. A rectangular loop of sides of length ℓ and b is placed in x-y plane. A uniform but time varying magnetic field of strength $\vec{B} = 20\ t\hat{i} + 10\ t^2\hat{j} + 50\hat{k}$ where t is time elapsed. The magnitude of induced e.m.f. at time t is:

(A) 20 + 20 t (B) 20 (C) 20 t (D) Zero

2. A flexible wire loop in the shape of a circle has a radius that grows linearly with time. There is a magnetic field perpendicular to the plane of the loop that has a magnitude inversely proportional to the distance from the centre of loop i.e. $B(r) \propto \frac{1}{r}$. How does the emf E vary with time?

(A) $E \propto t^2$ (B) $E \propto t$ (C) $E \propto \sqrt{t}$ (D) E is constant

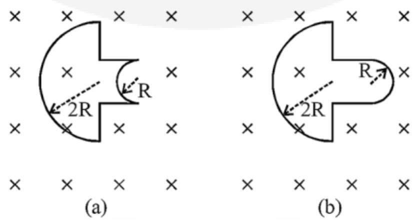
3. A uniform magnetic field *B* is directed out of the page. A metallic wire has the shape of a square frame and is placed in the field as shown. While the shape of the wire is steadily transformed into a circle in the same plane, the current in the frame:



(A) is directed clockwise (B) does not appear

(C) is directed counterclockwise (D) is alternating

4. A conducting loop with shape (a) is placed in uniform magnetic field B. Its one curved portion is turned so that the shape becomes (b). Find the correct statement(s). Given Ω be the resistance.



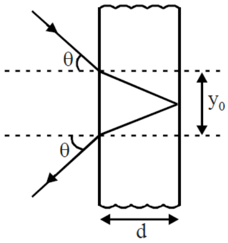
(A) Change in flux is given by $2B\pi R^2$.

(B) Change in flux is given by $\frac{B\pi R^2}{2}$.

(C) Total charge crossing any point of loop is $\frac{B\pi R^2}{2\Omega}$.

(D) Total charge crossing any point of loop is $\frac{B\pi R^2}{\Omega}$.

5. A ray of light incident from air on a glass plate of refractive index n is partly reflected and partly refracted at the two surfaces of the glass. The displacement y_0 in the figure is:



(A) $\frac{2d\sin\theta}{\sqrt{n^2 - \sin^2\theta}}$

(B) $\frac{2d\sin\theta}{\sqrt{\sin^2\theta \frac{1}{n^2}}}$

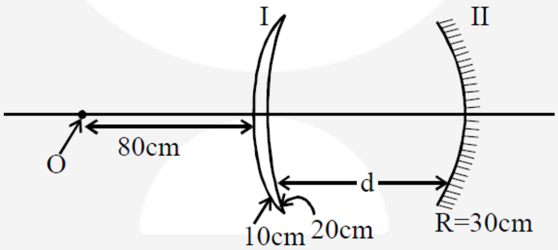
(C) $\frac{2d\sqrt{n^2 - \sin^2\theta}}{\sin\theta}$

(D) None of these

6. When a thin convergent glass lens (μ_g = 1.5) of power +5 D is immersed in a liquid of refractive index μ_ℓ it acts as a divergent lens of focal length 100 cm. Then μ_ℓ is:

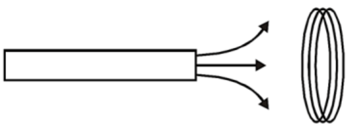
(A) 4/3
(B) 5/3
(C) 5/4
(D) 6/5

7. If final image formed after two refractions through the lens of refractive index 1.5 and one reflection from the mirror is forming at same point 'O' then d is equal to:



(A) 100 cm
(B) 120 cm
(C) 90 cm
(D) 80 cm

8.* You are given a bar magnet and a coil of wire. Which of the following would induce an emf in the coil?

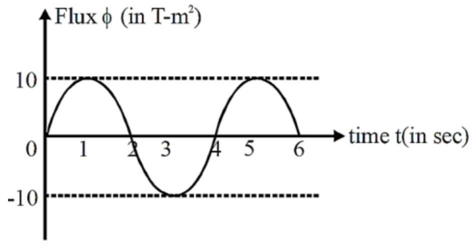


(A) Moving the magnet toward the coil.
(B) Moving the coil away from the magnet.
(C) Turning the coil about a vertical axis.
(D) none of these

9.* A ring of radius 20 cm has a total resistance of 0.04Ω. A uniform magnetic field varying with time B = (0.4t) T is perpendicular to the plane of the ring.

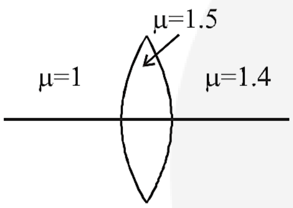
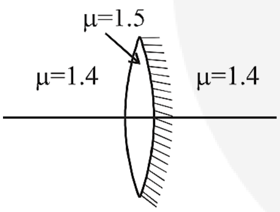
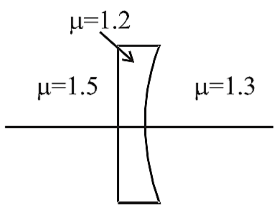
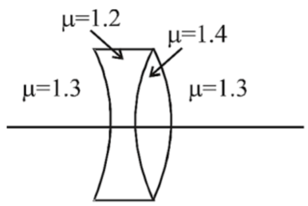
(A) Induced current in the ring is $\frac{2\pi}{5}$ A.
(B) The ring will be in tension.
(C) The ring will be in compression.
(D) The magnetic field due to ring at the center of the ring is in direction opposite to applied magnetic field.

10.* A closed conducting loop, having resistance R, is being rotated about an axis perpendicular to the magnetic field. Magnetic flux through the closed conducting loop is continuously changing according to the graph shown in the adjacent figure. Then, which of the following statement(s) is/are correct?



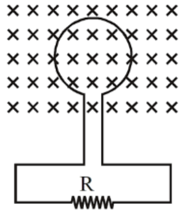
(A) The electric current through the loop is minimum (zero) at t = 1 s, 3s and 5s.
(B) The electric current through the loop is minimum (zero) at t = 0 s, 2s and 6s.
(C) Total charge flown through any cross-section of a closed conducting loop between 0 and 6 s is zero
(D) Total work done in rotating the loop in the magnetic field is zero

11. List-I gives different lens configurations. The radius of curvature of each curved surface is R. paraxial rays of light, parallel to the axis of lens traversing through the lens get focused at distance f from the lens. List-II gives corresponding values of f. (μ represent refractive index of medium)

List-1	List-II
(P) 	**(1)** 13 R
(Q)  Lens is silvered	**(2)** $\frac{13R}{4}$
(R)  Plano concave lens	**(3)** $\frac{7R}{3}$
(S) 	**(4)** $\frac{7R}{16}$
	(5) $\frac{16R}{7}$

(A) (P) → 1; (Q) → 4; (R) → 3; (S) → 2
(B) (P) → 3; (Q) → 2; (R) → 4; (S) → 1
(C) (P) → 1; (Q) → 5; (R) → 2; (S) → 3
(D) (P) → 3; (Q) → 4; (R) → 1; (S) → 2

12. In the figure, the flux due to magnetic field through the loop perpendicular to the plane of the coil and directed into the paper is varying according to the relation, $\phi = t^2 + 7t + 1$ where ϕ is in weber and t is in seconds. The magnitude of the emf induced in the loop at t = 1s is (in volt).



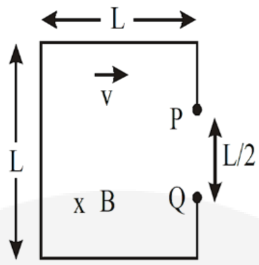
ANSWER KEY
ELP No.-49

1.	(D)	**2.**	(D)	**3.**	(A)	**4.**	(D)	**5.**	(A)	**6.**	(B)	**7.**	(D)
8.	(ABC)	**9.**	(ACD)	**10.**	(AC)	**11.**	(D)	**12.**	9				

SUBJECT: IIT-PHYSICS **COURSE: EXCEL (XII)** **ELP No.-50**

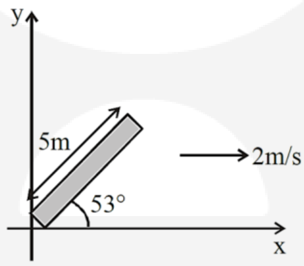
Note: (*) → Multiple Correct Type Question

1. The loop shown moves with a velocity υ in a uniform magnetic field of magnitude B, directed into the paper. The potential of P with respect to Q is :



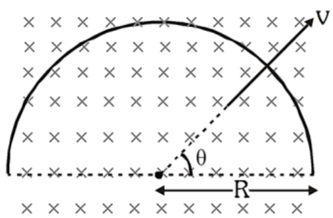
(A) $e = \frac{7}{2}Bl\upsilon$ (B) $e = -\frac{7}{2}Bl\upsilon$ (C) $\frac{Bl\upsilon}{2}$ (D) $-\frac{Bl\upsilon}{2}$

