PHYSICS

BOOKS - DISHA PHYSICS (HINGLISH)

ELECTROMAGNETIC INDUCTION

Physics

1. A loop of wire is placed in a magnetic field $\vec{B} = 0.02\hat{i}T$. Then the flux through the loop

if its area vector

$\vec{A} = 30\hat{i} + 16\hat{j} + 23\hat{k}cm^2$ is

A. $60\mu Wb$

B. $32\mu Wb$

C. $46\mu Wb$

D. $138\mu Wb$

Answer: A

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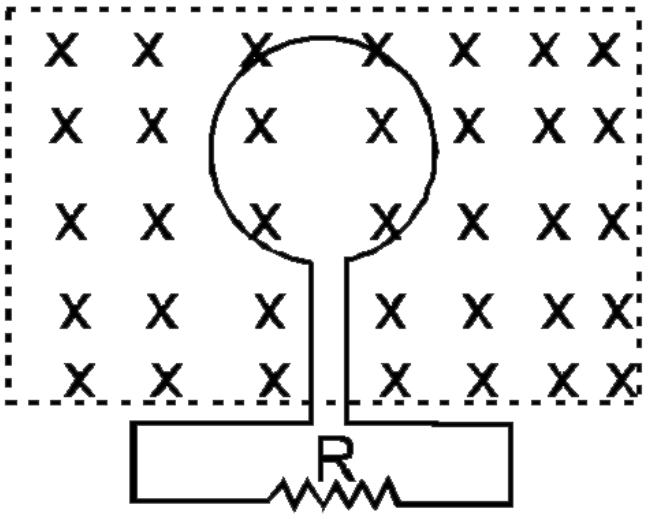
2. The magnetic flux passing perpendicular to the plane of the coil and directed into the paper is varying according to the relation $\phi = 3t^2 + 2t + 3$, where ϕ is in milliweber and t is in second. Then the magnitude of emf induced in the loop when $t = 2$ second is-



A. 31 mV

B. 19 mV

C. 14 mV

D. 6 mV

Answer:

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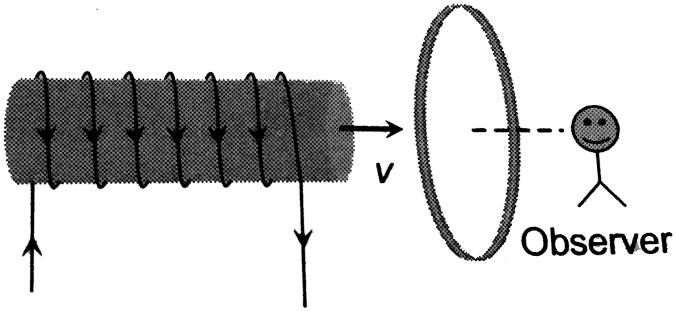
3. A current carrying solenoid id approaching a conducting loop as shown in the figure. The direction of induced current as observed by an

observer on the other side of the loop will be



A. anti-clockwise

B. clockwise

C. east

D. west

Answer:

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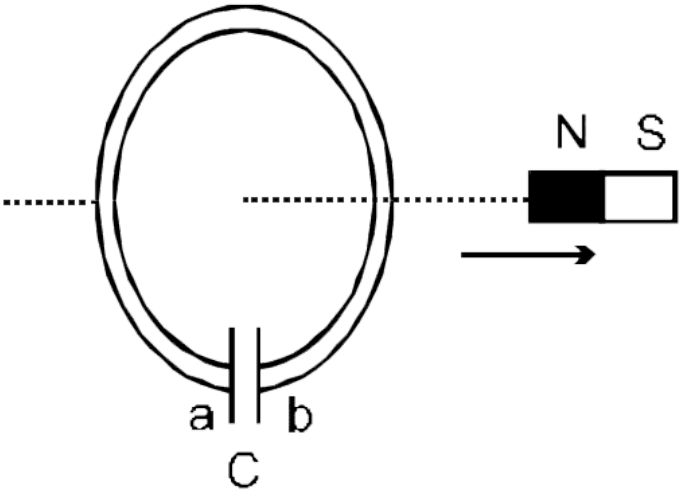
4. Consider the arrangement shown in figure in which the north pole of a magnet is moved away from a thick conducting loop containing capacitor. Then excess positive charge will arrive on



A. plate a

B. plate b

C. both plates a and b

D. neither a nor b plates

Answer: B

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5. When a small piece of wire passes between the magnetic poles of a horse-shoe magnet in 0.1 sec, emf of 4×10^{-3} volt is induced in it. The magnetic flux between the poles is :

A. 4×10^{-2} weber

B. 4×10^{-3} weber

C. 4×10^{-4} weber

D. 4×10^{-6} weber

Answer:

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6. The normal magnetic flux passing through a coil changes with time according to following equation

$\phi = 10t^2 + 5t + 1$

where ϕ is in milliweber and t is in second. The value of induced e.m.f. produced in the coil at $t = 5s$ will be –

