PHYSICS

FOR IIT JEE ASPIRANTS OF CLASS 12 FOR PHYSICS

ELECTROMAGNETIC INDUCTION

Illustratoin

1. A square plate of side length 4 cm is placed in a magnetic field of induction 20 mT in a direction making an angle 30° with the plane of coil then the magnetic flux linked with the coil is ?

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2. A circular loop of area $20cm^2$ is placed on x-y plane. Containing uniform magnetic field of induction

$\overrightarrow{B} = 0.4\hat{i} + 0.3\hat{j}$ Tesla

then the magnetic flux linked with the coil is ?

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3. A wire loop of 5 turns area vector $\overrightarrow{A} = \left(4\hat{i} + 3\hat{j}\right)m^2$ is placed is a magnetic field of induction $\overrightarrow{B} = 0.4\hat{j}$ T. Then the flux linked with the coil is ?

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4. A coil of N turns and area A is placed in a uniform transverse magnetic field B in such a way that $\overrightarrow{A}$ and $\overrightarrow{B}$ are parallel. If the plate in turned through 180° about its one of the diameter in 2 seconds then the (i) change of magnetic flux through the coil is ? (ii) rate of change of flux is the coil is ?

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5. A rectangular loop of area $0.06m^2$ is placed in a uniform magnetic field of $0.3T$ with its plane (i) normal to the field (ii) inclined 30° to the field (iii) parallel to the field. Find the flux linked with the coil in each case.

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6. At a certain location in the northern hemispehre ,the earth's magnetic field has magnitude of $42\mu T$ and points downwards at 53° to the vertical. Calculate the flux through a horizontal surface of area $2.5m^2 [\sin 53^\circ = 0.8]$

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7. A uniform magnetic field exists in the space $\overrightarrow{B} = B_1\hat{i} + B_2\hat{j} - B_3\hat{k}$. Find the magnetic flux through an area $\overrightarrow{S}$ if the area $\overrightarrow{S}$ is in X-Y plane

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8. A circular coil of 200 turns and mean radius 30 cm is placed in a uniform magnetic field of induction 0.02 T and is free to rotate about an axis coinciding with its own plane, but perpendicular to the uniform magnetic field. The coil is in closed circuit having a total resistance of 50Ω. if the plane of the coil is initially perpendicular to the field find the charge flown through the circuit, when the coil is rotated through (i) 60° (ii) 180° .

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9. A coducting circular loop of area $1mm^2$ is placed coplanarly with a long, straight wire at a distance of 20 cm from if. The straight wire carries an electric current which changes from 10A to zero is 0.1 s. Find the average emf induced in the loop in 0.1 s.

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10. The magnetic flux linked with a coil varies as $\phi = 3t^2 + 4t + 9.$ Find the magnitude of the emf induced at t = 2S.

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11. A magnetic field of induction 2T acts at right angles to a coil of area $100cm^2$ with 500 turns and having resistance of 10Ω . If the coil is removed at a uniform rate from the field in 0.1 sec, find the

(i) e.m.f induced

(ii) current induced

(iii) charge induced in the coil

12. A circular coil is kept on a horizontal plane. A barmagnet is held vertical with north pole down, above the coil.

13. When the magnet is allowed to fall through an open ring (or) cut ring , then

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14. The magnetic flux through a coil is varying according to the relation $\phi = \left(5t^3 + 4t^2 + 2t - 5\right)$ Wb. Calculate the induced current through the coil at $t = 2$ s if resistiance of coil is 5 ohm.

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15. A circular coil opf 500 turns of wire has an enclosed area of $0.1m^2$ per turn. It is kept perpendicular to a magnetic field of induction $0.2T$ and rotated by 180° about a diameter perpendicular to the field in 0.1 sec. how much charge will pass when the coil is connected to a gavanometer with a combined resistance of $50 ohms$

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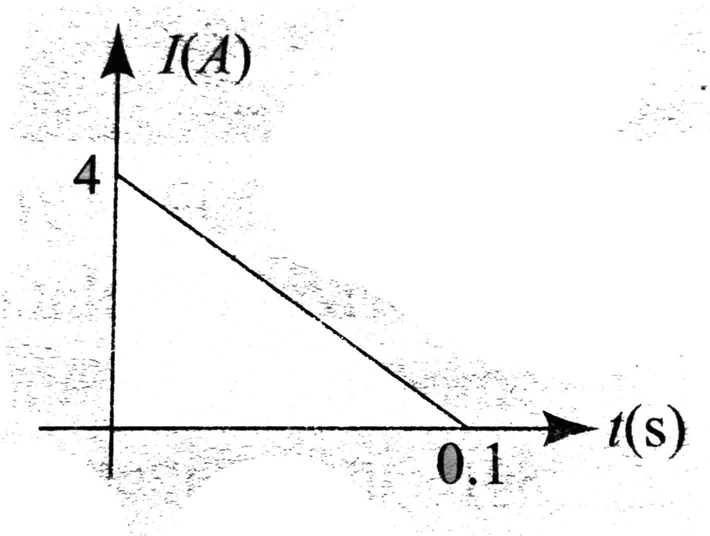
16. Some magnetic flux is changed from a coil of resitance 10Ω. As a result, an induced current is developed it, which varies with time as shown in Fig. 3.213. Find the magnitude of the change in flux through ythe coil in weber.



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17. A long solenoid with 1.5 turns per cm has a small loop of area $2.0cm^2$ placed inside the solenoid normal to its axis. If the current in the solenoid changes steadily from $2.0A$ to $4.0A$ in $1.0s$. The emf induced in the loop is

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18. A square loop of side $10cm$ and resistance 0.5Ω is placed vertically in the east-west plane. A uniform magnetic field of $0.10T$ is set up across the plane in the north-east direction. The magnetic field is decreased to zero in $0.70s$ at a steady rate. The magnitude of current in this time-interval is.

19. A square loop ACDE of area $20cm^2$ and resistance 5Ω is rotated in a magnetic field B = 2T through 180°

(a) in 0.01 s and (b) in 0.02 s .

Find the magnetic fo e.i and Δq in both the cases.

20. A bar magnet is brought near a solenoid as shown in fig. will the solenoid attract or repel the magnet ?

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21. Two circular loops of equal radii are placed coaxially at some separation. The first is cut and a battery is inserted in between to drive a current in it. The current changes slightly because of the variation in resistance with temperature. Durig this period, the two loops

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22. A current I from A to B is increasing in magnitudes as shown in figure. What is the direction of induced current in the loop.

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23. A rectangular loop of length $'l'$ and breadth $'b'$ is placed at a distance of x from an infinitely long wire carrying current $'i'$ such that the direction of current is parallel to breadth. If the loop moves away from the current wire in a direction perpendicular to it with a velocity $'v'$, the magnitude of the e.m.f. in the loop is: ($\mu_0 =$ permeability of free space)

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24. A horizontal magnetic field B is produced across a narrow gap between the two square iron pole pieces. A closed square loop of side a mass m and resistance R is allowed to fall with the top of the loop in the field . The loop attains a terminal velocity

equal to

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25. A conducting wire of mass m slides down two smooth conducting bars, set at an angle θ to the horizontal as shown in figure. The seperation between the bars is l. the system is located in the magnetic field B perpendicular to the plane of the sliding wire and bars. The constant velocity of the wire is

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26. A wire of length 2l is bent at mid point so that the angle between two halves is 60°. If it moves as shown with a velocity v in a magnetic field B find the induced emf.

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27. Figure shows a conducting rod PQ in contact with metal rails RP and SQ , which are 0.25 m apart in a uniform magnetic field of flux density 0.4 R acting perpendicular to the plane of the paper. Ends R and S are connected through a 5Ω resistance. what is the emf when the rod moves to the right with a velocity of $5ms^{-1}$? What is the magnitude and direction of the current through the 5Ω resistance ? if the rod PQ moves to the left with the same speed, what will be the new current and its direction ?

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28. A loop ABCD containing two resistors as shown in figure is placed in a uniform magnetic field B directed outwards to the plane of page. A sliding conductor EF of length l and of negligible resistance moves to the right with a uniform velocity v as shown if fig. determine the current in each branch.

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29. A rectangular loop with a slide wire of length l is kept in a uniform magnetic field as shown in the figure. The resistance of slider is R .

Neglecting self inductance of the loop find the current in the connector during its motion with a velocity v

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30. A conducting rod PQ of length L=1.0 m is moving with a uniform speed v=2.0 m/s in a uniform magnetic field B=4.0 T directed into the paper. A capacitor of capacity $C = 10\mu F$ is connected as shown in the figure. Then what are the charge on the plates A and B of the capcitor .

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31. Two parallel rails with negligible resistance are 10.0 cm apart. They are connected by a 5.0Ω resistor. The circuit also contains two metal rods having resistances of 10.0Ω and 15.0Ω along the rails. The rods are pulled away from the resistor at constant speeds 4.00 m/s and 2.00 m/s respectively. A uniform magnetic field of magnitude 0.01 T is applied perpendicular to the plane of the raisl.

Determine the current in the 5.0Ω resistor.

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32. A conducting rod MN moves with a speed v parallel to a long straight wire which carries a constant current I,as shown in fig. the length of the rod is normal to the wire. Find the emf induced in the total length of the rod.

State which end will be at a lower potential.

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33. A square loop of side a is placed in the same plane as a long straight wire carrying a current i. The centre of the loop is at a distance r from the wire where $r > > a$. The loop is moved away from the wire with a constant velocity v. The induced e.m.f in the loop is

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34. Two conducting rings of radii r and 2r move in apposite directions with velocities 2u and u respectively on a conducting surface S.

There is a uniform magnetic field of magnitude B perpendicular to the plane of the rings. The potential difference between the highest points of the two rings is

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35. A metallic square loop ABCD is moving in its own plane with velocity v in a uniform magnetic field perpendicular to its plane as shown in the figure. Find

(a) In which sides of the loop electric field is induced.

(b) net emf induced in the loop

(c) if one BC is outside the field with remaining loop in the field and is being pulled out with a costant velocity then induced current in the loop.

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36. A copper rod of length $2m$ is rotated with a speed of $10rps$, in a uniform magnetic field of 1 tesla about a pivot at one end.

The magnetic field is perpendicular to the plane of rotation. Find the emf induced across its ends

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37. A wheel ith 10 metallic spokes, each 0.5 m long is rotated with a speed of 120 rev/minute in a plane normal to the earth's magnetic field at the place. If the magnitude of the field is 0.40 gauss, what is the induced emf between the axe and the rim of the wheel ?

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38. A metal rod of resistance 20Ω is fixed along a diameter of a conducting ring of radius $0.1m$ and lies on $x-y$ plane. There is a magnetic field $\overrightarrow{B} = (50T)\overrightarrow{k}$. The ring rotates with an angular velocity $\omega = 20 rads^{-1}$ about its axis. An external resistance of 10Ω is connected across the center of the ring and rim. The current external resistance is

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39. A copper disc of radius $1m$ is rotated about its natural axis with an angular velocity $2\text{rad}/\text{sec}$ in a uniform magnetic field 5 telsa with its plane perpendicular to the field. Find the emf induced between the centre of the disc and its rim.

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40. A $0.1m$ long conductor carrying a current of $50A$ is perpendicular to a magentic field of $1.25mT$. The mechanical

power to move the conductor with a speed of $1ms^{-1}$ is

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41. A short-circuited coil is placed in a time-varying magnetic field. Electrical power is dissipated due to the current induced in the coil. If the number of turns were to be quadrupled and the wire radius halved, the electrical power dissipated would be

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42. A pair of parallel horizontal conducting rails of negligible resistance, shorted at one end is fixed on a table. The distance between R can slide on the rails frictionlessly.

The rod is tied to a massless string which passes over a pulley fixed to the edge of the table. A mass m , tied to the other end of the string, hangs vertically.

A constant magnetic field B exists perpendicular to the table. if the system is released from rest, calculate :

(i) the terminal velocity achieved by the rod.

(ii) the acceleration of the mass at the instant when the velocity of the rod, is half the terminal velocity.

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43. Two parallel vertical metallic bars XX^1 and YY^1 of negligible resistance and separated by a length 'l' are as shown in Fig. The ends of the bars are joined by resistance R_1 and R_2 . A uniform magnetic field of induction B exists in space normal to the plane of the bars.

A horizontal metallic rod PQ of mass m starts falling vertically making contact with the bars. it is observed that in the steady state the powers dissipated in the resistance R_1 and R_2 and the terminal velocity attained by the rod PQ.

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44. The loop ABCD is moving with velocity 'v' towards right. The magnetic field is 4T . The loop is connected to a resistance of 8Ω . If steady current of 2A flows in the loop then value of 'v' if loop has a resistance of 4Ω , is

(Given AB=30 cm, AD=30 cm)

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45. A square loop of side $12cm$ with its sides parallel to x and y-axes is moved with a velocity $8cm/s$ along positive x-direction in an environment containing magnetic field along $+ve$ z-direction. The field has a gradient of $10^{-3}\text{tesla}/\text{em}$ along $-ve$ x-direction (increasing along $-ve$ x-axis) and also decreases with time at the rate of $10^{-3}\text{tesla}/s$. The emf induced in the loop is

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46. A bar of mass m and length l moves on two frictionless parallel rails in the presence of a uniform magnetic field directed into the plane of the paper. The bar is given an initial velocity v_i to the right and released. Find the velocity of bar, induced emf across the bar and the current in the circuit as a function of time

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47. The arm PQ of the rectangular conductor is moved from x=0, outwards in the uniform magnetic field which extends from x=0 to x=b and is zero for $x > b$ as shown. Only the arm PQ possesses substantial resistance r.

Consider the situation when the arm PQ is pulled outwards from x=0 to x=2b , and is then moved back to x=0 with constant speed v.

Obtain expressions for the flux, the induced emf, the force necessary to pull the arm and the power dissipated as joule heat.

Sketch the variation of these quantities with distance.

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48. Figure shows a square of side 5 cm being moved towards right at a constant speed of 1cm /s. The front edge enters the 20 cm wide magnetic field at t=0 . Find the emf induced in the loop at (a) t=2s, bt=10s, c t=22s and d t =30 s.

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49. A right -angled triangle abc, made from a metallic wire, moves at a uniform speed v in its plane as shown in figure. A uniform magnetic field B exists in the perpendicular direction. Find the emf induced (a) in the loop abc, (b) in the segment bc, (C) in the segment ac and (d) in the segment ab. Given length of bc =1l

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50. A rectangular frame of wire abcd has dimensions 32 cm $\times$ 8.0 cm and a total resistance of 2.0Ω. It is pulled out of a magnetic field B=0.020 T by applying a force of 3.2×10^{-5} N. it is found that the frame moves with constant speed. . find (a) this constant speed, (b) the emf induced in the loop, (c) the potential difference between the points a and b and (d) the potential difference between the point c and d.

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51. A uniform magnetic field B exists in a cylindrical region of radius 10 cm as shown in figure. A uniform conducting wire of length 80 cm and resistance 4.0Ω is bent into a square frame abcd and is placed with one side along a diameter of the cylindrical region. if the magnetic field increases at a constant rate of 0.010 T/s, find the current induced in the frame.

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52. A square loop of edge a having n turns is rotated with a uniform angular velocity ω about one of its diagonals which is kept fixed in a horizontal position as shown in fig. A uniform magnetic field B exists in the vertical direction. Find the e.m.f induced in the coil

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53. Two different coils have self-inductances $L_1 = 8mH$ and $L_2 = 2mH$. The current in one coil is increased at a constant rate. The current in the second coil is also increased at the same constant rate. At a certain instant of time, the power given to the two coil is the same. At that time, the current, the induced voltage and the energy stored in the first coil are i_1, V_1 and W_1 respectively. Corresponding values for the second coil at the same instant are i_2, V_2 and W_2 respectively. Then:

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54. Two coaxial solenoids are made by winding thin insulated wire over a pipe of cross-sectional area $A = 10cm^2$ and length =20cm. If one of the solenoid has 300 turns and the other 400 turns, their mutual indcutance is

55. The self inductance of an inductance coil having 100 turns is 20 mH. Calculate the magnetic flux through the cross section of the coil corresponding to a current of 4 milliampere. Also, find the total flux

56. A coil of inductane 0.2 henry is connected to 600 volt battery. At what rate, will the current in the coil grow when circuit is completed ?

57. An inductor of 5 H inductance carries a steady current of 2 A. How can a 50 V self induced e.m.f. be made to appear in the inductor ?

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58. Two different coils have self inductane $L_1 = 16mH$ and $L_2 = 12mH$. At a certain instant, the current in the two coils is increasing at the same rate of power supplied to the two coils is the same. Find the ratio of $i)$ induced voltage $ii)$ current $iii)$ energy stored in the two coils at that instant.

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59. The network shown is a part of the closed circuit in which the current is changing. At an instant , currrent in it is 5 A . Potential difference between the points A and B if the current is

(1) Increasing at 1A/sec

(2) Decreasing at 1A/sec.

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60. Calculate the mutual inducatnce between two coils when a current of $2A$ changes to $6A$ in 2 seconds and induces an emf of $20mV$ in the secondary coil

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61. If the coefficient of mutual induction of the primary and secondary coils of an induction coil is $6H$ and a current of $5A$ is cut off in $1/5000$ second, calculate the emf induced in the secondary coil.

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62. A solenoid is of length $50cm$ and has a radius of $2cm$. It has 500 turns. Around its central section a coil of 50 turns is wound. Calculate the mutual inductance of the system.

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63. A solenoidal coil has 50 turns per centimetre along its length and a cross-sectional area of $4 \times 10^{-4} m^2$. 200 turns of another wire is wound round the first solenoid co-axially. The two coils are electrically insulated from each other. Calculate the mutual inductance between the two coils.

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64. Two circular coils, one of smaller radius r_1 and the other of very large radius r_2 are placed co-axially with centres coinciding. Obtain the mutual inductance of the arrangement.

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65. 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 centre coincide. What is the mutual inductance of the system ?

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66. A torodal solenoid with an air core has an average radius of 15 cm, area of cross-section `12 cm^(2) and 1200 turns. Obtain the self inductance of the toroid. Ignore field variations across the cross-section of the toroid.

(b) A second coil of 300 turns is wound closely on the toroid above. If the current in the primary coil is increased from zero to 2.0 A in 0.05 s, obtain the induced e.m.f. in the second coil.

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67. The ratio of lengths of two rods A and B of same material is $1:2$ and the ratio of their radii is $2:1$, then the ratio of modulus of rigidity of A and B will be

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68. Calculate the coefficient of self induction of a solenoid coil of 2000 turns, length 0.5 m and radius 5 cm , when the core is filled with

(i) air

(ii) soft iron $(\mu_r = \text{for soft iron} = 1000)$

N=2000 turns, l=0.5 m ,A = $\pi(5 \times 10^{-2})^2$

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69. An average emf of 20 V is induced in an inductor when the current in it is changed from $2.5A$ in one direction to the same valute in the opposite direction in 0.1 s. Find the self inductance of the inductor.

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70. The current is a solenoid of 240 turns, having a length of 12 cm and a radius of 2 cm, changes at a rate of $0.8As^{-}$. Find the emf indcued in it.

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71. The coefficient of mutal inductance between the primary and secondary of a transformer is 5 H. Calculate when 3 A current in the primary is cut off to zero in $25 \times 10 -^{-6}$ sec.

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72. An AC generator consists of a coil of 100 turns and area $5m^2$ rotating at an angular speed of 60 rad/s in a uniform magnetic

field B =0.5 T between two fixed pole pieces. Find the peak value of voltage drawn from generator.

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73. A boy pedals a stationary bicycle at one revolution per second. The pedals are attached to 100 turns coil of are $0.1m^2$ and placed in a uniform magnetic field of $0.1T$. What is the maximum voltage generated in the coil ?

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74. A coil of 800 turns $50cm^2$ area makes $10rps$ about an axis in its own plane in a magnetic field of 100 gauss perpendicular to the this axis. What is the instantaneous inducted emf in the coil ?

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75. A person peddles a stationary bicyle the pedals of the bicycle are attached to a 100 turn coil of area $0.10m^2$. The coil rotated at half a revolution per second and it is placed in a uniform magnetic field of $0.01T$

perpendicular to the axis of rotation of the coil, What is the maximum voltage generated in the coil ?

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76. In the given circuit, current through the 5 mH inductor in steady state is

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77. In the given circuit diagram, key K is switched on at t=0. the ratio of current I through the cell at t=0 to that at $t = \infty$ will be

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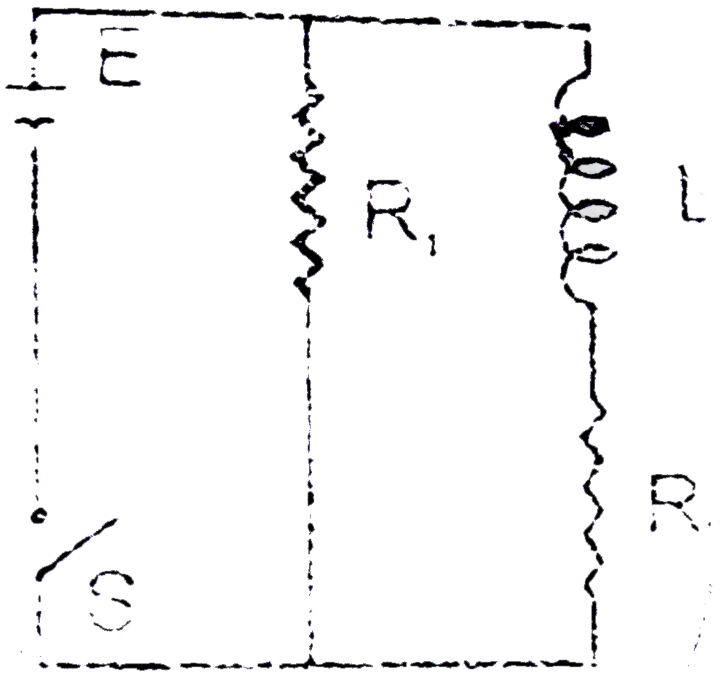
78. An inductor of inductance $L = 400 mH$ and resistors of resistances $R_1 = 2\Omega$ and $R_2 = 2\Omega$ are connected to a battery of $emf 12V$ as shown in figure.The internal resistance of the battery is negligible.The switch S is closed at $t = 0$.The potential drop across L as a function of time is:



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79. An inductor of $3H$ is connected to a battery of emf $6V$ through a resistance of 100Ω. Calculate the time constant. What will be the maximum value of current in the circuit ?

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80. A cell of $1.5V$ is connected across an inductor of $2mH$ in series with a 2Ω resistor. What is the rate of growth of current immediately after the cell is switched on.

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81. A coil having resistance 15Ω and inductance $10H$ is connected across a 90 Volt dc supply. Determine the value of current after $2 \sec$, What is the energy stored in the magnetic field at that instant.

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82. Calculate the back $e. m. f$ of a $10H, 200\Omega$ coil $100ms$ after a $100V$ d.c supply is connected to it.

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83. A coil of resistance 20Ω and inductance $0.5H$ is switched to $DC200V$ supply. Calculate the rate of increase of current

a. at the instant of closing the switch and

b. after one time constant.

c. Find the steady state current in the circuit.

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84. In the circuit shown in figure switch S is closed at time t=0. Find the current through different wires and charge stored on the capacitor at any tiem t .

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85. A parallel- plate capacitor, fileld with a dielectric of dielectric consatnt k, is charged to a potential V_0. It is now disconnected from the cell and the slab is removed. If it now discharges, with time constant τ, through a resistance then find time after which the potential difference across it will be V_0 ?