2. A conducting rod PQ of l = 5m oriented as shown is moving with V = (2m/s) $\hat{i}$ without any rotation in a uniform magnetic field $\left(3\hat{j} + 4\hat{k}\right)$ Tesla. Emf induced in the rod is:



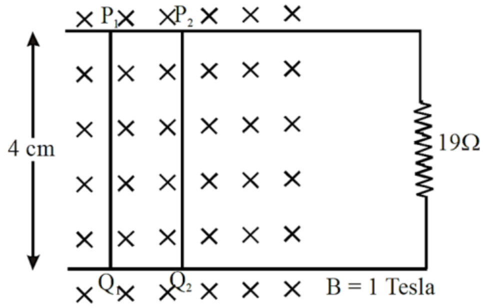
(A) 32 V (B) 40 V (C) 50 V (D) None

3. A semi circular loop of radius R is placed in a uniform magnetic field as shown. It is pulled with a constant velocity. The induced emf in the loop is:



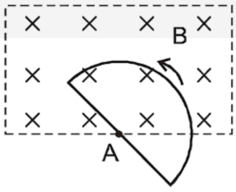
(A) Bv (πR) cosθ (B) Bv (πR) sinθ (C) Bv (2R) cosθ (D) Bv (2R) sinθ

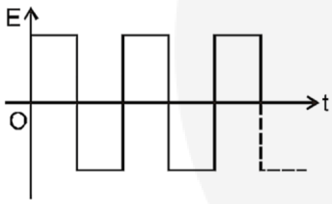
4. In figure shown, wire P_1Q_1 and P_2Q_2, both are moving towards right with speed 5 cm/sec. Resistance of each wire is 2Ω. Then current through 19Ω resistor is:

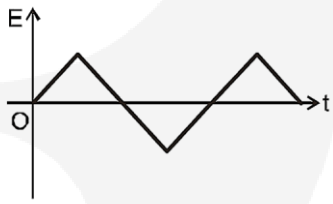


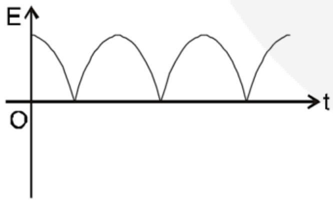
(A) 0
(B) 0.1 mA
(C) 0.2 mA
(D) 0.3 mA

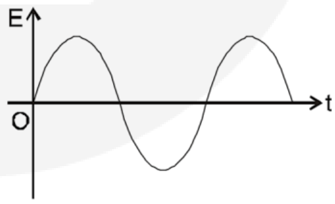
5. A uniform and constant magnetic field B is directed perpendicularly into the plane of the page everywhere within a rectangular region as shown in figure. A wire circuit in the shape of a semicircle is uniformly (that is with uniform angular speed) rotated counter clockwise in the plane of the page about an axis A. The axis A is perpendicular to the page at the edge of the field and directed through the centre of the straight line portion of the circuit. Which of the following graphs best approximates the emf E induced in the circuit as a function of time t?



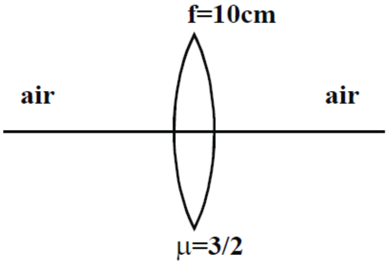
(A) 

(B) 

(C) 

(D) 

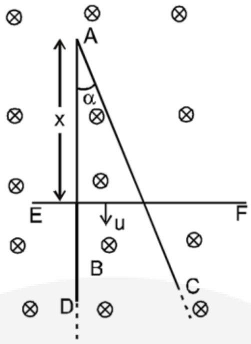
6. Given set-up which is shown in figure, converges parallel beam of light at point P_1. If the surrounding medium of above set-up is replaced by transparent fluid of refractive index $\mu_m = 2$, then same parallel beam converge at point P_2 then distance P_1P_2 is:



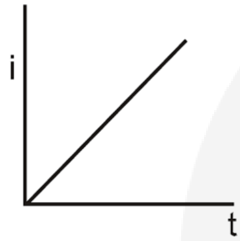
(A) 70 cm
(B) 20 cm
(C) 30 cm
(D) 10 cm

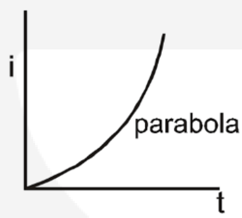
Paragraph for Questions 7 and 8

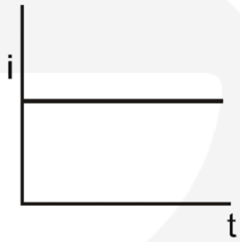
A long straight wire having uniform resistance per unit length λ (ohms/metre) is bent into V- shape as shown (angle DAC = α). A uniform and constant magnetic field B (tesla) exists in space which is perpendicular to the plane of V-shaped wire. Another straight wire EF of same uniform resistance per unit length λ (ohms/metre) is pulled with constant velocity u (m/s) such that the wire EF is always perpendicular to side AD of V-shape (the wire EF is always in conducting contact with the V-shaped wire at two points). At t = 0 (t is time in seconds) the value of x = 0 (x = distance of wire EF from end A, in metres)

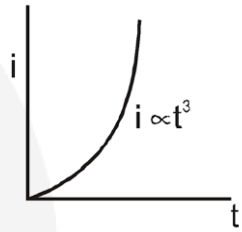


7. The variation of current 'i' induced in the triangular loop with time 't' is:

(A) 

(B) 

(C) 

(D) 

8. The magnetic force acting on the wire EF due to uniform magnetic field B at any time t (in N) is:

(A) $\dfrac{B^2tu^2\tan^2\alpha}{\lambda(1+\tan\alpha+\sec\alpha)}$ (B) $\dfrac{B^2u^2\tan^2\alpha}{\lambda(1+\tan\alpha+\sec\alpha)}$

(C) $\dfrac{B^2tu^2}{\lambda(2+\tan\alpha)}$ (D) None of these

Paragraph for questions 9 to 11

A plano convex lens has thickness 4 cm, when placed on a horizontal table with the curved surface in contact with it, the apparent depth of the bottom most point of the lens is found to be 3 cm. If the lens is inverted such that the plane is in contact with the table, the apparent depth of the centre of the plane face of the lens is found to be 25/8 cm.

9. radius of curvature of curved surface is

(A) 25 cm (B) 50 cm (C) 79 cm (D) 100 cm

10. Focal length of the plano convex lens is

(A) 25 cm (B) 50 cm (C) 75 cm (D) 100 cm

11. Refractive index of the lens is

(A) 4/3 (B) 8/5 (C) 5/3 (D) 8/7

12. A conducting rod of length 1 m aligned along the unit vector $\left(\frac{3}{5}\hat{j}+\frac{4}{5}\hat{k}\right)$ is moving with a velocity $\vec{v}=\left(2\hat{i}\right)$ m/s. The motion take place in a uniform magnetic field $\vec{B}=\left(\hat{j}-2\hat{k}\right)$ tesla. Find the magnitude of induced emf across the rod in volt.

ANSWER KEY

ELP No.-50

1.	(C)	**2.**	(A)	**3.**	(D)	**4.**	(B)	**5.**	(A)	**6.**	(C)	**7.**	(C)
8.	(A)	**9.**	(A)	**10.**	(C)	**11.**	(A)	**12.**	4				

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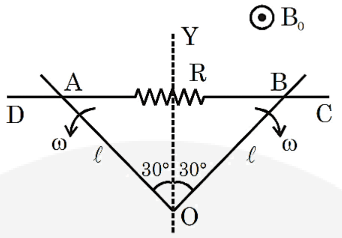
Educator Led Practice

SUBJECT: IIT-PHYSICS **COURSE: EXCEL (XII)** **ELP No.-51**

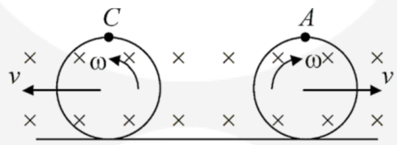
Note: (*) → Multiple Correct Type Question

1. In the shown figure, uniform magnetic field B_0 is pointing out of the plane in the region. Wire CD is fixed and has resistance R, while OA and OB are conducting wires rotating with angular velocity ω about O as shown. If at some instant OA = OB = ℓ and each wire makes angle $\theta = 30°$ with y-axis, then current through resistance R is:



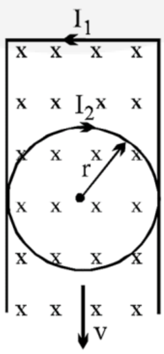
(A) $\frac{B_0\omega\ell^2}{R}$ (B) $\frac{\sqrt{3}B_0\omega\ell^2}{2R}$ (C) $\frac{\sqrt{3}B_0\omega\ell^2}{4R}$ (D) Zero

