



# PHYSICS

## BOOKS - DISHA PHYSICS (HINGLISH)

### ELECTROMAGNETIC INDUCTION

#### Physics

1. A metal disc of radius 100 cm is rotated at a constant angular speed of  $60 \text{ rad/s}$  in a plane at right angles to an external field of magnetic

induction  $0.05 \text{ Wb/m}^2$ . The emf induced between the centre and a point on the rim will be

A. 3 V

B. 1.5 V

C. 6 V

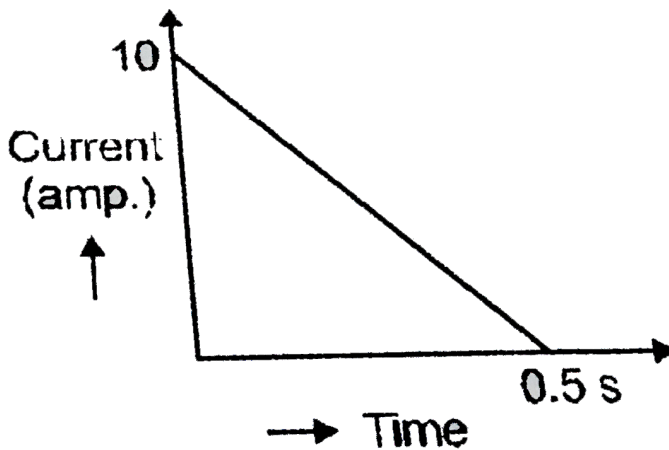
D. 9 V

**Answer:**



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2. In a coil of resistance  $100\Omega$  , a current is induced by changing the magnetic flux through it as shown in the figure. The magnitude of change in flux through the coil is



A. 250 Wb

B. 275 Wb

C. 200 Wb

D. 225 Wb

**Answer:**



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3. A 10-meter wire is kept in east-west direction. It is falling down with a speed of 5.0 meter / second, perpendicular to the horizontal component of earth's magnetic field of  $0.30x \times 10^{-4}$  weber / meter<sup>2</sup>. The

momentary potential difference induced  
between the ends of the wire will be

A. 0.0015 V

B. 0.015 V

C. 0.15 V

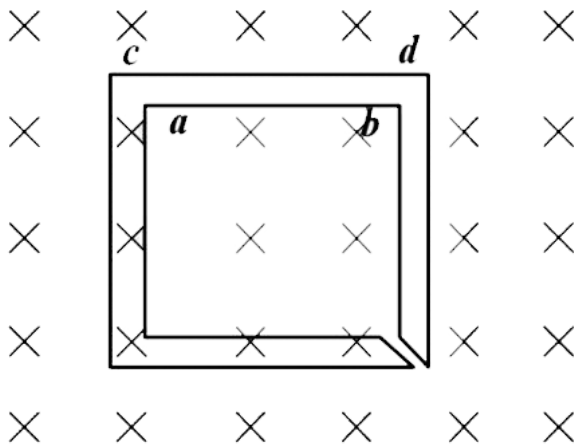
D. 1.5 V

**Answer:**



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4. 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.  $I_1$  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:**



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5. Two solenoids of equal number of turns have their lengths and the radii in the same ratio 1:2. The ratio of their self inductances will be

A. 1 : 2

B. 2 : 1

C. 1 : 1

D. 1 : 4

**Answer:**



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6. 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 mV

B.  $50\mu V$

C.  $5\mu V$

D. 50 mV

**Answer:**



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7. Eddy currents do not produce

