Assignment

(Basic & Advance Level Questions)

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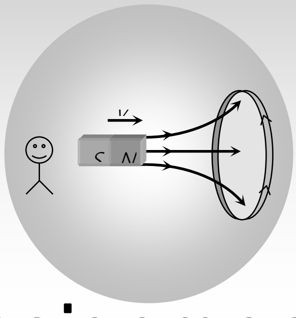
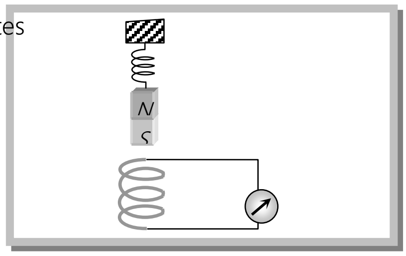


Assignment

Magnetic flux and Faraday's Law

Basic Level

1. A magnet *NS* is suspended from a spring and while it oscillates, the magnet moves in and out of the coil *C*. The coil is connected to a galvanometer *G*. Then, as the magnet oscillates [KCET 2004]



(a) *G* shows deflection to the left and right but the amplitude steadily decreases

(b) *G* shows no deflection

(c) *G* shows deflection on one side

(d) *G* shows deflection to the left and right with constant amplitude

2. 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 represented by [KCET 2004]

(a) $Q = \frac{\Delta\phi}{\Delta t}$ (b) $Q = R \cdot \frac{\Delta\phi}{\Delta t}$ (c) $Q = \frac{1}{R} \cdot \frac{\Delta\phi}{\Delta t}$ (d) $Q = \frac{\Delta\phi}{R}$

3. The magnetic flux linked with a coil, in *webers*, is given by the equations $\phi = 3t^2 + 4t + 9$. Then the magnitude of induced e.m.f. at $t = 2$ *second* will be [KCET (Engg./Med.) 2000; CPMT 2003]

(a) 2 *volt* (b) 4 *volt* (c) 8 *volt* (d) 16 *volt*

4. The magnetic flux linked with a coil at any instant '*t*' is given by $\phi = 5t^3 - 100t + 300$, the *emf* induced in the coil at $t = 2$ second is

[KCET 2003]

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(a) – 40 V (b) 40 V (c) 140 V (d) 300 V

5. The magnetic flux linked with a vector area $\vec{A}$ in a uniform magnetic field $\vec{B}$ is [MP PET 2003]

(a) $\vec{B} \times \vec{A}$ (b) AB (c) $\vec{B} \cdot \vec{A}$ (d) $\frac{B}{A}$

6. The magnetic flux linked with a circuit of resistance 100 *ohm* increases from 10 to 60 *webers*. The amount of induced charge that flows in the circuit is (in *coulomb*) [MP PET 2003]

(a) 0.5 (b) 5 (c) 50 (d) 100

7. The formula for induced e.m.f. in a coil due to change in magnetic flux through the coil is (here A = area of the coil, B = magnetic field) [MP PET 2002]

(a) $e = -A\frac{dB}{dt}$ (b) $e = -B.\frac{dA}{dt}$ (c) $e = -\frac{d}{dt}(A.B)$ (d) $e = -\frac{d}{dt}(A \times B)$

8. Faraday's laws are consequence of conservation of [CBSE PMT 1993; BHU 2002]

(a) Energy (b) Energy and magnetic field (c) Charge (d) Magnetic field

9. In a coil of area 20 cm^2 and 10 turns with magnetic field directed perpendicular to the plane changing at the rate of 10^4 T/s. The resistance of the coil is 20 Ω. The current in the coil will be [MH CET 2002]

(a) 10 A (b) 20 A (c) 0.5 A (d) 1.0 A

10. A coil having an area of 2 m^2 placed in a magnetic field which changes from 1 to 4 $weber/m^2$ in 2 *seconds*. The e.m.f. induced in the coil will be [DPMT 1999; MP PET 2000]

