PHYSICS

BOOKS - CENGAGE PHYSICS (HINGLISH)

ELECTROMAGENTIC INDUCTION

Question Bank

1. A flat, circular coil of radius $10cm$ has 100 turns of wire. Auniform magnetic field exists in a direction perpendicular to the plane of the coil. This ficld is increasing at the rate of $0.1\frac{T}{s}$. Calculate the magnitude of emf induced (in volt) in the coil.

2. A wire loop of area $0.2m^2$ has a resistance of $20ohm.$ (A) magnetic field, normal to the loop, initially has a magnifude of $0.25T$ and is reduced to zero at a uniform rate in $10^{-4}s.$ Estimate the resulting current in ampere.

Watch Video Solution

3. A long solenoid has 1000 turns. When a current of $4A$ flows through it, the magnetic flux linked with each tum of the solenoid is $4 \times 10^{-3}(wb).$ The self-inductance (in henry) of the solenoid is

Watch Video Solution

4. A condacting 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 $2m\frac{m}{s}$. The indaced emf in the loop whicn the redius is $2cm$ is $y\pi$ microvolt, then find y.

Watch Video Solution

Watch Video Solution

5. A coil having 30 tums of wire, each of area' $10cm^2$, is placed with its plane at rigiht angle to a magnetic fìcld of $0.1T$. When the coil is suddenly withdrawn from the field, a gaivanometer in series with the coil indicates that a charge of $10^{-5}C$ passes around the circuit. What is the combined resistânce (in ohm) of the coil and the galvanometer?

Watch Video Solution

6. A metal dise of radins $0.1m$ spins about a horizontal axis lyinig in the magnetic meridian' at a speed of 5 revis. If the horizontal componeat of the earth's.field is $B = 2 \times 10^{-5} W\frac{b}{m^2}$, the potential difference between the centre and the outer edge of the disc is $z \times 10^{-6} V$ Find z.

Watch Video Solution

7. In a coil of resistance $10 ohm$, the induced current developed by changing magnetic flux through it is shown in figure as a function of time. The magnitade of change in flux (in weber) through the coil is

'(##CEN_KSR_PHY_JEE_CO23_E01_007_Q01##)'

View Text Solution

8. A body enters in an MRI machine in $10s$. If the magnctic field is $1.5T$ and circumference of the MRI mechine is $0.9m$, then find out the magnitude of emf induced (in milli volt) in the body.

Watch Video Solution

9. A long solenoid of radius $2cm$ has $100\frac{turns}{cm}$ and carries a current of $5A$. A coil of radius $1cm$ having 100 tums and a total resistance of $20 ohm$ is placed inside the solenoid coraxially, The coil is cornected to a galwanometer and the current in the solenoid is reversed in direction. If the charge flown through the galvanometer is $k \times 10^{-\infty} C$, then find k.

(Take $\pi^2 = 10$)

Watch Video Solution

10. In an R-I circuit, $R = 4ohm, L = 0.5(H)$ and emf of cell $= 6V. Thew$ or $kdo \ne (\in mj) \in chang \in gthecurrentom$0.80A to $0.81A$ through the circuit is

View Text Solution

11. A long solenoid of diameter $0.1m$ has 2×10^4 turns per metre. At the centre of the solenoid, a coil of 100 turns and radius $0.01m$ is placed with its axis coinciding with the solenoid axis. The current in the solenoid reduces at a constant rate to $0A$ from $4A$ in 0.05 .If the resistance of the coil is $10\pi^2 ohm$, the total charge (in μC) flowing through the coil during this time is

Watch Video Solution

12. A small piece of metal $(\mu_r = 20)$of volume $10cm^3$ has a uniform magnetie field 4T $\in sideit, Th\acute{e}mag \ne tice \ne igys \rightarrow red \in them\eta lis$ (alpha)/(pi) J_(3)$then f \in d$alpha`.

View Text Solution

13. A solenoid having 500 turns and length $2m$ has radius of 2 cm. Then self-inductance (in milithenry) of solenoid is

Watch Video Solution

14. A simple electric motor has an armature resistance of 1Ω and runs from a dc source of 12 volt . When running unloaded it draws a current of 2 amp . When a certain load is connected , its speed becomes one-half of its unloaded value . The new value of current drawn

Watch Video Solution

15. In an ac dynamo, the peak value of emf is $60V$. The induced emf (in V) in the position when the armature makes an angle of 30° with the magnetic ficld perpendicular to the coil, will be

Watch Video Solution

16. An electric motor operating on a $60V$ dc supply draws a currrent of $10A$. If the effeciency of the motor is 50%, the resistance of its winding is

Watch Video Solution

17. The time constunt of an $L-R$ circuit is $10s$. When a resistance of $10ohm$ is connected in series in a previous circuit, then the time constant becomes. $2s$. The self-inductance (in henry) of the circuit is

Watch Video Solution

18. A square of side L meters lies in the $x - y$ plane in a region where tbe magnctic fleld is given by $\overrightarrow{B} = B_0\left(2\hat{i} + 3\hat{j} + 4\hat{k}\right)$ tesla $\_(3)$ where B_0 is a constant. If the magnitude of flux passing through the square is yB_aL^2 weber, then find the value of y.