A. zero

B. 1 V

C. 2 V

D. 0.105 V

Answer:

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7. A bicycle wheel of radius 0.5 m has 32 spokes. It is rotating at the rate of 120 revolutions per minute, perpendicular to the horizontal component of earth's magnetic field $B_H = 4 \times 10^{-5}$ tesla. The emf induced between the rim and the centre of the wheel will be-

A. $6.28 \times 10^{-5} V$

B. $4.8 \times 10^{-5} V$

C. $6.0 \times 10^{-5} V$

D. $1.6 \times 10^{-5} V$

Answer:

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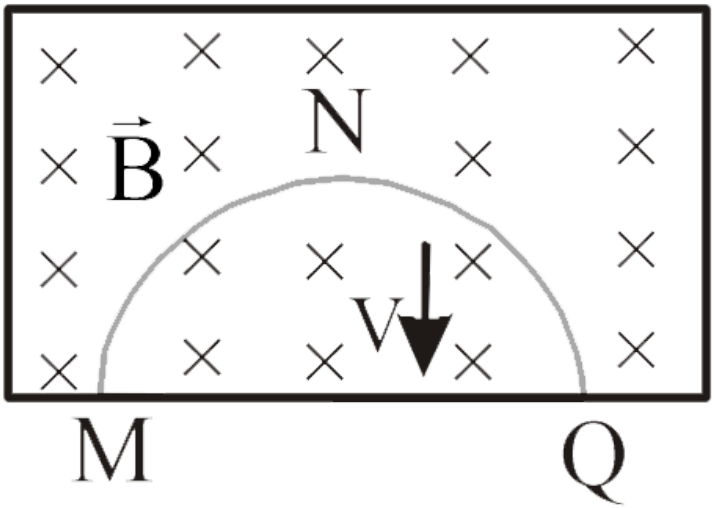
8. A thin semicircular conducting ring of radius R is falling with its plane vertical in a horizontal magnetic induction B. At the position MNQ shown in the fig, the speed of the ring is V. The potential difference

developed across the semicircular ring is



A. Zero

B. B $vR^2/2$ and M is at higher potential

C. πRBV and Q is at higher potential

D. $2RBV$ and Q is at higher potential

Answer:

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9. An aeroplane having a distance of 50 metre between the edges of its wings is flying horizontally with a speed of 360km/hour. If the vertical component of earth's magnetic field is 4×10^{-4} weber $/ m^2$, then the induced emf between the edges of its wings will be –

A. 2 mV

B. 2 V

C. 0.2 V

D. 20 V

Answer:

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10. At certain location in the northern hemisphere, the earth's magnetic field has a magnitude of $42\mu T$ and points down ward at 57° to vertical. The flux through a horizontal

surface of area $2.5m^2$ will be-

$(\text{Given} \quad \cos 33^\circ = 0.839, \cos 57^\circ = 0.545)$

A. $42 \times 10^{-6} Wb/m^2$

B. $42 \times 10^{-6} Wb/m^2$

C. $57 \times 10^{-6} Wb/m^2$

D. $57 \times 10^{-6} Wb/m^2$

Answer:

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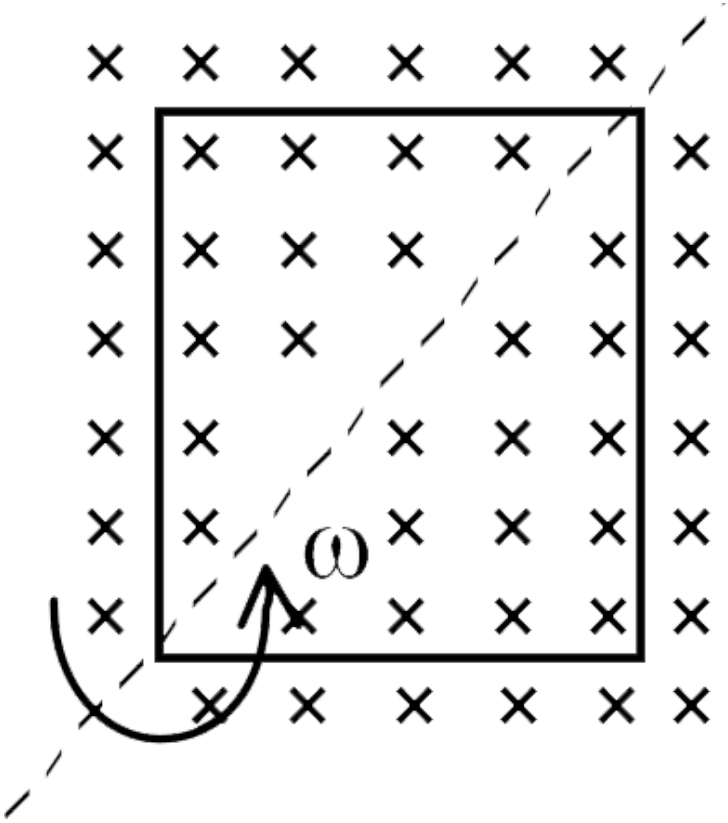
11. A square loop of side a is rotating about its diagonal with angular velocity w in a perpendicular magnetic field as shown in the figure. If the number of turns in it is 10 then the magnetic flux linked with the loop at any

instant will be–



A. $10Ba^2 \cos \omega t$

B. $10Ba$

C. $10Ba^2$

D. $20Ba^2$

Answer: A

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12. Two identical coaxial circular loops carry a current i each circulating int the same direction. If the loops approch each other the current in