A. heat

B. a loss of energy

C. spark

D. damping of motion

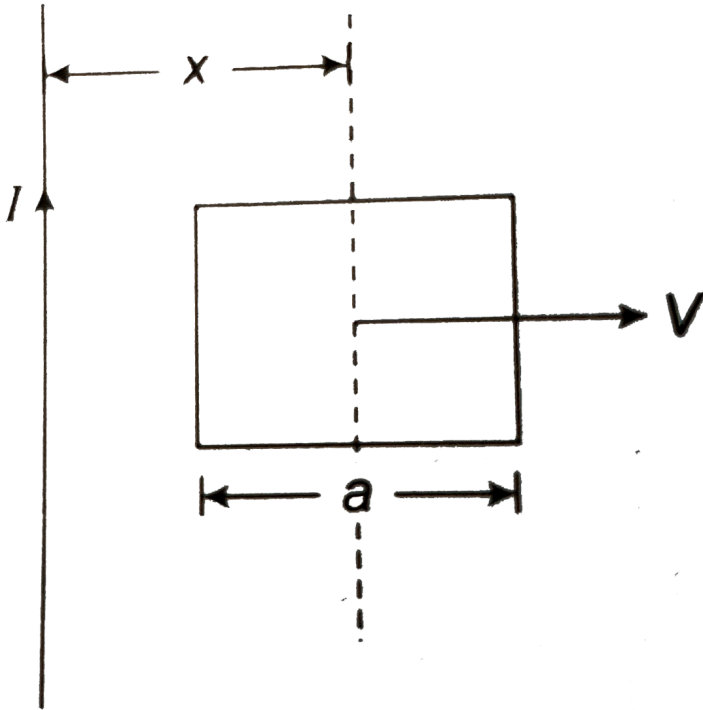
**Answer:**



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8. 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.  $\frac{1}{(2x + a)^2}$
- C.  $\frac{1}{(2x - a)(2x + a)}$

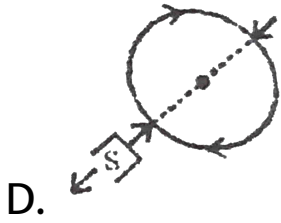
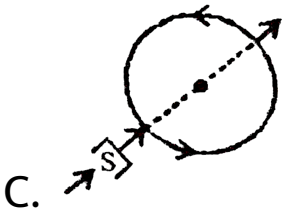
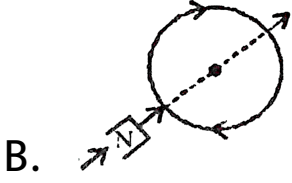
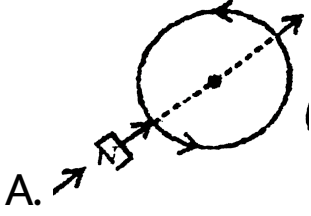
D.  $\frac{1}{x^2}$

**Answer:**



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9. 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



**Answer:**

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10. The magnetic flux (in weber) linked with a coil of resistance  $10\Omega$  is varying with respect to time  $t$   $\phi = 4t^2 + 2t + 1$ . Then the current in the coil at time  $t = 1$  second is

A. 0.5 A

B. 2A

C. 1.5 A

D. 1A

**Answer:**



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

A.  $2.4\pi \times 10^{-5})\text{H}$

B.  $4.8\pi \times 10^{-4}\text{H}$

C.  $4.8\pi \times 10^{-5}\text{H}$

D.  $2.4\pi \times 10^{-4}\text{H}$



**Answer:**



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**12.** When the current changes from  $+2A \rightarrow -2A$  in 0.05 second, an e.m.f. of 8 V is induced in a coil. The coefficient of self - induction of the coil is

A. 0.2 H

B. 0.4 H

C. 0.8 H

D. 0.1 H

**Answer:**



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**13.** 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. 2.5 henry

B. 2.0 henry

C. 1.0 henry

D. 40 henry

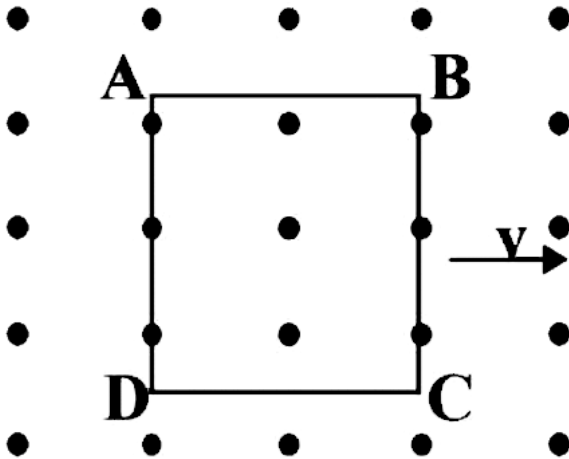
**Answer:**



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**14.** 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:**