2. Two metallic rings of radius R are rolling on a metallic rod. A magnetic field of magnitude B is applied in the region. The magnitude of potential difference between point A and point C on the two rings (as shown), will be:



(A) 0 B (B) $4B\omega R^2$ (C) $8B\omega R^2$ (D) $2B\omega R^2$

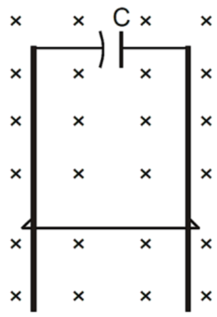
3. Figure shows a uniform cross-sectional conducting ring of radius r and total resistance R in contact with two vertical conducting rails, which are joined at the top. The rails have no friction and resistance. There is a uniform magnetic field B perpendicular to the plane of rails. If ring falls with the velocity v, then



(A) $I_1 = 0; I_2 = \frac{4Bvr}{R}$ (B) $I_1 = \frac{4Bvr}{R}; I_2 = 0$

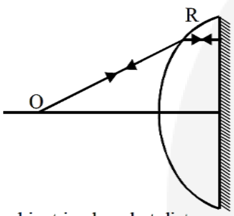
(C) $I_1 = \frac{8Bvr}{R}; I_2 = \frac{4Bvr}{R}$ (D) $I_1 = \frac{4Bvr}{R}; I_2 = \frac{2Bvr}{R}$

4. A wire of mass m and length ℓ can slide freely on a pair of smooth, vertical rails (figure). A magnetic field B exists in the region in the direction perpendicular to the plane of the rails. The rails are connected at the top end by a capacitor of capacitance C. The acceleration of the wire neglecting any electric resistance is:

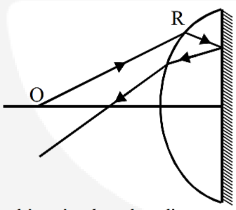


(A) $\frac{mg}{m+CB^2\ell^2}$ (B) $\frac{2mg}{m+CB^2\ell^2}$ (C) $\frac{mg}{CB^2\ell^2}$ (D) $\frac{mg}{2\left(m+CB^2\ell^2\right)}$

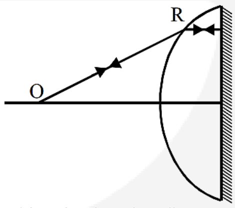
5. A thin plano-convex glass lens (μ = 1.5) has its plane surface reflecting and R is the radius of curvature of curved part, then which of the following ray diagram is true for an object placed at O?

(A)


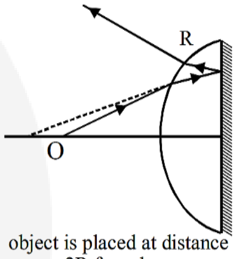
object is placed at distance 2R from lens

(B)


object is placed at distance 2R from lens

(C)


object is placed at distance 3R from lens

(D)


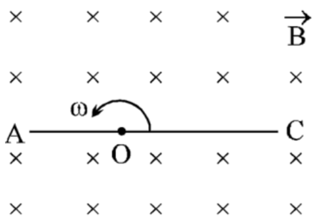
object is placed at distance 2R from lens

6. Two thin symmetrical lenses of different nature have equal radii of curvature R = 20 cm. The lenses are put close together and immersed in water. The converging focal length of the system is 24 cm. Find the difference between refractive indices of the two lenses. (Refractive index for water = $\frac{4}{3}$)

(A) $(\mu_1-\mu_2)=\frac{1}{24}$ (B) $(\mu_1-\mu_2)=\frac{1}{20}$

(C) $(\mu_1-\mu_2)=\frac{5}{9}$ (D) $(\mu_1-\mu_2)=\frac{4}{3}$

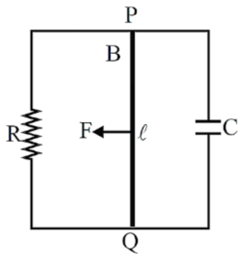
7*. conducting rod AC of length 4l is rotated about a point O in a uniform magnetic field $\vec{B}$ directed into the paper. AO = l and OC = 3l. Then:



(A) $V_A - V_0 = \frac{B\omega l^2}{2}$ (B) $V_0 - V_C = \frac{9}{2}B\omega l^2$

(C) $V_A - V_C = 4B\omega l^2$ (D) $V_C - V_0 = \frac{9}{2}B\omega l^2$

8*. conducting rod PQ of length ℓ is pulled with a constant force F along two smooth parallel rails separated by a distance ℓ as shown in the adjacent figure. Then choose the correct statement(s):



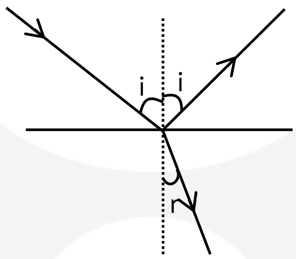
(A) terminal velocity of the rod, $v_t = \frac{2FR}{B^2\ell^2}$

(B) terminal velocity of the rod, $v_t = \frac{FR}{B^2\ell^2}$

(C) maximum charge on the capacitor, $q_{max} = \frac{FCR}{B\ell}$

(D) maximum charge on the capacitor, $q_{max} = \frac{2FCR}{B\ell}$

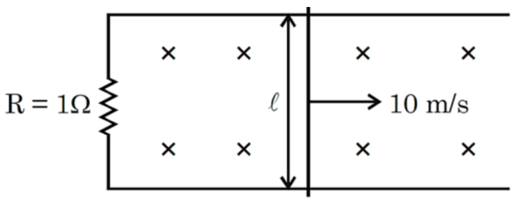
9*. A ray of light from a denser medium strikes a rarer medium at an angle of incidence i. The reflected and refracted rays make an angle of 90° with each other. The angles of reflection and refraction are i and r. The critical angle is:



(A) $\sin^{-1}(\cot r)$ (B) $\sin^{-1}(\tan i)$ (C) $\sin^{-1}(\tan r)$ (D) $\tan^{-1}(\sin i)$

Paragraph for Questions No. 10 and 11

A conducting rod of negligible resistance can slide on smooth U shaped rail as shown. At t = 0, conducting rod is given a velocity of 10 m/s towards right. A uniform magnetic field B = 1 T exists in the region. [Mass of conducting rod is 1 kg and ℓ = 1 m]



10. The distance travelled by the conducting rod when its speed is 5 m/s is:

(A) $\frac{5}{2}$m (B) 5 m

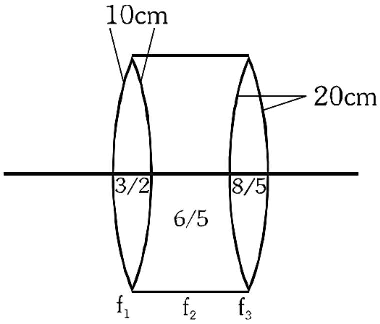
(C) 10 m (D) 20 m

11. Heat loss in the resistor during the time interval t = 0 to time t when the speed of the conducting rod is 6 m/s is:

(A) 64 J (B) 36 J

(C) 32 J (D) 50 J

12. In the shown figure the focal length (in cm) of equivalent system is in the form of $\left(\frac{50x}{13}\right)$. Find the value of x.



ANSWER KEY
ELP No.-51

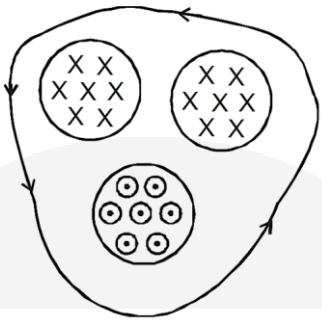
1.	(A)	**2.**	(B)	**3.**	(C)	**4.**	(A)	**5.**	(A)	**6.**	(C)	**7.**	(BC)
8.	(BC)	**9.**	(AB)	**10.**	(B)	**11.**	(C)	**12.**	2				

ELP
Educator Led Practice

SUBJECT: IIT-PHYSICS | **COURSE: EXCEL (XII)** | **ELP No.-52**

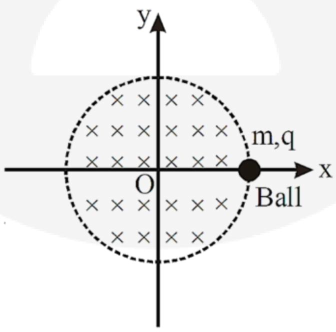
Note: (*) → Multiple Correct Type Question

1. Figure shows three regions of magnetic field, each of area A, and in each region magnitude of magnetic field decreases at a constant rate α. If $\vec{E}$ is induced electric field then value of line integral $\oint \vec{E} \cdot d\vec{r}$ along the given loop is equal to:



(A) αA
(B) $-\alpha A$
(C) $3\alpha A$
(D) $-3\alpha A$

2. A small ball having charge q and mass m lies on a horizontal smooth surface (take it as xy-plane) at distance b from origin. A magnetic field exists within the region enclosed by the circle $x^2 + y^2 = b^2$ and directed towards negative z-axis as shown. If magnetic field starts increasing with time as $B = B_0(10 + t)$, then:



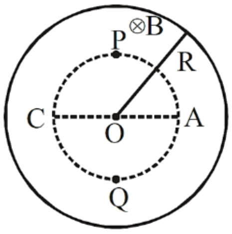
(A) The ball will start to move towards +ve x-axis with acceleration $\frac{bqB_0}{2m}$

(B) The ball will start to move towards –ve x-axis with acceleration $\frac{bqB_0}{2m}$

(C) The ball will start to move towards +ve y-axis with acceleration $\frac{bqB_0}{2m}$

(D) The ball will start to move towards –ve y-axis with acceleration $\frac{bqB_0}{2m}$

3. A uniform magnetic field B increasing with time exists in a cylindrical region of centre O and radius R. The direction of magnetic field is inwards the paper as shown. The work done by external agent in taking a unit positive charge slowly from A to C via paths APC, AOC and AQC be W_{APC}, W_{AOC} and W_{AQC} respectively. Then



(A) $W_{APC} = W_{AOC} = W_{AQC}$
(B) $W_{APC} > W_{AOC} > W_{AQC}$
(C) $W_{APC} < W_{AOC} < W_{AQC}$
(D) $W_{APC} = W_{AQC} < W_{AOC}$

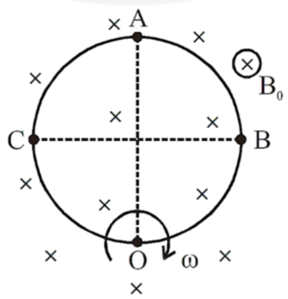
4. Given a ring of mass M, radius R resting on a rough horizontal plane, with coefficient of friction 'μ'. A cylindrical, vertical magnetic field passing through ring is switched on at t = 0 which varies with time as $B = Kt^2$. Ring has charge Q distributed uniformly over it. Find the time after which ring starts rotating.

(A) $\frac{\mu Mg}{QKR}$
(B) $\frac{2\mu Mg}{QKR}$
(C) $\frac{\mu Mg}{2QKR}$
(D) $\frac{\mu Mg}{4QKR}$

5. The string of a simple pendulum is replaced by a thin uniform rod of mass M and length L. The mass of the bob is m. If it is allowed to oscillate with small amplitude, the period of oscillation is:

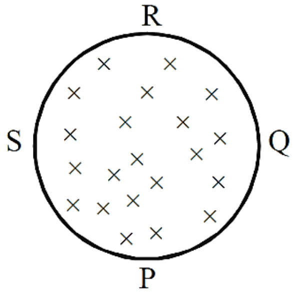
(A) $2\pi\sqrt{\frac{2(M+3m)L}{3(M+2m)g}}$
(B) $2\pi\sqrt{\frac{3(M+2m)L}{2(M+3m)g}}$
(C) $2\pi\sqrt{\frac{(M+2m)L}{(M+3m)g}}$
(D) $2\pi\sqrt{\frac{2(M+m)L}{3(M+2m)g}}$

6*. In the figure, there is a conducting ring having resistance R placed in the plane of paper in a uniform magnetic field B_0. If the ring is rotating about an axis passing through point O and perpendicular to the plane of paper with constant angular speed ω in clockwise direction, then:



(A) point A will be at higher potential than O.
(B) the potential of point B and C will be same.
(C) the current in ring will be zero.
(D) the current in the ring will be $\frac{2B_0\omega r^2}{R}$.

7*. A conducting ring is placed in a uniform external magnetic field present in the space within the ring and perpendicular to plane of ring. The magnetic field changes at a constant rate due to which a current of magnitude 4 amp flows in the ring. The resistance of parts PQR and PSR are 4Ω and 8Ω respectively. Then:



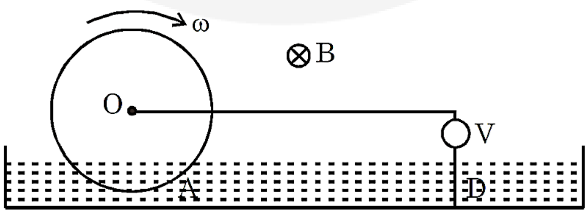
(A) The emf induced in the ring 48 V
(B) Potential difference between P & R is 24 V
(C) Potential difference between P & R is 8V
(D) Potential difference between P & R is zero as conservative electric field in the ring wire is zero

8*. x-t equation of a particle moving along x-axis is given as:
$x = A + A(1-\cos\omega t)$
(A) particle oscillates simple harmonically between points x= 2A and x = A.
(B) Velocity of particle is maximum at x =2A.
(C) Time taken by the particle in travelling from x = A to x = 3A is π/ω.
(D) Time taken by particle in travelling from x = A to x = 2A is $\pi/2\omega$.

Paragraph for Questions 9 and 10

The first generator, was developed by Faraday, called 'Faraday's disk' (As shown in figure). A copper disk of radius 'R' rotates about 'O' with clockwise angular speed 'ω'. The lowest part of the disk dips into a container of mercury at 'A'. A voltmeter 'V' makes contact with the mercury at 'D' and having a sliding contact with the metal axle. The disk is in a uniform magnetic field of magnitude 'B' directed into the plane of page.

Faraday made certain observations and found that hand operated generator is easy to turn when it is not connected to any electric device. However it becomes quite difficult to turn when it is connected, particularly if the device has low resistance.

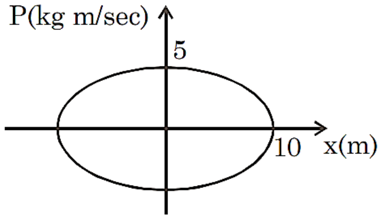


9. The direction of current through voltmeter is:
(A) Clockwise
(B) Anticlockwise
(C) sometime clockwise and sometime anticlockwise
(D) cannot be determined

10. If the generator is attached to resistance of 0.16 ohm. When it runs at rated speed, it yields 132 volt on open circuit and 126 volt on full load. The current at full load is:
(A) 75 amp (B) 37.5 amp
(C) 150 amp (D) 25 amp

Paragraph for Questions 11 and 12

Momentum (P) displacement (x) graph of a particle of unit mass performing SHM along x-axis is shown in the figure.



11. Angular frequency of the SHM is:

(A) 1 rad/sec
(B) $\frac{1}{2}$ rad/sec
(C) 2 rad/sec
(D) 4 rad/sec

12. Total energy of oscillation is (potential energy at mean position = 0):

(A) 500 Joule
(B) 25 Joule
(C) 12.5 Joule
(D) 100 Joule

ANSWER KEY

ELP No.-52

1. (B)	**2.** (C)	**3.** (C)	**4.** (A)	**5.** (A)	**6.** (ABC)	**7.** (AC)
8. (BCD)	**9.** (B)	**10.** (B)	**11.** (B)	**12.** (C)		

SUBJECT: IIT-PHYSICS **COURSE: EXCEL (XII)** **ELP No.-53**

Note: (*) → Multiple Correct Type Question

1. A magnetic flux of 5×10^{-4}wb is associated with every 10 turns of a 500 turns coil. The electric current flowing through the wire is 5A. The self inductance of the coil will be:

(A) 0.5 H (B) 5×10^{-3}H (C) 5 H (D) 5×10^{-2} H

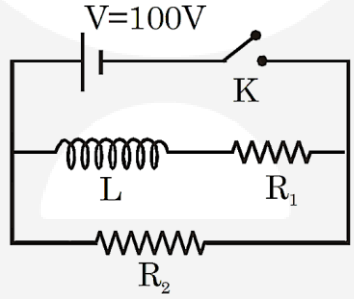
2. A long solenoid is made of a superconducting wire carrying a current I_0. The solenoid is slowly stretched so that its cross section does not change but its length changes from L_0 to L_1. What is the new current in the solenoid assuming the solenoid is still tightly wound?

(A) $\frac{L_0 i_0}{L_1}$ (B) $\frac{L_1 i_0}{L_0}$ (C) $\frac{L_0^2 i_0}{L_0}$ (D) $\frac{L_1^2 i_0}{L_0^2}$

3. Self inductance of a coil is 8 H. The power (in watt) consumed by coil (purely inductive) is given by $P = 8i^2$ where 'i' is current in ampere. The time for the current to change from i_0 to $2i_0$ will be

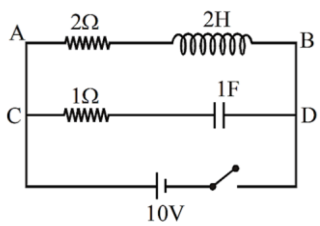
(A) ln 2 (B) 5 i_0 (C) $\frac{i_0^2}{\ln 2}$ (D) None of these

4. In the circuit shown below, the key K is closed at t = 0. If current through battery at t = 0 is 20 A and at t = ∞ is 40 A, then value of R_1 and R_2 is:



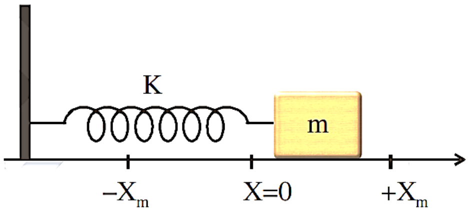
(A) $R_1 = 5\Omega$, $R_2 = 4\Omega$ (B) $R_1 = 4\Omega$, $R_2 = 5\Omega$ (C) $R_1 = 5\Omega$, $R_2 = 5\Omega$ (D) $R_1 = 4\Omega$, $R_2 = 4\Omega$

5. In the given circuit shown, the switch is closed at t = 0. The battery is ideal. Then,



(A) Initial current through battery is 5A.
(B) Current through battery after a long time is 10 A.
(C) The time when current in both branches (AB & CD) are equal is $\ell n2$ sec.
(D) The time when current in both branches (AB & CD) are equal is $\ell n3$ sec.