Watch Video Solution

19. A $10(\text{~}V)$ battery, comnected to $5ohm$ resistance coil having inductance 10 H $throughaswitch, drivesacons\tan tcarrent \in the \circ uit, Theswitchissadde$ 2 ms $. Iftheavera \geq emf \in ducedacrossthecoilis$varepsilon $, thenf \in d$(E)/(1000)`.

View Text Solution

20. A wooden stick of length $3l$ is rotated ahout an end with constant angular velocity ohm in a uniform magnetic ficld $\underline{B}$ pérpendicular to the plane of motion. If the upper oaethird of its length is coated with copper, the potential. difference across the whole length of the stick is $\frac{xBohml^2}{2}$

. Find x.

'(##CEN_KSR_PHY_JEE_CO23_E01_020_Q02##)'

View Text Solution

21. A physicist works in a laboratory where the magnetic field 'is 2T $. Shewearsa \ne cklaceofenclo\sin gare$0.01 m^2 $\in suchawayt\hat{t}hepla \ne ofthe \ne cklaceisn$ or $\in al \rightarrow thefield$ and $isha$ R=0.01 ohm. $Becauseofpowerfailure, thefielddecays \rightarrow 1'$T $\in time$ 10^(-1)s`. Then what is the total beat produced (in joule) in her necklace?

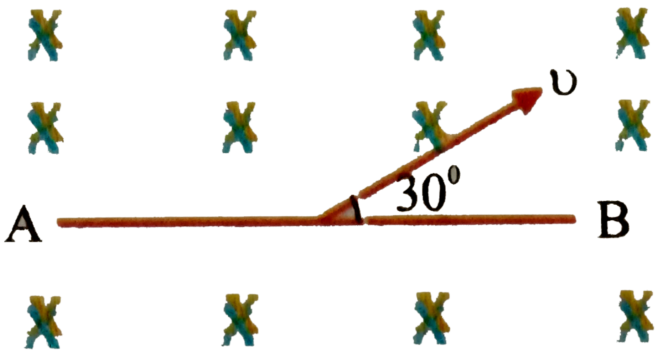
View Text Solution

22. The network shown in the figure is a part of a copmplete circuit. If at a certain instant, the current i is $5A$ and decreasing at the rate of $10^3 \frac{A}{s}$, then $V_s - V_A$ (in volt) is

'(##CEN_KSR_PHY_JEE_CO23_E01_022_Q03##)'

View Text Solution

23. 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 :



Watch Video Solution

24. A wire is sliding on two parallel conducting rails placed at a separation of $1m$ as shown in the figure."Magnetic field of $2T$ exists in a direction perpendicular to the rails. The necessary force required to keep the wire moving with a constant velocity of $1c\frac{m}{s}$ is $\pi \times 10^{-4}N$. Find n.

View Text Solution

25. The below figure shows a circuit that contains threc identical resistors with resistance $R = 9.0 ohm$ each, two identical inductors with inductance $L = 2.0 mH$ each, and an ideal battery with emf $\varepsilon = 18V$. The current i (in ampere) through the bettery just after the switch is closed,

View Text Solution

26. A copper disc of radius $10cm$ is rotating in magnetic field $B = 0.4G$ with $10re\frac{v}{s}$. What will be the potential differenee across the peripheral points of disc?

Watch Video Solution

27. An inductor $(L = 100 mH)$, a resistor $(R = 100 ohm)$ and a battery $(E = 100V)$ are. initially connected in series as shown in the figure. Afler a long time, the battery is disconnected after short-circuiting the points

A and B. The current in the circuit, $1ms$ after the short-circuit, is $\frac{k}{4}$. Find k.

Watch Video Solution

28. 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

Watch Video Solution

29. A rectangular loop of sides $8cm$ and $2cm$ with a small cut is moving out of a region of uniform magnetic field of magnitude 0.3 T directed normal to the loop. The velocity of the loop is $1cms^{-1}$ in the direction normal 'to the (i) longer side, (ii) shorter side of the loop. If the ratio of voltage induced in case (i) to case (ii) is α and the ratio of time for which voltage induced in case (ti) to case (i) is β, then calculate $(\alpha \times \beta)$.