A. Current in each loop increases

B. Current in each loop remains the same

C. Current in each loop decreases

D. Current in one-loop increases and in the other it decreases

Answer:

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13. The distance between the ends of wings of an aeroplane is 3m. This aeroplane is descending down with a speed of 300

km/hour. If the horizontal component of earths magnetic field is 0.4 gauss then the value of e.m.f. induced in the wings of the plane will be –

A. 1 V

B. 2 V

C. 0.01 V

D. 0.1 V

Answer:

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14. A gramophone disc of brass of diameter 30 cm rotates horizontally at the rate of $100/3$ revolutions per minute. If the vertical component of the earth's magnetic field be $0.01 \ \text{weber}/\text{metre}^2$, then the emf induced between the centre and the rim of the disc will be-

A. $7.065 \times 10^{-4} V$

B. $3.9 \times 10^{-4} V$

C. $2.32 \times 10^{-4} V$

D. None of the above

Answer:

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15. A closed coil consists of 500 turns has area $4cm^2$ and a resistance of 50Ω. The coil is kept with its plane perpendicular to a uniform magnetic field of $0.2W\frac{b}{m^2}$. Calculate the amount charge flowing through the coil if it is rotated through 180°

A. $1.6 \times 10^{-19} C$

B. $1.6 \times 10^{-9} C$

C. $1.6 \times 10^{-3} C$

D. $1.6 \times 10^{-2} C$

Answer:

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16. A copper disc of radius 0.1 m rotates about its centre with 10 revolution per second in 'a

uniform magnetic field of 0.1 T. The emf induced across the radius of the disc is -

A. $\pi / 10V$

B. $2\pi / 10V$

C. $10\pi mV$

D. $20\pi mV$

Answer:

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17. Two rail tracks, insulated from each other and the ground, are connected to milli voltmeter. What is the reading of the milli voltmeter when a train passes at a speed of 180 km/hr along the track ? Given that – the horizontal component of earth's magnetic field B_H is $0.2 \times 10-4Wb/m^2$ and rails are separated by 1 metre.

A. 1 mV

B. 10 mV

C. 100 mV

D. 1 V

Answer:

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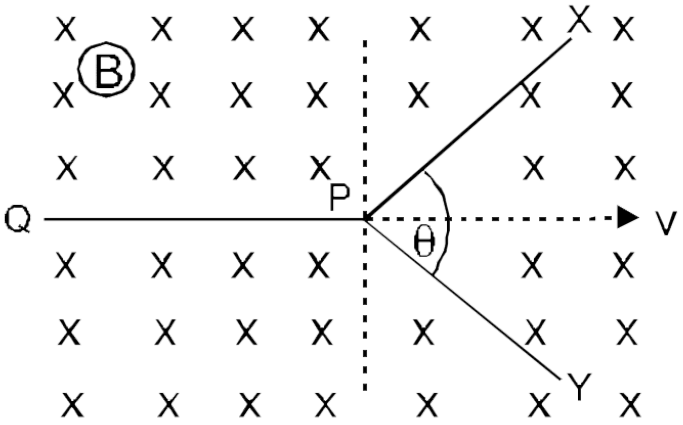
18. The annular disc of copper, with inner radius a and outer radius b is rotating with a uniform angular speed ω, in a region where a uniform magnetic field B along the axis of rotation exists. Then, the emf induced between inner side and the outer rim of the

disc is-



A. Zero

B. $\frac{1}{2}B\omega a^2$

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

D. $\frac{1}{2}B\omega\left(b^2-a^2\right)$

Answer:

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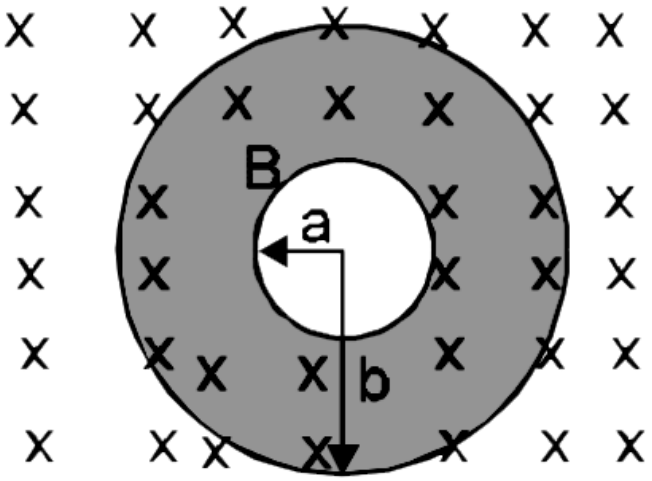
19. A conducting wire in the shape of Y with each side of length l is moving in a uniform magnetic field B, with a uniform speed v as shown in fig. The induced emf at the two ends X and Y of the wire will be-