6. At $t = 0$, the displacement of the block in a linear oscillator as shown is -0.08 m. At the same moment $t = 0$, its velocity is -1.6 m/s and acceleration is 32 m/s^2. Choose the INCORRECT statement.



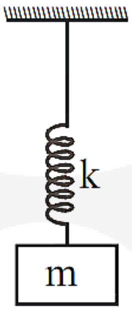
(A) Angular frequency of the motion is 20 rad/s

(B) Amplitude of the motion is 11.3 cm

(C) Phase constant ϕ of the motion if the equation of motion is expressed as $x = A \sin(\omega t + \phi)$ is $\frac{\pi}{4}$

(D) Phase constant ϕ of the motion if the equation of motion is expressed as $x = A \sin(\omega t + \phi)$ is $\frac{5\pi}{4}$

7. A block of mass 'm' is suspended by string spring combination as shown in the diagram. The string is sufficiently long. The system is at rest in equilibrium. The block is pulled by a distance 'x' from the equilibrium position and released. It performs oscillatory motion and let $x = x_0$ is maximum possible value for which string is not becoming slacked in the subsequent motion. If $x = 2x_0$ then time for which string becomes slacked in one complete oscillation is



(A) $\sqrt{\frac{3m}{K}}$ (B) $\sqrt{\frac{6m}{K}}$ (C) $3\sqrt{\frac{m}{K}}$ (D) $\sqrt{\frac{12m}{K}}$

8*. A time varying voltage $V = 10 - 2i$ (volt) is applied across an inductor of inductance $L = 2H$ where i is current at any time t with $i = 0$ at $t = 0$. Then

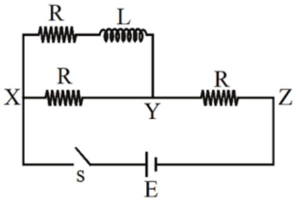
(A) Current increases with time

(B) Energy stored in magnetic field at $t = \ln 2$ sec is 6.25 J

(C) At time $t = \ln 2$ sec energy stored in magnetic field is increasing at a rate of 12.5 J/sec

(D) Energy stored in magnetic field is zero all the time

9*. The switch is closed at $t = 0$ in the adjoining circuit. Which of the following is/are CORRECT?



(A) The potential difference across YZ at $t = 0$ is 2E/3

(B) The potential difference across XY at $t = \infty$ is E/2

(C) The potential difference across YZ at $t = 0$ is E/2

(D The potential difference across XY at $t = \infty$ is 2E/3

Paragraph for Questions No. 10 and 11

A variable force given by F = –8x + 16N is applied on a block of mass 2kg. At t = 0 particle is at rest at x = 5 m.

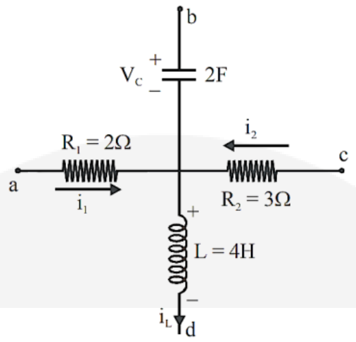
10. Equation of motion of block is given by :

(A) x = 3 cos 2πt (B) x = 2 + 3 cos2t (C) x = 2 – 3 cos2t (D) None of these

11. Speed of block at t = π/4 sec is :

(A) 6 m/s (B) 2m/s (C) 3 m/s (D) None of these

12. In the figure shown $i_1 = 10\ e^{-2t}$ A, i_2 = 4A and $V_C = 3e^{-2t}$ V. If $V_L = ae^{-bt}$ then find $\left|\frac{a}{b}\right|$:



ANSWER KEY

ELP No.-53

1. (B) **2.** (B) **3.** (A) **4.** (C) **5.** (D) **6.** (C) **7.** (D)

8. (ABC) **9.** (C) **10.** (B) **11.** (A) **12.** 8

SUBJECT: IIT-PHYSICS **COURSE: EXCEL (XII)** **ELP No.-54**

Note: (*) → Multiple Correct Type Question

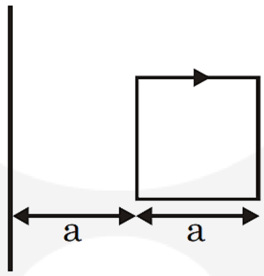
1. A particle is vibrating in SHM. If its speed is v_1 and v_2 when its displacement from mean position is x_1 and x_2, respectively, then the period of particle is

(A) $2\pi\sqrt{\frac{x_1^2+x_2^2}{v_1^2+v_2^2}}$ (B) $2\pi\sqrt{\frac{x_1^2-x_2^2}{v_1^2-v_2^2}}$ (C) $2\pi\sqrt{\frac{x_1^2-x_2^2}{v_2^2-v_1^2}}$ (D) $2\pi\sqrt{\frac{x_1^2+x_2^2}{v_1^2-v_2^2}}$

2. The KE of particle executing SHM is 16 J when it is at mean position. If amplitude is 25 cm and mass of particle is 5.12 Kg, the time period is :

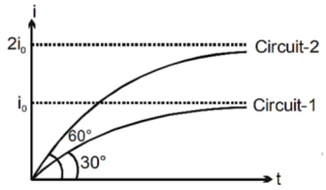
(A) $\frac{\pi}{5}$ sec (B) 2π sec (C) 20π sec (D) 5π sec

3*. A very long straight conductor and a square conducting frame lie in a plane and are separated from each other as shown in the figure (a = 10 cm). If current in the square frame is increasing at a rate of 2A/s in clockwise direction.



(A) Mutual inductance of the two loops is $2\ell n2 \times 10^{-8}$H.
(B) The current induced in the wire is upwards.
(C) The current induced in the wire is downwards.
(D) The current induced in the wire is zero.

4*. Growth of current in two different L-R circuit are depicted by the i-t graph shown. Angle subtended by the curves with time axis at time t = 0 are also shown in the graph. τ_1 and τ_2 are time constants for the circuits 1 and 2 respectively. Choose the correct alternative.

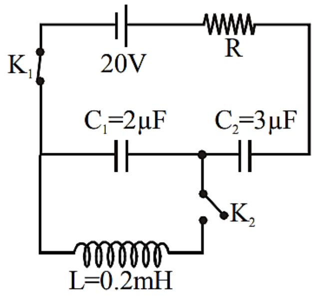


(A) $\frac{\tau_1}{\tau_2}=\frac{2}{3}$

(B) $\frac{\tau_1}{\tau_2}=\frac{3}{2}$

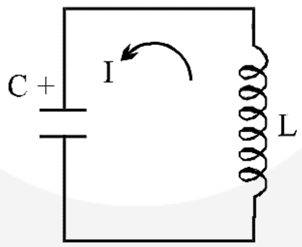
(C) Initial rate of change of current for circuit-2 is 2 times that of circuit-1.
(D) Initial rate of change of current for circuit-2 is 3 times that of circuit-1.

5*. A circuit containing capacitors C_1 and C_2, shown in the figure is in the steady state with the key K_1 closed. At the instant t = 0, K_1 is opened and K_2 is closed. The ratio of energy in the inductor and that of capacitor C_1 becomes one third at time 't' for the first time. If charge on capacitor C_1 at that instant is q_1 and that on capacitor C_2 is q_2 then choose the CORRECT statement(s):



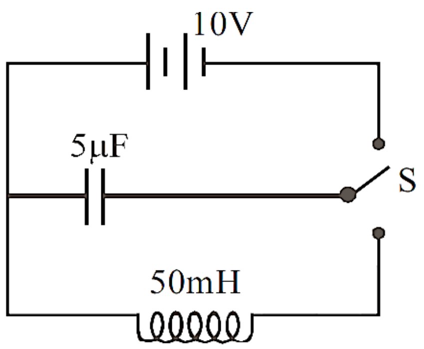
(A) Angular frequency of oscillations of the L.C. circuit will be 5×10^4 rad/s
(B) Time 't' will be 21 μs.
(C) Charge on capacitor C_1 at that instant will be, $q_1 = 12\sqrt{3}\mu C$.
(D) Charge on capacitor C_2 at that instant will be, q_2 = 24 μC

6*. At time t = 0, the LC circuit shown in the figure has equal amount of energy stored in the capacitor C = 20 μF and in the inductor, each equal to 200 μJ. The current amplitude in the circuit is $1/\sqrt{10}$A



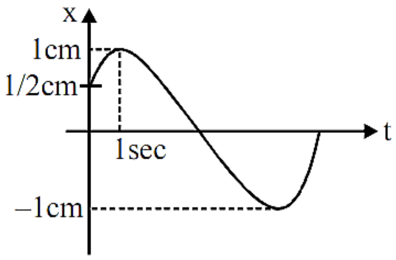
(A) The natural frequency of oscillation is 398 Hz.
(B) The natural frequency of oscillation is 199 Hz.
(C) The equation for current in terms of t is $\frac{1}{\sqrt{10}}\cos\left(2500t + \frac{\pi}{4}\right)$
(D) The equation for current in terms of t is $\frac{1}{\sqrt{10}}\cos\left(2500t + \frac{3\pi}{4}\right)$

7*. In the circuit shown, switch S is kept pushed up to charge the capacitor. Switch S is then pushed down.