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

A.  $N. A. B. R. \omega$

B.  $N.A.B$

C.  $N.A.B.R.$

D.  $N. A. B. \omega$

**Answer:**



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**16.** 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. 4s

B. 3s

C. 2s

D. 1s

**Answer:**



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**17.** Choke coil works on the principle of

A. transient current

B. self induction

C. mutual induction

D. wattles current

**Answer:**



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18. A coil having  $n$  turns and resistance  $R\Omega$  is connected with a galvanometer of resistance  $4R\Omega$ . This combination is moved in time  $t$  seconds from a magnetic field  $W_1$  weber to  $W_2$  weber. The induced current in the circuit is

A.  $-\frac{(W_1 - W_2)}{Rnt}$

B.  $\frac{n(W_2 - W_1)}{5Rt}$

C.  $-\frac{(W_2 - W_1)}{5Rnt}$



$$D. - \frac{n(W_2 - W_1)}{5Rt}$$

**Answer:**



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**19.** A thin circular ring of area  $A$  is held perpendicular to a uniform magnetic field of induction  $B$ . A small cut is made in the ring and a galvanometer is connected across the ends such that the total resistance of the circuit is  $R$ . When the ring is suddenly

squeezed to zero area, the charge flowing through the galvanometer is

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

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

C.  $ABR$

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

**Answer:**



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20. A boat is moving due east in a region where the earth's magnetic field is  $5.0 \times 10^{-5} \text{ N A}^{-1} \text{ m}^{-1}$  due north and horizontal. The boat carries a vertical aerial 2 m long. If the speed of the boat is  $1.50 \text{ m s}^{-1}$ , the magnitude of the induced emf in the wire of aerial is:

A. 0.75 mV

B. 0.50 mV

C. 0.15 mV

D. 1 mV

**Answer:**



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

A. 0.5 A

B.  $5A$

C.  $50 A$

D.  $5 \times 10^8 A$

**Answer:**



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22. A horizontal straight wire 20 m long extending from east to west falling with a speed of  $5.0m/s$ , at right angles to the horizontal component of the earth's magnetic

field  $0.30 \times 10^{-4} \text{Wb}/\text{m}^2$ . The instantaneous value of the e.m.f. induced in the wire will be

A. 3mV

B. 4.5mV

C. 1.5mV

D. 6.0mV

**Answer:**



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23. The self inductance of a long solenoid cannot be increased by

A. increasing its area of cross section

B. increasing its length

C. changing the medium with greater permeability

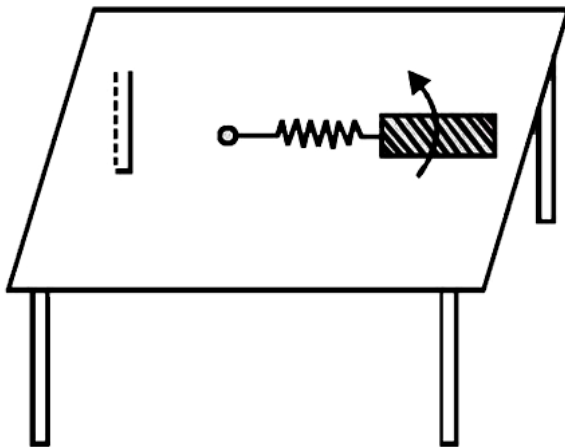
D. increasing the current through it

**Answer:**



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**24.** A metallic rod of length ' $l$ ' is tied to a string of length  $2l$  and made to rotate with angular speed  $\omega$  on a horizontal table with one end of the string fixed. If there is a vertical magnetic field ' $B$ ' in the region, the e.m.f. Induced across the ends of the rod is