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86. A $4\mu F$ capacitor, a resistance of $2.5 M\Omega$ is in series with $12V$ battery. Find the time after which the potential difference across the capacitor is 3 times the potential difference across the resistor. [Given In (2) = 0.693]

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87. In a circuit inductance L and capacitance C are connected as shown in figure and A_1 and $A - 2$ are ammeters. When key k is pressed to complete the circuit, then just after closing key k , the readig of A_1 and A_2 will be

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Evaluate Yourself 1

1. The flux in a closed circuit of resistance 10Ω varies with time according to the equation $\phi = 3t^2 - t + 1$, where ϕ is in weber and t is in , s the value of induced current at t=1 s is

A. 0.3 A

B. 0.5A

C. 0.7A

D. 1A

Answer: B

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2. If a coil of 40 turns and area $4.0cm^2$ is suddenly remove from a magnetic field, it is observed that a charge of $2.0 \times 10^{-4}C$

flows into the coil. If the resistance of the coil is 80Ω, the magnetic flux density in Wb/m^2 is

A. 0.5

B. 1.0

C. 1.5

D. 2.0

Answer: B

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3. The magnetic flux through a circuit of resistance R changes by an amount $\Delta\phi$ in a time Δt. Then the total quantity of electric charge Q that passes any point in the circuit during the time Δt is represent by

A. $Q = \frac{\Delta\phi}{\Delta t}$

B. $Q = R\frac{\Delta\phi}{\Delta t}$

C. $Q = \frac{1}{R}\frac{\Delta\phi}{\Delta t}$

D. $Q = \frac{\Delta\phi}{R}$

Answer: D

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4. A circular coil of diameter 21 cm is placed in a magnetic field of induction 10^{-4}T. the magnitude of flux linked with coil when the plane of coil makes an angle 30° with the field is

A. 3.1×10^{-6}Wb

B. 1.414 Wb

C. 1.73×10^{-6} Wb

D. 14.14 Wb

Answer: C

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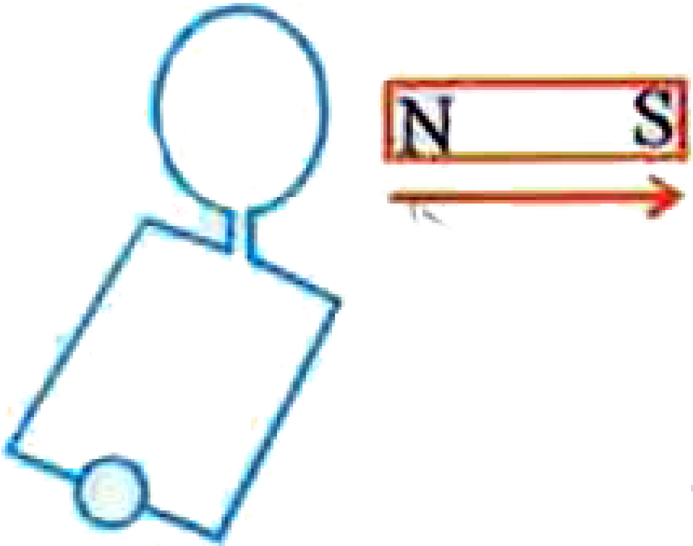
Evaluate Yourself 2

1. A bar magnet is placed along the axis of the loop and carrying away from it as shown in figure. The direction of the current as seen from other side is



A. Anticlockwise

B. clock wise

C. No current

D. Can't say

Answer: A

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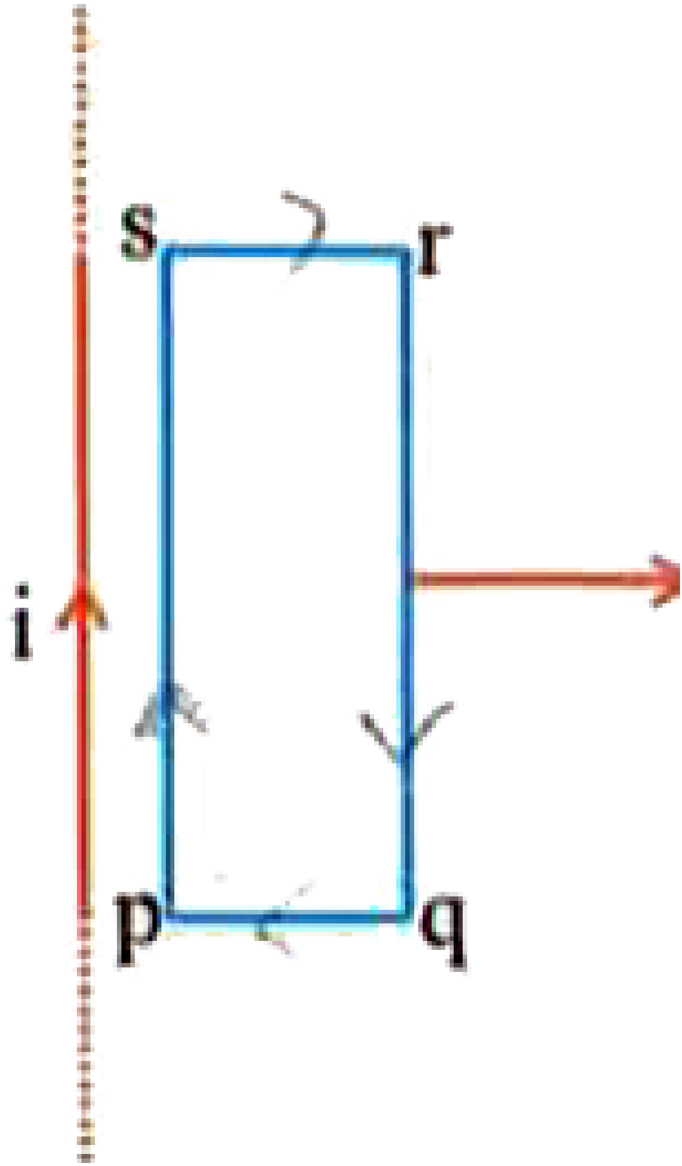
2. A rectangular coil pqrs is moved away from an infinite, straight wire carrying a current as shown in figure. Which of the following statements is corrent ?



A. There is no induced current in coil pqrs

B. The induced current in coil pqrs is in the clockwise sense

C. The induced current in the coil pqrs is in anticlockwise direction

D. none of these

Answer: B

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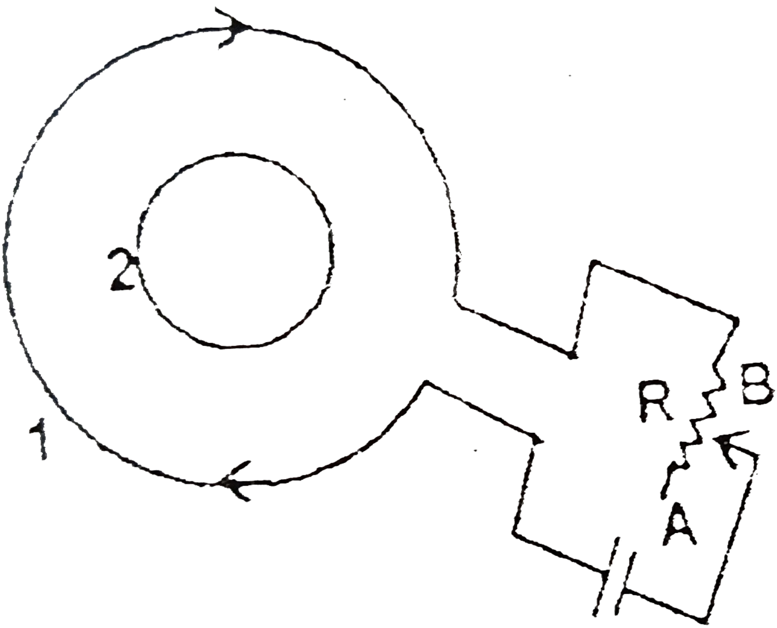
3. shown in the figure is a small loop that is kept co-axially with the bigger loop. If the slider moves from A to B, then



A. Current flow in both the loop

B. Clockwise current in loop 1 and anti-clockwise current in loop 2 flow

C. No current flows in loop 2

D. Clockwise current flows in loop 2

Answer: B

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4. The induced e.m.f in a circuit

A. Decreases the magnetic flux through the circuit

B. increases the magnetic flux through the circuit

C. May increase or decrease the magnetic flux through the circuit

D. Leaves the magnetic flux through the circuit unchanged

Answer: C

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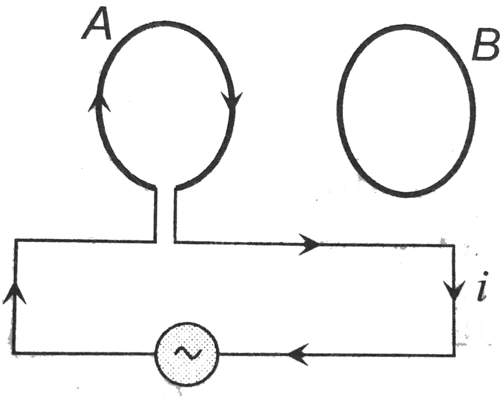
5. Two circular coils A and B are facing each other as shown in figure. The current i through A can be altered



A. There will be repulsion between A and B if I is increased

B. There will be attraction between A and B if I is increased

C. There will be neither attraction nor repulsion when I is changed

D. Attraction or repulsion between A and B depends on the direction of current . It does not depend whether the current is increased or decreased

Answer: A

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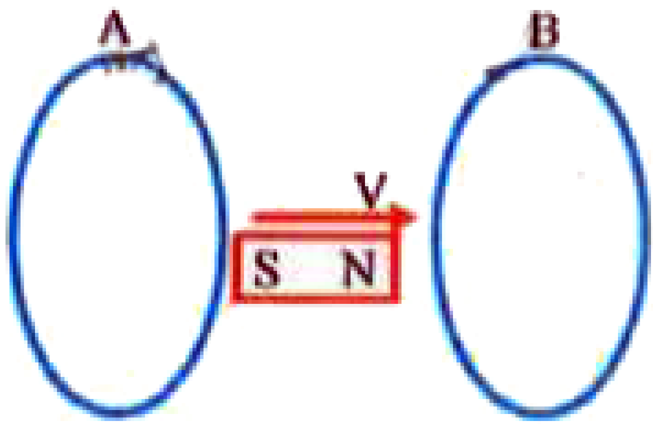
6. A,B are two conducting circular loops with their planes parallel and a magnet is moved in between them. Then



A. The loops will experience no force upon each other

B. The loops will repel each other

C. The loops will attract each other

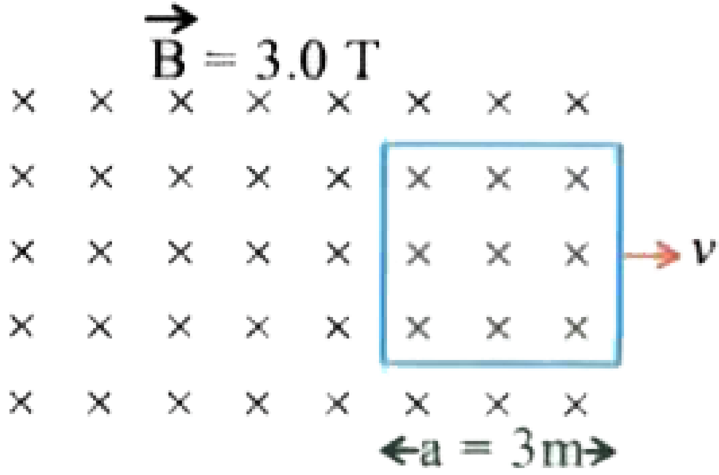
D. Both the loops move toward left with velocity V

Answer: B

Watch Video Solution

Evaluate Yourself 3

1. Figure shows loop of 200 turns and side a=3m and resistance of one coil $R = 1000\Omega$. The work done in pulling the loop out of the field, slowly and uniformly in 1.0 s is



A. 130 J

B. 125 J

C. 146 J

D. None

Answer: C

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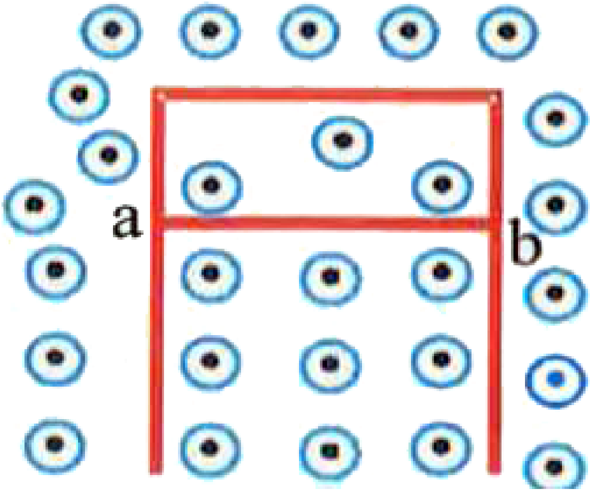
2. A conducting wire ab of length l resistance r and mass m starts sliding down at t=0 on a smooth, vertical thick pair of connected rails as shown. The terminal speed of the wire is



A. $\frac{mgR}{Bl}$

B. $\frac{mgr}{B^2l^2}$

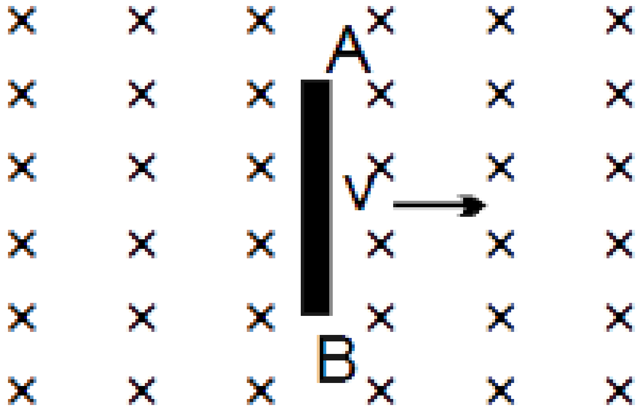
C. $\frac{mgl}{B^2r^2}$

D. None

Answer: B

Watch Video Solution

3. A rod AB moves with a uniform velocity v in a uniform magnetic field as shown in figure.



A. the end A becomes positively charged

B. the rod gets heated due to joule heating

C. the end B gets positive charge

D. none of these

Answer: A

Watch Video Solution

4. A conducting rod is moved with a constant velocity v n a magnetic field. A potential difference appears across the two ends

A. $\vec{v} \mid \mid \vec{B}$

B. $\vec{l} \mid \mid \vec{B}$

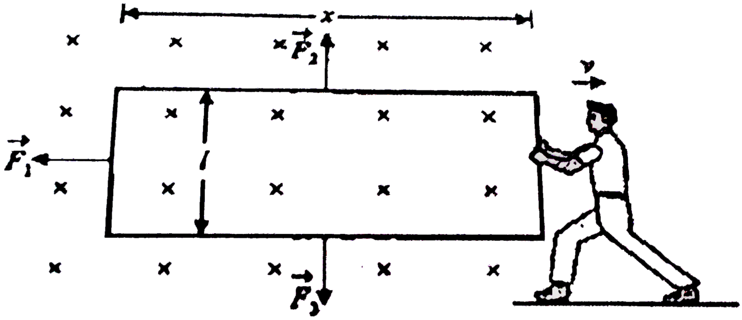
C. $\vec{V} \mid \mid \vec{l}$

D. $\vec{V} \perp \vec{l} \perp \vec{B}$

Answer: D

Watch Video Solution

5. A rectangular loop of wire is placed in a uniform magnetic field B acting normally to the plane of the loop. If a man attempt to pull it out ofthefield with velocityv as shown in figure-5.338, calculate the power required for this purpose.if resistance of loop is R.



A. Bil.v

B. $\frac{B^2 l^2 v^2}{R}$

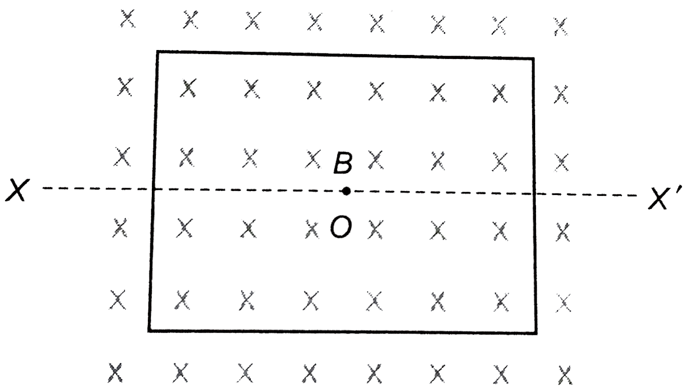
C. $\frac{B l^2 v^2}{R}$

D. $\frac{B v l}{R}$

Answer: B

Watch Video Solution

6. A rectangular coil is placed in a region having a uniform magnetic field B perpendicular to the plane of the coil. An emf will not be induced ion the coil if the



A. Magnetic field increases uniformly

B. Coil is rotated about an axis perpendicular to the plane of the coil and passing through its centre O, the coil remaining in the same plane

C. Coil is rotated about the axis OX

D. Magnetic field is suddenly switched off

Answer: B

Watch Video Solution

7. A metal disc of radius R rotates with an angular velcoity ω about an axis perpendiclar to its plane passing through its centre in a magnetic field B acting perpendicular to the plane of the disc. Calculate the induced emf between the rim and the axis of the disc.

A. $B\pi R^2\omega$

B. $BR^2\omega$

C. $\frac{1}{2}B\pi R^2\omega$

D. $\frac{1}{2}BR^2\omega$

Answer: D

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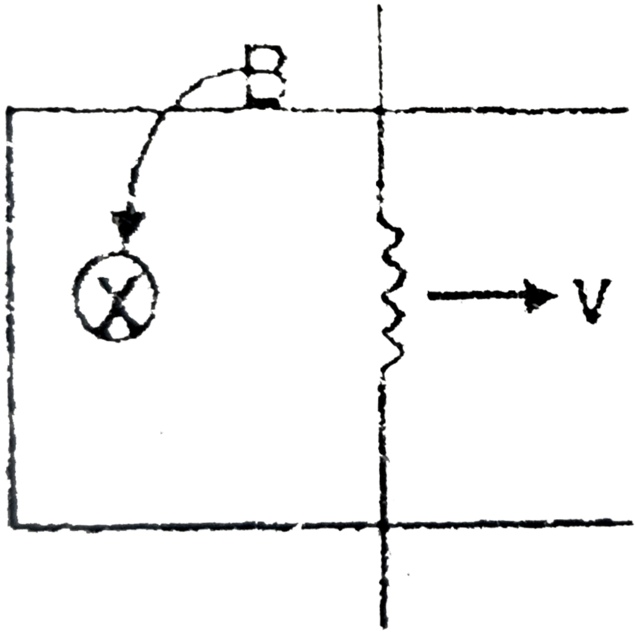
8. A conducting bar is pulled with a constant speed v on a smooth conducting rail. The region has a steady magnetic field of induction B as shown in the figure. If the speed of the bar is doubled then the rate of heat dissipation will



A. Constant

B. Quarter of the initial value

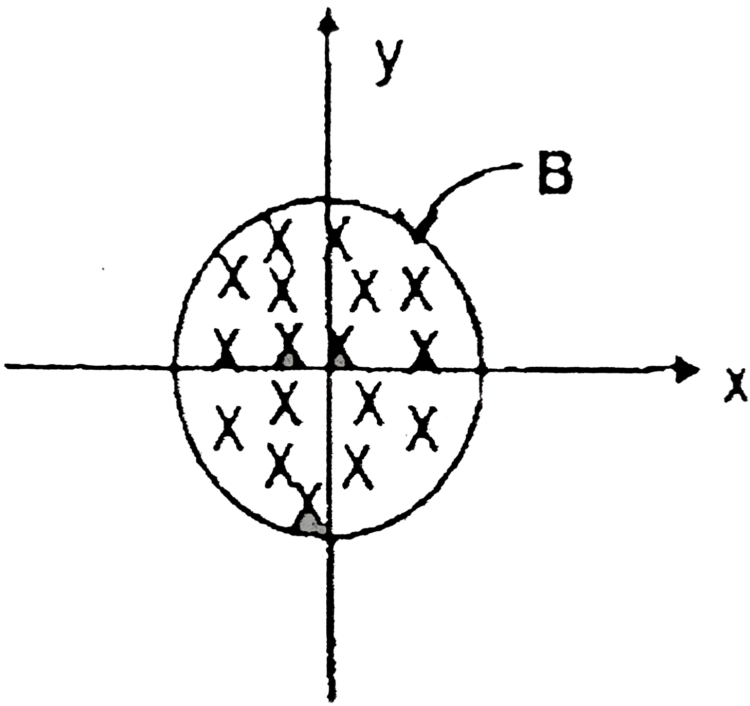
C. Four fold

D. Doubled

Answer: C

Watch Video Solution

9. A loop is kept so that its center lies at the origin of the coordinate system. A magnetic field has the induction B pointing along Z axis as shown in the figure



A. NO emf and current wil be induced in the loop if it rotates about Z axis

B. Emf induced but no current flows if the loop is a fiber when it rotates about y axis

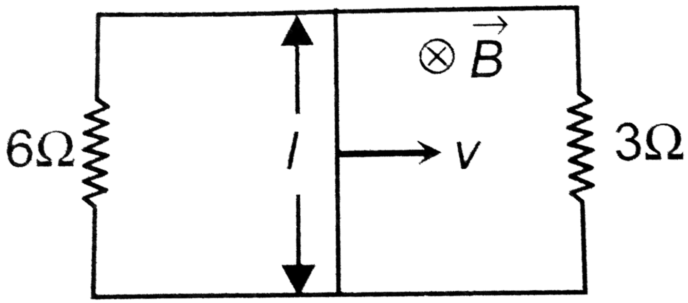
C. If the loops moves along z-axis with constant velocity no current flows in it

D. All of above

Answer: D

Watch Video Solution

10. A rectangle loop with a sliding connector of length $l = 1.0m$ is situated in a uniform magnetic field $B = 2T$ perpendicular to the plane of loop. Resistance of connector is $r = 2\Omega$. Two resistance of 6Ω and 3Ω are connected as shown in figure. the external force required to keep the connector moving with a constant velocity $v = 2m/s$ is



A. 6 N

B. 4 N

C. 2 N

D. 1 N

Answer: C

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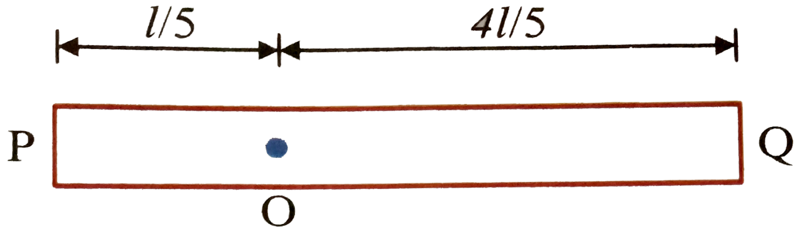
11. A straight rod of length l si rotating about axis passing through O is shown. A uniform magnetic field B exists parallel to the axis of rotation. $E.m.f$ induced between P and Q is:



A. $\frac{8}{25}BL^2\omega$

B. $\frac{7}{25}BL^2\omega$

C. $\frac{3}{10}BL^2\omega$

D. zero

Answer: C

Watch Video Solution

12. Deternine the magnitude of the emf generated between the ends of the axle of a railway carriage, 1m in length, when it is moving with a velocity of 36 km/hr along a horizontal track, given horizontal component to Earth's magnetic field $B_H = 4 \times 10^{-5}$ Tesla and angle of dip $\delta = 60^\circ$.

A. 7.9×10^{-4} volt

B. 6.9×10^{-4} Volt

C. 5.9×10^{-4} Volt

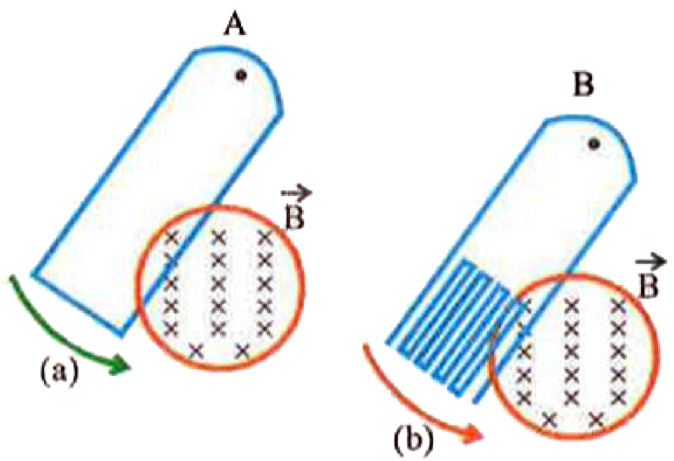
D. 3.9×10^{-4} Volt

Answer: B

Watch Video Solution

Evaluate Yourself 4

1. Two identical solid metal (A &B) plates are oscillating between external magnetic field $\vec{B}$ as shown in figure plate 'B' has slots cutting in it. Which one will stop earlier



A. Plate A

B. Plate B

C. Plate A & B both stop at same time

D. Data is insuffcient

Answer: A

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2. A Conducting ring of radius 1 meter is placed in an uniform magnetic field B of 0.01 tesla oscillating with frequency $100Hz$ with its plane at right angles to B. What will be the induced electric field?

A. $\pi \text{volt} / m$

B. 0.5 V/m

C. 10 V/m

D. 62 V/m

Answer: B

Watch Video Solution

3. In an AC generator, a coil with N turns, all of the same area A and total resistance R, rotates with frequency (ω) in a magnetic field B. The maximum value of emf generated in the coils is

A. NAB

B. NABR

C. $NAB\omega$

D. $NABR\omega$

Answer: C

Watch Video Solution

4. Formation of Eddy currents has desirable effects in

I Electromagnetic damping

II. Transformer

III. Inductothcrmy

A. All are correct

B. Only II is correct

C. I and IiI are correct

D. II and III are correct

Answer: A

View Text Solution

Evaluate Yourself 5

1. A magnetic flux of 9×10^{-4} weber is linked with each turn of a 200 turn coil when there is an electric current of 3 A in it. The self inductance of the coil is

A. 3×10^{-2} H

B. 6×10^{-2} H

C. 4×10^{-2} H

D. 10^{-3} H

Answer: B

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2. A constant current I is maintained in a solenoid. Which of lthe following quantities will increase if an iron rod is inserted in the solenoid along its asix?