A. zero

B. $2Blv$

C. $2Blv\sin(\theta/2)$

D. $2Blv\cos(\theta/2)$

Answer:

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20. A rectangular coil of size $10cm \times 20$ cm has 60 turns. It is rotating about one of its diagonals in magnetic field $0.5Wb/m^2$ with a

rate of 1800 revolution per minute. The induced e.m.f. in the coil can be

(1) 111 V (2) 112 V (3) 113 V (4) 114 V

A. 1, 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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21. 2A closed coil of copper whose area is $1m \times 1m$ is free to rotate about an axis. The coil is placed perpendicular to a magnetic field of $0.10Wb/m^2$. It is rotated through 180° in 0.01 second. Then (The resistance of the coil is 2.0Ω)

A. The induced e.m.f. in the coil is 20 V

B. The induced current in the coil is 10 A

C. The induced e.m.f. in the coil is 10 V

D. The induced current in the coil is 20 A

Answer:

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22. 5.5×10^{-4} magnetic flux lines are passing through a coil of resistance 10 ohm and number of turns 1000. If the number of flux lines reduces to 5×10^{-5} in 0.1 sec. Then

A. The electromotive force induced in the coil is 5V

B. The electromotive force induced in the coil is $5 \times 10^{-4} V$

C. The current induced in the coil is 0.5 A

D. The current induced in the coil is 10 A

Answer:

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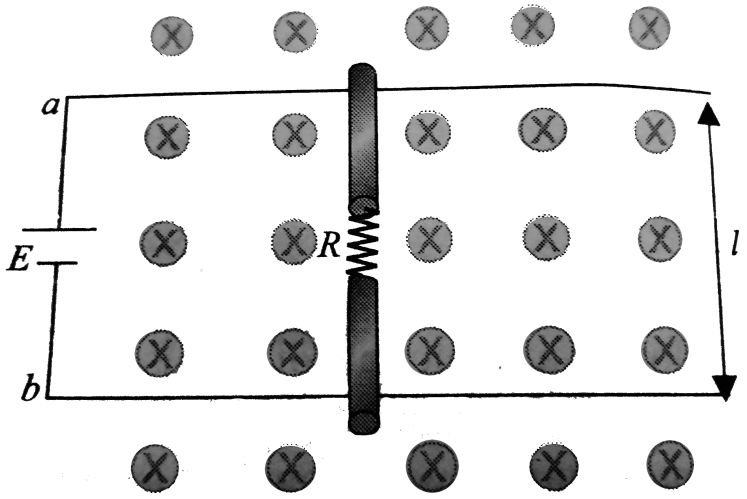
23. In Fig. shown, the rod has a resistance R, the horizontal rails have negligible friction. A battery of emf E and negligible internal

resistance is connected between points a and b. The rod is released from rest.



The velocity of the rod as function of time is

A. $\frac{E}{Bl}\left(1-e^{-t/\tau}\right)$

B. $\frac{E}{Bl}\left(1+e^{-t/\tau}\right)$

C. $\frac{3}{2}\frac{E}{Bl}\left(1-e^{-t/\tau}\right)$

D. $\frac{E}{2Bl}\left(1-e^{-t/\tau}\right)$

Answer:

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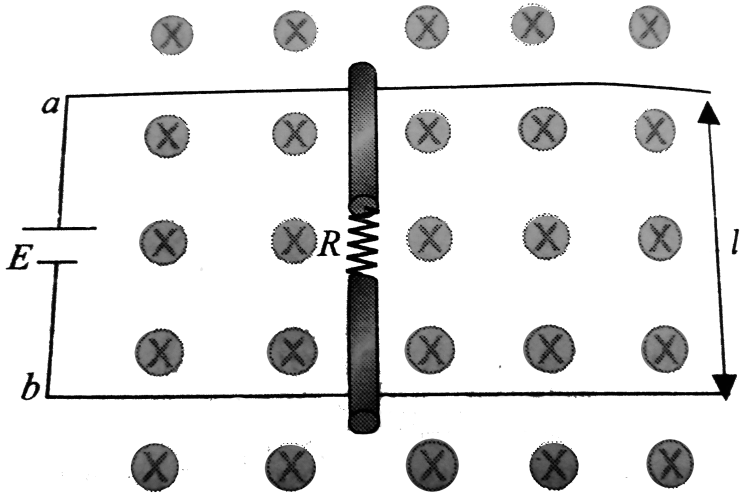
24. In Fig. shown, the rod has a resistance R, the horizontal rails have negligible friction. A battery of emf E and negligible internal resistance is connected between points a and b. The rod is released from rest.



after some time, the rod will approach a terminal speed . Find an expression for it.

