PHYSICS

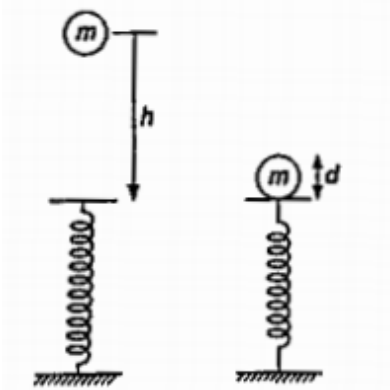
BOOKS - SARAS PUBLICATION

MAGNETIC EFFECTS OF CURRENT AND MAGNETISM

Example

1. A vertical spring with force constant K is fixed on a table. A ball of mass m at a height H

above the free upper end of the spring falls vertically on the spring so that the spring is compressed by a dsitance d. The net work done in the process is:



A. $mg(h-d)+\frac{1}{2}Kd^2$

B. $mg(h+d)+\frac{1}{2}Kd^2$

C. $mg(h+d)-\frac{1}{2}Kd^2$

D. $mg(h-d)-\frac{1}{2}Kd^2$

Answer:

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2. Under the influence of a uniform magnetic field a charged particle is moving in a circle of radius r with constant speed v. The time period of the motion:

A. depends on R and not on v

B. depends on v and not on R

C. depends on both R and v

D. is independent of both R and v

Answer:

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3. The primary and secondary coils of a transformer 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 second and ϕ_0 is

a constant , the output voltage across the secondary coil is:

A. `30 volts

B. 90 volts

C. 120 volts

D. 220 volts

Answer:

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4. The ratio of the radii of gyration of a circular disc to that of a circular ring, each of same mass and radius, around their respective axes is:

A. $\sqrt{3}:\sqrt{2}$

B. $1:\sqrt{2}$

C. $\sqrt{2}:1$

D. $\sqrt{2}:\sqrt{3}$

Answer:

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5. The ground state energy of hydrogen atom is -13.6 eV. When its electron is in the first excited state, its excitation energy is:

A. $3.4eV$

B. $6.8eV$

C. $10.2eV$

D. 0

Answer:

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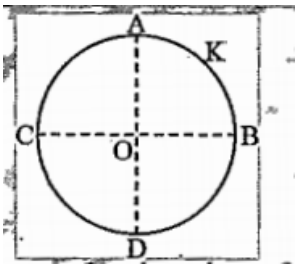
6. A thin conducting ring of radius R is given a change +Q . The electric field at the centre O of the ring due to the charge on the part AKB of the ring is E. The electric field at the centre due to the charge on the part ACDB of the ring is:



A. $3E, along KO$

B. $EalongOK$

C. $EalongKO$

D. $3EalongOK$

Answer:

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7. The velocity of electromagnetic radiation in a medium of permittivity ε_0 and permeability μ_0 is given by:

A. $\sqrt{\frac{\varepsilon_0}{\mu_0}}$

B. $\sqrt{\mu_0 \varepsilon_0}$

C. $\frac{1}{\sqrt{\mu_0 \varepsilon_0}}$

D. $\sqrt{\frac{\mu_0}{\varepsilon_0}}$

Answer:

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8. A circular disc of radius 0.2 meter is placed in a uniform magnetic field of induction

$\frac{1}{\pi}\left(\frac{Wb}{m^2}\right)$ in such a way that its axis makes an angle of 60° with B The magnetci flux linked with the disc is:

A. $0.02\omega b$

B. $0.06\omega b$

C. $0.08\omega b$

D. $0.01\omega b$

Answer:

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9. When a diamagnetic substance is brough near the north or the south pole of a bar magnet, it is

A. repelled by the north pole and attracted by the south pole

B. attracted by the north pole and repelled by the south pole

C. attracted by both the poles

D. repelled by both the poles

Answer:

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

A. $4.8\pi\mu V$

B. $0.8\pi\mu V$

C. $1.6\pi\mu V$

D. $3.2\pi\mu V$

Answer:

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11. The magnetic force acting on a charged particle of charge $-2\mu C$ in a magnetic field of 2T acting in y direction, when the particle velocity is $\left(2\hat{i}+3\hat{j}\right)\times 10^{6}ms^{-1}$, is:

A. 4 N is z direction

B. 8 N is y direction

C. 8 N in z direction

D. 8 N in -z direction

Answer:

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12. Under the influence of a uniform magnetic field a charged particle is moving in a circle of radius r with constant speed v. The time period of the motion:

A. depends on R and not on V

B. is independent of both V and R

C. depends on both V and R

D. depends on V and not on R

Answer:

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13. A beam of cathode rays is subjected to crossed electric (E) and magnetic fields (B). The fields are adjusted such that the beam is not

deflected. The specific charge of the cathode rays is given by:

A. $\frac{B^2}{2VE^2}$

B. $\frac{2VB^2}{E^2}$

C. $\frac{2VE^2}{B^2}$

D. $\frac{E^2}{2VB^2}$

Answer:

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

A. $2\pi\mu V$

B. $\pi\mu V$

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

D. $2\mu V$

Answer:

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15. A vibration magnetometer placed in magnetic meridian has a small bar magnet. The magnet executes oscillations with a time period of 2 sec in earths horizontal magnetic field of 24 microtesla. When a horizontal field of 18 microtesla is produced opposite to the earths field by placing a current carrying wire, the new time period of magnet will be

A. $1s$

B. $2s$

C. $3s$

D. $4s$

Answer:

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16. Electromagnets are made of soft iron because soft iron has ..... .

A. low retentivity and high coercive force

B. high retentivity and high coercive force

C. low retentivity and low coercive force

D. high retentivity and low coercive force

Answer:

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17. A parallel plate condenser has a uniform electric field E (V/m) in the space between the plates. If the distance between the plates

is d (m) and area of each plate is A $\left(m^2\right)$ the energy (joules) stored in the condenser is:

A. $\frac{1}{2}\varepsilon_0 E^2 Ad$

B. $E^2 Ad / \varepsilon_0$

C. $\frac{1}{2}\varepsilon_0 E^2$

D. $\varepsilon_0 E^2 Ad$

Answer:

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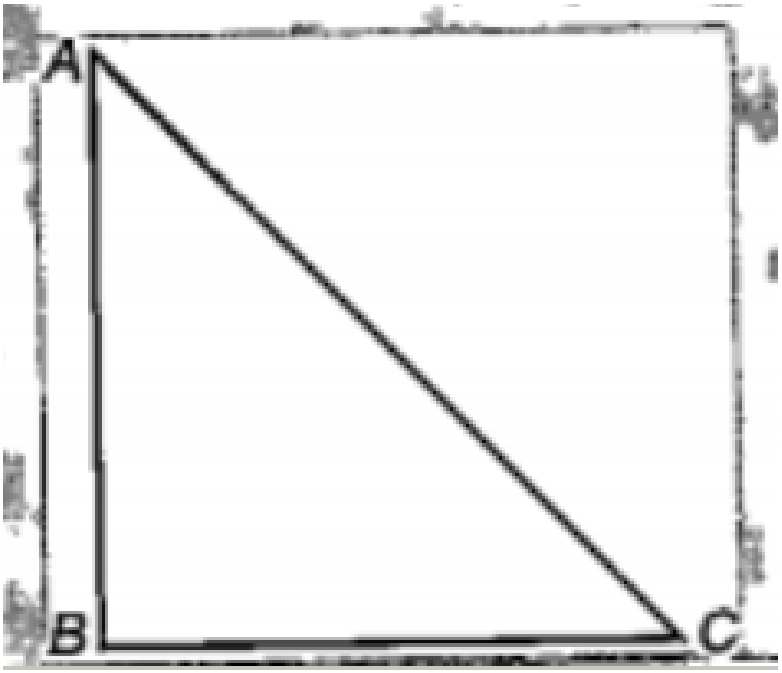
18. A current carrying closed loop in the form of a right angle isosceles triangle ABC is placed in a uniform magnetic field acting along AB. If the magnetic force on the arm BC is F, the force on the arm AC is:



A. $\sqrt{2F}$

B. $-\sqrt{2F}$

C. $-\overrightarrow{F}$

D. $\overrightarrow{F}$

Answer:

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19. the electric and the magnetic field, associated with an electromagnetic wave,

propagating along X axis can be represented by

A. $\left[\vec{E} = E_0\hat{j}, \vec{B} = B_0\hat{k}\right]$

B. $\left[\vec{E} = E_0\hat{i}, \vec{B} = B_0\hat{j}\right]$

C. $\left[E = E_0\hat{k}, \vec{B} = B_0\vec{i}\right]$

D. $\left[\vec{E} = E_0\hat{j}, \vec{B} = B_0\hat{i}\right]$

Answer:

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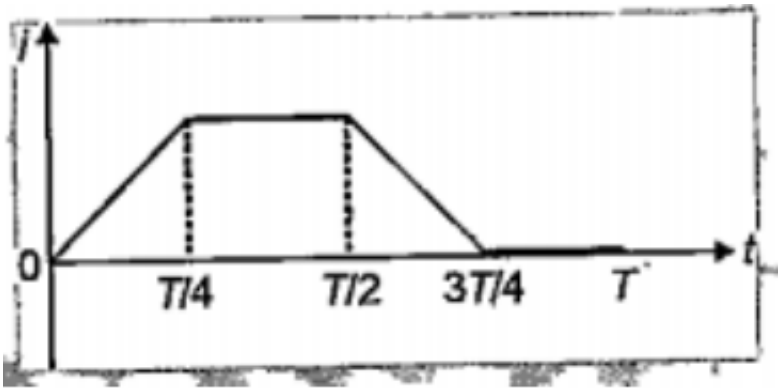
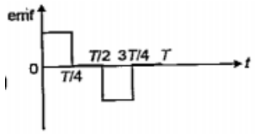
20. The current I in a coil varies with time as shownn in the figure. The variation of induced emf with time would be:



A.



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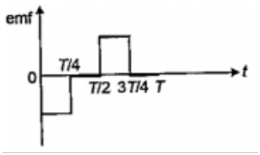
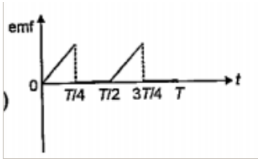


C.



D.

Answer:

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21. The magnifying power of a telescope is 9. When it is adjusted for parallel rays the distance between the objective and eyepiece is 20 cm. The focal length of lenses are:

A. 15 cm, 5 cm

B. 18 cm, 2 cm

C. 11 cm, 9 cm

D. 10 cm, 10 cm

Answer:

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22. A compass needle which is allowed to move in a horizontal plane is taken to a geomagnetic pole it:

A. will stay in any position

B. will stay in north - south direction only

C. will stay in east-west direction only

D. will become rigid showing no movement

Answer:

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23. Two similar coils of radius R are lying concentrically with their planes at right angles to each other. The currents flowing on them are I and 2I, respectively. The resultant magnetic field induction at the centre will be:

A. $\frac{3\mu_0 I}{2R}$

B. $\frac{\mu_0 I}{2R}$

C. $\frac{\mu_0 I}{R}$

D. $\frac{\sqrt{5}\mu_0 I}{2R}$

Answer:

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24. A coil of resistance 400 is placed in a magnetic field. If the magnetic flux $\phi(wb)$ linked with the coil varies with time t (sec) as $\phi = 50t^2 + 4$. The current in the coil t= 2sec is:

A. $0.1A$

B. $2A$

C. $1A$

D. $0.5A$

Answer:

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25. When a proton is released from rest in a room, it starts with an initial acceleration a_0 towards west. When it is projected towards north with a speed ν_0 it moves with an initial acceleration $2a_0$ toward west. The electric and magnetic fields in the room are

A. $\frac{ma_0}{e} west, \frac{2ma_0}{ev_0} up$

B. $\frac{ma_0}{e} west, \frac{2ma_0}{ev_0} down$

C. $\frac{ma_0}{e} e*, \frac{3ma_0}{ev_0} up$

D. $\frac{ma_0}{e} e*, \frac{3ma_0}{ev_0} up$

Answer:

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26. A current loop in a magnetic field

A. Experiences a torque whether the field is uniform or non uniform in all orientations

B. Can be in equilibrium in one orientation

C. Can be in equilibrium in two orientations, both the equilibrium states are unstable

D. Can be in equilibrium in two orientations, one stable while the other is unstable

Answer:

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27. A long straight wire carries a certain current and produces a magnetic field $2 \times 10^{-4} Weber/m^2$ at a perpendicular distance of 5 cm from the wire. An electron situated at 5 cm from the wire. An electron situated at 5cm from the wire moves with a velocity $10^7 m/s$ towards the wire along perpendicular to it. The force experience by

the electron will be (charge on electron $1.6 \times 10^{-19} C$).