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

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

C.  $\frac{4B\omega l^2}{2}$

D.  $\frac{5B\omega l^2}{2}$

**Answer:**



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**25.** Lenz's law gives:

A. the magnitude of the induced e.m.f.

B. the direction of the induced current

C. both the magnitude and direction of the induced current

D. the magnitude of the induced current

**Answer:**



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**26.** A metal ring is held horizontally and bar magnet is dropped through the ring with its

length along the axis of the ring. The acceleration of the falling magnet

A. is equal to  $g$

B. is less than  $g$

C. is more than  $g$

D. depends on the diameter of ring and length of magnet

**Answer:**



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27. The pointer of a dead-beat galvanometer gives a steady deflection because

A. eddy currents are produced in the conducting frame over which the coil is wound.

B. its magnet is very strong

C. its pointer is very light.

D. its frame is made of ebonite.

**Answer:**



28. A metal rod of length  $l$  cuts across a uniform magnetic field  $B$  with a velocity  $v$ . If the resistance of the circuit of which the rod forms a part is  $r$ , then the force required to move the rod is

A.  $\frac{B^2 l^2 v}{r}$

B.  $\frac{Blv}{r}$

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

D.  $\frac{B^2 l^2 v^2}{r}$

**Answer:**



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**29.** In an A.C. generator, when the plane of the armature is perpendicular to the magnetic field

A. both magnetic flux and emf are maximum

B. both magnetic flux and emf are zero

C. both magnetic flux and emf are half of their respective maximum values

D. magnetic flux is maximum and emf is zero

**Answer:**



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**30.** A copper disc of radius  $0.1m$  rotates about its centre with 10 revolution per second in a

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

A.  $\frac{\pi}{10}$  volt

B.  $\frac{2\pi}{10}$  volt

C.  $\pi \times 10^{-2}$  volt

D.  $2\pi \times 10^{-2}$  volt

**Answer:**



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31. The mutual inductance of a pair of coils, each of  $N$  turns, is  $M$  henry. If a current of  $I$  ampere in one of the coils is brought to zero in  $t$  second, the emf induced per turn in the other coil, in volt, will be

A.  $\frac{MI}{t}$

B.  $\frac{NMI}{t}$

C.  $\frac{MN}{It}$

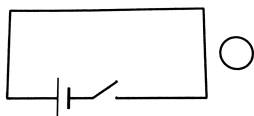
D.  $\frac{MI}{Nt}$

**Answer:**



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



A. a clockwise current

B. an anticlockwise current

C. an anticlockwise current and then clockwise

D. a clockwise current and then an anticlockwise current

**Answer:**



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**33.** 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 to both the cases

D. larger or smaller depending upon the radius of the coil

**Answer:**



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**34.** A circular wire of radius  $r$  rotates about its own axis with angular speed  $\omega$  in a magnetic field  $B$  perpendicular to its plane, then the induced e.m.f. is

A.  $\frac{1}{2}Br\omega^2$

B.  $Br\omega^2$

C.  $2Br\omega^2$

D. zero

**Answer:**



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**35.** A conducting ring of radius 1 m kept in a uniform magnetic field  $B$  of 0.01 T, rotates uniformly with an angular velocity  $100 \text{ rad s}^{-1}$

with its axis of rotation perpendicular to  $B$ .

The maximum induced emf in it is

A.  $1.5\pi V$

B.  $\pi V$

C.  $2\pi V$

D.  $0.5\pi V$

**Answer:**



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**36.** A magnetic field of  $2 \times 10^{-2}T$  acts at right angles to a coil of area  $100\text{cm}^2$  with 50 turns. The average emf induced in the coil is  $0.1V$ , when it is removed from the field in time  $t$ . The value of  $t$  is