A. $\frac{3}{2}\frac{E}{Bl}$

B. $\frac{E}{2Bl}$

C. $\frac{E}{Bl}$

D. $\frac{2E}{Bl}$

Answer:

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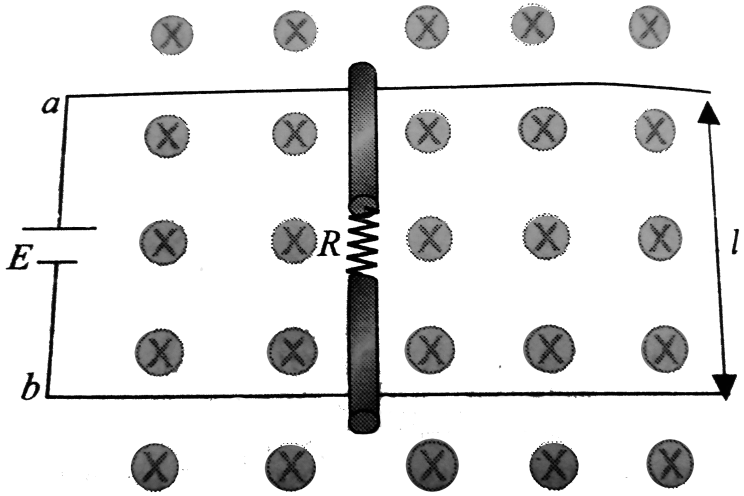
25. In Fig. shown, the rod has a resistance R, the horizontal rails have negligible friction. A battery of emf E and negligible internal resistance is connected between points a and b. The rod is released from rest.



The current when the rod attains its terminal speed is

A. $\frac{2E}{R}$

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

C. $\frac{3}{2}\frac{E}{R}$

D. zero

Answer:

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26. Statement-1 : The induced e.m.f. and current will be same in two identical loops of copper and aluminium, when rotated with same speed in the same magnetic field.

Statement-2 : Induced e.m.f. is proportional to rate of change of magnetic field while induced current depends on resistance of wire.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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27. Statement-1 : An aircraft flies along the meridian, the potential at the ends of its wings will be the same.

Statement-2 : Whenever there is change in the magnetic flux e.m.f. induces.

A. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for

Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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28. 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. Statement-1 is True, Statement-2 is True, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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29. A current increase uniformly from zero to one ampere in 0.01 second , in a coil of unductance $10mH$. The induced e.m.f. will be-

A. 1 V

B. 2 V

C. 3 V

D. 4 V

Answer: A

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30. The current in a coil varies with respect to time t as $I = 3t^2 + 2t$. If the inductance of coil be 10 mH, the value of induced e.m.f. at $t = 2s$will be-

A. $0.14V$

B. $0.12V$

C. $0.11V$

D. $0.13V$

Answer: A

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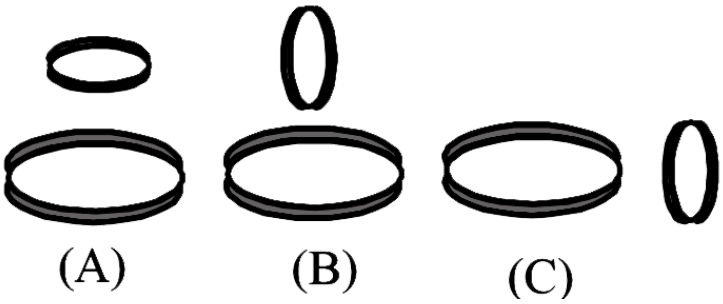
31. Two circule coil can be arranged in any of the three situations shown in the figure. Their mutual inductance will be



A. Maximum in situation (A)

B. Maximum in situation (B)

C. Maximum in situation (C)

D. The same in all situations

Answer: A

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32. A current of 10 A in primary of a circuit is reduced to zero at a unifrom rate in 10^{-3}s. If coeff.of mutual inductance is 3 H, what is the induced e.m.f. in the secondary ?

A. 3 kV

B. 30 kV

C. 2 kV

D. 20 kV

Answer: B

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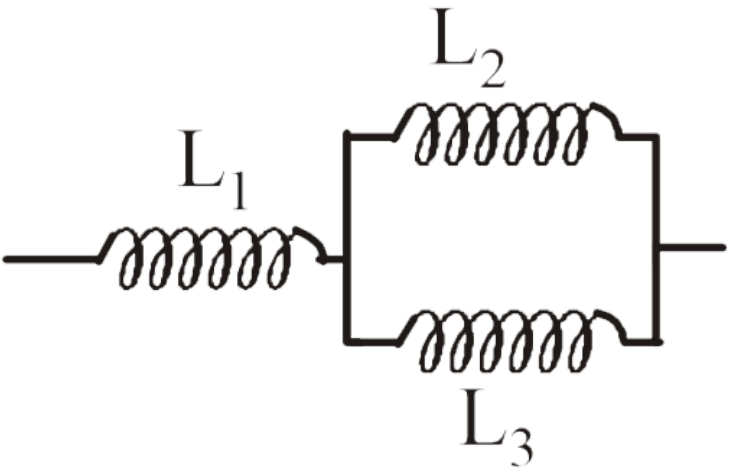
33. Three inductances are connected as shown below. Assuming no coupling, the resultant inductance will be-



$(L_1 = 0.75H, L_2 = L_3 = 0.5H)$

A. $0.25H$

B. $0.75H$

C. $0.01H$

D. $1H$

Answer:

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34. A solenoid has an inductance of 50 mH and a resistance of 0.025Ω. If it is connected to a battery, how long will it take for the current to reach one half of its final equilibrium value?