A. $zero$

B. $3.2N$

C. $3.2 \times 10^{-16} N$

D. $1.6 \times 10^{-16} N$

Answer:

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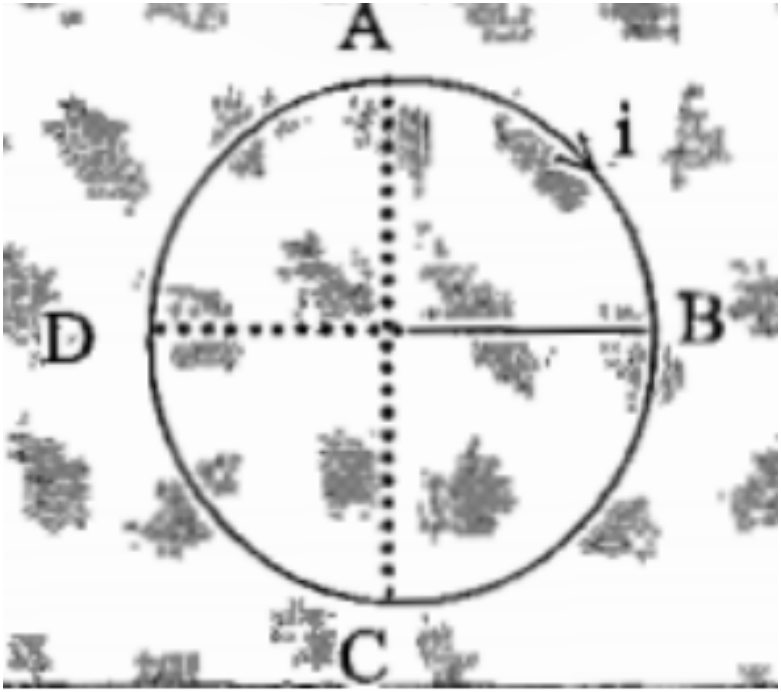
28. A circular coil ABCD carrying a current i is placed in a uniform magnetic field. If the magnetic force on the segment AB is $\overrightarrow{F}$, the force on the remaining segment BCDA is:



A. $\overrightarrow{F}$

B. $-\overrightarrow{F}$

C. $3\overrightarrow{F}$

D. $-3\overrightarrow{F}$

Answer:

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29. A bar magnet of magnetic moment M is placed at right angles to magnetic induction B. If a force F is experience by each pole of the magnet, the length of the magnet will be

A. F/MB

B. MB/F

C. BF/M

D. MF/B

Answer:

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30. Copper of fixed volume V is drawn into a wire of length l. When this wire is subjected to a constant force F, the extension produced in

the wire is Δl. Which of the following graphs is a straight line?

A. $\Delta l Versus \frac{1}{I}$

B. $\Delta l Versus I^2$

C. $\Delta l Versus \frac{1}{I^2}$

D. $\Delta l Versus l$

Answer:

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31. In a region, the potential is represented by V (x,y,z) = 6x - 8xy - 8y + 6yz, where V is in volts and x, y, z are in meters. The electric force experienced by a charge of 2 coulomb situated at point (1,1,1) is

A. $6\sqrt{5}N$

B. $30N$

C. $24N$

D. $4\sqrt{35}N$

Answer:

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32. In an ammeter 0.2% of main current passes through the galvanometer. If resistance of galvanometer is G, the resistance of ammeter will be

A. $\frac{1}{499}G$

B. $\frac{499}{500}G$

C. $\frac{1}{500}G$

D. $\frac{500}{499}G$

Answer:

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33. Two identical long conducting wires AOB and COD are placed at right angle to each other, with one above other such that O is their common point for the two. The wires carry I_1 and I_2 currents, respectively. Point P is lying at distance d from O along a direction perpendicular to the plane containing the wires. The magnetic field at the point P will be