A. 10 s

B. 0.1s

C. 0.01s

D. 1s

**Answer:**



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

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

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

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



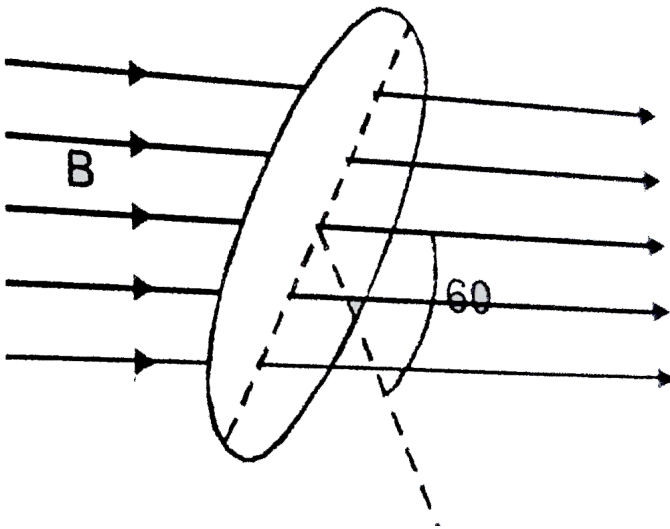
$$D. Q = \frac{\Delta\phi}{\Delta t}$$

**Answer:**



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**38.** Fig shown below represents an area  $A = 0.5m^2$  situated in a uniform magnetic field  $B = 2.0\text{weber} / m^2$  and making an angle of  $60^\circ$  with respect to magnetic field.



The  
value of the magnetic flux through the area  
would be equal to

- A. 2.0 weber
- B.  $\sqrt{3}$  weber
- C.  $\sqrt{3}/2$  weber
- D. 0.5 weber

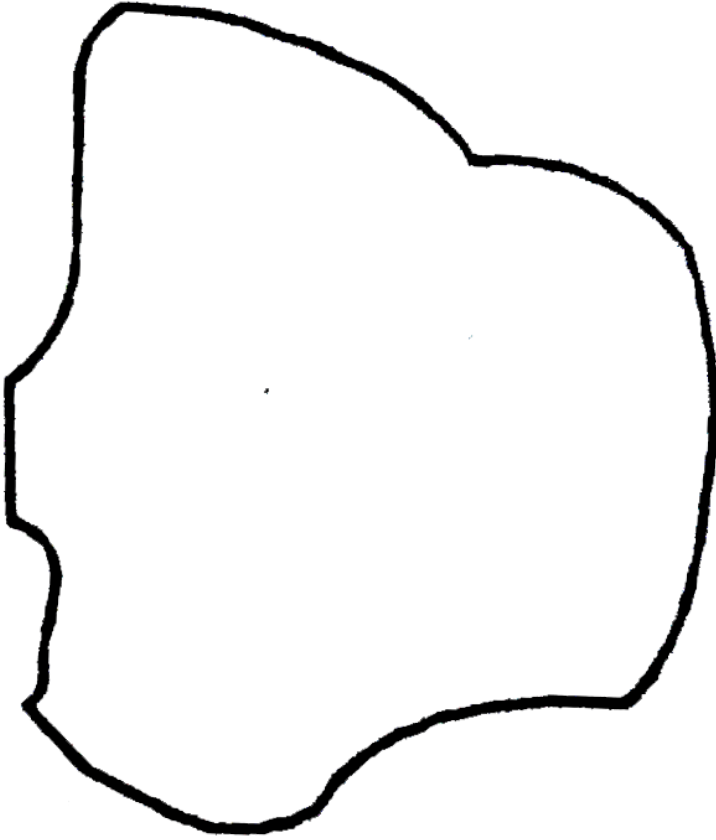
**Answer:**



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**39.** As a result of change in the magnetic flux linked to the closed loop shown in the fig, an e.m.f.  $V$  volt is induced in the loop. The work done (joule) in taking a charge  $Q$  coulomb

once along the loop is



A.  $QV$

B.  $2QV$

C.  $QV / 2$

D. Zero

**Answer:**



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**40.** Two coil are placed close to each other. The mutual inductance of the pair of coils depends upon.