A. $1.34s$

B. $1.38s$

C. $1.38ms$

D. $0.23s$

Answer:

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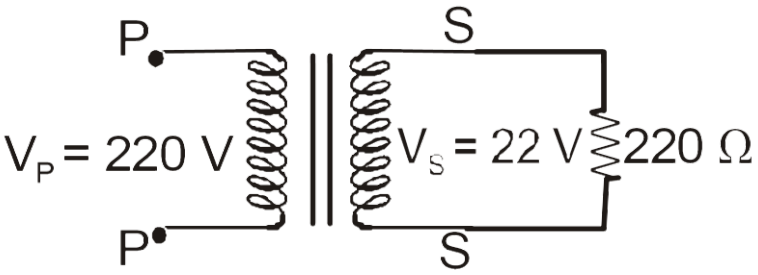
35. The current in the primary coil of a transformer (assuming no power loss) as shown in fig. will be –



A. $0.01A$

B. $1.0A$

C. $0.1A$

D. 10_6 A.

Answer:

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36. A current of 5A is flowing at 220V in the primary coil of a transformer. If the voltage produced in the secondary coil is 2200V and

50% of power is lost, then the current in the secondary coil will be –

A. $2.5A$

B. $5A$

C. $0.25A$

D. $0.025A$

Answer:

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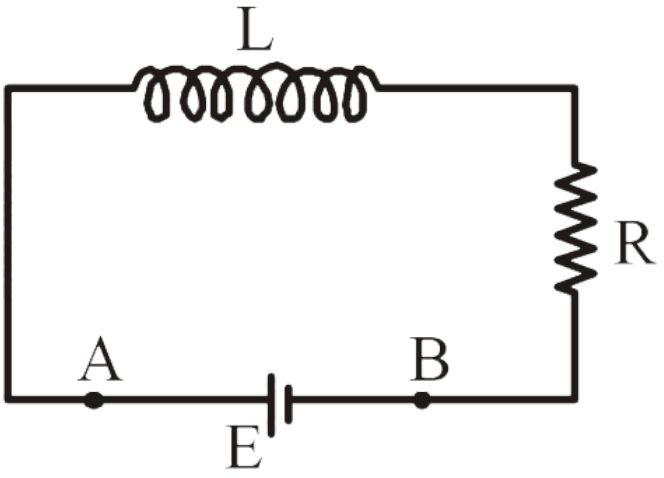
37. An inductor (L = 100 mH), a resistor $(R = 100\Omega)$ and a battery (E = 100 V) are initially connected in series as shown in the figure. After a long time the battery is disconnected after short circuiting the points A and B. The current in the circuit 1 ms after the short circuit is



A. e A

B. $0.1A$

C. $1A$

D. $1/eA$

Answer:

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38. which of ther following is constructed on the principle of electromagnetic induction?

A. Galvanometer

B. Electric motor

C. Generator

D. Voltmeter

Answer:

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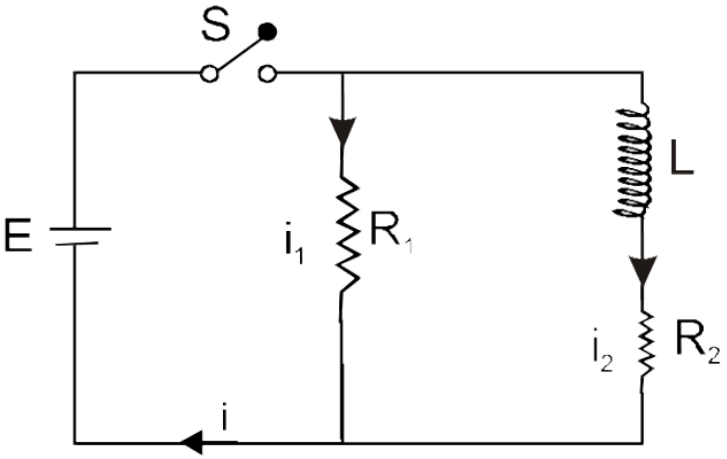
39. In the circuit, $E = 10$ volt, $R_1 = 5.0$ ohm, $R_2 = 10$ohm and $L = 5.0$ henry. The current

just after the switch S is pressed is.