(A) Maximum value of energy stored in the inductor is 250×10^{-6} J
(B) Maximum value of energy stored in the capacitor is 250×10^{-6}J
(C) Maximum current in the circuit is 100 mA.
(D) Maximum charge on the capacitor is 5 μC.

8*. The displacement time graph of a block of mass 1 kg executing SHM is given by following graph. Choose the correct statement(s)



(A) The equation of motion can be $x = 1 \text{ cm} \sin\left(2\pi t + \frac{\pi}{6}\right)$

(B) The force constant is $\frac{\pi^2}{9}$ N/m

(C) After t = 0, the block first crosses mean position at t = 2 sec.

(D) The energy of SHM is $\frac{\pi^2}{18} \times 10^{-4}$ J

9*. Two simple harmonic motions are represented by the equation

$y_1 = 3(\sqrt{3}\cos 3\pi t + \sin 3\pi t)$ and $y_2 = 6\sin(6\pi t + \pi/6)$

(A) The ratio A_1/A_2 of their amplitude is 1/2

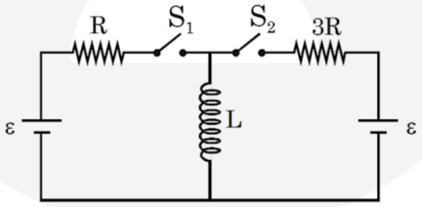
(B) The ratio A_1/A_2 of their amplitude is 1

(C) The ratio V_1/V_2 of their maximum velocities is 1/2

(D) The ratio V_1/V_2 of their maximum velocities is 2

Paragraph for question no. 10 & 11

In the given switch S_2 is kept closed and S_1 is kept open for a very long time such that the system is in steady-state. Now S_1 is also closed keeping S_2 closed.



10. Current passing through R just after S_1 closed is

(A) $\frac{\varepsilon}{R}$ (B) $\frac{\varepsilon}{3R}$ (C) $\frac{\varepsilon}{4R}$ (D) $\frac{\varepsilon}{2R}$

11. Current passing through inductor L long time after S_1 is closed is :

(A) $\frac{\varepsilon}{3R}$ (B) $\frac{4\varepsilon}{3R}$ (C) $\frac{\varepsilon}{2R}$ (D) $\frac{\varepsilon}{R}$

12. Two coils, 1 and 2, have mutual inductance = M and resistance R, each. A current flows in coil 1, which varies with time as : $i_1 = kt^2$, where k is a constant and 't' is time. The total change that has flown through coil 2, between t = 0 and t = T is $\left(\frac{\lambda}{-\lambda+1}\right)\frac{kMT^2}{R}$. Find $\left(\frac{1}{\lambda}\right)$.

ANSWER KEY

ELP No.-54

1.	(C)	**2.**	(A)	**3.**	(AC)	**4.**	(BD)	**5.**	(ACD)	**6.**	(AC)	**7.**	(ABC)
8.	(BD)	**9.**	(BC)	**10.**	(C)	**11.**	(B)	**12.**	2				

SUBJECT: IIT-PHYSICS **COURSE: EXCEL (XII)** **ELP No.-55**

Note: (*) → Multiple Correct Type Question

1. In an ac circuit, the instantaneous voltage ε(t) and current I(t) are given by $\varepsilon(t) = 5\,[\cos \omega t + \sqrt{3}\,\sin \omega t]$ volt ; $I(t) = 5\left[\sin\left(\omega t + \frac{\pi}{4}\right)\right]$ amp then:

(A) Current leads voltage by $\frac{\pi}{4}$

(D) Volatge leads current by $\frac{\pi}{3}$

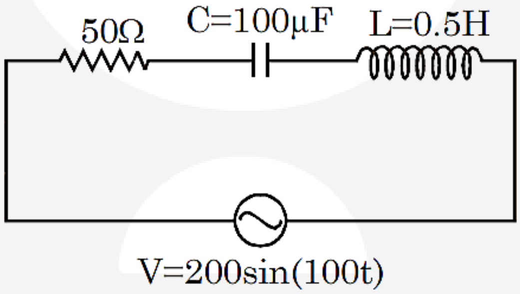
(C) Volatge leads current by $\frac{\pi}{6}$

(D) Current leads voltage by $\frac{\pi}{12}$

2. A charged capacitor discharges through a resistance R with time constant τ. The two are now placed in series across an AC source of angular frequency $\omega = \frac{1}{\tau}$. The impedance of the circuit will be-

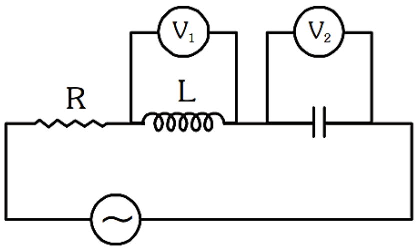
(A) $\frac{R}{\sqrt{2}}$ (B) R (C) $\sqrt{2}$ R (D) 2R

3. In the given LCR AC circuit, the effective current flowing through the circuit will be :



(A) 2A (B) $2\sqrt{2}$A (C) 4A (D) $4\sqrt{2}$A

4. In the circuit shown, resistance R = 100Ω, inductance $L = \frac{2}{\pi}$ H and capacitance $C = \frac{8}{\pi}$ μF are connected in series with an ac source of 200 volt and frequency 'f'. If the readings of the hot wire voltmeters V_1 and V_2 are same then which of the following is INCORRECT:



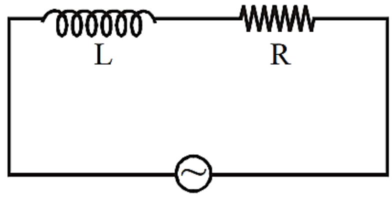
(A) f = 125 Hz

(B) $V_1 = V_2 = 1000$ V

(C) Current through R is 1A

(D) Current through R is 2A.

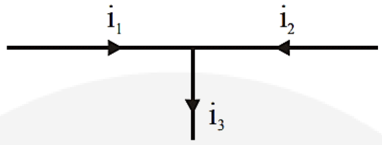
5. In the given figure, the current amplitude is :



$V = V_0 \sin\omega t + (V_0/2)\cos\omega t$

(A) $\sqrt{\dfrac{5v_0^2}{4\left(\omega^2L^2+R^2\right)}}$ (B) $\dfrac{V_0}{\sqrt{4\left(\omega^2L^2+R^2\right)}}$ (C) $\dfrac{\sqrt{5}V_0}{2\sqrt{\omega^2L^2-R^2}}$ (D) $\dfrac{\sqrt{5}V_0}{2\sqrt{R-\omega^2L^2}}$

6. In the given figure, if $i_1 = 3\sin\omega t$ and $i_2 = 4\cos\omega t$, then i_3 is :



(A) $5\sin(\omega t + 53°)$ (B) $5\sin(\omega t + 37°)$ (C) $5\sin(\omega t + 45°)$ (D) $5\cos(\omega t + 53°)$

7.* A particle performing SHM is seen at $x = \dfrac{\sqrt{3}A}{2}$ at some instant. It is seen at $x = -\dfrac{A}{2}$ after some time. What can be the possible value of time interval if 'T' is the time period of SHM.

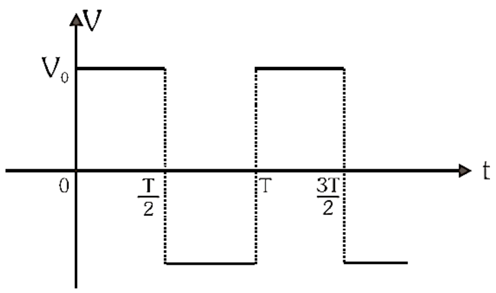
(A) $\dfrac{3T}{4}$ (B) $\dfrac{5T}{12}$ (C) $\dfrac{T}{4}$ (D) $\dfrac{7T}{12}$

Paragraph for question 8 and 9

An electric current that reverses its direction with a constant frequency is called alternating current.