A. Magnetic flux linked with the solenoid

B. Self-inductance of the solenoid

C. Magnetic field at the centre

D. All of above

Answer: D

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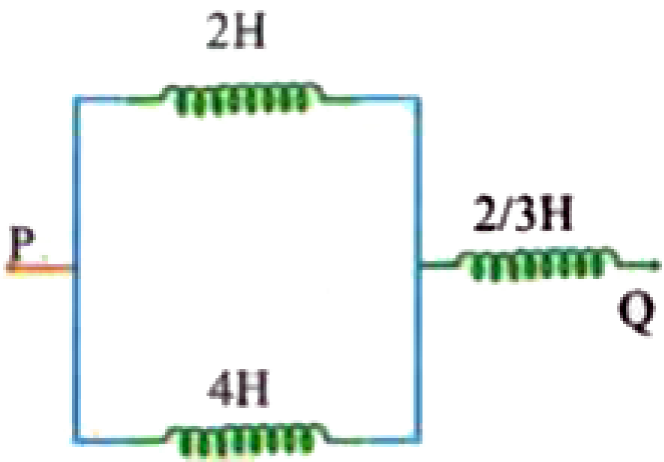
3. The equivalent inductance between points P and Q in figure is



A. 2 H

B. 6 H

C. 8/3 H

D. 4/9 H

Answer: A

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4. The current is a solenoid of 240 turns, having a length of 12 cm and a radius of 2 cm, changes at a rate of $0.8As^{-}$. Find the emf indcued in it.

A. $8 \times 10^{-4}V$

B. $6 \times 10^{-4}V$

C. $3 \times 10^{-4}V$

D. $10^{-4}V$

Answer: B

Watch Video Solution

5. A solenoid of length 20cm, area of cross- section $4.0 cm^2$ and having 4000 turns is placed inside another solenoid of 2000 turns having a cross - sectional area $8.0 cm^2$ and length 10 cm. Find the mutual inductance between the solenoids.

A. 3×10^{-2} H

B. 20 mH

C. 30 mH

D. 40 mH

Answer: B

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6. Induction furnace works on the principle of

A. Self induction

B. Mutual induction

C. Eddy current

D. None of these

Answer: C

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7. Self inductance of a coil is independent of

A. current flowings in the coil

B. emf induced in the coil

C. rate of change of current in the coil

D. All of these

Answer: D

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8. A small circular loop of radius a is placed inside a large square loop of edge $L(>>a)$. The loops are coplanar and concentric. Find mutual inductance.

A. $\frac{r}{R}$

B. $\frac{r^2}{R}$

C. $\frac{r}{R^2}$

D. $\frac{r^2}{R^2}$

Answer: B

Watch Video Solution

Evaluate Yourself 6

1. An a.c. generator consists of a coil of 50 turns and area $2.5m^2$ rotating att an angular speed of $60rads^{-1}$ in a uniform magnetic field B = 0.3 T between two fixed pole pieces. The resistance of the circuit including that of coil is 500Ω. Find (i) the max. current drawn from the generator.

(ii) What will be the orientaiton of the coil w.r.t. the magnetic field to have (a) maximum (b) zero magnetic flux ?

(iii) Would the generator work if the coil were stationary and instead, the pole pieces rotated together with the same speed as above ?

A. $2A$

B. $4A$

C. $4.5A$

D. $3A$

Answer: C

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2. The induced emf of a generator when the flux of poles is doubled and speed is doubled

A. becomes half

B. remains same

C. becomes double

D. becomes 4 time

Answer: D

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3. when the plane of the armature of an a.c. generator is parallel to the field, in which it is rotating,

A. both the flux linked and induced e.m.f in the coil are zero

B. the flux linked with it is zero, while induced e.m.f is maximum

C. flux linked is max. while induced e.m.f is zero

D. both ,the flux and e.m.f have their respective maximum values

Answer: B

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CUQ

1. When ever the flux linked with a coil changes, then

A. Current is always induced

B. an emf and a currect are always induced

C. an emf is induced but a currect is never induced

D. an emf is always induced and a currect is induced, when the coil is a closed one

Answer: D

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2. Whenever the magnet flux linked with a coil changes, then is an induced emf in the circuit. This emf lasts

A. For a short time

B. For a long time

C. For ever

D. So long as the change in the flux takes place

Answer: D

Watch Video Solution

3. A magnet is moved towards a coil (i) quickly (ii) slowly, then the induced e.m.f. is

A. Larger in case (i)

B. Smaller in case(i)

C. Equal in both

D. Larger or smaller dependding upon the radius of the coil

Answer: A

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4. The law of electromagnetic induction have been used in the construction of

A. Galvanometer

B. Voltmeter

C. electric motor

D. electric generator

Answer: D

Watch Video Solution

5. When a rate of change of current in a circuit is unity, the induced emf is equal to

A. Total flux linked with the coil

B. induced charge

C. Number of turns in the circle

D. Coefficient of self induction

Answer: D

Watch Video Solution

6. A bar magnet is dropped along the axis of copper ring held horizontally. The acceleration of fall is

A. Equal to 'g' at the place

B. Less than 'g'

C. More than 'g'

D. Depends upon diameter of the ring and length of the magnet.

Answer: B

Watch Video Solution

7. An annular circular brass disk of inner radius $'r'$ and outer radius $'R'$ is rotating about an axis passing through its centre and perpendicular to its plane with a uniform angular velocity $'\omega'$ in a uniform magnetic filed of induction $'B'$ normal to the plane of the disk. The induced emf between the inner and outer edge of the annular disk is

A. $\dfrac{B\omega(r^2 + R^2)}{2}$

B. $\dfrac{B\omega(R^2 - r^2)}{2}$

C. $\dfrac{B\omega(r - R)}{2}$

D. $\dfrac{B\omega(r + R)}{2}$

Answer: B

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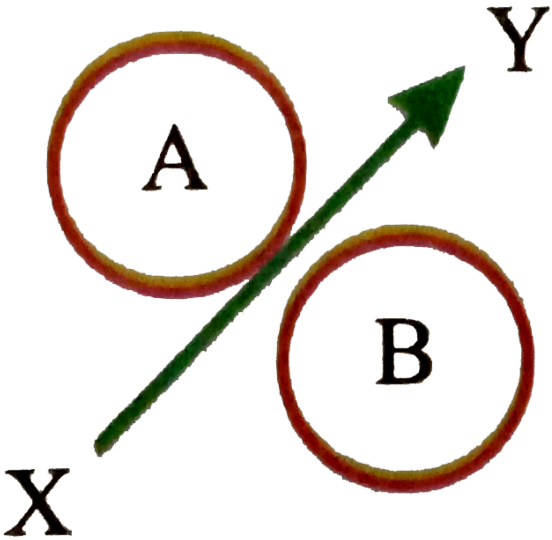
8. Consider the situation shown in the figure. If the current I in the long straight conducting wire XY is increased at a steady rate then the induced $e.m.f.$'s in loop A and B will be



A. Clockwise in A anti clockwise in

B. anticlockwise in A, clockwise in B

C. Clockwise in both A and B

D. anti clockwise in both A and B

Answer: A

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9. The direction of the induced $e.m.f.$ is determined by

A. Fleming's left hand rule

B. Fleming 's right hand rule

C. Maxwell's right hand screw rule

D. Ampere's rule of swimming

Answer: B

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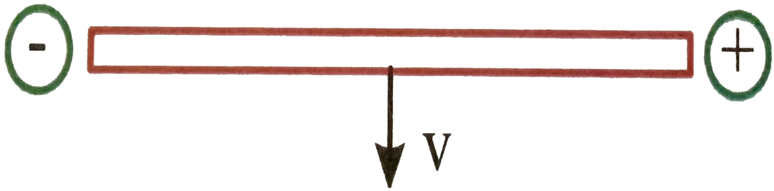
10. A wire moves with a velocity $''v''$ through a magnetic field and experiences an induced charge sepration as shown. Then the direction of the magnetic field is



A. in to the page

B. out of the page

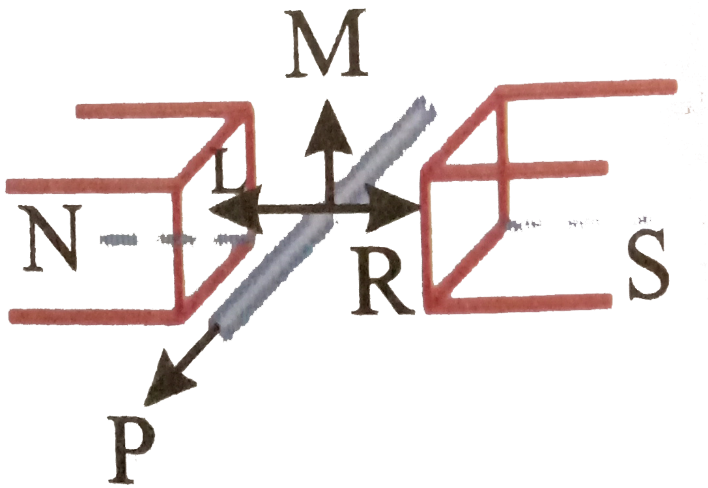
C. towards the bottom of the pageq

D. towards the top of the page

Answer: A

Watch Video Solution

11. An electric potential difference will be induced between the ends of the conductor shown in the figure, if the conductor moves in the direction shown by



A. P

B. R

C. L

D. M

Answer: D

Watch Video Solution

12. A horizontal straight conductor when placed along south-north direction falls under gravity, there is

A. an induced currect form south-to -north direction

B. an induced currect from north-to south direction

C. no induced emf along the length of the conductor

D. an induced emf along the length of the conductor

Answer: C

Watch Video Solution

13. Two circular, similar, coaxial loops carry equal currents in the same direction. If the loops are brought nearer, what will happen?

A. Current will increase in each loop

B. Current will decrease in each loop

C. Current will remain same in each loop

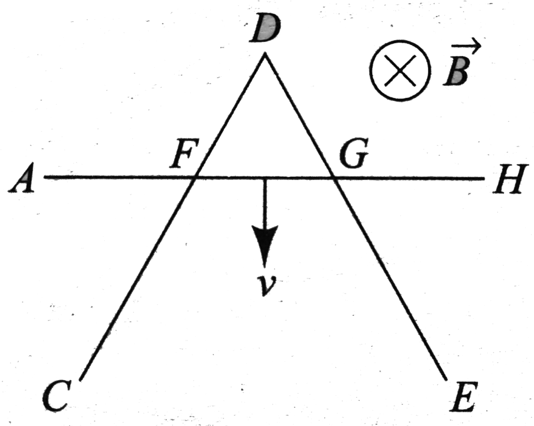
D. Current will increase in one and decrease in the other

Answer: B

Watch Video Solution

14. A long conducting wire AH is moved over a conducting triangular wire CDE with a constant velocity v in a uniform magnetic field $\vec{B}$ directed into the plane of the paper.

Resistance per unit length of each wire is ρ. Then



A. a constant clockwise induced current will flow in the closed loop

B. an increasing anticlockwise induced current will flow in the closed loop

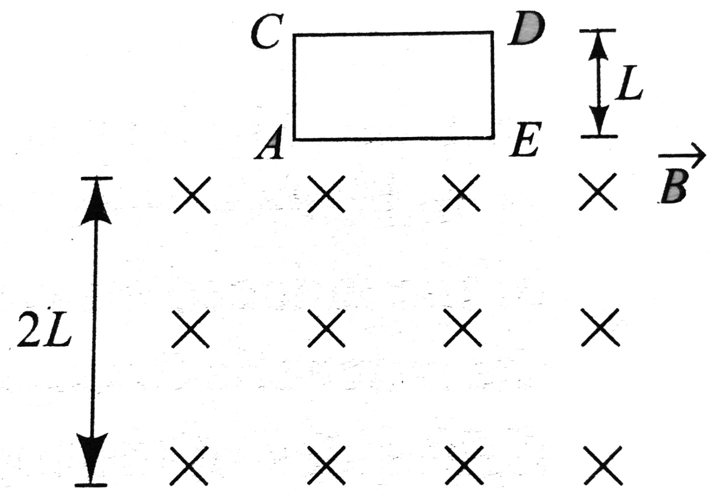
C. a decreasing anticlockwise induced current will flow in the closed loop

D. a constant anticlockwise induced current will flow in the closed loop

Answer: D

Watch Video Solution

15. A square coil $ACDE$ with its plane vertically is released from rest in a horizontal uniform magnetic field $\vec{B}$ of length $2L$. The accelaration of the coilis



A. less than 'g' for all the time till the loop crosses the magnetic field completely

B. less than 'g' when it enters the field and greater than 'g' when it comes out of the field

C. g' all the time

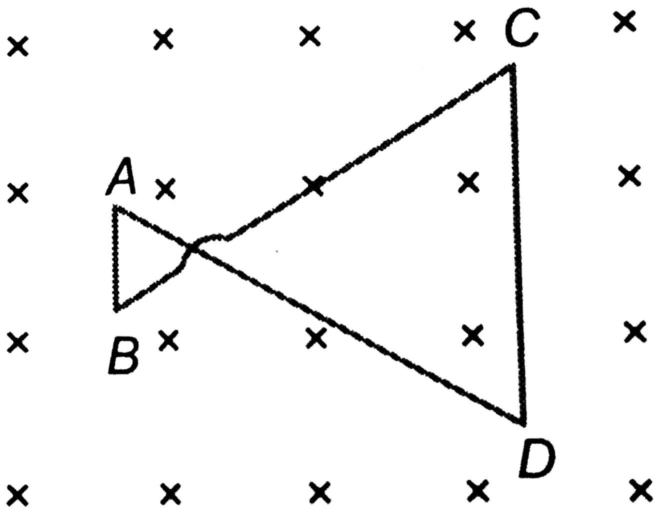
D. less than 'g' when it enters and comes out of the field but equal to 'g' when it is within the field

Answer: D

Watch Video Solution

16. A conducting wire frame is placed in a magnetic field which is directed into the paper. The magnetic field is increasing at a constant rate. The direction of induced current in wire AB and

CD are



A. B to A and D to C

B. A to B and C to D

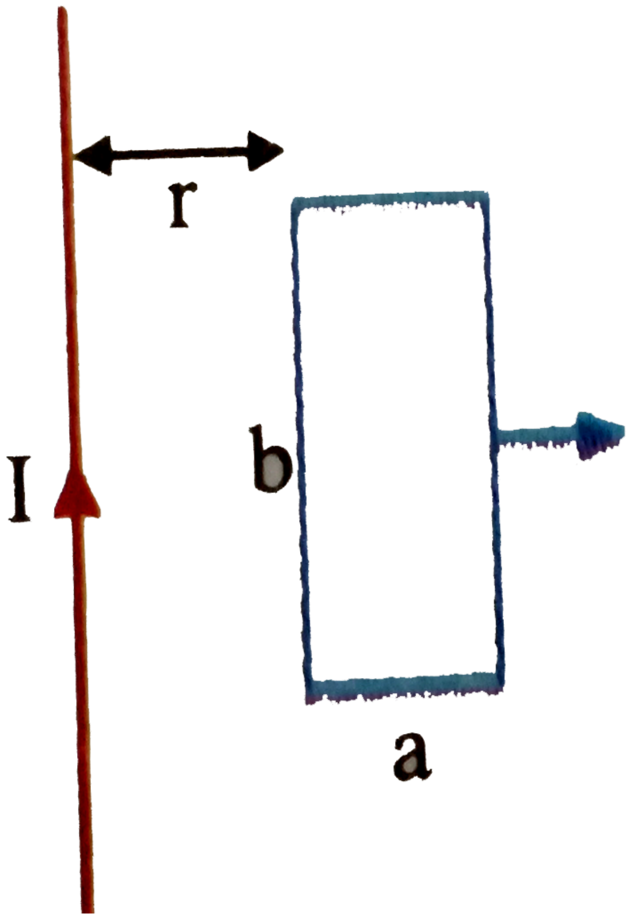
C. A to B and D to C

D. B to A and C to D

Answer: A

Watch Video Solution

17. A rectangular loop of wire with dimensions shown in figure is coplanar with a long wire carrying current $'I'$. The distance between the wire and the left side of the loop is r. The loop is pulled to the right as indicated. What are the directions of the induced current in the loop and the magnetic forces on the left and right sides of the loop when the loop is pulled ?



A.

Induced	Force on left side	Force on right side
Counter clockwise	To the left	To the left

B.

Induced	Force on left side	Force on right side
Counter clockwise	To the right	To the left

C.

Induced	Force on left side	Force on right side
clockwise	To the right	To the left

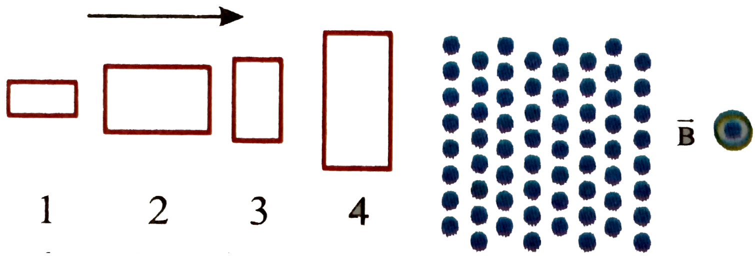
D.

Induced	Force on left side	Force on right side
clockwise	To the left	To the right

Answer: D

Watch Video Solution

18. The four wire loops shown figure have vertical edge lengths of either L, $2L$ or $3L$. They will move with the same speed into a region of uniform magnetic field $\overrightarrow{B}$ directed out of the page. Rank them according to the maximum magnitude of the induced emf greatest to least.



A. 1 and 2 tie, then 3 and 4 tie

B. 3 and 4 tie, then 1 and 2 tie

C. 4,2,3,1

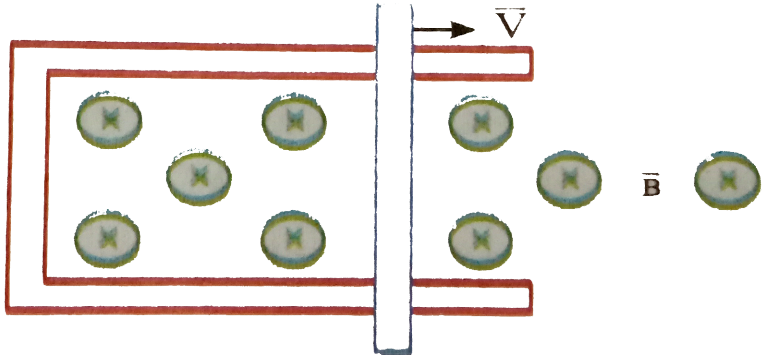
D. 4 then, 2 and 3 tie and then 1

Answer: D

Watch Video Solution

19. A rod lies across frictionless rails in a uniform magnetic field $\vec{B}$ as shown in figure. The rod moves to the right with speed V.

In order to make the induced emf in the circuit to be zero, the magnitude of the magnetic field should



A. not change

B. increase linearly with time

C. decrease linearly with time

D. decrease nonlinearly with time

Answer: D

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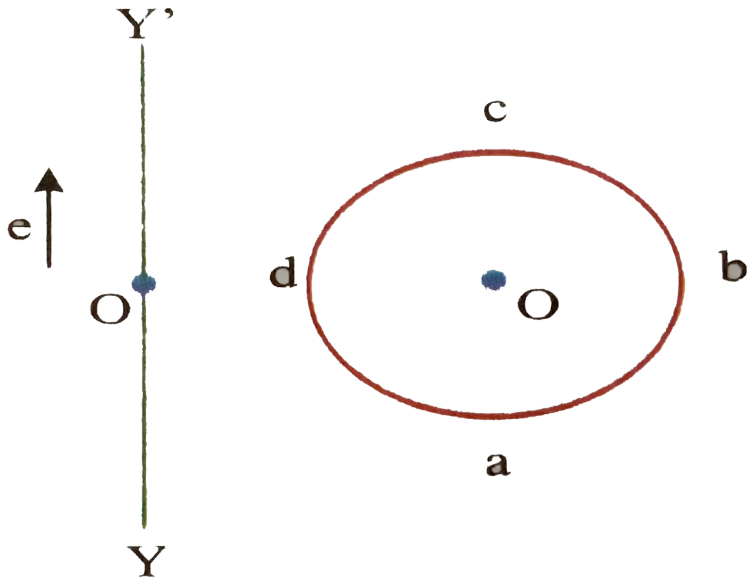
20. An electron moves on a straight line path YY' as shown in figure. A coil is kept on the right such that YY' is the plane of the coil. At the instant when the electron gets closest to the coil (neglect self-induction of the coil)



A. The current in the coil flows clockwise

B. The current in the coil flows anticlockwise

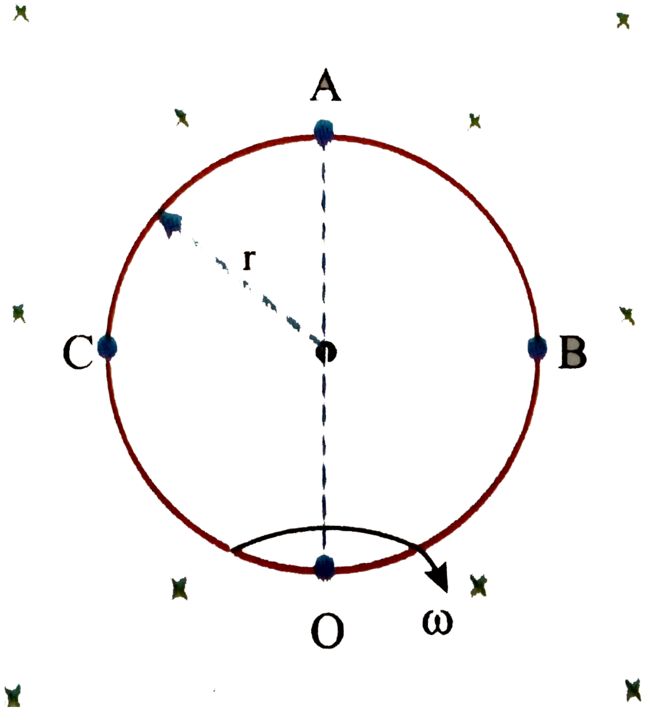
C. The current in the coil is zero

D. The current in the coil does not change the directions as the electron crosses point O

Answer: C

Watch Video Solution

21. In figure, there is conducting ring having resistance R placed in the plane of paper in a uniform magnetic field B_0. If the rings is rotating in the plane of paper 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 O will be at higher potential then A

B. the potential of point B and C will be different

C. the current in the ring will be zero

D. the current in the ring will be $2B_0\omega r^2 / R$

Answer: C

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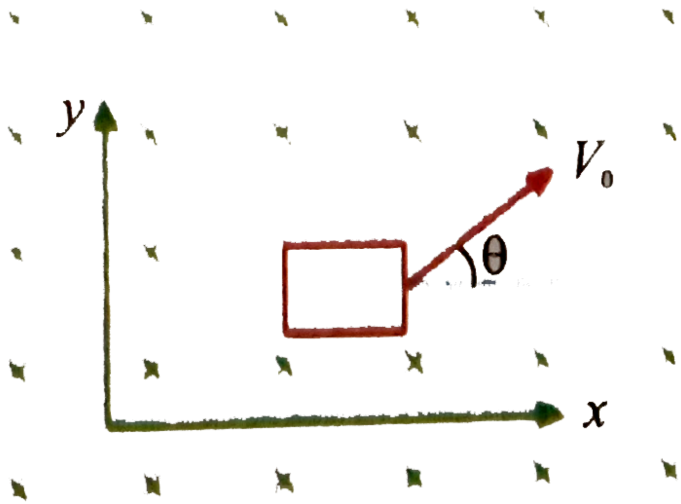
Watch Video Solution

22. In the space shown a non-uniform magnetic field $\vec{B} = B_0(1+x)\left(-\hat{k}\right)$ tesla is present. A closed loop of small resistance, placed in the xy plane is given velocity V_0. The force due to magnetic field on the loop is



A. zero

B. Along+x direction

C. along -x direction

D. along |y direction

Answer: C

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23. Two identical cycle wheels (geometrically have different number of spokes connected from center to rim. One if having 20 spokes and the other having only 10 (the rim and the spokes are resistance less). One resistance of value R is connected between centre and rim. The current in R will be

A. double in the first wheel than in the second wheel

B. four times in the first wheel than in the second wheel

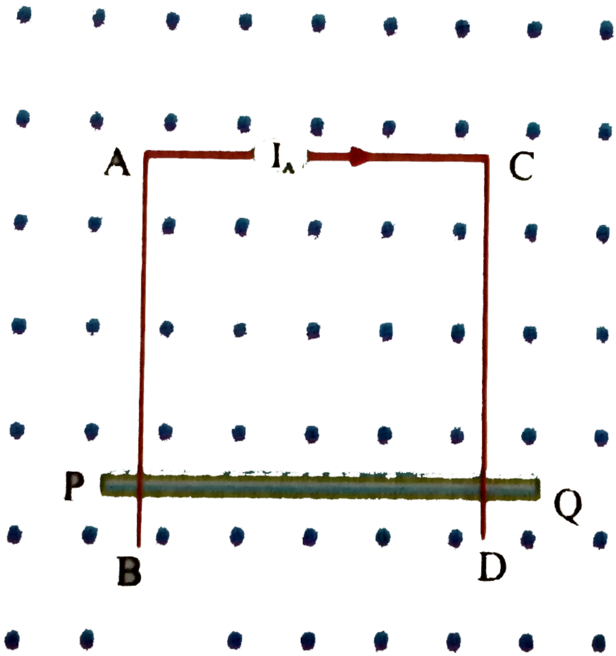
C. will be double in the second wheel than that of the first wheel

D. will be equal in both these wheels

Answer: D

Watch Video Solution

24. AB and CD are fixed conducting smooth rails placed in a vertical plane and joined by a constant current source at its upper end. PQ is a conducting rod which is free to slide on the rails. A horizontal uniform magnetic field exists in space as shown in figure. If the rod PQ is released from rest then,