(a) 4 *volt* (b) 3 *volt* (c) 2 *volt* (d) 1 *volt*

11. If a coil of metal wire is kept stationary in a non-uniform magnetic field, then [BHU 2000]

(a) An *emf* is induced in the coil (b) A current is induced in the coil

(c) Neither *emf* nor current is induced (d) Both *emf* and current is induced

12. Initially plane of coil is parallel to the uniform magnetic field B. In time Δt it becomes perpendicular to magnetic field, then charge flows in it depend on this time as

(a) $\propto \Delta t$ (b) $\propto l/\Delta t$ (c) $\propto (\Delta t)^0$ (d) $\propto (\Delta t)^2$

13. A coil of area 100 cm^2 has 500 turns. Magnetic field of 0.1 $weber/metre^2$ is perpendicular to the coil. The field is reduced to zero in 0.1 *second*. The induced *emf* in the coil is [MP PMT 1991; MH CET (Med.) 1999]

(a) 1 V (b) 5 V (c) 50 V (d) Zero

14. S.I. unit of magnetic flux is [MP PMT 1994; MP PET 1995; AFMC 1998]

(a) $Weber\ m^{-2}$ (b) *Weber* (c) *Weber* per m (d) *Weber* per m^4

15. A coil of 100 turns and area 5 square cm is placed in a magnetic field B = 0.2 T. The normal to the plane of the coil makes an angle of 60° with the direction of the magnetic field. The magnetic flux linked with the coil is [MP PMT 1997]

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(a) 5×10^{-3} *Wb* (b) 5×10^{-5} *Wb* (c) 10^{-2} *Wb* (d) 10^{-4} *Wb*

16. A coil of 40 Ω resistance has 100 turns and radius 6 *mm* is connected to ammeter of resistance of 160 *ohms*. Coil is placed perpendicular to the magnetic field. When coil is taken out of the field, 32 μC charge flows through it. The intensity of magnetic field will be [RPET 1997]

(a) 6.55 *T* (b) 5.66 *T* (c) 0.655 *T* (d) 0.566 *T*

17. A coil of copper having 1000 turns is placed in a magnetic field ($B = 4 \times 10^{-5}$) perpendicular to its plane. The cross-sectional area of the coil is 0.05 m^2. If it turns through 180° in 0.01 second, then the *EMF* induced in the coil is [AIIMS 1997]

(a) 0.4 *V* (b) 0.2 *V* (c) 0.04 *V* (d) 4 *V*

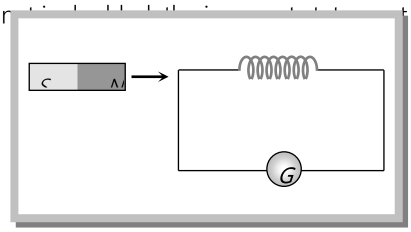
18. The instantaneous magnetic flux ϕ in a circuit is $\phi = 4t^2 - 4t + 1$. The total resistance of the circuit is 10 Ω. At $t = \frac{1}{2} s$, the induced current in the circuit is [AMU 1997]

(a) 0 (b) 0.2 *A* (c) 0.4 *A* (d) 0.8 *A*

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 [IIT-JEE 1995]

(a) $\frac{BR}{A}$ (b) $\frac{AB}{R}$ (c) ABR (d) $\frac{B^2A}{R^2}$

20. As shown in the figure, a magnet is moved with a fast speed towards a coil at rest. Due to this induced *e.m.f.*, induced charge and induced current in the coil is *e.q.* and *i* respectively. If the speed of the magn ... is [MP PET 1995]



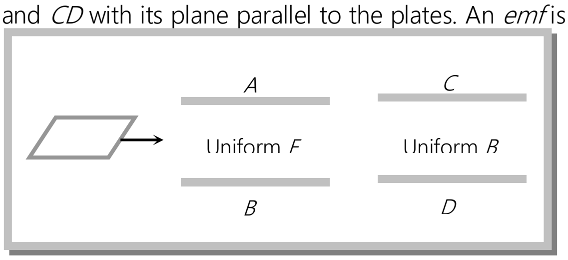
(a) *e* increases

(b) *i* increases

(c) *q* increases

(d) *q* remain same

21. A uniform electric field *E* exists between the plates *A* and *B* and a uniform magnetic field *B* exists between the plates *C* and *D*. A rectangular coil *X* moves with a constant speed between *AB* and *CD* with its plane parallel to the plates. An *emf* is induced in the coil when it [DPMT 1995]