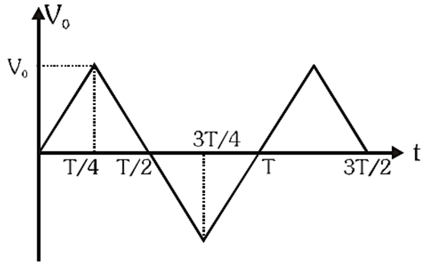
The average or mean value of ac is defined for half cycle as $I_{mean} = \dfrac{\int_0^{T/2} I\,dt}{\int_0^{T/2} dt}$. The effective, virtual or rms value of ac is defined as $I_{rms} = \sqrt{\dfrac{\int_0^{T} I^2 dt}{\int_0^{T} dt}}$

8. The mean and rms value of an alternating voltage as shown in figure is :



(A) V_0 , V_0 (B) $\dfrac{V_0}{2}, V_0$ (C) $\dfrac{3V_0}{2}, \dfrac{V_0}{2}$ (D) $\dfrac{V_0}{4}, \dfrac{V_0}{2}$

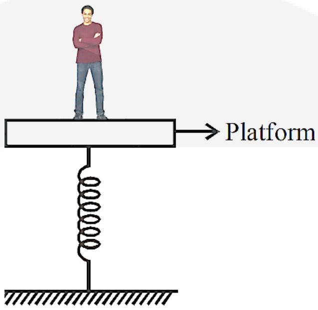
9. The mean and rms value of an alternating voltage as shown in figure is :



(A) $\frac{V_0}{3}, \frac{V_0}{2}$ (B) $\frac{V_0}{\sqrt{2}}, \frac{V_0}{\sqrt{3}}$ (C) $\frac{V_0}{2}, \frac{V_0}{3}$ (D) $\frac{V_0}{2}, \frac{V_0}{\sqrt{3}}$

Paragraph for question 10 to 11

Mr. Saransh having mass 50 kg is standing on a platform of mass 10 kg oscillating up & down (doing SHM) of frequency 0.5 sec^{-1} & amplitude 0.4 m. Platform has a weighing machine fitted in it (which is massless) on which person is standing. (Take π^2 = 10 & g = 10 m/s^2). Assume that at t = 0 (platform + man) is at their highest point of oscillation.



10. Maximum reading of weighing machine is :
(A) 60 kg (B) 70 kg (C) 84 kg (D) 50 kg

11. Find compression in spring when weighing machine reads 55 kg :
(A) 1 m (B) 1.1 m (C) 1.4 m (D) 0.1 m

12. Find minimum time after which speed of person is 0.2 π m/s :
(A) $\frac{1}{6}$ sec (B) $\frac{1}{3}$ sec (C) 1 sec (D) $\frac{1}{4}$ sec

ANSWER KEY
ELP No.-55

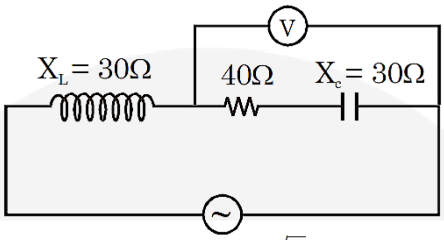
1.	(D)	**2.**	(C)	**3.**	(A)	**4.**	(C)	**5.**	(A)	**6.**	(A)	**7.**	(ABCD)
8.	(A)	**9.**	(D)	**10.**	(B)	**11.**	(B)	**12.**	(A)				

SUBJECT: IIT-PHYSICS **COURSE: EXCEL (XII)** **ELP No.-56**

Note: (*) → Multiple Correct Type Question

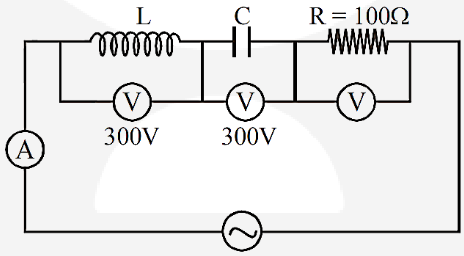
1. When resonance is produced in a series LCR circuit, then which of the following is NOT CORRECT?
(A) Current in the circuit is in phase with the applied voltage.
(B) Inductive and capacitive reactance are equal.
(C) If R is reduced, the voltage across capacitor will increase.
(D) Impedance of the circuit is maximum

2. In the following figure, the reading of ideal AC voltmeter will be.



(A) 90 V (B) 150 V (C) 300 V (D) 120 V

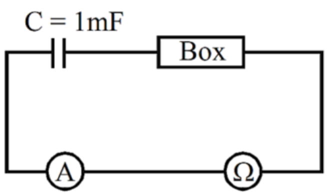
3. In the circuit shown below, what will be the readings of the voltmeter connected across R and ammeter?



(A) 800 V, 2A (B) 300 V, 2A (C) 220 V, 2.2A (D) 100 V, 2A

4. An inductor of reactance 1 Ω and a resistor of 2Ω are connected in a series to the terminals of a 6 V (rms) a.c. source. The power dissipated in the circuit is :
(A) 8 w (B) 12 W (C) 14.4 W (D) 18 W

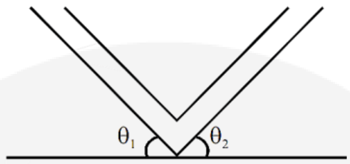
5. In the circuit shown, power factor of circuit is 1 and power factor of box is $\frac{3}{5}$. Find reading of ammeter:



(A) 5A (B) 6A (C) 4A (D) 3A

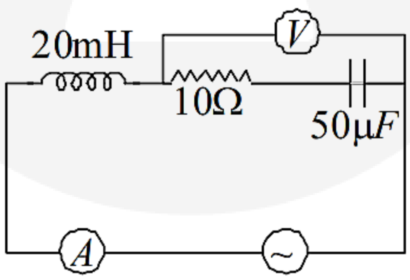
6. A series RLC circuit is driven by a generator at frequency 1000 Hz. The inductance is 90.0 mH; capacitance is 0.500 μF; and the phase constant has a magnitude of 60.0° (Take $\pi^2 = 10$)
Choose the incorrect statement:
(A) Here currents leads the voltage in phase
(B) Here voltage leads the current in phase
(C) Resistance of circuit is $\frac{80\pi}{\sqrt{3}}\Omega$
(D) At resonance $\omega = \frac{\sqrt{2}}{3} \times 10^4$ rad/sec

7. A non-viscous liquid of density ρ is filled in a tube with A as the area of cross-section, as shown in the figure. If the liquid is slightly displaced in one of the arms, the liquid column oscillates with a frequency:



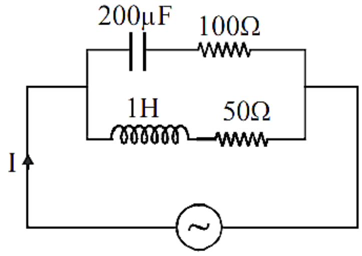
(A) $\frac{1}{2\pi}\sqrt{\frac{\rho g A \sin\left(\frac{\theta_1+\theta_2}{2}\right)}{m}}$
(B) $\frac{1}{2\pi}\sqrt{\frac{\rho g A(\sin\theta_1 - \sin\theta_2)}{m}}$
(C) $\frac{1}{2\pi}\sqrt{\frac{\rho g A(\sin\theta_1 + \sin\theta_2)}{m}}$
(D) $\frac{1}{2\pi}\sqrt{\frac{\rho g A \sin\left(\frac{\theta_1-\theta_2}{2}\right)}{m}}$

8*. For the AC circuit shown, the reading of ammeter and voltmeter are 5A and $50\sqrt{5}$ volts respectively, then

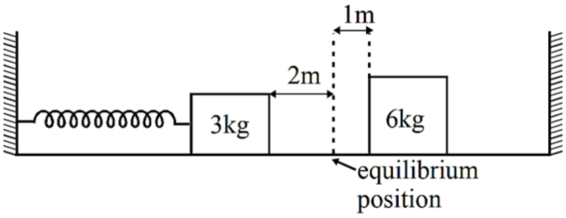


(A) Average power delivered by the source is 250W.
(B) rms value of AC source is 50 volts
(C) rms value of AC source is 100 volts.
(D) frequency of AC source is 100/2π Hz

9*. In the given circuit, the AC source has ω = 50 rad/s. Considering the inductor and capacitor to be ideal, the CORRECT choice (s) is (are) :
(A) The voltage across 100Ω resistor = $20\sqrt{2}$ V
(B) The voltage across 50Ω resistor = $20\sqrt{2}$ V
(C) The current through the circuit I is $\frac{2}{\sqrt{10}}$ A.
(D) The current through the circuit, I is 1.2A



10*. Two blocks of masses 3 kg and 6 kg rest on a horizontal smooth surface. The 3 kg block is detached to a spring with a force constant k = 900 Nm^{-1} which is compressed 2 m from beyond the equilibrium position. The 6 kg mass is at rest at 1 m from equilibrium as shown in the figure. 3 kg mass strikes the 6 kg mass and the two stick together.