A. the rod PQ will move downward with constant acceleration

B. the rod PQ will move upward with constant acceleration

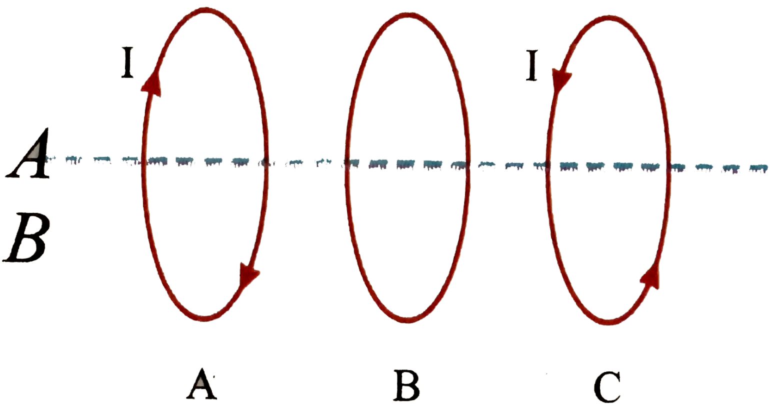
C. the rod will remain at rest

D. any of the above

Answer: D

Watch Video Solution

25. Three identical coils A, B and C carrying currents are placed co-axially with their planes parallel to one another. A and C carry current as shown in figure B is kept fixed while A and C both are moved towards B with the same speed. Initially, B is equally separated from A and C. The direction of the induced current in the coil B is



A. Same as that in coil A

B. Same as that in coil B

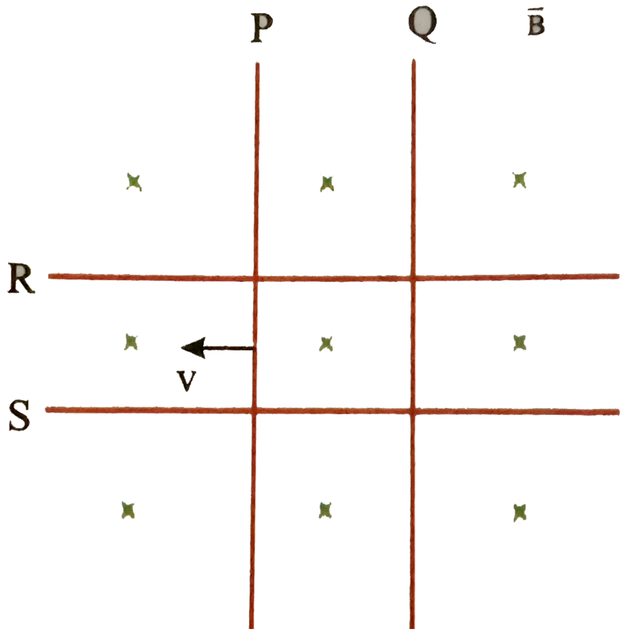
C. zero

D. none of these

Answer: C

Watch Video Solution

26. Two identical conductors P and Q are placed on two friction less rails R and S in a uniform magnetic field directed into the plane. If P is moved in the direction shown in figure with a constant speed, then rod Q



A. will be attracted towards P

B. will be repelled away from P

C. will remain stationary

D. may be repelled away orattracted towards P

Answer: A

Watch Video Solution

27. An inductor may store energy in

A. electric field

B. magnetic field

C. resistance of the coil

D. electric and magentic fields

Answer: B

Watch Video Solution

28. If $'N'$ is the number of turns in a coil, the value of self inductance varies as

A. N^0

B. N

C. N^2

D. N^{-2}

Answer: C

Watch Video Solution

29. A series combination of L and R is connected to a battery of emf E having negligible internal resistance. The final value of current depends upon

A. L and R only

B. E and L only

C. E and R only

D. L,R and E only

Answer: C

Watch Video Solution

30. A circuit contains two inductors of self-inductance L_1 and L_2 in series (Fig) If M is the mutual inductance, then the effective inductance of the circuit shows will be

A. $L_1 + L_2$

B. $\frac{1}{2}(L_1 + L_2)$

C. $(L_1 \pm L_2)$

D. $\sqrt{L_1 L_2}$

Answer: D

Watch Video Solution

31. The coefficient of self inductance and the coefficient of mutual inductance have

A. same units but different dimensions

B. different units but same dimenstions

C. different units and different dimensions

D. same units and same dimensions

Answer: D

Watch Video Solution

32. The mutual inductance between a pair of coils each of $'N'$ turns is $'M'$. If a current is $'I'$ in the first coil is brought to zero in a time t, then the avergae emf induced in the second coil is

A. MI/t

B. Mt/I

C. Mt/IN

D. It/MN

Answer: A

Watch Video Solution

33. A circuit contains two inductors of self-inductance L_1 and L_2 in series (Fig) If M is the mutual inductance, then the effective inductance of the circuit shows will be

A. $L_1 + L_2$

B. $L_1 + L_2 - 2M$

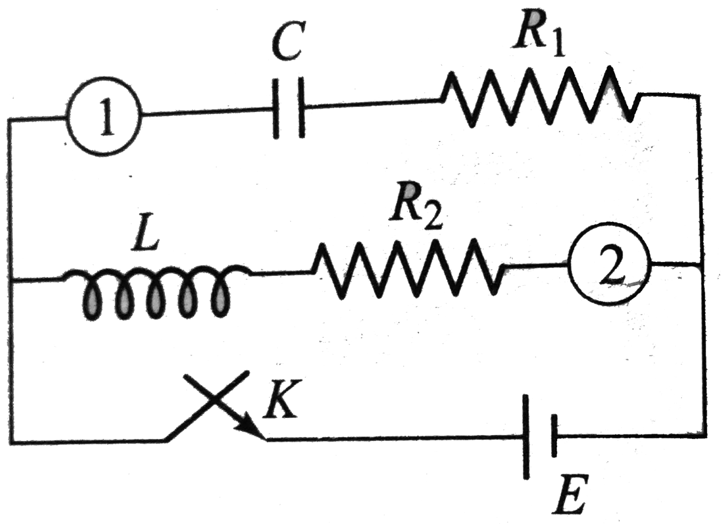
C. $L_1 + L_2 + M$

D. $L_1 + L_2 + 2M$

Answer: D

Watch Video Solution

34. In the circuit of Fig. (1) and (2) are ammeters. Just after the key K is pressed to complete the circuit, the reading is



A. maximum in both (1) and (2)

B. zero in both (1) and (2)

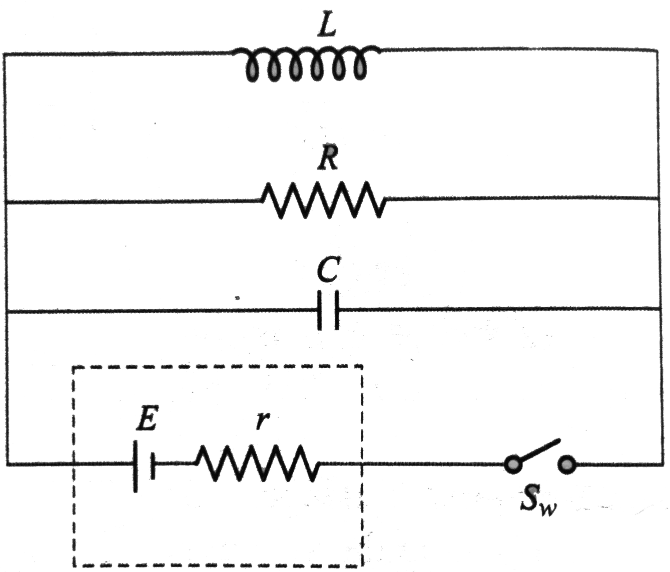
C. zero in (1) minimum in (2)

D. maximum in (1) ,zero in (2)

Answer: D

Watch Video Solution

35. A pure inductor L, a capactior C and a resistance R are connected across a battery of emf E and internal resistance r as shows in Fig. Switch S_W is closed at $t = 0$, select the correct altermative (S).



A. current through resistance R is zero all the time

B. current through resistance R is zero at t=0 and $t \rightarrow \infty$

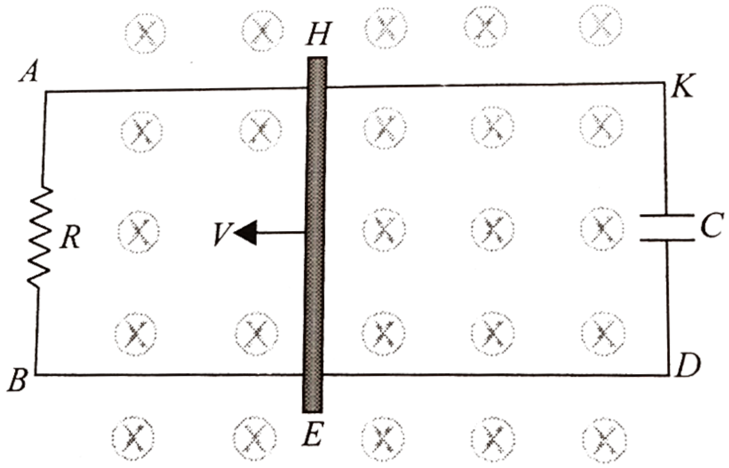
C. maximum charge stored in the capacitor is CE

D. maximum energy stored in the inductor is equal to the maximum energy stored in the capacitor

Answer: B

Watch Video Solution

36. In the circuit shown in Fig. A conducting wire HE is moved with a constant speed v towards left. The complete circuit is placed in a uniform magnetic field $\vec{B}$ perpendicular to the plane of circuit inwards. The current in HKDE is



A. clockwise

B. anticlockwise

C. alternating

D. zero

Answer: D

Watch Video Solution

37. In which of the following cases the emf is induced due to time varying magnetic feld (induced field emf)? Case I A magnet is moving along the axis of a conducting coil

Case II A loop having varying area (due to moving jumper) is placed in a magnetic field

case III The resistance of the coil is changing, which is connected to an ideal battery. case IV a current carrying wire is approaching a conducting ring.

A. I,II and III only

B. I,III and IV only

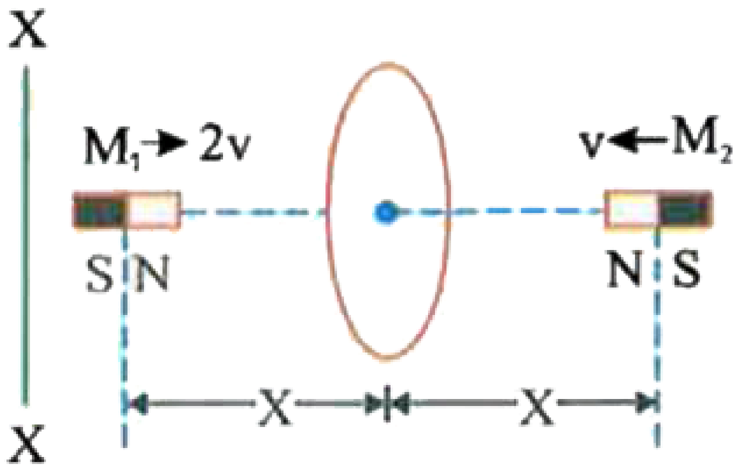
C. I,II and IV only

D. All the four

Answer: B

Watch Video Solution

38. A closed conducting ring is placed in between two bar magnets as shown in the figure. The pole strength of M_1 is double that of M_2 . When the two bar magnets are at same distance from the centre of the ring, the bar magnet M_1 has given a velocity 2v while M_2 is given velocity v in the direction as shown in the figure.



The direction of induced current in the ring as seen from XX from this moment to the moment till bar magnets collide is

A. always clockwise

B. always anticlockwise

C. first clockwise , and then anticlockwise

D. first anti-clockwise, and then clockwise

Answer: B

Watch Video Solution

39. Two identical circular loops of metal wire are lying on a table without touching each other. Loop A carries a current which increases with time. In response, the loop B

A. remains stationary

B. is attracted by the loop A

C. is repelled by the loop A

D. rotates about its CM,with CM fixed

Answer: C

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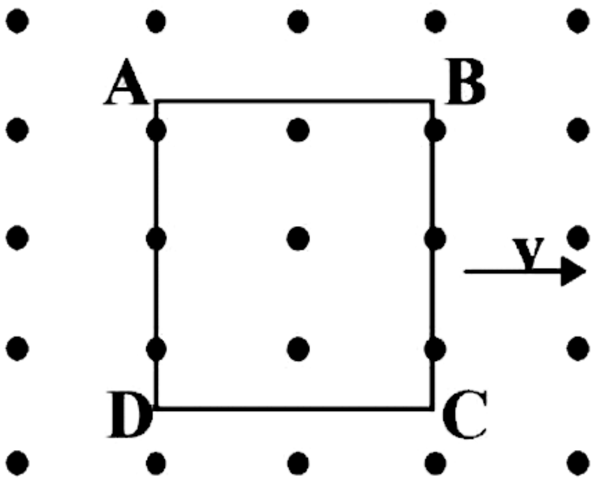
40. A metallic square loop ABCD is moving in its own plane with velocity v in a uniform magnetic field perpendicular to its plane as shown in the figure. An electric field is induced



A. in AD,but not in BC

B. in BC , but not in AD

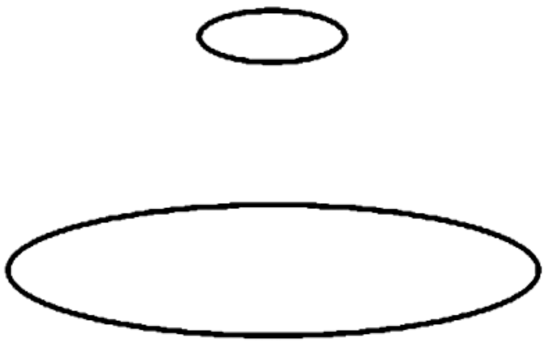
C. neither in AD nor in BC

D. in both AD and BC

Answer: D

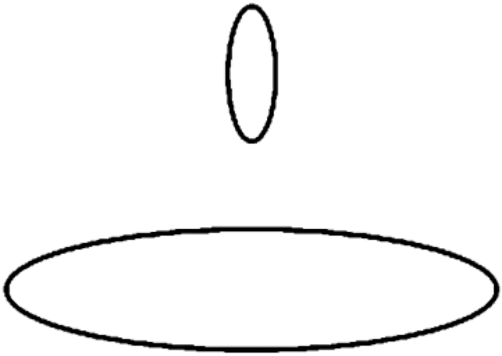
Watch Video Solution

41. Two circular coils can be arranged in any of the three situation shown in the figure. Their mutual inductance will be



(a)

,



(b)

,

(c)

A. maximum in situation(A)

B. maximum in situation (B)

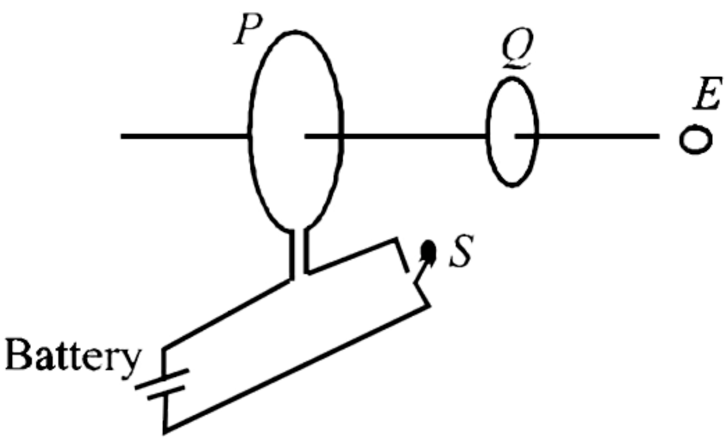
C. maximum in situation (C)

D. the same in all situations

Answer: A

Watch Video Solution

42. As shown in the figure, P and Q are two coaxial conducting loops separated by some distance. When the switch S is closed, a clockwise current I_P (as seen by E) and an induced current I_{Q1} flows in Q. The switch remains closed for a long time. when S is opened, a current I_{Q2} flows in Q. Then the direction IQ_1 and IQ_2 (as seen by E) are



A. respectively clockwise and anticlockwise

B. both clockwise

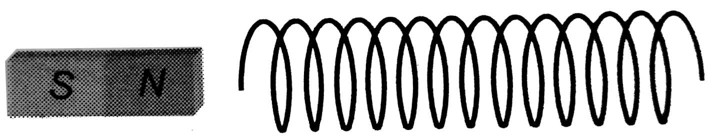
C. both anticlockwise

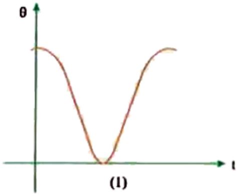
D. respectively anticlockwise and clockwise

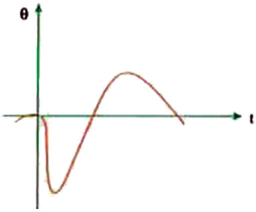
Answer: D

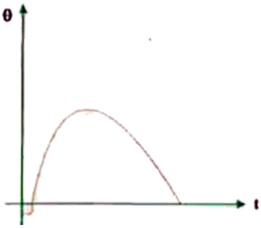
Watch Video Solution

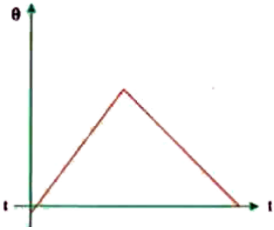
43. The variation of induced emf (E) with time (t) in a coil if a short bar magnet is moved along its axis with a constant velocity is best represent as



A. 

B. 

C. 

D. 

Answer: B

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44. An infinitely long cylinder is kept parallel to an uniform magnetic field B directed along positive z-axis. The direction of induced current as seen from the z-axis will be

A. clockwise of the +ve z-axis

B. anticlockwise of the +ve z-axis

C. zero

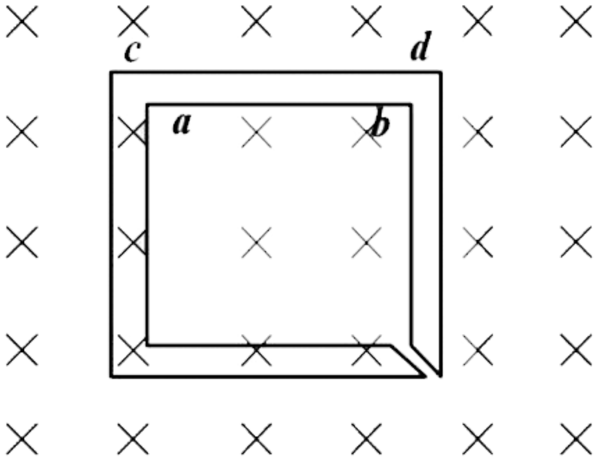
D. along the magnetic field

Answer: C

Watch Video Solution

45. The figure shows certain wire segments joined together to form a coplaner loop. The loop is placed in a perpendicular magnetic field in the direction going into the plane of the figure.

The magnitude of the field increases with time I_1 and I_2 are the currents in the segments ab and cd. Then,



A. $I_1 > I_2$

B. $I_1 < I_2$

C. I is in the direction ba and I_2 is in the direction cd

D. I_1 is in the direction ab and I_2 is in the direction dc

Answer: D

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46. A coil is suspended in a uniform magnetic field, with the plane of the coil parallel to the magnetic lines of force. When a current is passed through the coil it starts oscillating, It is very difficult to stop. But if an aluminium plate is placed near to the coil, it stops. This is due to :

A. development of air current when the plate is placed

B. induction of electrical charge on the plate

C. shileding of magnetic lines of force as aluminium is a paramagnetic material

D. electromagnetic induction in the aluminimum plate giving rise to electromagnetic damping

Answer: D

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47. Which of the following units denotes the electrical inductance ?

A. Wb/m^2

B. henry (H)

C. H/m^2

D. weber (Wb)

Answer: B

Watch Video Solution

48. A rod of length l rotates with a small but uniform angular velocity ω about its perpendicular bisector. A uniform magnetic field B exists parallel to the axis of rotation. The potential difference between the centre of the rod and an end is

A. zero

B. $1/8\omega Bl^2$

C. $1/2\omega Bl^2$

D. $B\omega l^2$

Answer: B

Watch Video Solution

49. A rod of length l rotates with a uniform angular velocity omega about its perpendicular bisector. A uniform magnetic field B exists parallel to the axis of rotation. The potential difference between the two ends of the lrod is

A. zero

B. $1/2Bl\omega^2$

C. $Bl\omega^2$

D. $2Bl\omega^2$

Answer: A

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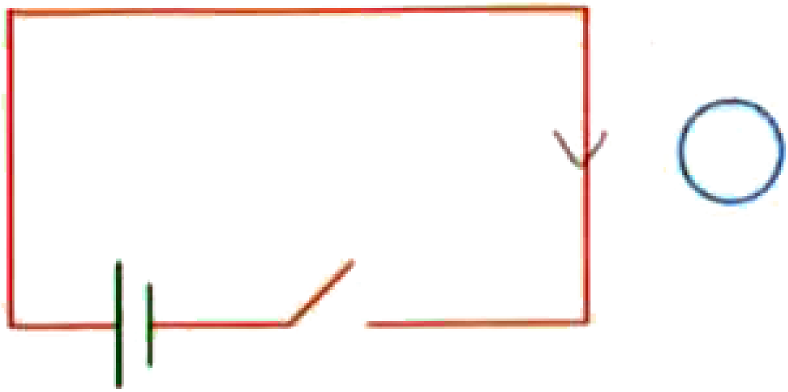
50. Consider the situation shown in figure. If the switch is closed and after some time it is opened again, the closed loop will show



A. an anticlockwise current-pulse

B. a clockwise current -pulse

C. an anticlockwise current -pulse and then a clockwise current -pulse

D. a clockwise current-pulse and then an anticlockwise current -pulse

Answer: D

Watch Video Solution

51. A bar magnet is released from rest along the axis of a very long, vertical copper tube. After some time the magnet.

A. will stop in the tube

B. will move with almost constant speed

C. will move with an acceleration g

D. will oscillate

Answer: B

Watch Video Solution

Exercise 1 C W

1. A coil of 100 turns, $5cm^2$ area is placed in external magnetic field of 0.2 Tesla (S.I) in such a way that plane of the coil makes an angle 30° with the field direction. Calculate magnetic flux of the coil (in weber)

A. 5×10^{-3}

B. 4×10^{-3}

C. 1.2×10^{-3}

D. 3×10^{-3}

Answer: A

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2. The magnetic field perpendicular to the plane of a loop of area $0.1m^2$ is 0.2 T . Calculate the magnetic flux through the loop (in weber)

A. 0.01

B. 0.02

C. 0.03

D. 0.04

Answer: B

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3. The magnetic field in a certain region is given by $\vec{B} = \left(4\hat{i} - \hat{k}\right)$ tesla. How much magnetic flux passes through the loop of area 100.0cm2 lies flat in xy plane ?

A. -0.01

B. -0.02

C. -0.03

D. -0.04

Answer: A

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4. A coil and a magnet moves with their constant speeds 10 m/sec and 5 m/sec respectively, towards each other, then induced emf in coil is 12mV. If both are move in same direction , then induced emf in coil

A. 15 mV

B. 4 mV

C. 64 mV

D. zero

Answer: B

Watch Video Solution

5. The radius of a circular coil having 100 turns is 2 cm. its plane is normal to the magnetic field.

The magnetic field changes from 4T to 8T in 3.14 sec. The induced emf in coil will be

A. 0.08 V

B. 0.04 V

C. 0.16V

D. 0.12 V

Answer: B

Watch Video Solution

6. A short magnet is allowed to fall along the axis of a horizontal metalic ring. Starting from rest, the distance fallen by the magnet in one second may be

A. $4.0m$

B. $5.0m$

C. $6.0m$

D. $7.0m$

Answer: A

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7. Magnetic flux in a circuite containing a coil of resistance 2Ω change from $2.0Wb$ to $10Wb$ in 0.2sec. The charge passed

through the coil in this time is

A. $5.0C$

B. $4.0C$

C. $1.0C$

D. $0.8C$

Answer: B

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8. A coil of self inductance 2H carries a 2A current If direction of current is reversed in 1 sec., then induced emf in it :-

A. $-8V$

B. $8V$

C. $-4V$

D. zero

Answer: B

Watch Video Solution

9. In an inductor of self-inductance L=2 mH, current changes with time according to relation $i = t^2 e^{-t}$. At what time emf is zero ?

A. 2 sec

B. 1 sec

C. 4 sec

D. 3 sec

Answer: A

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10. A Conducting ring of radius 1 meter is placed in an uniform magnetic field B of 0.01 tesla oscillating with frequency $100 Hz$ with its plane at right angles to B. What will be the induced electric field?