A. $\frac{\mu_0}{2\pi d}\left(\frac{I_1}{I_2}\right)$

B. $\frac{\mu_0}{2\pi d}(I_1 + I_2)$

C. $\frac{\mu_0}{2\pi d}(I_1^2 - I_2^2)$

D. $\frac{\mu_0}{2\pi d}(I_1^2 + I_1^2)^{\frac{1}{2}}$

Answer:

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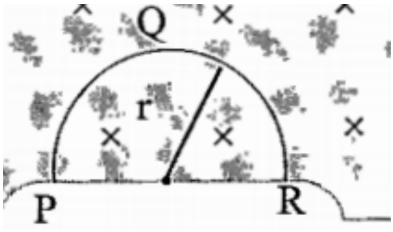
34. A thin semicircular conducting ring (PQR) of radius r is falling with its plane vertical in a horizontal magnetic field B, as shown in figure.

The potential difference developed across the ring when its speed is v, is:



A. zero

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

C. πBv and R is at higher potential

D. 2rBv and R is at higher potential

Answer:

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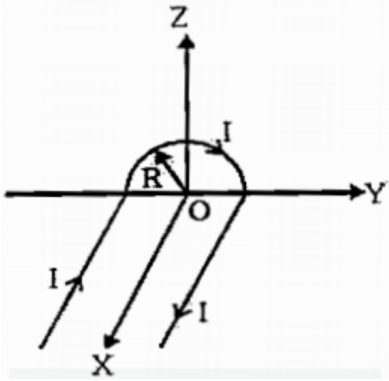
35. A wire carrying current I has the shape as shown in adjoining figure. Linear parts of the wire are very long and parallel to X- axis while semicircular portion of radius R is lying in Y - Z plane. Magnetic field at point O is:



A. $\overrightarrow{B} = \frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} - 2\hat{k}\right)$

B. $\overrightarrow{B} = \frac{-\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} + 2\hat{k}\right)$

C. $\vec{B} = \frac{-\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} - 2\hat{k}\right)$

D. $\vec{B} = \frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} + 2\hat{k}\right)$

Answer:

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36. A rectangular coil of length 0.12 m and width 0.1m having 50 turns of wire is suspended vertically in a uniform magnetic field of strength $0.2\frac{Weber}{m^2}$. The coil carries a current of 2A. If the plane of the coil is inclined

at an angle of 30degree with the direction of the field, the torque required to keep the coil in stable equilibrium will be

A. $0.12Nm$

B. $0.15Nm$

C. $0.20Nm$

D. $0.24Nm$

Answer:

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37. A proton and an alpha particle both enter a region of uniform magnetic field, B, moving at right angles to the field B. If the radius of circular orbits for both the particles is equal and the kinetic energy acquired by proton is 1 MeV, the energy acquired by the alpha particle will be

A. $1MeV$

B. $4MeV$

C. $0.5MeV$

D. $1.5MeV$

Answer:

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38. 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 4x 10^{-3} Wb. The self - inductance of the solenoid is

A. $1H$

B. $4H$

C. $3H$

D. $2H$

Answer:

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39. A long straight wire of radius carries a steady current I. The current is uniformly distributed over its cross - section. The ratio of the magnetic fields B and B', at a radial

distances $\frac{a}{2}$ and 2a respectively, from the axis of the wire is

A. 4

B. $\frac{1}{4}$

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

D. 1

Answer:

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40. A long wire carrying a steady current is bent into a circular loop of one turn. The magnetic field at the centre of the loop is B. It is then bent into a circular coil of n turns. The magnetic field at the centre of this coil of n turns will be

A. $2nB$

B. $2n^2B$

C. nB

D. n^2B

Answer:

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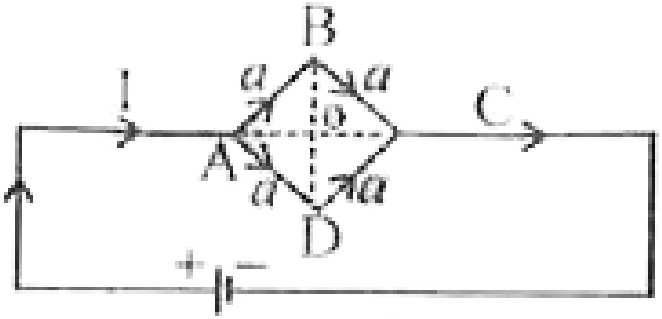
41. Magnetic field induction at athe cetre O of a square loop of side a carrying current I as shown in figure is