Watch Video Solution

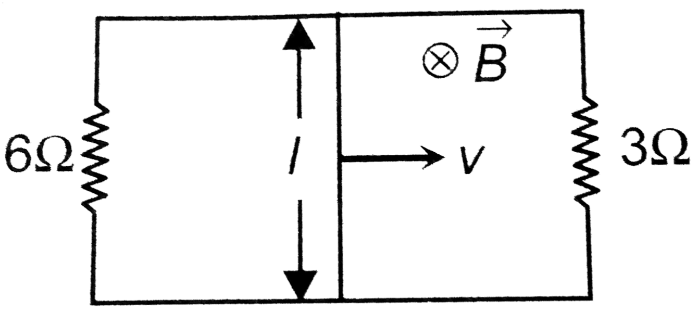
Watch Video Solution

30. In the given circuit, the ratio of $(t)_1$ to i_2 is $\frac{x}{y}$, where i_1 is the initial (at $t = 0$) current and i_2 is steady state (at $t = \infty$) current through the battery. Find $(x + y)$.

'(##CEN_KSR_PHY_JEE_CO23_E01_030_Q09##)'

View Text Solution

31. 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



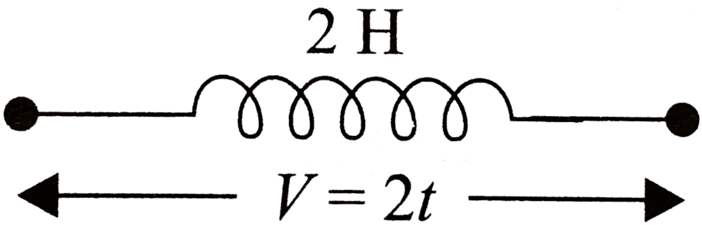
Watch Video Solution

32. An inductor coil stores 32 J of magnetic field energy and dissiopates energy as heat at the rate of 320 W when a current of 4 A is passed through it. Find the time constant of the circuit when this coil is joined across on ideal battery.

Watch Video Solution

33. A time varying voltage V= 2t (Volt) is applied across and ideal inductor of inductance L =2H as shown in Fig. Then (assume current to be zero at t

=0)



Watch Video Solution

34. The ratio of time constant in charging and discharging in the circuit shown in the figure is $\frac{x}{y}$. Find $(x+y)$

'(##CEN_KSR_PHY_JEE_CO23_E01_034_Q12##)'

View Text Solution

35. The magnetic flux through a stationary loop with a resistanoe R varies during interval of time T as $\phi =$ at $(T -$ t). If the heat generated during this time, neglecting the inductance of the loop, is $\frac{a^2T^3}{pR}$, then find p.

View Text Solution

36. As shown in the figare, wire PQ has negligible resistance. B, the magnetic field, is coming out of the paper, θ is a fixed angle mede by PQ travelling smoothly over two condiucting parallel wires separated by a distance d, If the current in the wirc for the configuration is $I=\frac{xdVB}{4R}$, then find x.

'(##CEN_KSR_PHY_JEE_CO23_E01_036_Q13##)'

View Text Solution

37. There are two coils A and B separated by some distance. If a curreat of 2 A flows through A, a magnetic flux of $10^{-2} Wb$ passes through B (no current through B). If no current passes through A and 'a current of 1 A.passes through B, then what is the flux (in (mWb)) through A ?

View Text Solution

38. The induced emf in the loop, if the long wire carries a current of $50A$ and the loop has an instantaneous velocity $v = 10\frac{m}{s}$ at the location $x = 0, 2m$ as shown in figure is e microvolt. Caluclate 3ε (Take $a = 0.1m$)

'(##CEN_KSR_PHY_JEE_CO23_E01_038_Q14##)'

View Text Solution

39. A small square loop of wire of side l is placed inside a large square loop of wire of side $(L > > l)$. The loops are coplanar and their centres coincide. If the mutual inductance of the system is $p\sqrt{q}\frac{\mu_0}{\pi}\frac{l^2}{L}$, then find $(p + q)$.

View Text Solution

40. A square wire of length L_1 mass m and resistance R slides without friction on parallel conducting resistanceless rails. The rails are interconinected at the bottom by resistanceless rails so that the wire and the rails form a closed rectangular loop. The plane of the rails is inclined at an angle θ with the horizontal and a vertical uniform magnetic field B exists within the frame. If the wire acquires a steady velocity of magnitude $v = \frac{kmgR\sin\theta}{6B^2l^2}, \cos^2\theta$

'(##CEN_KSR_PHY_JEE_CO23_E01_040_Q15##)'

View Text Solution