A. 1 volts/m

B. 2 volts/m

C. 10 volts/m

D. 62 volts/m

Answer: B

Watch Video Solution

11. when the wire loop is rotated in the magnetic field between the poles of a magnet the direction of emf changes once in every

A. 1 revolution

B. 2 revolution

C. 1/4 revolution

D. 1/2 revolution

Answer: D

Watch Video Solution

12. An inductor of 2 henry and a resistance of 10 ohms are connected in series with a battery of 5 volts. The initial rate of change of current is

A. $0.5As^{-1}$

B. $2.0As^{-1}$

C. $2.5As^{-1}$

D. $0.25As^{-1}$

Answer: C

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13. A solenoid is 1.5 m long and its inner diameter is 4.0 cm . It has three layers of windings of 1000 turns each and carries a current of 2.0 amperes. The magnetic flux for a cross-section of the solenoid is nearly

A. 4.1×10^{-5}weber

B. 5.2×10^{-5} weber

C. 6.31×10^{-3} weber

D. 2.5×10^{-7} weber

Answer: C

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14. The current in ampere in an inductor is given by I=5 +16 t where t is in s. The self induced e.m.f in it is 10mv. The self inductance is

A. 5.55×10^{-5} H

B. 6.25×10^{-4} H

C. 5.26×10^{-6} H

D. 7.5×10^{-7} H

Answer: B

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15. The magnetic flux linked with a coil, in webers is given by the equation $\phi = 3t^2 + 4t + 9$. Then, the magnitude of induced emf at t = 2 s

A. 2 V

B. 4 V

C. 8V

D. 16 V

Answer: D

Watch Video Solution

16. In a magnetic field of $0.05T$, area of a coil changes from $101cm^2$ to $100cm^2$ without changing the resistance which is 2Ω. The amount of charge that flow during this period is

A. 2.5×10^{-6}C

B. 2×10^{-6} C

C. 10^{-6} C

D. 8×10^{-8} C

Answer: A

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17. The magnetic flux ϕ (in weber) in a closed circuit of resistance 10Ω varies with time t (in secnod) according to equation $\phi = 6t^2 - 5t + 1$. The magnitude of induced current at $t = 0.25$ s is

A. 1.2 A

B. 0.8 A

C. 0.6 A

D. 0.2 A

Answer: D

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18. A field of strenght $5 \times 10^4 / \pi$ ampere turns / meter acts at right angles to the coil of 50 turns of area$10^{-2} m^2$. The coil is removed from the field in 0.1 second. Then the induced $e. m. f$ in the coil is

A. 0.1 V

B. 0.2 V

C. 1.96 V

D. 0.98V

Answer: A

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19. A coil has $1,000$ turns and $500cm^2$ as its area. The plane of the coil is placed at right angles to a magnetic induction field of $2 \times 10^{-5} web/m^2$. The coil is rotated through 180° in 0.2 second. The average emf induced in the coil, in milli volts, is :

A. 5

B. 10

C. 15

D. 20

Answer: B

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20. A square loop of side $22cm$ is changed to a circle in time $0.4 \sec$ with its plane normal to a magnetic field $0.2T$. The emf induced is

A. $+6.6mv$

B. $-6.6mv$

C. $+13.2mv$

D. $-13.2mv$

Answer: B

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21. a coil of 1200 turns and mean area of $500cm^2$ is held perpendicular to a uniform magnetic field of induction $4 \times 10^{-4}T$. The resistance of the coil is 20 ohms. When the coil is rotated through 180° in the magnetic field in 0.1 seconds the average electric current (in mA) induced is :

A. 12

B. 24

C. 36

D. 48

Answer: B

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22. A closed coil with a resistance R is placed in a magnetic field. The flux linked with the coil is ϕ. If the magnetic field is suddenly reversed in direction, the charge that flows through the coil will be

A. $\phi / 2R$

B. ϕ / R

C. $2\phi / R$

D. zero

Answer: C

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23. A train is moving towards north with a speed of 180 kilometre per hour. If the vertical comonent of the earth's magnetic field is 0.2×10^{-4} T, the emf induced in the axle 1.5 m longs is -

A. 5.4 mV

B. 54 mV

C. 15 mV

D. 1.5 mV

Answer: D

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24. A wheel with a certain number of spokes is rotated in plane normal to earth's magnetic field so the an e.m.f. is induced between the axle and rim of the wheel. Keeping all other things same, number of spokes is changed. How is the e.m.f. affected ?

A. 3 e

B. $\frac{3}{2}e$

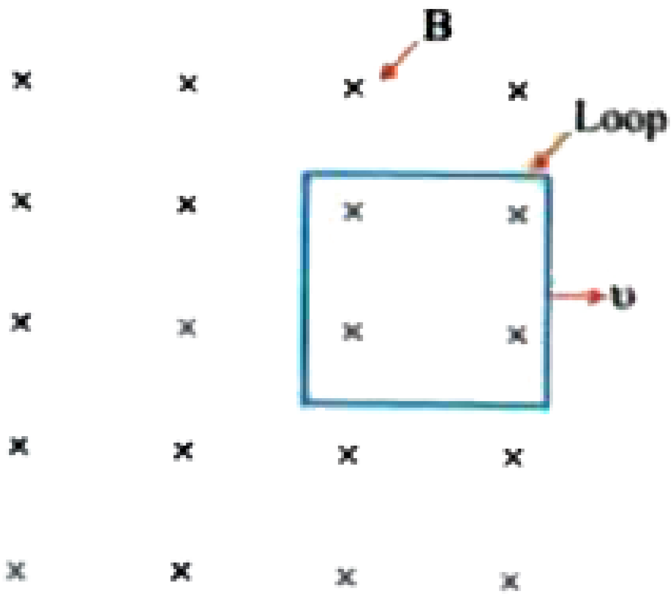
C. e/3

D. e

Answer: D

Watch Video Solution

25. A square loop is placed in a uniform magnetic field $\vec{B}$ as shown in fig. The power needed to pull it out of the field with a velocity v is proportional to



A. $v^{1/2}$

B. v

C. v^2

D. $v^{3/2}$

Answer: C

Watch Video Solution

26. A metal conductor of length 1m rotates vertically about one of its ends at angular velocity 5 radians per second. If the horizontal component of earth's magnetic field is $0.2 \times 10^{-4} T$, then the emf developed between the two ends of hte conductor is

A. $5 \mu V$

B. $50 \mu V$

C. 5 mV

D. 50 mV

Answer: B

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27. An air plane , with 20 m wingspread is flying at $250ms^{-1}$ parallel to the earth's surface at a place whre the horizontal component of earth's magnetic field is 2×10^{-5} T and angle of dip is 60°. The magnitude of the induced emf between the tips of the wings is

A. $\frac{1}{10}V$

B. $\frac{\sqrt{2}}{10}V$

C. $\frac{\sqrt{3}}{10}V$

D. $\frac{1}{5}V$

Answer: C

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28. An aeroplane, in which the distance between the tips of thie wings is 50m, is flying horizontally with a speed of $360km / hour$, over a place where the vertical component of earth's magnetic field is 2.0×10^{-4} tesla. The potential difference between the tips of the wings would be

A. 0.1 V

B. $1.0V$

C. $0.2V$

D. $0.01V$

Answer: B

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29. The horizontal component of the earth's magnetic field at a place is $3 \times 10^{-4} T$ and the dip is $\tan^{-1}\left(\frac{4}{3}\right)$. A metal rod of length $0.25m$ placed in the north -south position and is moved at a constant speed of $10cm/s$ towards the east. The emf induced in the rod will be

A. zero

B. 1 mV

C. 5 mV

D. 10 mV

Answer: B

Watch Video Solution

30. A metal bar of length $1m$ falls from rest under the action of gravity remaining horizontal with its ends in east-west direction. The induced $e. m. f$ in it at the instant when it fallen for $10s$ is $\left(B_H = 1.7 \times 10^{-5} T \text{ and } g = 10ms^{-2}\right)$

A. 2.5 mV

B. 3.2 mV

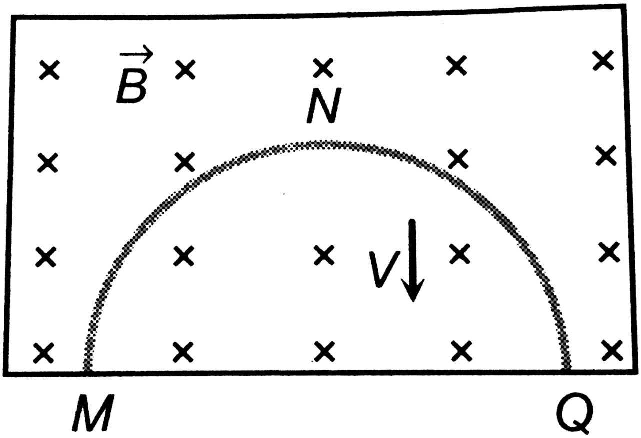
C. 1.7 mV

D. 0.5 mV

Answer: C

Watch Video Solution

31. A thin semicircular conducting ring of radius R is falling with its plane verticle in a horizontal magnetic inducting B. At the position MNQ, the speed of the ring is V and the potential difference developed across the ring is



A. zero

B. $BV\pi\frac{R^2}{V}$ and M is at higher potential

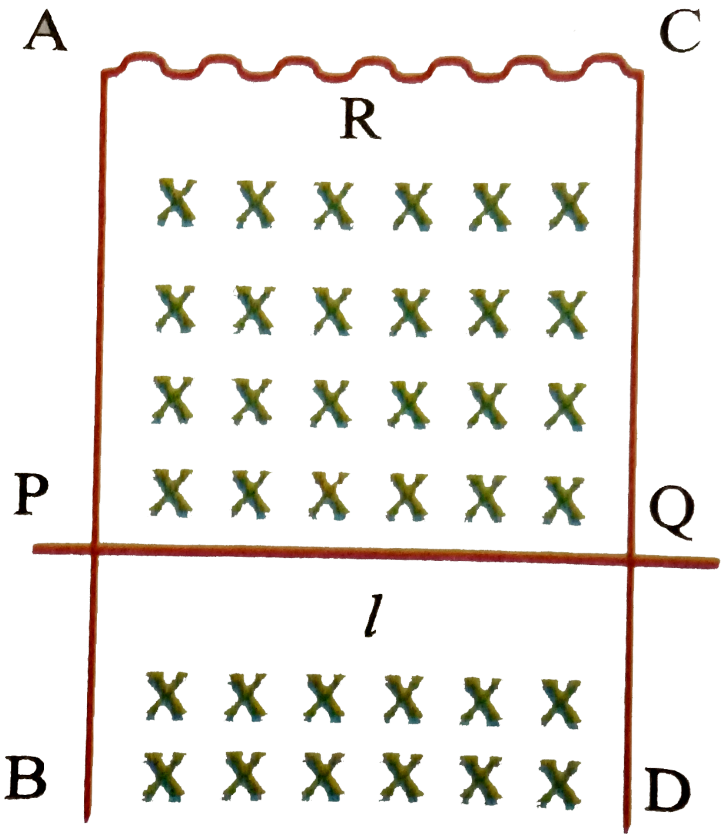
C. πRBV and Q is at higher potential

D. 2RBV and Q is at higher potential

Answer: D

Watch Video Solution

32. Two thick rods AB, CD are placed parallel to each other at a distance l. their ends are joined to a resistance R. A magnetic field of induction B is applied perpendicular to the plane contaning the rods. If the rods are vertical, the terminal uniform velocity of the rod PQ of mass m is given by



A. $\frac{mg.\ R}{B^2 l^2}$

B. $\frac{mg.\ R}{Bl}$

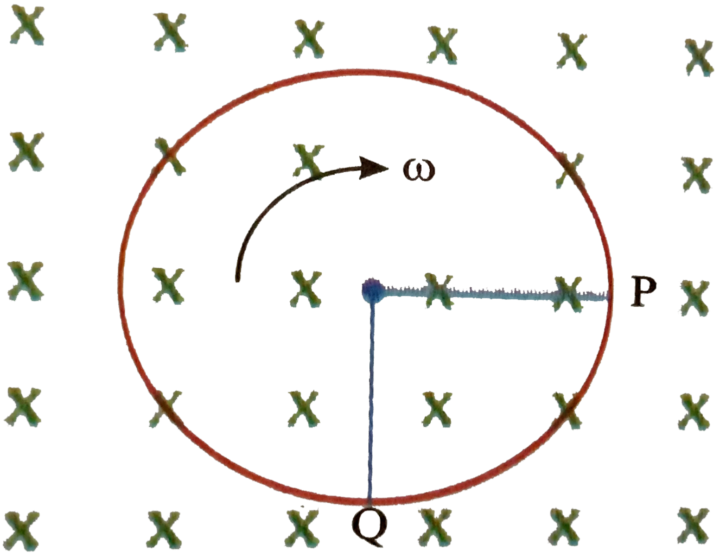
C. $\frac{mg}{BlR}$

D. $\frac{mgl}{BR}$

Answer: A

Watch Video Solution

33. A conducting ring of radius $'r'$ is rolling without slipping with a constant angular velocity ω (figure). If the magnetic field strengh is B and is directed into the page the emf induced across PQ is



A. $B\omega r^2$

B. $\dfrac{B\omega r^2}{2}$

C. $3B\omega r^2$

D. $\dfrac{\pi^2 r^2 B\omega}{8}$

Answer: A

Watch Video Solution

34. A cycle wheel with 64 spokes is rotating with N rotations per second at right angles to horizontal component of magnetic field. The induced $e.\,m.\,f$ generated between its axle and rim is E. If the number of spokes is reduced to 32 then the value of induced e.m.f. will be

A. E

B. 2E

C. E/2

D. E/4

Answer: A

Watch Video Solution

35. A uniform circular metal disc of radius R is rotating about a vertical axis passing through its centre and perpendicular to its plane with constant frequency f. If B_H and B_V are horizontal and vertical components of the Earth's magnetic field respectively, then the induced e.m.f between its centre and the rim is

A. $\pi B_v f R^2$

B. $\pi B_H f R^2$

C. $2\pi B_v f R^2$

D. zero

Answer: A

Watch Video Solution

36. a copper disc of diameter $20cm$ makes 1200 r.p.m. about its natural axis kept parallel to a uniform magnetic field of $10^{-2}T$. The potential difference between the centre and edge of the disc is

A. 6.28×10^{-3}V

B. 62.8×10^{-3} V

C. 0.628×10^{-3} V

D. $0.628V$

Answer: A

Watch Video Solution

37. In an AC generator, a coil with N turns, all of the same area A and total resistance R, rotates with frequency (ω) in a magnetic field B. The maximum value of emf generated in the coils is

A. $NABR\omega$

B. NAB

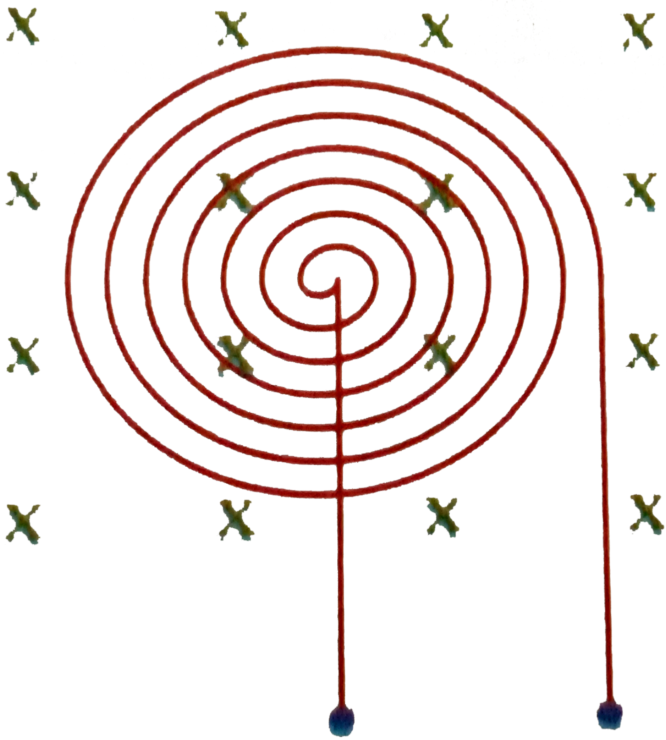
C. $NABR$

D. $NAB\omega$

Answer: D

Watch Video Solution

38. A flat circular coil having N turns (tightly wound D) is placed in a time varying magnetic field $B = B_0 \sin \omega t$. The outer radius of the coil is R. Determine the maximum value of the induced emf in the circuit.



A. $\pi R^2 N B_0 \omega$

B. $3\pi R^2 N B_0 \omega$

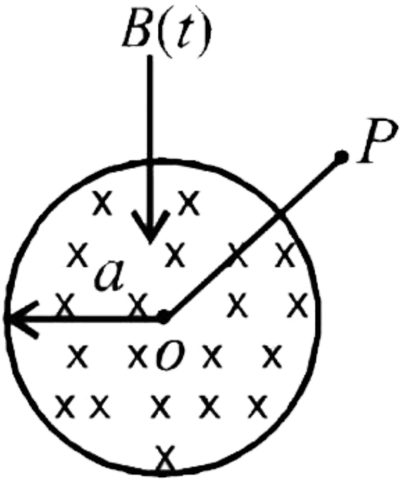
C. $\frac{\pi R^2 N B_0}{\omega}$

D. $\frac{\pi R^2 N B_0 \omega}{3}$

Answer: D

Watch Video Solution

39. A uniform but time-varying magnetic field B(t) exists in a circular region of radius a and is directed into the plane of the paper, as shown. The magnitude of the induced electric field at point P at a distance r from the centre of the circular region



A. is zero

B. decreases as 1/r

C. increases as r

D. decreases $1/r^2$

Answer: B

Watch Video Solution

40. A solenoid have self inductance 2H. If length of the solenoid is double having turn density and area constant then new self inductance is :-

A. 4H

B. 1H

C. 8H

D. 0.5 H

Answer: A

Watch Video Solution

41. A solenoid is wound over a rectangular frame. If all the linear dimensions of the frame are increased by a factor 3 and the number of turns per unit length remains the same, the self inductance increased by a factor of:

A. 3

B. 9

C. 27

D. 63

Answer: D

42. Two coils A and B having turns 300 and 600 respectively are placed near each other, on passing a current of 3.0 ampere in A, the flux linked with A is 1.2×10^{-4} and with B it is 9.0×10^{-5} weber. The mutual inuctance of the system is

A. $2 \times 10^{-5} H$

B. $3 \times 10^{-5} H$

C. $4 \times 10^{-5} H$

D. $6 \times 10^{-5} H$

Answer: B

Watch Video Solution

43. The number of turns of primary and secondary coils of a transformer are 5 and 10 respectively and the mutual inductance of the tranformar is 25 henry. Now the number of turns in the primary and secondary of the transformar are made 10 and 5 respectivaly. The mutual inductance of the transformar in henry will be

A. 6.25 H

B. 12.5 H

C. 25 H

D. 50 H

Answer: C

Watch Video Solution

44. Two conducting circular loops of radii R_1 and R_2 are placed in the same plane with their centres coincidingt. Find the mutual inductane between them assuming $R_2 < \; < R_1$.

A. R_1 / R_2

B. R_2 / R_1

C. R_1^2 / R_2^2

D. R_2^2 / R_1

Answer: D

Watch Video Solution

45. If the length and area of cross-section of an inductor remain same but the number of turns is doubled, its self-inductance will become-

A. Half

B. Doubled

C. 1/4 times

D. Quadruped

Answer: D

Watch Video Solution

46. Two inductors each of inductance L are joined in parallel. Their equivalent inductance is

A. zero

B. 2L

C. L/2

D. L

Answer: C

Watch Video Solution

47. An air-cored coil has a self-inductance of 0.1 H. A soft iron core of relative permeability 1000 and value of turns becomes 1/10th of initial. The value of self-inductance now becomes

A. 0.1 H

B. 10 mH

C. 1 H

D. 1 mH

Answer: C

Watch Video Solution

48. A solenoid is 1.5 m long and its inner diameter is 4.0 cm . It has three layers of windings of 1000 turns each and carries a current of 2.0 amperes. The magnetic flux for a cross-section of the solenoid is nearly

A. 4.1×10^{-5}weber

B. 5.2×10^{-5} weber

C. 6.31×10^{-3} weber

D. 2.5×10^{-7} weber

Answer: C

Watch Video Solution

49. A coil of wire of a certain radius has 600 turns and a self-inductance of $108mH$. The self-inductance of a 2^{nd} similar coil of

500 turns will be

A. 74 mH

B. 75 mH

C. 76 mH

D. 77mH

Answer: B

Watch Video Solution

50. Two coils are at fixed location: When coil 1 has no corrent and the current in coil 2 increase at the rate of $15.0 A s^{-1}$, the emf in coil 1 is $25 mV$, when coil 2 has no current and coil 1 has a current of $3.6 A$, the flux linkange in coil 2 is

A. 16 mWb

B. 10 mWb

C. 4.00 mWb

D. 6.00 mWb

Answer: D

Watch Video Solution

51. If a current of 10 A changes in one second throught a coil, and the induced emf is 20 V, then the self-inductance of the coil is

A. $\frac{2}{5}H$

B. $\frac{4}{5}$H

C. $\frac{5}{4}H$

D. 1H

Answer: D

Watch Video Solution

52. A coil of 100 turns carries a current of $5mA$ and creates a magnetic flux of 10^{-5}weber. The inductance is

A. 0.2 mH

B. 2.0 mH

C. 0.02 mH

D. none of these

Answer: C

Watch Video Solution

53. A solenoid of lenght 30 cm with 10 turns per centimetre and area of cross-section $40cm^2$ completely surrounds another co-axial solenoid of same length, area of cross-section $20cm^2$ with 40 turns per centimetre. The mutual inductance of the system is

A. 10 H

B. 3 mH

C. 30 mH

D. $30\mu H$

Answer: B

Watch Video Solution

54. A coil has self inductance of $0.01H$. The current through it is allowed to change at the rate of $1A$ in $10^{-2}s$. The induced emf is

A. 1V

B. 2 V

C. 3 V

D. 4 V

Answer: A

Watch Video Solution

55. The average self-induced emf in a $25mH$ solenoid when the current in it falls from $0.2A$ to $0A$ in 0.01 second, is

A. 0.05 V

B. 0.5 V

C. 500 V

D. 50 V

Answer: B

Watch Video Solution

56. Two inductors each of inductance L are joined in parallel. Their equivalent inductance is

A. zero

B. 2 L

C. L/2

D. L

Answer: C

Watch Video Solution

57. A coil of 100 turns with a current of $5A$ produce a magnetic flux of $1\mu Wb$ and each turn of the coil. The coefficeint of self induction is

A. $10\mu H$

B. $20\mu H$

C. $30\mu H$

D. $40\mu H$

Answer: B

Watch Video Solution

58. In an inductance coil the current increases from zero to 6 ampere in 0.3 second by which an induced e.m.f. of 60 volt is produced in it. The value of coefficient of self-induction of coil is

A. 1 henry

B. 1.5 henry

C. 2 henry

D. 3 henry

Answer: D

Watch Video Solution

Exercise 1 H W

1. A coil of 200 turns $8cm^2$ area is placed in external magnetic field of 0.4 Tesla (S.I) in such a way that its area vector makes an angle 60° with the field direction. Calculate magnetic flux through the coil (in weber)

A. 5×10^{-3}

B. 3.2×10^{-2}

C. 1.2×10^{-3}

D. 4.3×10^{-2}

Answer: B

Watch Video Solution

2. The magnetic field perpendicular to the plane of a loop of area $0.5m^2$ is 0.6 T . Calculate the magnetic flux through the loop (in weber)

A. 0.1

B. 0.2

C. 0.3

D. 0.4

Answer: C

Watch Video Solution

3. The magnetic field in a certain region is given by $\overrightarrow{B} = \left(4\hat{i} + 2\hat{j} - 3\hat{k}\right)$ tesla. How much magnetic flux passes through the loop of area $0.2m^2$ in this region if the loop lies flat in xy plane ?

A. -0.1

B. -0.2

C. 0.4

D. -0.6

Answer: D

Watch Video Solution

4. A coil and a magnet moves with their constant speeds 6 m/sec and 2 m/sec respectively, towards each other, then induced emf in coil is 18 mV. If both are move in same direction , then induced emf in coil

A. 5 mV

B. 7 mV

C. 3 mV

D. 9 mV

Answer: D

Watch Video Solution

5. The radius of a circular coil having 100 turns is 5 cm .its plane is normal to the magnetic field. The magnetic field changes from 2T to 10 T in 3.14 sec. The induced emf in coil will be

A. 2 V

B. 4 V

C. 6V

D. 8V

Answer: A

Watch Video Solution

Watch Video Solution

6. A short magnet is allowed to fall along the axis of a horizontal metalic ring. Starting from rest, the distance fallen by the magnet in one second may be

A. 22 m

B. 25 m

C. 23 m

D. 19 m

Answer: D

Watch Video Solution

7. Magnetic flux in a circuite containing a coil of resistance 2Ω change from $2.0Wb$ to $10Wb$ in 0.2sec. The charge passed through the coil in this time is

A. 5.0 C

B. 4.0 C

C. 2.5 C

D. 4.5 C

Answer: C

Watch Video Solution

8. A coil of self inductance 4H carries a 10 A current. If direction of current is reversed in 2 sec, then induced emf in it

A. -80

B. $+80$

C. -40

D. $+40V$

Answer: D

Watch Video Solution

9. For a coil having L=4 mH , current flow through it is $I = t^3 . e^{-t}$ then the time at which emf becomes zero

A. 2 sec

B. 1 sec

C. 4 sec

D. 3 sec

Answer: D

Watch Video Solution

10. A conducting ring of radius 2 metre is placed in an uniform magnetic field B of 0.01 Tesla oscillating with frequency 200 Hz with its plane at right angles to B . What will be the induced electric field ?