A. $2.0A$

B. $3.0A$

C. $5.0A$

D. $6.0A$

Answer: A

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40. Two inductors L_1 and L_2 are at a sufficient distance apart. Equivalent inductance when they are connected (i) in series (ii) in parallel are

A. $L_1 + L_2, \dfrac{L_1 L_2}{L_1 + L_2}$

B. $L_1 - L_2, \dfrac{L_1 L_2}{L_1 - L_2}$

C. $L_1 L_2, \dfrac{L_1 + L_2}{L_1 L_2}$

D. None of these

Answer:

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41. If the current in the primary coil is reduced from 3.0 ampere to zero in 0.001 second, the induced e.m.f in the secondary coil is 1500 volt. The mutual inductance of the two coils will be-

A. $0.5H$

B. $0.05H$

C. $0.005H$

D. $0.0005H$

Answer:

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42. A 50 Hz a.c. current of crest value 1A flows through the primary of a transformer. If the mutual inductance between the primary and secondary be $1.5H$, the crest voltage induced in secondary is-

A. 75 V

B. 150 V

C. 471 V

D. 300 V

Answer:

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43. In an inductor of inductance $L = 100mH$, a current of $I = 10A$ is flowing. The energy stored in the inductor is

A. 5 J

B. 10 J

C. 100 J

D. 1000 J

Answer: A

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44. A step up transformer has transformation ratio $5:3$. What is voltage in secondary if voltage in primary is $60V$

A. 20 V

B. 60 V

C. 100 V

D. 180 V

Answer:

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45. A step down transformer has turn ration $100/1$. If secondary coil has $4amp$ current then current in primary coil is

A. $4A$

B. $0.04A$

C. $0.4A$

D. $400A$

Answer:

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46. A step-down transformer is used on a $1000V$ line to deliver $20A$ at $120V$ at the secondary coil. If the efficiency of the

transformer is 80% the current drawn from the line is.

A. $3A$

B. $30A$

C. $0.3A$

D. $2.4A$

Answer:

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47. Energy stored in an inductor is proportional to (i = current in the inductor)

A. i

B. $\sqrt{i}$

C. i^2

D. I^3

Answer: C

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48. 1Voltage (r. m. s) in the secondary coil of a transformer depends upon

(1) voltage in the primary coil

(2) ratio of number of turns in the two coils

(3) frequency of the source

(4) time-period of the source

A. 1, 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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49. Large transformers, when used for some time, become hot and are cooled by circulating oil. The heating of transformer is due to

A. 1, 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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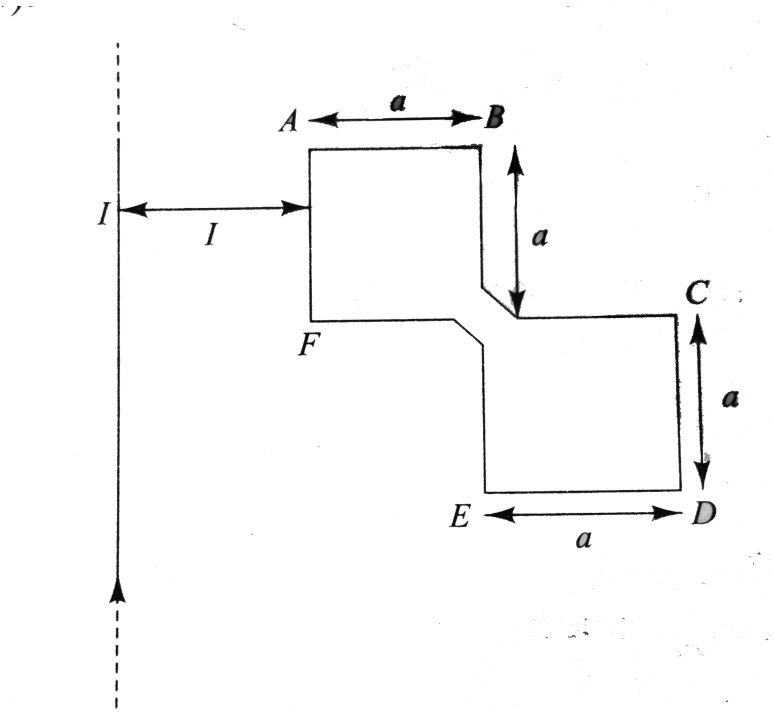
50. In Fig. there is a conducting loop $ABCDEF$ of resistance λ per unit length placed near a long straight current-carrying wire. The dimension are shown in the figure. The long wire lies in the plane of the loop. The current in the long wire varies as $I = I_0(t)$.