A. the rates at which currents are changing  
in the two coils

B. relative position and orientation of the  
two coils

C. the materials of the wires of the coils

D. the currents in the two coils

**Answer:**



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**41.** When current  $i$  passes through an inductor of self inductance  $L$ , energy stored in it is  $\frac{1}{2} Li^2$ . This is stored in the

A. current

B. voltage

C. magnetic field

D. electric field

**Answer:**

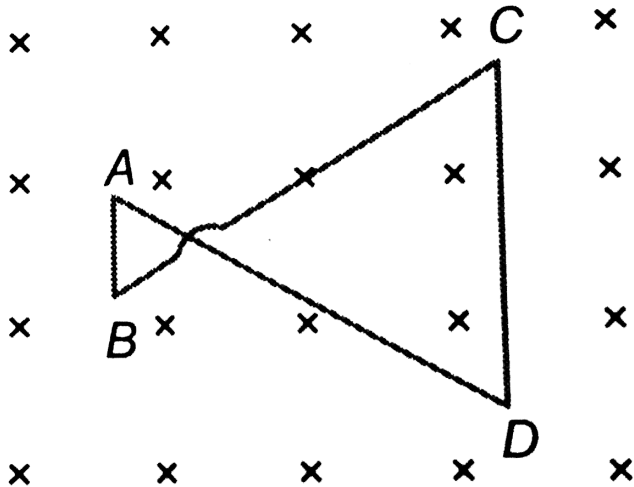


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**42.** A conducting wire frame is placed in a magnetic field which is directed into the paper. The magnetic field is increasing at a constant

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



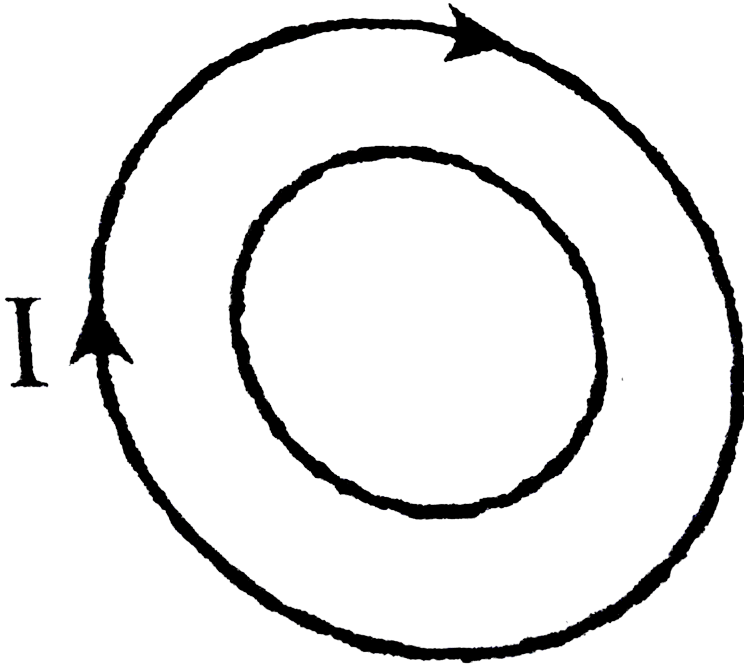
**Answer:**



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**43.** Two different wire loops are concentric and lie in the same plane. The current in the outer loop ( $I$ ) is clockwise and increases with time.

The induced current in the inner loop



A. is clockwise

B. is zero

C. is counter clockwise

D. has a direction that depends on the ratio of the loop radii.

**Answer:**



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**44.** When current in a coil changes from 5 A to 2 A in 0.1 s, average voltage of 50 V is produced. The self - inductance of the coil is :

A. 6 H

B. 0.67 H

C. 3 H

D. 1.67 H

**Answer:**



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**45.** Two concentric circular coils, one of small radius  $r_1$  and the other of large radius  $r_2$ , such that  $r_1 \ll r_2$ , are placed co-axially

with centres coinciding. Obtain the mutual inductance of the arrangement.

A.  $R_1 / R_2$

B.  $R_2 / R_1$

C.  $R_1^2 / R_2$

D.  $R_2^2 / R_1$

**Answer:**



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