A. 4 volts/m

B. 6 volts /m

C. 10 volts/m

D. 8 volts/m

Answer: D

Watch Video Solution

11. When the wire loop is rotated in the magnetic field between the poles of a magnet the frequency of emf is

A. 1 revolution

B. 2 revolution

C. 1/4 revolution

D. 1/2 revolution

Answer: D

Watch Video Solution

12. An inductor of 5 henry and a resistance of 20 ohm are connected in series with a battery of 5 volt. The initial rate of change of current is

A. $1As^{-1}$

B. $2.0As^{-1}$

C. $2.5As^{-1}$

D. $0.25As^{-1}$

Answer: A

Watch Video Solution

13. A solenoid is 3 m long and its inner diameter is 4.0 cm . It has three layers of windings of 2000 turns each and carries a current of 2.0 amperes. The magnetic flux for an cross-section of the solenoid is nearly

A. 3.8 mwb

B. 12.8 mwb

C. 18.2 mwb

D. 6.4 mwb

Answer: B

Watch Video Solution

14. The current in ampere in an inductor is given by $I = 4t^2 + 6t$ where is in s. The self induced e.m.f in it is 20 mV. The self inductance of the coil t=0

A. 5.55 mH

B. 2.55×10^{-3} H

C. $3.33mH$

D. 7.5×10^{-3} H

Answer: C

Watch Video Solution

15. The magnetic flux linked with a coil , in Webers, is given by the equation $\phi = 4t^2 + 3t + 5$. Then the magnitude of induced emf at t=2s will be

A. 12 V

B. 19 V

C. 18 V

D. 16 V

Answer: B

Watch Video Solution

16. In a magnetic field of 0.08 T, area of a coil changes from $101 cm^2$ to $99 cm^2$ without changing the resistance which is 5Ω. The amount of charge that flows during this period is

A. 2.5×10^{-6}C

B. 2×10^{-6} C

C. 1.6×10^{-6} C

D. 8×10^{-8} C

Answer: C

View Text Solution

17. The magnetic flux ϕ (in weber) in a closed circuit of resistance 10Ω varies with time t (in second) according to equation $\phi = 5t^2 - 6t + 2$. The magnetic of induced current at t = 0.5 s is

A. 1.2 A

B. 0.1A

C. 0.6 A

D. 0.2 A

Answer: B

Watch Video Solution

18. A field of strength $8 \times 10^4 / \pi$ ampere turns / meter acts at right angles to the coil of 500 turns of area $10^{-2} m^2$. The coil is removed from the field in 0.2 second. Then the induced e.m.f in the coil is

A. 0.1 V

B. 0.2 V

C. 1.6 V

D. 2.5 V

Answer: B

Watch Video Solution

19. A coil has 4000 turns and $500 cm^2$ as its area. The plane of the coil is placed at right angles to a magnetic induction field of 4×10^{-5} web/m^2. The coil is rotated through 180° in 0.5 seconds. The average emf induced in the coil, in milli volts, is

A. 15

B. 20

C. 16

D. 32

Answer: D

View Text Solution

20. A square loop of side 44 cm is changed to a circle in time 0.5 sec with its plane normal to a magnetic field 0.6 T. The emf induced is

A. 0.5 V

B. 0.4 V

C. 0.2 V

D. 0.6 V

Answer: D

Watch Video Solution

21. A coil of 1500 turns and mean area of $500 cm^2$ is held perpendicular to a uniform magnetic field of induction 2×10^{-4} T . The resistance of the coil is 40 ohms. When the coil is rotated through 180° in the magnetic field in 0.2 seconds the average electric current (in mA) induced is

A. 1.2

B. 2.4

C. 3.7

D. 4.3

Answer: C

Watch Video Solution

22. A closed coil with a resistance 2R is placed in a magnetic field. The flux linked with the coil is `phi .if the magnetic field is suddenly reversed in direction , the charge that flows through the coil will be

A. $\phi / 2R$

B. π / R

C. $2\phi / R$

D. zero

Answer: B

View Text Solution

23. A coil of area $10 cm^2$ and 10 turns is in magnetic field directed perpendicular to the plane and changing at a rate of $10^8 gauss / s$. The resistance of coil is 20Ω. The current in the coil will be

A. 0.5 A

B. 5

C. 50 A

D. 5×10^8 A

Answer: B

Watch Video Solution

24. A magnetic flux of 500 microweber passing through a 200 turn coil is reversed in $20 \times 10^{-3} s$. The average induced emf in the coil (in volt) is

A. 2.5

B. 5.0

C. 7.5

D. 10.0

Answer: D

Watch Video Solution

25. A rectangular coil of 200 turns and area $100 cm^2$ is kept perpendicular to a uniform magnetic field of induction 0.25

tesla. If the field is reversed in direction in 0.01 second, the average induced emf in the coil is

A. $10^6 V$

B. 10^4 V

C. 10^2 V

D. zero

Answer: C

Watch Video Solution

26. A coil having an area $2m^2$ is placed in a magnetic field which changes from $1Wb/m^2$ to $4Wb/m^2$ in an interval of 2 second. The average e.m.f. induced in the coil will be

A. 4 volts/m

B. 3 V

C. 1.5 V

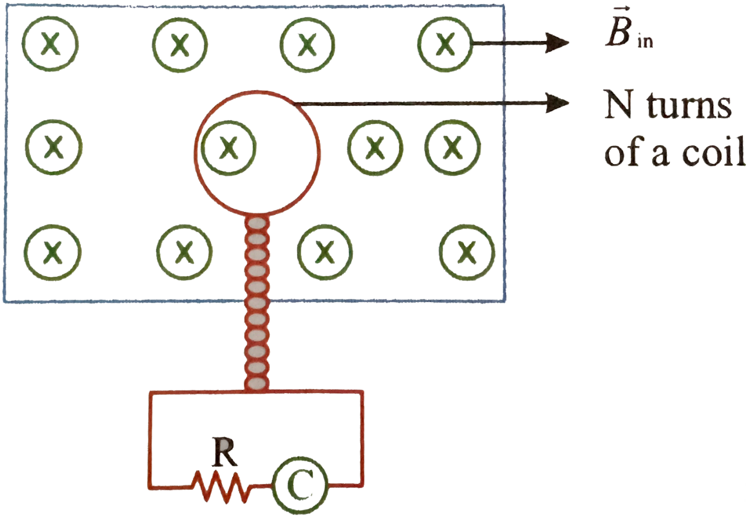
D. 2 V

Answer: B

Watch Video Solution

27. A flip coil consits of N turns of circular coils which lie in a uniform magnetic field. Plane of the coils is perpendicular to the magnetic field as shown in figure. The coil is connected to a current integrator which measures the total charge passing through it. The coil is turned through 180° about the diameter.

The charge passing through the coil is



A. $\dfrac{NBA}{R}$

B. $\dfrac{\sqrt{3}NBA}{2R}$

C. $\dfrac{NBA}{\sqrt{2}R}$

D. $\dfrac{2NBA}{R}$

Answer: D

Watch Video Solution

28. A conductor AB of length l moves in xy plane with velocity $\vec{v} = v_0(\hat{i} - \hat{j})$. A magnetic field $\vec{B} = B_0(\hat{i} + \hat{j})$ exists in the region. The induced emf is

A. zero

B. $2B_0lv_0$

C. B_0lv_0

D. $\sqrt{2}B_0lv_0$

Answer: A

Watch Video Solution

29. To measure the field $'B'$ between the poles of an electronmagnet, a small test loop of area $1cm^2$, resistance 10Ω

and 20 turns is pulled out of it. A galvanometer shows that a total charge $2\mu C$ passed through the loop. The value of $'B'$ is

A. 0.001 T

B. 0.01 T

C. 0.1 T

D. 1.0 T

Answer: B

Watch Video Solution

30. A thin circular ring of area A is perpendicular to uniform magnetic field of induction B. A small cut is made in the ring and a galavanometer is connected across the ends such that the total resistance of circuit is R. When the ring is suddenly sqeezed to zero area, the charge flowing through galvanometer is:

A. $\frac{BR}{A}$

B. $\frac{AB}{R}$

C. ABR

D. $\frac{B^2A}{R^2}$

Answer: B

Watch Video Solution

31. A short-circuited coil is placed in a time-varying magnetic field. Electrical power is dissipated due to the current induced in the coil. If the number of turns were to be quadrupled and the wire radius halved, the electrical power dissipated would be

A. halved

B. the same

C. doubled

D. quadrupled

Answer: D

Watch Video Solution

32. A train is moving towards north with a speed of 25 m/s. if the vertical component of the earth's magnetic field is 0.2×10^{-4} T, the emf induced in the axle 1.5 m long is

A. 0.25 mV

B. 0.45 mV

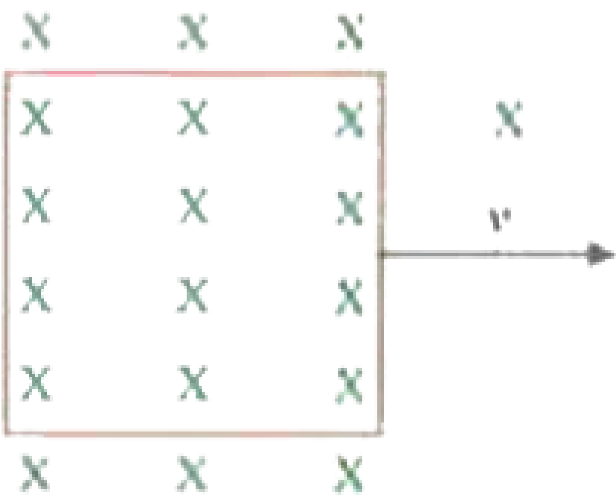
C. 0.75 mV

D. 0.50 mV

Answer: C

Watch Video Solution

33. A conducting square loop of side L and resistance R moves in its to one of tis sides. A magnetic induction B , constant in time and space, pointing perpendicular to and into the plane of the loop exists every where. The current induced in the loop is



A. $B \ln u / R$ clock wise

B. $B \ln u / R$ anticlockwise

C. $2B \ln u / R$ anticlockwise

D. zero

Answer: D

Watch Video Solution

34. A metal rod moves at a constant velocity in a direction perpendicular to its length. A constant, uniform magnetic field exists in space in a direction perpendicular to the rod as well as its velocity. Select the correct statements(s) from the following

A. The entire rod is at the same electric potential

B. There is an electric field in the rod

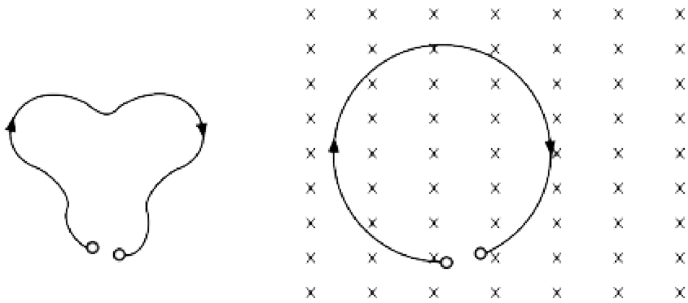
C. The electric potential is highest at the centre of the rod and decrease towards its ends.

D. The electric potential is lowest at the centre of the rod and increases towards its ends.

Answer: B

Watch Video Solution

35. A thin flexible wire of length L is connected to two adjacent fixed points and carries a current I in the clockwise direction, as shown in the figure. When the system is put in a uniform magnetic field of strength B going into the plane of the paper, the wire takes the shape of a circle. The tension in the wire is :



A. IBL

B. $\dfrac{IBL}{\pi}$

C. $\dfrac{IBL}{2\pi}$

D. $\dfrac{IBL}{4\pi}$

Answer: C

Watch Video Solution

36. A coil has an inductance of $0.05H$ and 100 turns and $0.02A$ current is passed through it. Flux linked with coil is

A. 10^{-2} Wb

B. 10^{-3}Wb

C. 10^{-4} Wb

D. 10^{-5} Wb

Answer: D

Watch Video Solution

37. A current of $2A$ is increasing at a rate of $4A/s$ through a coil of inductance $2H$. The energy stored in the inductor per unit time is

A. 2 w

B. 1 W

C. 16 W

D. 4 W

Answer: C

Watch Video Solution

38. The current decays from $5A$ to $2A$ in $0.01s$ in a coil. The emf induced in a coil nearby it is $30V$. The mutual inductance between the coils is

A. 1.0 H

B. 0.1 H

C. 0.001 H

D. 10 H

Answer: B

Watch Video Solution

39. A varying current in a coil change from $10A$ to $0A$ in $0.5\,\text{sec.}$ If the average emf induced in the coil is $220V$, the self inductance of the coil is

A. 5 H

B. 6H

C. 11H

D. 12 H

Answer: C

Watch Video Solution

Watch Video Solution

40. An air cored solenoid is of length 0.3 m, area of cross section $1.2 \times 10^{-3} m^2$ and has 2500 turns. Around its central section, a coil of 350 turns is wound. The solenoid and the coil are electrically insulated from eachother. Calculate the e.m.f. induced in the coil if the initial current of 3 A in the solenoid is reversed in 0.25 s.

A. 0.1056 V

B. 1.056 V

C. 10.56 V

D. 0.01056 V

Answer: A

Watch Video Solution

41. A solenoid of length 50 cm with 20 turns per cm and area of cross section 40 cm^2 comletely surrounds another co-axial solenoid of the same length, area of cross seciton $25cm^2$ with 25 turns per cm. Calculate the mutual inductance of the system.

A. 9.7 mH

B. 7.9 mH

C. 8.9 mH

D. 6.8 mH

Answer: B

Watch Video Solution

42. The current in a coil is changed from $5A$ to $10A$ in $10^{-2}s$. An emf of $50mV$ is induced in coil near by it. The mutual inductance of two coils is

A. $100\mu H$

B. $200\mu H$

C. $300\mu H$

D. $400\mu H$

Answer: A

Watch Video Solution

43. 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 coplaner 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

Answer: B

Watch Video Solution

Exercise 2 C W

1. A circular coil of $'n'$ turns is kept in a uniform magnetic field such that the plane of the coil is perpendicular to the field. The magnetic flux associated with the coil is now ϕ. Now the coil is opened and made into another circular coil of twice radius of the previous coil and kept in the same field such that the plane of the coil is perpendicular to the field. The magnetic flux associated with this coil now is

A. ϕ

B. 2ϕ

C. $\frac{\phi}{4}$

D. $\frac{\phi}{2}$

Answer: B

Watch Video Solution

2. a physicist works in a laboratory where the magnetic field is $2T$. She wears a necklace enclosing of an area $100cm^2$ of field and having a resistance of 0.1Ω. Because of power failure, the field decays to $1T$ in millisecond. The electric charge circulated in the necklace assuming that the magnetic field is perpendicular to area covered by the necklace is

A. 0.01 C

B. 0.001 C

C. 0.1 C

D. 1.0 C

Answer: C

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3. Two parallel rails of a railway track insulated from each other and with the ground are connected to a millivoltmeter. The distance between the rails is one metre. A train is traveling with a velocity of $72kmph$ along the track. The reading of the millivoltmetre (in mV) is : (Vertical component of the earth's magnetic induction is $2 \times 10^{-5}T$)

A. 144

B. 0.72

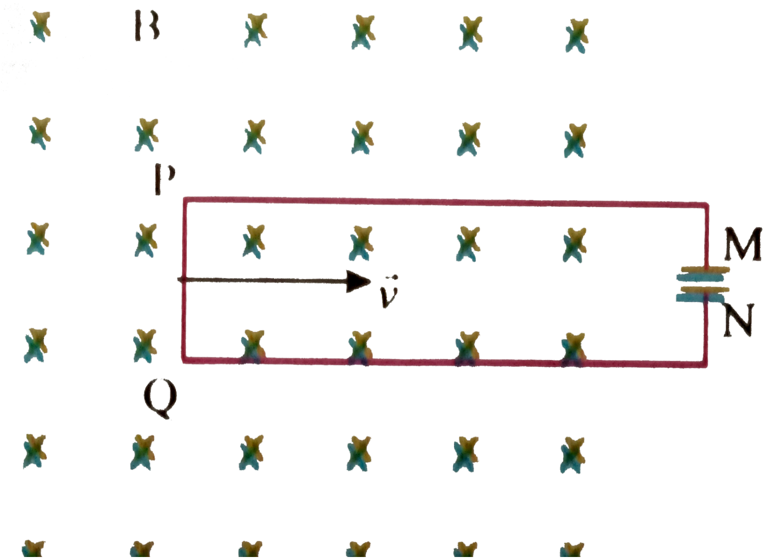
C. 0.4

D. 0.2

Answer: C

Watch Video Solution

4. A rod PQ is connected to the capacitor plates. The rod is placed in a magnetic field (B) directed downwards perpendicular to the plane of the paper. If the rod is pulled out of magnetic field with velocity $\vec{v}$ as shown in Figure.



A. Plate M will be positively charged

B. Plate N will be positively charged

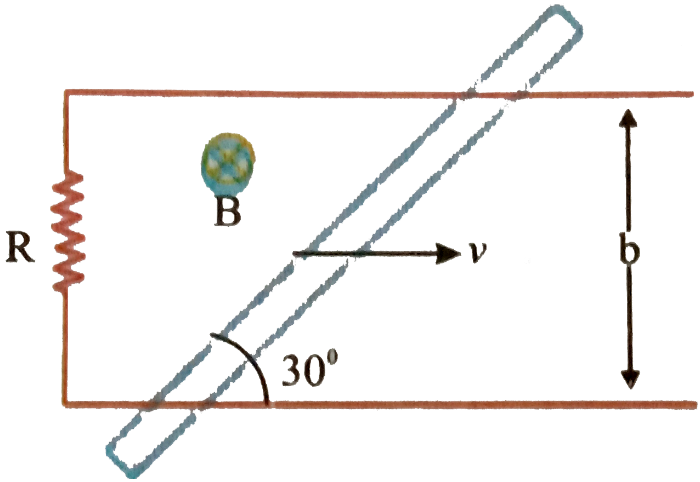
C. Both plates will be similarly charged

D. no charge will be collected on paltes.

Answer: A

Watch Video Solution

5. A wire is sliding as shown in Figure. The angle between the acceleration and the velocity of the wire is



A. 30°

B. 40°

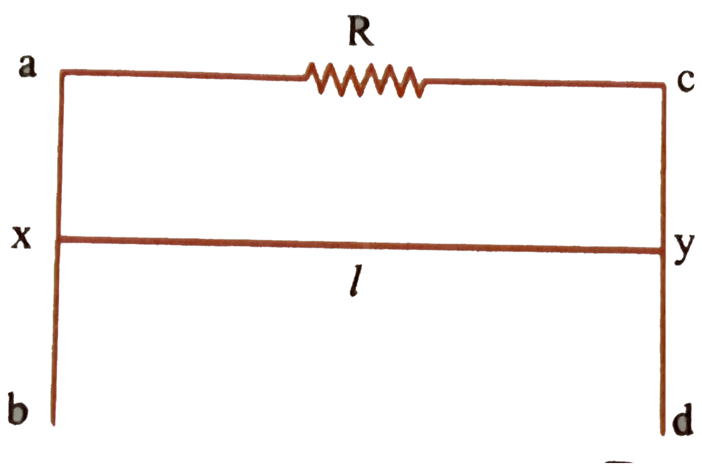
C. 120°

D. 90°

Answer: C

Watch Video Solution

6. A conducting wire xy of lentgh l and mass m is sliding without friction on vertical conduction rails ab and cd as shown in figure. A uniform magnetic field B exists perpendicular to the plane of the rails, x moves with a constant velocity of



A. $\frac{mgR}{Bl}$

B. $\frac{mgR}{Bl^2}$

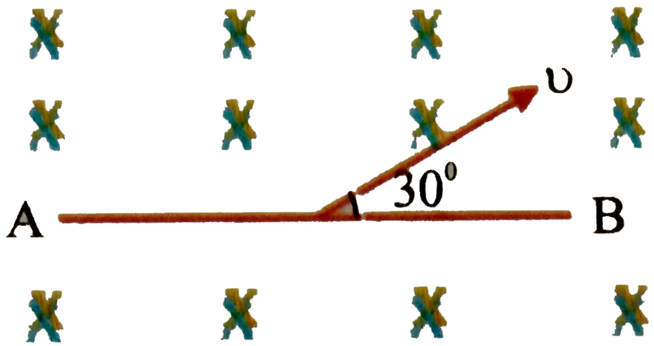
C. $\frac{mgR}{B^2l^2}$

D. $\frac{mgR}{B^2l}$

Answer: C

Watch Video Solution

7. A conducitng rod AB of length $l = 1m$ moving at a velcity $v = 4m/s$ making an angle 30° with its length. A uniform magnetic field $B = 2T$ exists in a direction perpendicular to the plane of motion. Then :



A. $V_A - V_B = 8V$

B. $V_A - V_B = 4V$

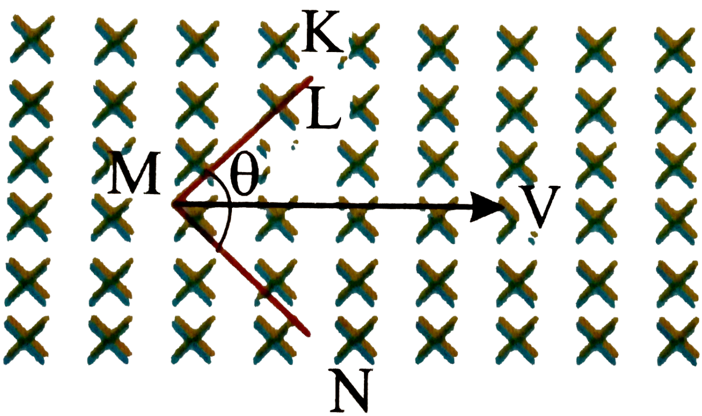
C. $V_B - V_A - 8V$

D. $V_B - V_A = 4V$

Answer: B

Watch Video Solution

8. A wire KMN moves along the bisector of the angle θ with a constant velocity v in a uniform magnetic field B perpendicular to the plane of the paper and directed inward. Which of the following is correct?



A. Effective length of the wire is $2L\sin\frac{\theta}{2}$

B. E.m.f induced between K and N is $2BLV\sin\frac{\theta}{2}$

C. The shape of KMN is immaterial, only the end points KN are important.

D. All the above

Answer: D

Watch Video Solution

9. A uniform magnetic field existsin region given by $\vec{B} = 3\hat{i} + 4\hat{j} + 5\hat{k}$. A rod of length $5m$ is placed along y-axis is moved along x- axis with constant speed $1m/\sec$. Then the magnitude of induced $e.m.f$ in the rod is :

A. zero

B. 25 volt

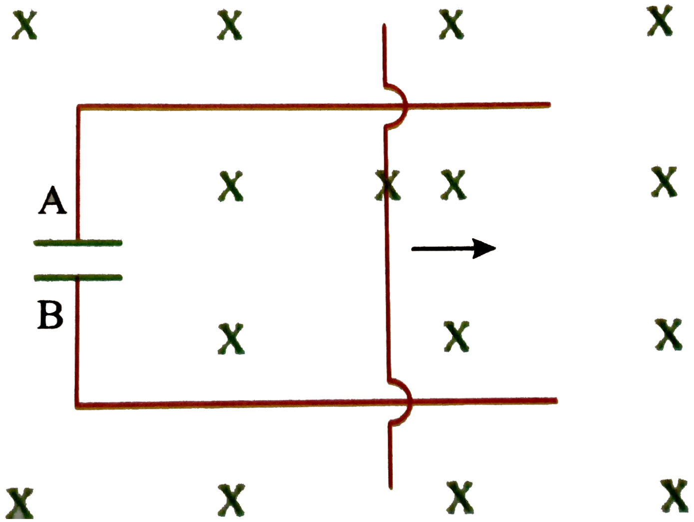
C. 20 volt

D. 15 volt

Answer: B

Watch Video Solution

10. A conducting rod PQ of length $1m$ is moving with uniform velocity of $2m/s$ in a uniform magnetic field of $2T$ directed inot the plane of paper. A capacitor of capacity $c = 10\mu F$ is connected as shown. Then :



A. $q_A = +40\mu C, q_B = +40\mu C$

B. $q_A = +40\mu C, q_B = -40\mu C$

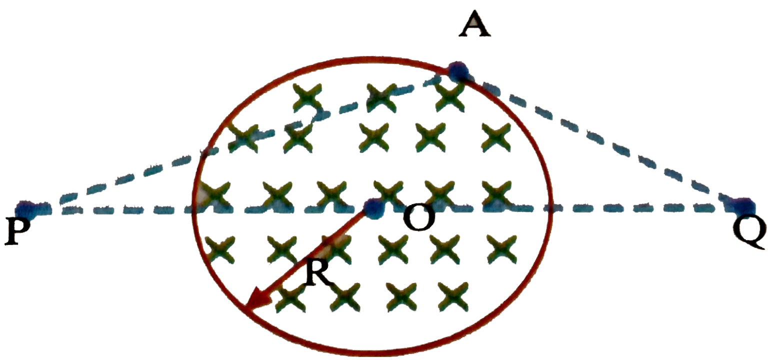
C. $q_A = -40\mu C, q_B = +40\mu C$

D. $q_A = q_B = 0$

Answer: B

Watch Video Solution

11. A time varying magnetic field is present in a cyclindrical region R as shown in the figure. A positive charge q is taken slowly from P to Q through POQ, the magnetic field varies with time as $B = B_0 t$ (where B_0 is a constant) are directed into the plane of the paper. If W is the workdone then $W =$



A. zero

B. B_0

C. Infinite

D. $2B_0$

Answer: A

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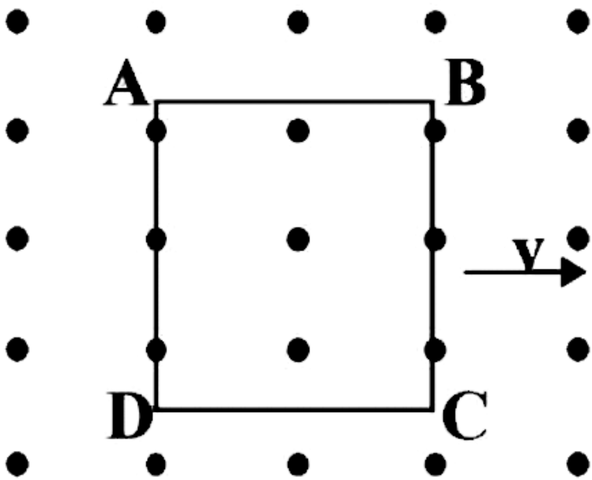
12. A metallic square loop ABCD is moving in its own plane with velocity v in a uniform magnetic field perpendicular to its plane as shown in the figure. An electric field is induced



A. in AD, but not in BC

B. in BC , but not in AD

C. neither in AD nor in BC

D. in both AD and BC

Answer: D

Watch Video Solution

13. The flux linked with a coil is $0.8Wb$ when a 2 A current is flowing through it. If this current begins to increases at the rate of $400A/s$, the induced emf in the coil will be

A. 20 V

B. 40 V

C. 80 V

D. 160 V

Answer: D

Watch Video Solution

14. A solenoid of self inductance $1.2H$ is in series with a tangent galvanonmeter of reduction factor $0.9A$.They are connected to a battery and the tangent galvanometer shows a deflection of 53°. The energy stored in the magnetic field of the solenoid is $(\tan 53^\circ = 4/3)$

A. 0.864 J

B. 0.72 J

C. 0.173 J

D. 1.44 J

Answer: A

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15. There are two batteries $'A'$ and $'B'$ having same emf. A has no internal resistance and B has some internal restance. An inductance is connected first to $'A'$ and the energy in the uniform magnetic field setup inside is $'U'$. It is now disconnected from $'A'$ and reconnected to $'B'$. The energy stored in the uniform magnetic field will be

A. U

B. $> U$

C. $< U$

D. zero

Answer: C

Watch Video Solution

16. An emf induced in a secondary coil is $10000V$ when the current breaks in the primary. The mutual inductance is $5H$ and the current reaches to zero in $10^{-4}s$ in primary. The maximum current in the primary before the breaks is

A. 0.2 A

B. 0.3 A

C. 0.4 A

D. 0.5 A

Answer: A

Watch Video Solution

17. A mutual inductor consists of two coils X and Y as shown in Fig. in which one-quarter of the magnetic flux produced by X links with Y, giving a mutual inductance M. What will be the mutual inductance when Y is used as the primary?