The mutual inductance of the pair is



A. $\frac{\mu_0 a}{2\pi} \ln\left(\frac{2a+l}{l}\right)$

B. $\frac{\mu_0 a}{2\pi} \ln\left(\frac{2a-l}{l}\right)$

C. $\frac{2\mu_0 a}{\pi} \ln\left(\frac{a+l}{l}\right)$

D. $\frac{\mu_0 a}{2\pi} \ln\left(\frac{a+l}{l}\right)$

Answer:

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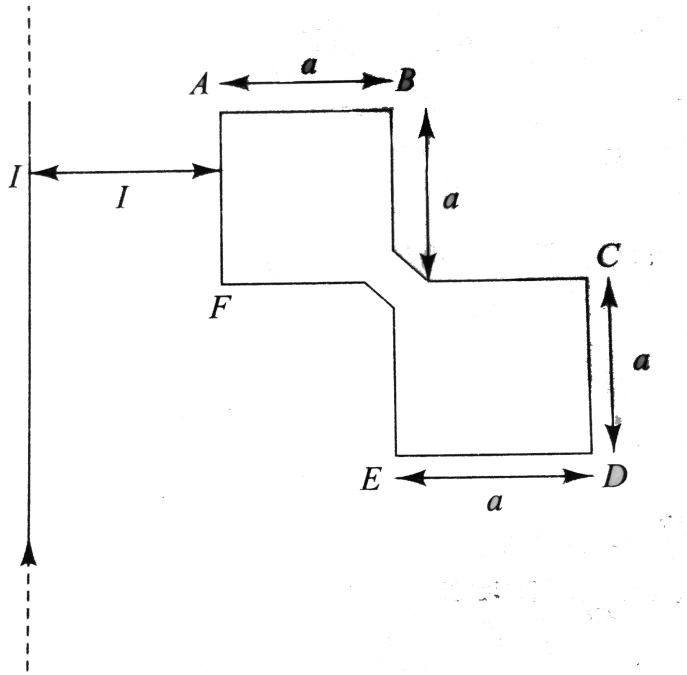
51. In Fig. there is a conducting loop $ABCDEF$ of resistance λ per unit length placed near a long straight current-carrying wire. The dimension are shows in the figure. The long wire lies in the plane of the loop. The current in the long wire varies as $I = I_0(t)$.



The emf induced in the closed loop is

A. $\frac{\mu_0 I_0 a}{2\pi} \ln\left(\frac{2a+l}{l}\right)$

B. $\frac{\mu_0 I_0 a}{2\pi} \ln\left(\frac{2a-l}{l}\right)$

C. $\frac{2\mu_0 I_0 a}{\pi} \ln\left(\frac{a+l}{l}\right)$

D. $\frac{\mu_0 I_0 a}{\pi} \ln\left(\frac{a+l}{l}\right)$

Answer:

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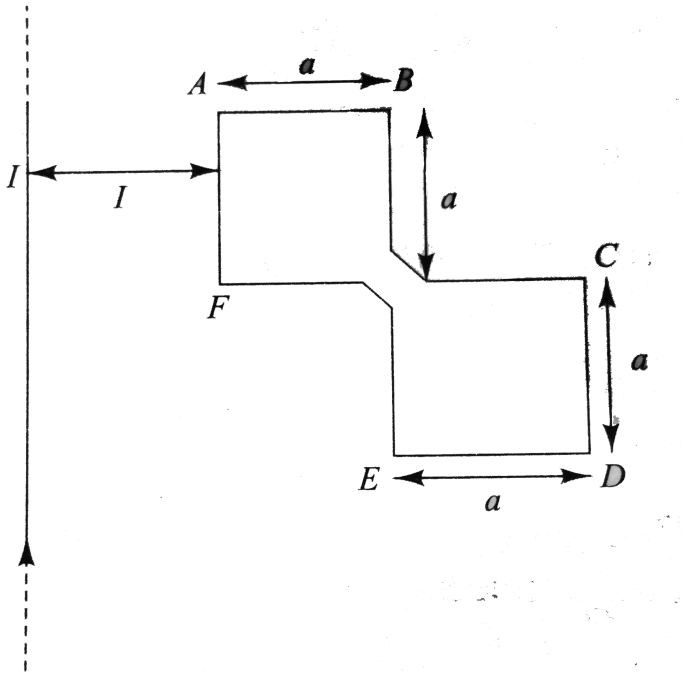
52. In Fig. there is a conducting loop $ABCDEF$ of resistance λ per unit length placed near a long straight current-carrying wire. The dimension are shows in the figure. The long wire lies in the plane of the loop. The current in the long wire varies as $I = I_0(t)$.



The heat produced in the loop in time t is

A. $\dfrac{\left[\frac{\mu_0}{2\pi}\ln\left(\frac{a+l}{l}\right)I_0\right]^2 at}{4\lambda}$

B. $\dfrac{\left[\frac{\mu_0}{2\pi}\ln\left(\frac{2a+l}{l}\right)I_0\right]^2 at}{8\lambda}$

C. $\dfrac{\left[\frac{\mu_0}{2\pi}\ln\left(\frac{3a+l}{l}\right)I_0\right]^2 at}{6\lambda}$

D.

Answer:

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53. Assertion: Soft iron is used as transformer core.

Reason: Soft iron has narrow hysteresis loop.

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54. Assertion : An electric motor will have maximum efficiency when back emf becomes equal to half of applied emf.

Reason : Efficiency of electric motor depends only on magnitude of back emf.

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55. Statement-1 : A transformer cannot work on dc supply.

Statement-2 : dc changes neither in magnitude nor in direction.

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