(A) Velocity of the combined masses immediately after the collision is 10 ms^{-1}
(B) Velocity of the combined masses immediately after the collision is 5 ms^{-1}
(C) Amplitude of the resulting oscillation is $\sqrt{2}$ m.
(D) Amplitude of the resulting oscillation is $5\sqrt{2}$ m.

11*. Speed of a particle moving along x-axis is given by v = $\sqrt{16x - x^2 - 48}$. Which of the following is/are correct? (x is in m)
(A) Amplitude of oscillation is 4 m.
(B) Maximum speed of particle is 4 m/s.
(C Mean position of particle is (8,0)
(D) Acceleration of particle at x = 9 m is 2 m/s^2.

12. The speed (v) of a particle moving along a straight line, when it is at a distance (x) from a fixed point on the line is given by : $v^2 = 144 - 9x^2$

Column-I	**Column-II**
(A) Displacement of the particle in $\frac{4\pi}{3}$ sec is	(P) T = $2\pi/3$ units
(B) Time period of simple harmonic motion is	(Q) Less than distance moved by it
(C) Maximum displacement from the fixed point is	(R) 27 units
(D) Magnitude of acceleration at a distance 3 cm from the fixed point is	(S) 4 units
	(T) 3 units

ANSWER KEY

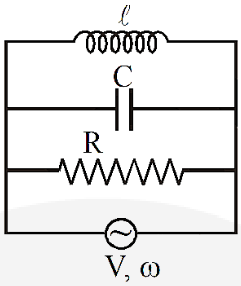
ELP No.-56

1. (D) **2.** (B) **3.** (C) **4.** (C) **5.** (D) **6.** (A) **7.** (C)
8. (AB) **9.** (ABC) **10.** (AC) **11.** (ABC) **12.** (A)→(Q); (B)→(P); (C)→(S); (D)→(R)

SUBJECT: IIT-PHYSICS **COURSE: EXCEL (XII)** **ELP No.-57**

Note: (*) → Multiple Correct Type Question

1. Consider L, C, R circuit as shown in figure, with a.c. source of peak value V and angular frequency ω. Then the peak value of current through the ac source is :



(A) $\dfrac{V}{\sqrt{\dfrac{1}{R^2}+\left(\omega L-\dfrac{1}{\omega C}\right)^2}}$

(B) $V\sqrt{\dfrac{1}{R^2}+\left(\dfrac{1}{\omega L}-\omega C\right)^2}$

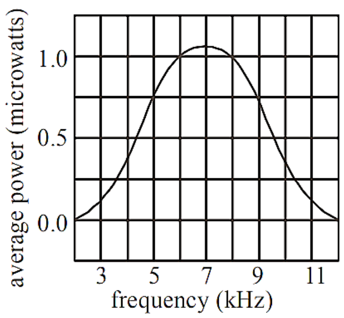
(C) $\dfrac{V}{\sqrt{R^2+\left(\omega C-\dfrac{1}{\omega C}\right)^2}}$

(D) $\dfrac{VR\omega}{\sqrt{\omega^2C^2+R\left(\omega^2C^2-1\right)^2}}$

2. A series LR circuit is connected to an ac source of frequency ω and the inductive reactance is equal to 2R. A capacitance of capacitive reactance equal to R is added in series with L and R. The ratio of the old power factor to the new one is:

(A) $\sqrt{\dfrac{2}{3}}$ (B) $\sqrt{\dfrac{2}{5}}$ (C) $\sqrt{\dfrac{3}{2}}$ (D) $\sqrt{\dfrac{5}{2}}$

3. The plot given below is of the average power delivered to an LCR circuit versus frequency. The quality factor of the circuit is nearly :



(A) 5 (B) 2.4 (C) 2.8 (D) 1.4

4. Mark the INCORRECT statement regarding an ideal transformer:

(A) In a ideal transformer primary has negligible resistance and all the flux in the core links both primary and secondary windings.

(B) The alternating magnetic flux induces eddy currents in the iron core and causes heating.

(C) Soft iron core is used in transformer to minimize hysteresis loss.

(D) Primary current and secondary current are in same phase.

5. 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) $T < 2\pi\sqrt{\frac{\ell}{g}}$ and damping is smaller then in air alone

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

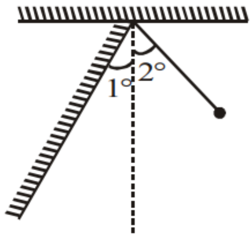
(C) $T > 2\pi\sqrt{\frac{\ell}{g}}$ and damping is smaller than in air alone

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

6. If a 2 kg mass is attached to a spring of force constant k = 1250 N/m, the period of oscillation is $T = \frac{\pi}{12}$ sec. The damping constant 'b' has the value.

(A) 9.8 kg/sec (B) 98 kg/sec (C) 2.8 kg/sec (D) 28 kg/sec

7. A simple pendulum of length 1m is allowed to oscillate with amplitude 2°. It collides elastically with a wall inclined at 1° to the vertical. Its time period will be : (use $g = \pi^2$)



(A) 2/3 sec (B) 4/3 sec

(C) 2 sec (D) None of these

8. Frequency of oscillation of a body is 6 Hz when force F_1 is applied and 8 Hz when F_2 is applied. If both forces F_1 & F_2 are applied together then the frequency of oscillation, is :-

(A) 14 Hz (B) 2 Hz (C) 10 Hz (D) $10\sqrt{2}$ Hz

9.* A circuit, containing an inductance and a resistance connected in series, has an AC source of 200 V, 50 Hz connected across it. An AC current of 10A rms flows through the circuit and the power loss is measured to be 1 kW.

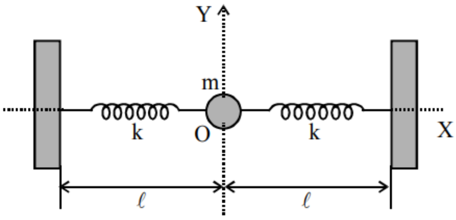
(A) The inductance of the circuit is $\frac{\sqrt{3}}{10\pi}$ H.

(B) The frequency of the AC when the phase difference between the current and emf becomes $\pi/4$, with the above components is $\frac{50}{\sqrt{3}}$ Hz.

(C) The frequency of the AC when the phase difference between the current and emf becomes $\pi/3$, with the above components is $\frac{25}{\sqrt{3}}$ Hz.

(D) The frequency of the AC when the phase difference between the current and emf becomes $\pi/4$, with the above components is $\frac{25}{\sqrt{3}}$ Hz

10.* Figure shows a smooth horizontal table in x–y plane between two identical fixed walls. Two identical springs are connected to the small ball. The length of the springs in the free state is ℓ. The ball is shifted slightly from the equilibrium position in two different ways once along the axis OX and second along the y-axis and it begins to perform vibrations. The time period for these motions is T_x and T_y respectively.



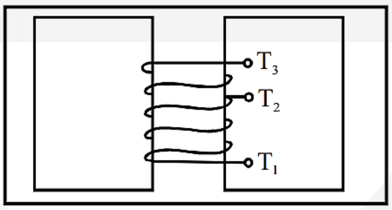
(A) Motion along x-axis simple harmonic

(B) Motion along y axis simple harmonic

(C) $T_x = 2\pi\sqrt{\frac{m}{2k}}$

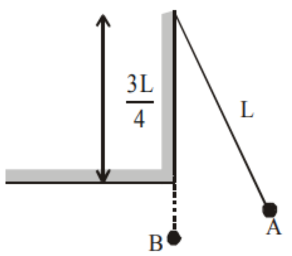
(D) $T_y = 2\pi\sqrt{\frac{m}{2k}}$

11. An autotransformer consists of a single coil with a ferromagnetic core. Three connections are provided. Between connections T_1 and T_2 there are 200 turns and between T_2 and T_3 there are 800 turns. Any two connections can be used as primary and any two can be used as secondary.



List-I	**List-II**
(A) For step up transformer, maximum value of $\frac{V_{secondary}}{V_{primary}}$	(1) 0.8
(B) For step down transformer, maximum value of $\frac{V_{secondary}}{V_{primary}}$	(2) 0.2
(C) For step up transformer, minimum value of $\frac{V_{secondary}}{V_{primary}}$	(3) 1.25
(D) For step down transformer, minimum value of $\frac{V_{secondary}}{V_{primary}}$	(4) 5

12. A pendulum has period T for small oscillations. An obstacle is placed directly beneath the pivot, so that only the lowest one quarter of the string can follow the pendulum bob when it swings in the left of its resting position as shown in the figure. The pendulum is released from rest at a certain point A. The time taken by it to return to that point is nT/4. Find the value of n?



ANSWER KEY

ELP No.-57

1.	(B)	**2.**	(B)	**3.**	(D)	**4.**	(D)	**5.**	(D)	**6.**	(D)	**7.**	(B)
8.	(C)	**9.**	(AB)	**10.**	(AC)	**11.**	(A)-4; (B)-1; (C)-3; (D)-2	**12.**	3				