A. M/4

B. M/2

C. M

D. 2M

Answer: C

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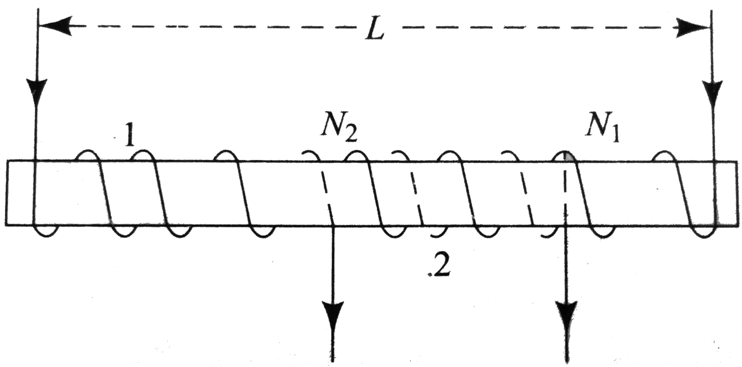
18. A long solenoid of length L, cross section A having N_1 turns has about its center a small coil of N_2 turns as shows in Fig The mutual inductance of two circuits is



A. $\frac{\mu_0 A(N_1 / N_2)}{L}$

B. $\frac{\mu_0 A(N_1 N_2)}{L}$

C. $\mu_0 A(N_1 N_2) L$

D. $\frac{\mu_0 A(L_1^2 N_2)}{L}$

Answer: B

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19. A small coil of radius r is placed at the centre of a large coil of radius R, where $R > > r$. The two coils are coplanar. The mutual inductance between the coils is proportional to

A. r / R

B. r^2 / R

C. r^2 / R^2

D. r / R^2

Answer: B

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20. The coefficient of mutual inductance of two circuits A and B is $3mH$ and their respective resistances are 10Ω and 4Ω. How much current should change in $0.02s$ in circuit A, so that the induced current in B should be $0.0060A$?

A. 0.24 A

B. 1.6 A

C. 0.18 A

D. 0.16 A

Answer: D

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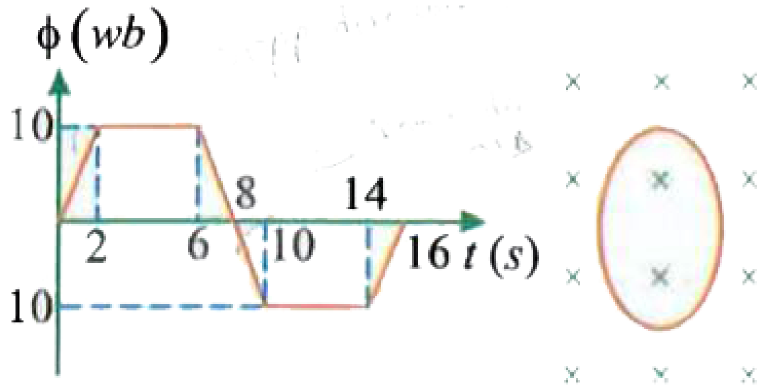
21. Magnetic flux in a circular coil of resistance 10Ω changes with time as shown in figure.

Symbol ⊗ indicates a direction perpendicular to paper inwards.

Match the following.



	Table−1		Table−2
1	At 1 s is induced current is	p	clockwise
2	At 5s induced current is	q	anticlockwise
3	At 9s induced current is	r	zero
4	At 15 s induced current is	s	$2A$
		t	None

A. a-q,b-r,c-p,d-q

B. a-p,b-r,c-q,d-p

C. a-q,b-r,c-q,d-p

D. a-p,b-t,c-q,d-p

Answer: A

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22. Three coils are placed infront of each other as shown currents in 1 and 2 are in same direction while that in 3 is in opposite direction. Match the following table

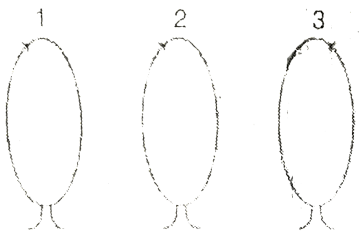

Table-1		Table-2	
(A)	When current in 1 is increased	(P)	current in 1 will increase
(B)	When current in 2 is increased	(Q)	current in 2 will increase
(C)	When current in 3 is increased	(R)	current in 3 will increase
		(S)	None

A. a-r,b-r,c-p,q

B. a-p,b-p,c-q

C. a-q,b-q,c-r

D. a-r,b-q,c-p

Answer: A

Watch Video Solution

Exercise 2 H W

1. A coil of 30 turns of wire each of $10cm^2$ area is placed with its plance perpendicular to a magnetic field of $0.1T$. When the coil is suddenly withdraw from the field, a galvanometer connected in series with the coil indicated that a $10\mu C$ charge passes around the circuit. The combined resistance of the coil and galvanometer is

A. 3Ω

B. 30Ω

C. 300Ω

D. 3000Ω

Answer: C

Watch Video Solution

2. A square coil of side $0.5m$ has movable sides. It si placed such that its plance is perpendiuclar to uniform magnetic field of induction $0.2T$. If all the sides are allowed to move with a speed of $0.1m/s$ for 4 sec outwards, average induced emf is

A. zero

B. 0.01 V

C. 0.028 V

D. 0.072V

Answer: D

Watch Video Solution

3. A uniform magnetic field existsin region given by $\overrightarrow{B} = 3\hat{i} + 4\hat{j} + 5\hat{k}$. A rod of length $5m$ is placed along y-axis is moved along x- axis with constant speed $1m/\sec$. Then the magnitude of induced $e.m.f$ in the rod is :

A. 0

B. 25 V

C. 20 V

D. 15 V

Answer: B

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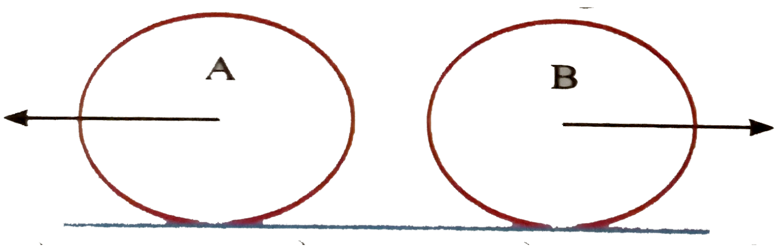
4. Two identical conducting rings A and B of radius R are rolling over a horizontal conducting plane with same speed v but in opposite direction. A constant magnetic field B is present pointing into the plane of paper. Then the potential difference between the highest points of the two rings is



A. 0

B. $2B\nu R$

C. $4B\nu R$

D. none of these

Answer: C

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5. 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 the loop, $B(r) \propto \frac{1}{r}$ 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

Answer: D

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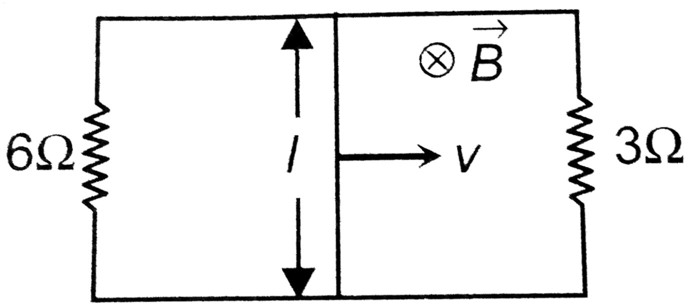
6. A rectangle loop with a sliding connector of length $l = 1.0m$ is situated in a uniform magnetic field $B = 2T$ perpendicular to the plane of loop. Resistance of connector is $r = 2\Omega$. Two resistance of 6Ω and 3Ω are connected as shown in figure. the external force required to keep the connector moving with a constant velocity $v = 2m/s$ is



A. 6 N

B. 4 N

C. 2 N

D. 1 N

Answer: B

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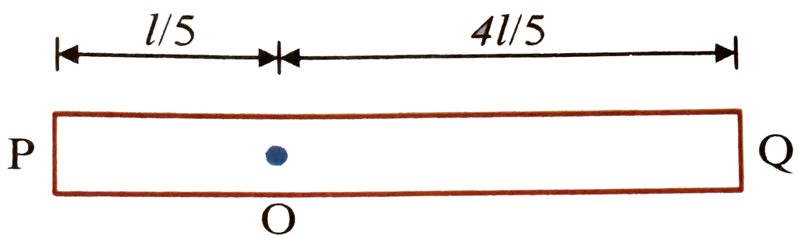
7. A straight rod of length l si rotating about axis passing through O is shown. A uniform magnetic field B exists parallel to the axis of rotation. $E.m.f$ induced between P and Q is:



A. $\frac{8}{25}B\omega l^2$

B. $\frac{3}{10}B\omega l^2$

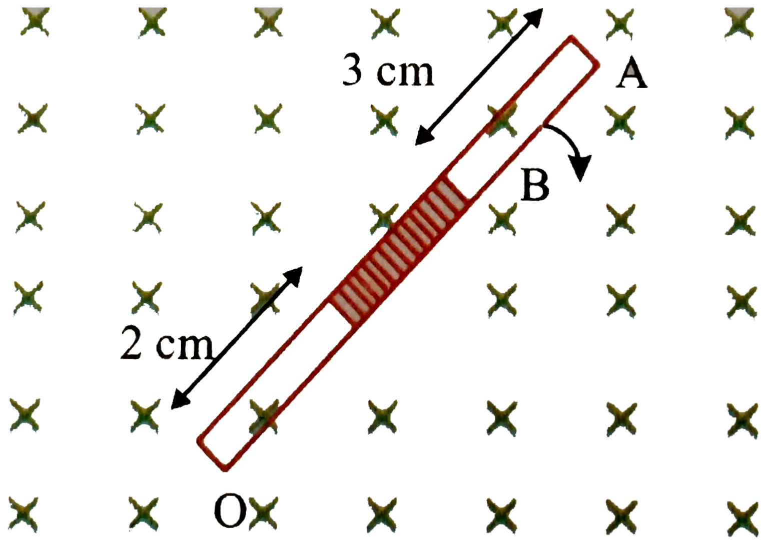
C. $\frac{7}{25}B\omega l^2$

D. zero

Answer: B

Watch Video Solution

8. A rod of length $10cm$ made up of conducting and non-conducting material (shaded part is non-conducting). The rod is rotated with constant angular velocity $10rad/s$ about point O, in constant magnetic field of $2T$ as shown in the figure. The induced emf between the point A and B of rod will be:



A. 0.029 V

B. 0.1 V

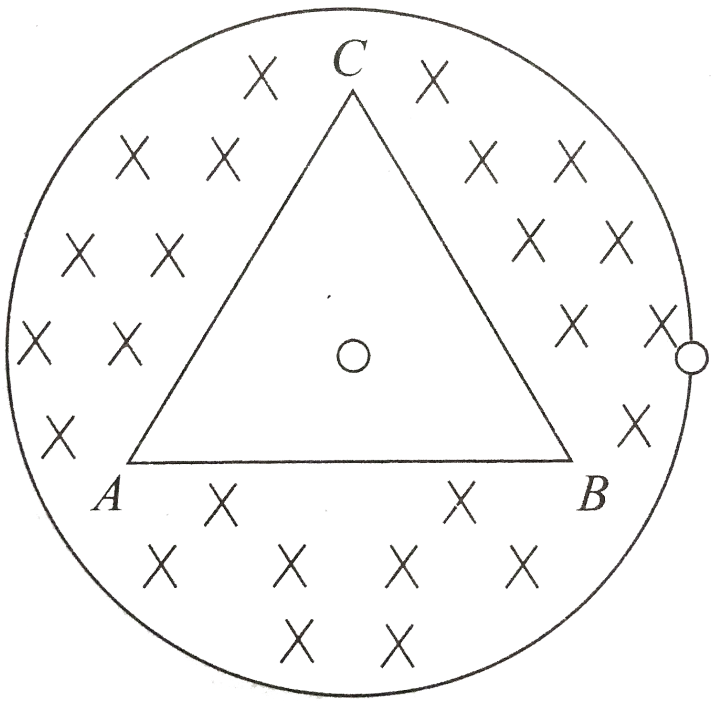
C. 0.051 V

D. 0.064 V

Answer: C

Watch Video Solution

9. A triangular wire frame (each side =2m) is placed in a region of time variant magnetic field $dB/dt = (\sqrt{3})T/s$. The magnetic field is perpendicular to the plane of the triangle and its centre coincides with the centre of triangle. The base of the triangle AB has a resistance $1(\Omega)$ while the other two sides have resistance $2(\Omega)$ each. The magnitude of potential difference between the points A and B will be



A. 0.4 V

B. 0.6 V

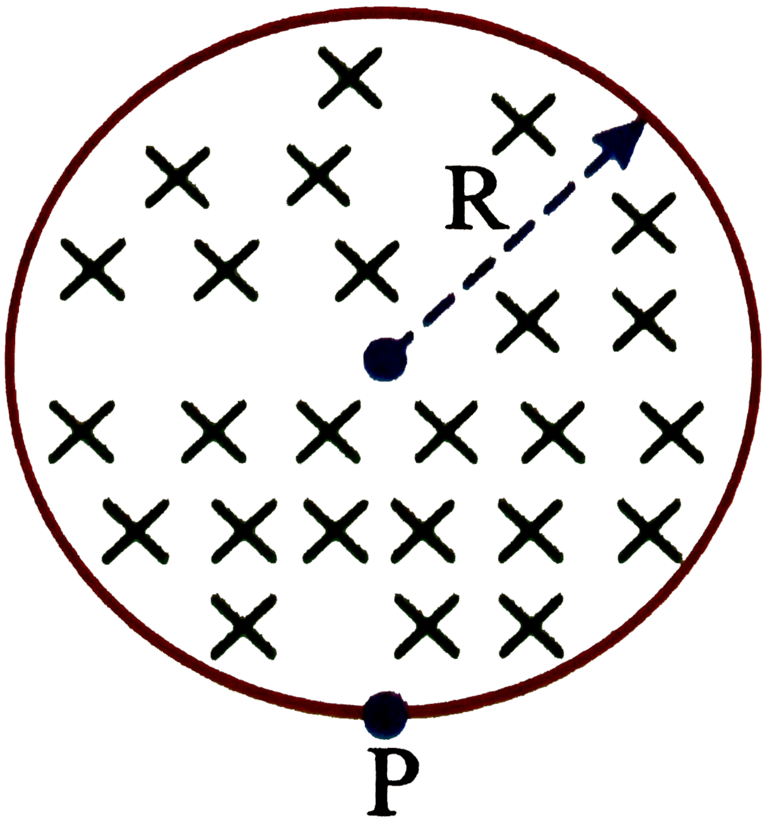
C. 1.2 V

D. None

Answer: B

Watch Video Solution

10. A uniform magnetic field of induction B is confined to a cylindrical region of radius R. The magnetic field is increasing at a constant rate of dB/dt (tesla / second). A charge e of mass m, placed at the point P on the periphery of the fixed experiences an acceleration :



A. $\frac{1}{2}\frac{eR}{m}\frac{dB}{dt}$ toward left

B. $\frac{1}{2}\frac{eR}{m}\frac{dB}{dt}$ toward right

C. $\frac{eR}{m}\frac{dB}{dt}$ toward left

D. zero

Answer: A

Watch Video Solution

11. The e.m.f. induced in a secondary coil is $20000V$ when the current breaks in the primary coil. The mutual inductance is $5H$ and the current reaches to zero in 10^{-4}sec in the primary. The maximu current in the primary before it breaks is

A. 0.1 A

B. 0.4 A

C. 0.6 A

D. 0.8 A

Answer: B

Watch Video Solution

12. 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 centre coincide. What is the mutual inductance of the system ?

A. L/l

B. l/L

C. L^2 / l

D. l^2 / L

Answer: D

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13. A straight solenoid of length $1m$ has 5000 turns in the primary and 200 turns in the secondary coil. If the area of cross section is $4cm^2$, the mutual inductance will be

A. 503 H

B. 503 mH

C. $503\mu H$

D. 5.03 H

Answer: C

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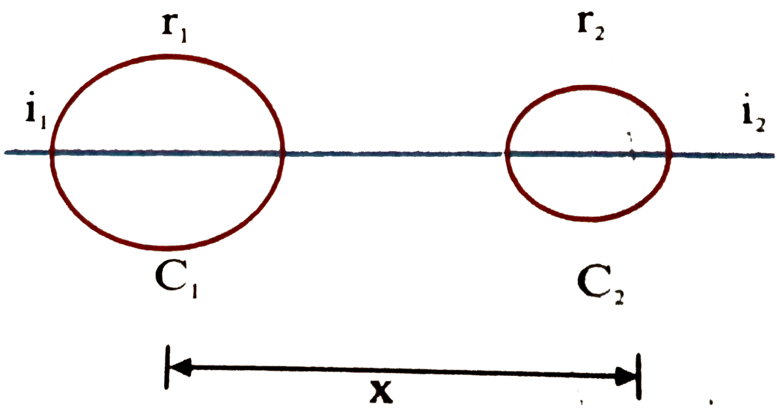
14. Two coaxial circular loops of radius $0.5m$ and $5 \times 10^{-2}m$ are separated by a distance $0.5m$ and carry currents $2A$ and $1A$ respectively. The force between the loops due to mutual induction is



A. $2.09 \times 10^{-8} N$

B. 1.06×10^{-6} N

C. $4.18 \times 10^{-8} N$

D. $8.3 \times 10^{-5} N$

Answer: A

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15. The mutual inductance between the rectangular loop and the long straight wire as shown in figure is M .

A. M =zero

B. $M = \frac{\mu_0 a}{2\pi} \ln\left(1 + \frac{c}{b}\right)$

C. $M = \frac{\mu_0 a}{2\pi} \ln\left(\frac{a+c}{b}\right)$

D. $M = \, = \frac{\mu_0 a}{2\pi} ln\left(1 + \frac{b}{c}\right)$

Answer: D

View Text Solution

16. An infinite long straight conducting cylinderical shell of radius a is surrounded by a thin coaxial infinite conducing cylinderical shell of radius b. Assuming current flows uniformly through the cylinderical shell returns through the outer shell, the inductance per unit length for this arrangement is

A. $\frac{2\mu_0}{\pi}1n\left(\frac{b}{a}\right)$

B. $\frac{\mu_0}{\pi}1n\left(\frac{b}{a}\right)$

C. $\frac{\mu_0}{2\pi}1n\left(\frac{b}{a}\right)$

D. $\frac{\mu_0}{4\pi}1n\left(\frac{b}{a}\right)$

Answer: C

Watch Video Solution

Exercise 3

1. A coil of inductive reactance 31Ω has a resistance of $8ohm$. It is placed in series with a condenser of capacitive reactance 25Ω.

The combination is connected to an ac source of $110V$. The power factor of the circuit is

A. 0.33

B. 0.56

C. 0.64

D. 0.8

Answer: D

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2. Two coils of self-inductance $2mH$ and $8mH$ are placed so close together that the effective flux in one coil is completely linked with the other. The mutual inductance between these coil is

A. 16 mH

B. 10 mH

C. 6 mH

D. 4 mH

Answer: D

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3. The core of any transformer is laminated so as to

A. ratio of voltage in primary and secondary may be increased

B. energy losses due to eddy currents may be minimised

C. the weight of the transformer may be reduced

D. rusting of the core may be prevented

Answer: B

Watch Video Solution

4. A transistor -oscillator using a resonant circuit with an inductor L (of negligible resistance) and a capacitor C in series produce oscillations of frequency f. If L is doubled and C is changed to $4C$, the frequency will be

A. f/2

B. f/4

C. 8f

D. $f/2\sqrt{2}$

Answer: D

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5. The primary and secondary coils of a transmformer have 50 and 1500 turns respectively. If the magnetic flux ϕ linked with the primary coil is given by $\phi = \phi_0 + 4t$, where ϕ is in weber, t is time in second and ϕ_0 is a constant, the output voltage across the secondary coil is

A. 120 volts

B. 220 volts

C. 30 volts

D. 90 volts

Answer: A

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6. A transformer is used to light a $100W$ and $110V$ lamp from a $220V$ mains. If the main current is $0.5A$, the Efficiency of the transformer is approximately:

A. 50%

B. 90%

C. 10%

D. 30%

Answer: B

Watch Video Solution

7. What is the value of inductance L for which the current is a maximum in series LCR circuit with $C = 10\mu F$ and $\omega = 1000\frac{rad}{s}$?

A. 1 mH

B. cannot be calculated uncless R is known

C. 10 mH

D. 100 mH

Answer: D

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8. The primary and secondary coils of a transmformer have 50 and 1500 turns respectively. If the magnetic flux ϕ linked with the primary coil is given by $\phi = \phi_0 + 4t$, where ϕ is in weber, t is time in second and ϕ_0 is a constant, the output voltage across the secondary coil is

A. 120 volts

B. 220 volts

C. 30 volts

D. 90 volts

Answer: A

Watch Video Solution

9. A long solenoid has 500 turns. When a current of $2A$ is passed through it, the resulting magnetic flux linked with each turn of the solenoid is $4 \times 10^{-3} Wb$. The self-inductance of the solenoid is

A. 1.0 henry

B. 4.0 henry

C. 2.5 henry

D. 2.0 henry

Answer: A

Watch Video Solution

10. A circular disc of radius $0.2m$ is placed in a uniform magnetic fied of induction $\frac{1}{\pi}\left(\frac{Wb}{m^2}\right)$ in such a way that its axis makes an angle of 60° with The magnetic flux linked with the disc is

A. $0.01\omega b$

B. $0.02\omega b$

C. 0.06ω

D. $0.08\omega b$

Answer: B

Watch Video Solution

11. A long solenoid has 500 turns. When a current of 2 A is passed through it, the resulting magnetic flux linked with each turn of the solenoid is $4 \times 10^{-3} wb$. The self-inductance of the solenoid is

A. 4.0 henry

B. 2.5 henry

C. 2.0 henry

D. 1.0 henry

Answer: D

Watch Video Solution

12. A conducting circular loop is placed in a uniform magnetic field $0.04T$ with its plane perpendicular to the magnetic field. The radius of the loop starts shrinking at $2mm/\sec$. The induced emf in the loop when the radius is $2cm$ is

A. $3.2\pi\mu V$

B. $4.8\pi\mu V$

C. $0.8\pi\mu V$

D. $1.6\pi\mu V$

Answer: A

Watch Video Solution

13. A rectangular, a square , a circular and an elliptical loop, all in the $(x - y)$ plane, are moving out of a uniform magnetic field with a constant velocity $\overrightarrow{v} = v\hat{i}$. The magnetic field is directed along the negative z-axis direction. The induced emf, during the passage of these loops , out of the field region, will not remain constant for :

A. the rectangular, circular and elliptical loops

B. the circular and the elliptical loops

C. only the elliptical loop

D. any of the four loops

Answer: B

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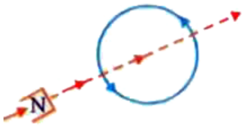
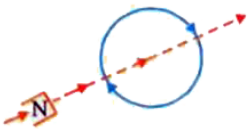
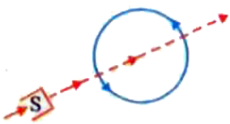
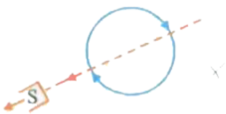
14. Which of the following figure correctly depicts the Lenz's law. The arrows show the movement of the labelled pole of a bar magnet into a closed circular loop and the arrows on the circle show the direction of the induced current

A. 