A. $-\frac{d\vec{B}}{dt}\pi r^2$ in loop 1 and zero in loop 2

B. $-\frac{d\vec{B}}{dt}\pi R^2$ in loop 1 and zero in loop 2

C. Zero in loop 1 and zero in loop 2

D. $-\frac{d\vec{B}}{dt}\pi r^2$ in loop 1 and $\frac{d\vec{B}}{dt}\pi r^2$ in loop 2

Answer:

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42. A long solenoid of diameter 0.1 m has 2×10^4 turns per meter. At the centre of the

solenoid, a coil of 100 turns and radius 0.01 m is placed with its axis coinciding with the solenoid axis.The current in the solenoid reduces at a constant rate to 0A from 4 A in 0.05 s. If the resistance of the coil is $10\pi^2\Omega$, the total charge flowing through the coil during this time is

A. $16\mu C$

B. $32\mu C$

C. $16\mu C$

D. $32\mu C$

Answer:

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43. In an electromagnetic wave in free space the root mean square value of the electric field is $E_rms = 6V/m$. The peak value of the magnetic field is:

A. $2.83 \times 10^{-8}T$

B. $0.70 \times 10^{-8}T$

C. $4.23 \times 10^{-8}T$

D. $1.41 \times 10^{-8} T$

Answer:

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44. A 250-Turn rectangular coil length 2.1 cm and width 1.25 cm carries a current of $85 \mu A$ and subjected to a magnetic field of strength 0.85 T. Work done for rotating the coil by 180° against the torque is:

A. $9.4 \mu J$

B. $2.3\mu J$

C. $1.15\mu J$

D. $9.1\mu J$

Answer:

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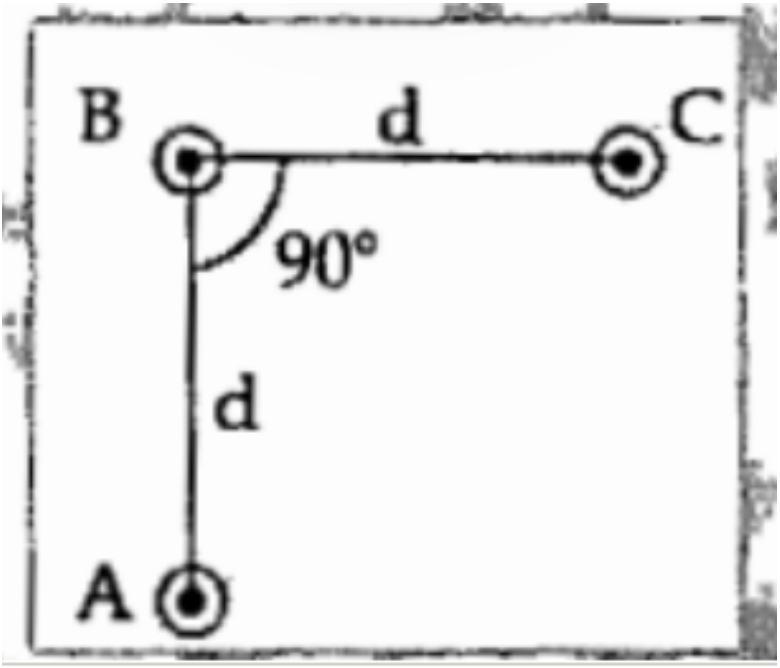
45. An arrangement of three parallel straight wires placed perpendicular to plane of paper carrying same current 'I' along the same direction is shown in Fig. magnitude of force

per unit length on the middle wire 'B: is given by:



A. $\frac{2\mu_0 i^2}{\pi d}$

B. $\frac{2\mu_0 i^2}{\pi d}$

C. $\frac{\mu_0 i^2}{\sqrt{2}\pi d}$

D. $\frac{\sqrt{\mu_0 i^2}}{2\pi d}$

Answer:

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