B. 

C. 

D. 

Answer: A

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15. A conducting circular loop is placed in a uniform magnetic field, $B = 0.025T$ with its plane perpendicular to the loop. The radius of the loop is made to shrink at a constant rate of $1mms^{-1}$. The induced emf when the radius is $2cm$ is

A. $2\pi\mu V$

B. $\pi\mu V$

C. $\frac{\pi}{2}\mu V$

D. $2\mu V$

Answer: B

Watch Video Solution

16. A coil has resistance $30ohm$ and inductive reactance $20ohm$ at $50Hz$ frequency. If an ac source of 200 volts. $100Hz$, is connected across the coil, the current in the coil will be

A. 4.0 A

B. 8.0 A

C. $\frac{20}{\sqrt{13}}$

D. 2.0 A

Answer: A

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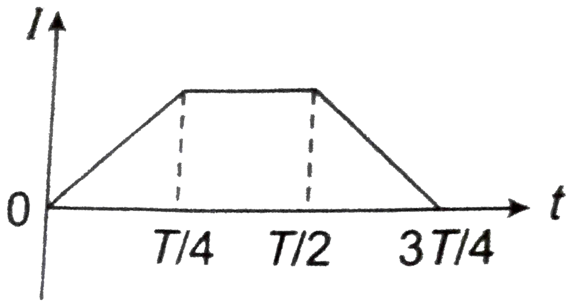
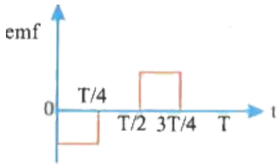
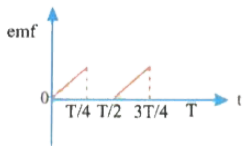
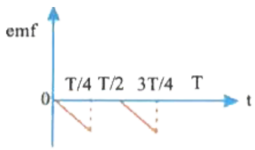
17. The current i in a coil varies with time as shown in the figure.

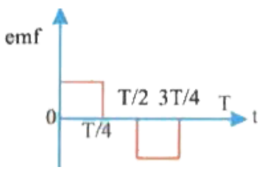
The variation of induced emf with time would be



A. 

B. 

C. 

D. 

Answer: A

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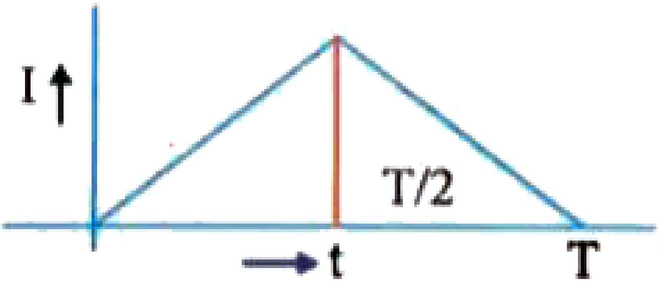
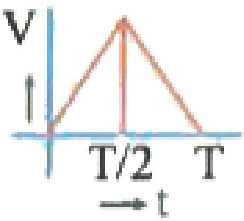
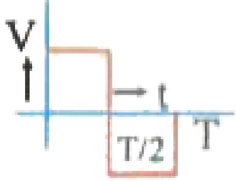
18. The current (I) in the inductance is varying with time according to the plot shown in figure

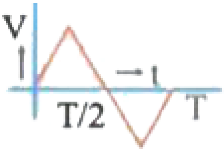


Which one of the following is the correct variation of voltage with time in the coil ?

A. 

B. 

C. 

D. 

Answer: C

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19. A coil of resistance 400Ω is placed in a magnetic field. If the magnetic flux ϕ (wb) linked with the coil varies with time t (sec) as $f = 50t^2 + 4$, the current in the coil at $t = 2$ sec is

A. 0.1 A

B. 2A

C. $1A$

D. 0.5 A

Answer: D

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20. A wire loop is rotated in magneitc field. The frequency of change of direction of the induced e.m.f. is.

A. once per revolution

B. twice per revolution

C. four times per revolution

D. six times per revolution

Answer: B

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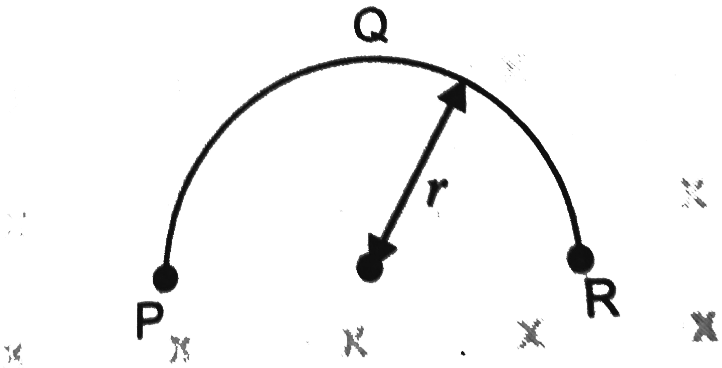
21. A thin semicircular conducting ring (PQR) of radius r is falling with its plane vertical in a horizontal magnetic field B, as shown in Fig. The potential difference developed across the ring when its speed is v, is



A. 2rBv and R is at higher potential

B. zero

C. $B v \pi r^2 / 2$ and P is at higher potential

D. $\pi r B v$ and R is at higher potential

Answer: A

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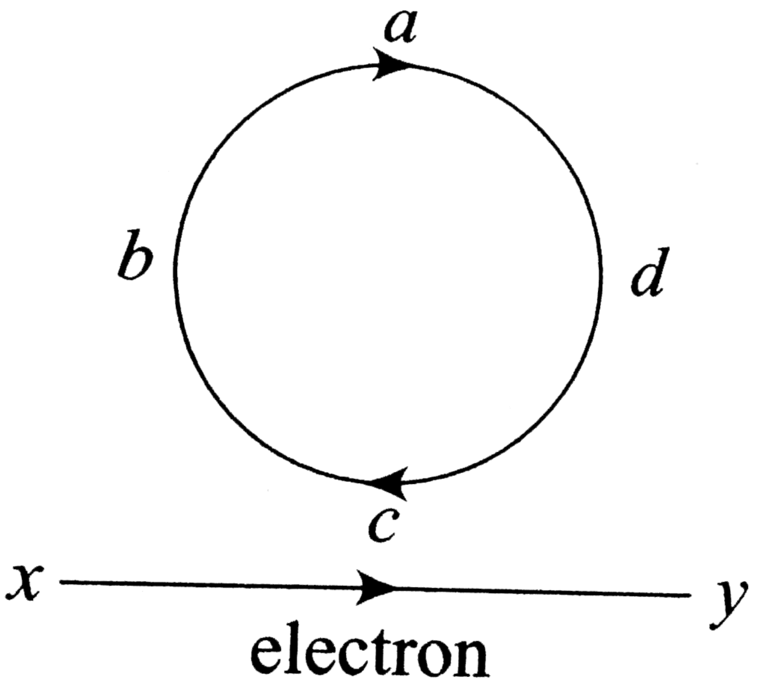
22. An electron moves on a straight line path XY as shown. The $abcd$ is a adjacent to the path of electron. What will be the direction of current, if any, induced in the coil?



A. No current induced

B. abcd

C. adcb

D. The current will reverse its directions as the electron goes

past the coil

Answer: D

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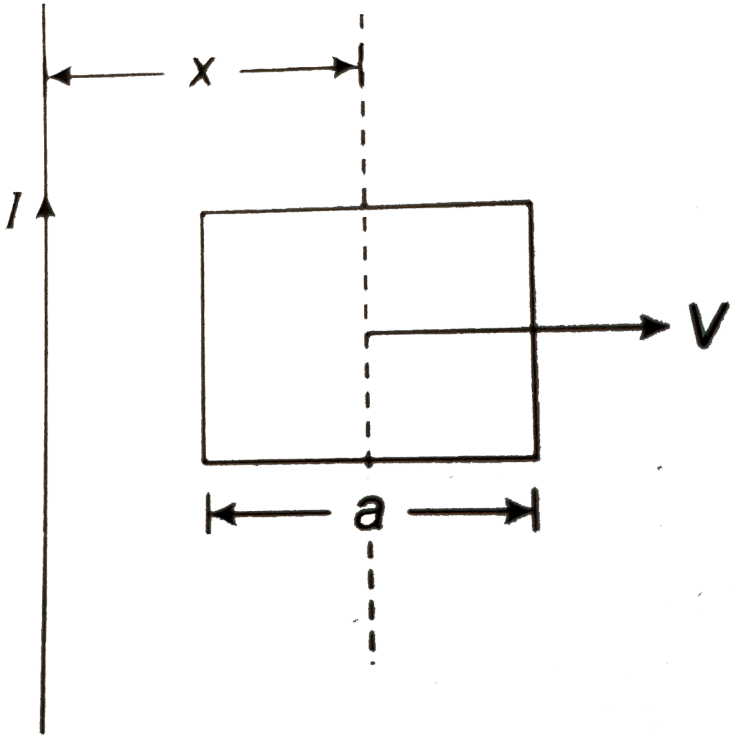
23. A conducting square frame of side $'a'$ and a long straight wire carrying current I are located in the same plane as shown in the figure. The frame moves to the right with a constant velocity $'V'$. The emf induced in the frame will be proportional to



A. $\frac{1}{(2x+a)^2}$

B. $\frac{1}{(2x-a)(2x+a)}$

C. $\frac{1}{x^2}$

D. $\frac{1}{(2x-a)^2}$

Answer: B

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24. A long solenoid has 1000 turns. When a current of $4A$ flows through it, the magnetic flux linked with each turn of the solenoid is $4 \times 10^{-3} Wb$. The self-inductance of the solenoid is

A. 2H

B. 1 H

C. 4 H

D. 3 H

Answer: B

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Exercise 4

1. A square of side L meters lies in the x-y plane in a region, where the magnetic field is give by $B = B_0\left(2\hat{i} + 3\hat{j} + 4\hat{k}\right)$T, where B_0 is constant. The magnitude of flux passing through the square is

A. $2B_0L^2Wb$

B. $3B_0L^2Wb$

C. $4B_0L^2Wb$

D. $\sqrt{29}B_0L^2Wb$

Answer: C

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2. A loop made of straight edegs has six corners at $A(0, 0, 0)$, $B(L, O, 0)C(L, L, 0)$, $D(0, L, 0)E(0, L, L)$ and

$F(0, 0, L)$. Where L is in meter. A magnetic field $B = B_0\left(\hat{i} + \hat{k}\right)T$ is present in the region. The flux passing through the loop $ABCDEFA$ (in that order) is

A. $B_0 L^2 Wb$

B. $2B_0 L^2 Wb$

C. $\sqrt{2}B_0 L^2 Wb$

D. $4B_0 L^2 Wb$

Answer: B

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3. The self inductance L of a solenoid of length l and area of cross-section A, with a fixed number of turns N increases as

A. l and increase

B. l decreases and A increases

C. l increases and A decreases

D. both l and A decrease

Answer: B

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4. A $0.1m$ long conductor carrying a current of $50A$ is perpendicular to a magentic field of $1.25mT$. The mechanical power to move the conductor with a speed of $1ms^{-1}$ is

A. 0.25 mW

B. 6.25 mW

C. 0.625 mW

D. 1 W

Answer: B

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5. A wheel has three spokes and is an uniform magnetic field perpendicular to its plane, with the axis of rotation of the wheel parallel to the magnetic field. When the wheel rotates with a uniform angualr velocity ω, the emf induced between the centre and rim of the wheel is $'e'$. If another wheel having same radius but with six spokes is kept in the same field and rotated with a uniform angular velocity $'\omega/2'$, the emf induced between the centre and the rim will be

A. 2

B. e/2

C. 2e

D. e/4

Answer: B

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6. Find the linear speed the bicycle required to power its head light by a generator, whose rubber shaft presses against the wheel of cycle of radius $0.33m$, turns at an angular speed of 44 times as great as the angular speed of the tire itself. The coil consists of 75 turns, has an area of $2.6 \times 10^{-3} m^2$, and rotates in a $0.10T$ magnetic field. When the peak emf being generated is $6.0V$.

A. 2.5 m/s

B. 5 m/s

C. 2.3 m/s

D. 4.6 m/s

Answer: C

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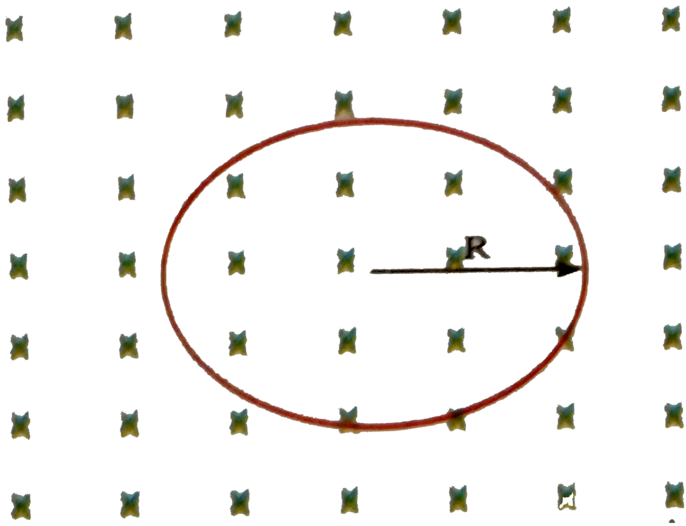
7. A conducting loop of radius R is present in a uniform magnetic field B perpendicular to the plane of ring. If radius R varies as a function of time t as $R = R_0 + t^2$. The emf induced in the loop is



A. $2\pi Bt(R_0 + t^2)$ Clockwise

B. $2\pi Bt(R_0 + t^2)$ Anticlockwise

C. $4\pi Bt(R_0 + t^2)$ Anticlockwise

D. $4\pi Bt(R_0 + t^2)$ clockwise

Answer: C

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8. A magnetic field induction is changing in magnitude in a region at a constant rate dB/dt. A given mass m of copper drawn into a wire and formed into a loop is placed perpendicular to the field. If the values of specific resistance and density of copper are ρ and σ respectively, then the current in the loop is given by :

A. $\frac{4\pi m}{\rho\sigma}\frac{dB}{dt}$

B. $\frac{m}{4\pi\rho\sigma}\frac{dB}{dt}$

C. $\frac{m}{\rho\sigma}\frac{dB}{dt}$

D. $\frac{2\pi m}{\rho\sigma}\frac{dB}{dt}$

Answer: B

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9. A magnetic flux through a stationary loop with a resistance R varies during the time interval τ as $\phi = at(\tau - t)$. Find the amount of the generated in the loop during that time

A. $\dfrac{aT}{3R}$

B. $\dfrac{a^2T^2}{3R}$

C. $\dfrac{a^2T^2}{R}$

D. $\dfrac{a^2T^3}{3R}$

Answer: D

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10. The length of a wire required to manufacture a solenoid of length l and self-induction L is (cross-sectional area is negligible)`

A. $\sqrt{\frac{2\pi Li}{\mu_0}}$

B. $\sqrt{\frac{\mu_0 Ll}{4\pi}}$

C. $\sqrt{\frac{4\pi Ll}{\mu_0}}$

D. $\sqrt{\frac{\mu_0 Ll}{2\pi}}$

Answer: C

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11. The inductance L of a solenoid of length l, whose windings are made of material of density D and resistivity ρ, is (the winding resistance is R)

A. $\frac{\mu_0}{4\pi l}\frac{Rm}{\rho D}$

B. $\frac{\mu_0}{4\pi r}\frac{lm}{\rho D}$

C. $\frac{\mu_0}{4\pi l}\frac{R^2 m}{\rho D}$

D. $\frac{\mu_0}{2\pi R}\frac{lm}{\rho D}$

Answer: A

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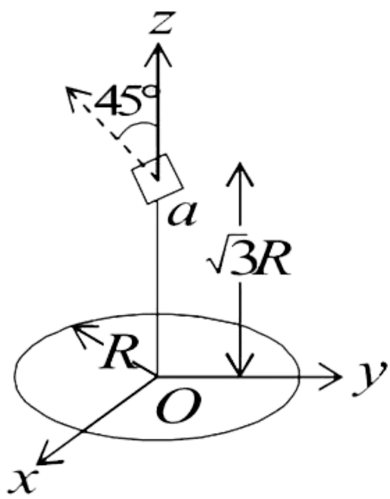
12. A circular wire loop of radius R is placed in the x-y plane centered at the origin O. A square loop of side a(altltR) having two turns is placed with its centre at $=\sqrt{3}R$ along the axis of hte circular wire loop, as shown in figure. The plane of the square loop makes an angle of 45° with respect to the z-axis. If the mutual inductance between the loops is given bu $\frac{\mu_0 a^2}{2^{p/2}R}$, then the value of p is



A. 3

B. 5

C. 7

D. 9

Answer: C

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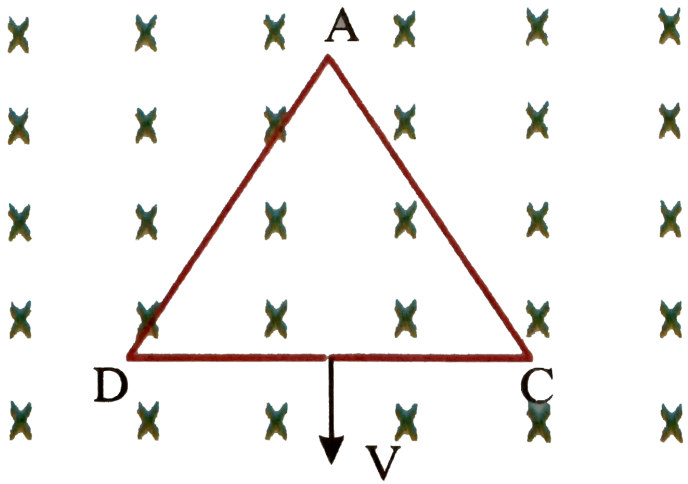
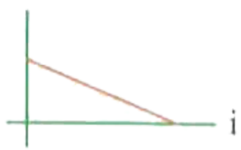
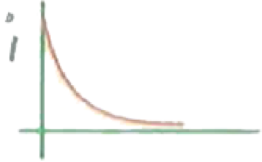
13. An equilateral triangular loop ADC having some resistance is pulled with a constant velocity v out of a uniform magnetic field directed inot the paper. At time $t = 0$, side DC of the loop at is at edge of the magnetic field.

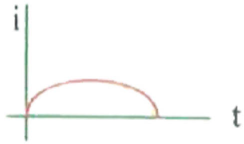


The induced current (i) versus time (t) graph will be as

A. 

B. 

C. 

D. 

Answer: B

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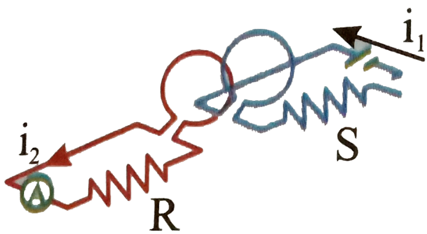
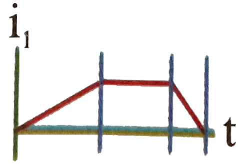
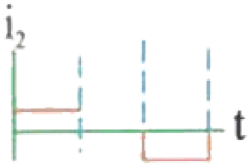
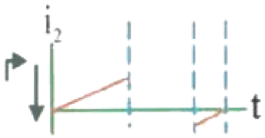
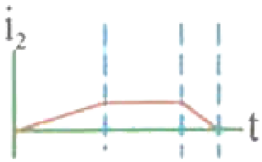
14. The current through the coil in figure (i) varies as shown in figure (ii). Which graph best shows the ammeter A reading as a function of time?

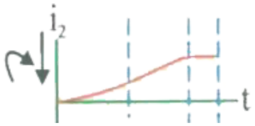




A. 

B. 

C. 

D. 

Answer: A

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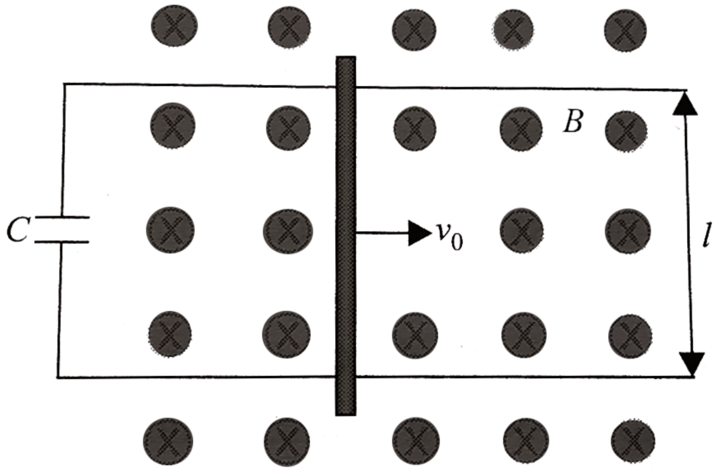
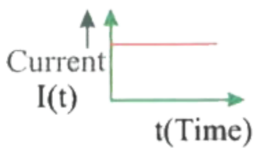
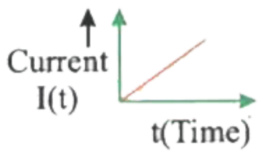
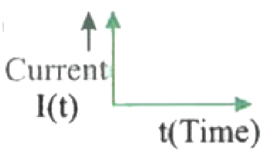
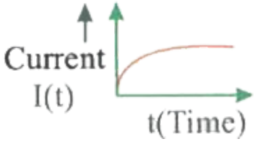
15. Two infinitely long conducting parallel rails are connected through a capacitor C as shown in Fig. A conductor of length l is moved with constant speed v_0. Which of the following graph truly depicts the variation of current through the conductor with time?



A. 

B. 

C. 

D. 

Answer: C

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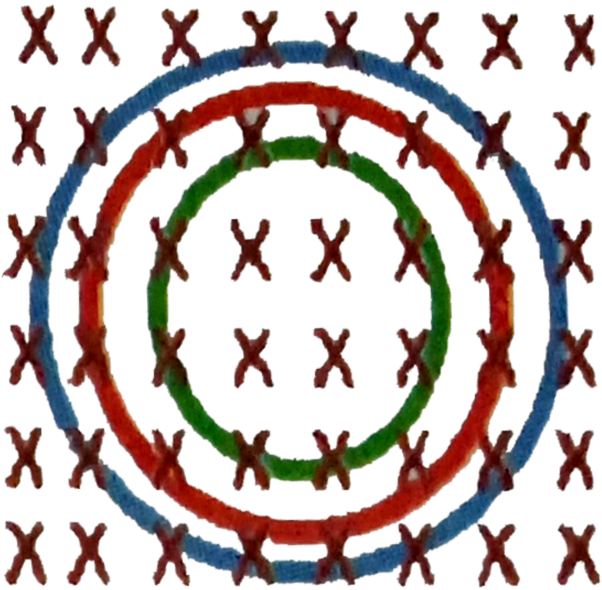
16. A flexible conducting wire in the form of a circle is kept in a uniform magnetic field with its plane normal to the field. Radius of that circle changes with time as shown. Then which of the following graphs represents the variation of induction emf with time $R = R_0, t < t_0, R = R_0 + t, t_0 < t < 2t_0$:



A.

B.

C.

D.

Answer: C

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Assertion Reason

1. Assertion: Magnetic flux is a vector quantity

Reason: Vlaue of magnetic flux can be positive, negative or zero

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true but R is false

D. A is false but R is true.

Answer: D

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2. Asseration:Lenz's law violates the principle of conservation of energy.

Reason: Induced e.m.f. opposes always the change in magnetic flux responsible for its production.

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true but R is false

D. A is false but R is true.

Answer: D

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3. Assertion : When number of turns in a coil is doubled, coefficient of self-inductance of the coil becomes 4 times.

Reason : This is because $L \propto N^2$

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true but R is false

D. A is false but R is true.

Answer: A

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4. Assertion : The induced emf and current will be same in two identical loops of copper and aluminium, when rotated with same speed in the same magnetic field.

Reason : Mutual induction does not depends on the orientation of the coils

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true but R is false

D. A is false but R is true.

Answer: C

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5. Asseration: When two coils are wound on each other, the mutual induction between the coils is maximum.

Reason: Mutual induction does not depend on the orientation of the coils.

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true but R is false

D. A is false but R is true.

Answer: C

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6. Assertion: Only a charge in magnetic flux will maintain an induced current in the coil.

Reason: The presence of large magnetic flux through a coil maintains a current in the coil if the circuit is continuous.

A. Both A and R are true and R is the correct explanation of A

B. Both A and R are true and R is not the correct explanation of A

C. A is true but R is false

D. A is false but R is true.

Answer: C

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