(a) Enters and leaves *AB*

(b) Enters and leaves *CD*

(c) Moves completely with in *CD*

(d) Enters and leaves both *AB* and *CD*

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22. To induce an e.m.f. in a coil, the linking magnetic flux [KCET 1994]

(a) Must decrease (b) Can either increase or decrease

(c) Must remain constant (d) Must increase

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

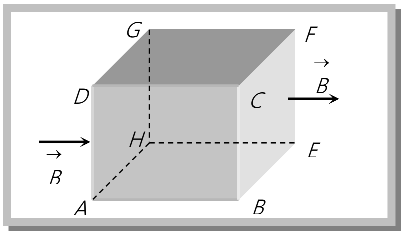
(a) 0.1 second (b) 0.01 second (c) 1 second (d) 20 second

24. A cylindrical bar magnet is kept along the axis of a circular coil. If the magnet is rotated about its axis, then

(a) A current will be induced in a coil (b) No current will be induced in a coil

(c) Only an e.m.f. will be induced in the coil (d) An e.m.f. and a current both will be induced in the coil

25. A cube *ABCDEFGH* with side *a* is lying in a uniform magnetic field *B* with its face *BEFC* normal to it as shown in the figure. The flux emanating out of the face *ABCD* will be



(a) $2\vec{B}a^2$

(b) $-\vec{B}a^2$

(c) $+\vec{B}a^2$

(d) 0

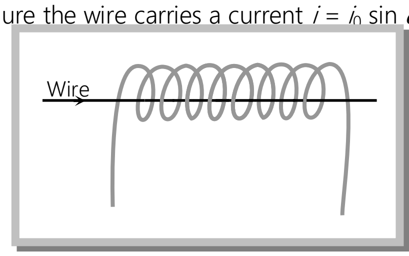
26. The flux passing through a coil having the number of turns 40 is 6×10^{-4} *weber*. If in 0.02 second, the flux decreases by 75%, then the induced *emf* will be

(a) 0.9 *V* (b) 0.3 *V* (c) 3 *V* (d) 6 *V*

27. The magnetic field normal to a coil of 40 turns and area 3 cm^2 is $B = (250 - 0.6t)$ *millitesla*. The *emf* induced in the coil will be

(a) 1.8 μV (b) 3.6μV (c) 5.4 μV (d) 7.2 μV

28. A long straight wire lies along the axis of a straight solenoid as shown in figure the wire carries a current $i = i_0 \sin \omega t$. The induced *emf* in solenoid is



(a) $e_0 \sin \omega t$

(b) $e_0 \cos \omega t$

(c) Zero

(d) e_0

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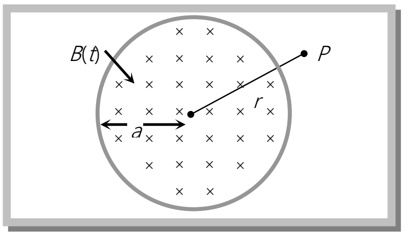
Advance Level

29. 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

[IIT-JEE (Screening) 2000]



(a) Is zero

(b) Decreases as $\frac{1}{r}$

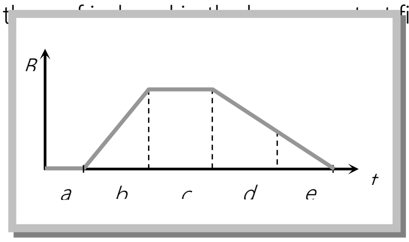
(c) Increases as r

(d) Decrease as $\frac{1}{r^2}$

30. 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) 2.5×10^{-7} *weber* (b) 6.31×10^{-6} *weber* (c) 5.2×10^{-5} *weber* (d) 4.1×10^{-5} *weber*

31. The graph gives the magnitude $B(t)$ of a uniform magnetic field that exists throughout a conducting loop, perpendicular to the plane of the loop. Rank the five regions of the graph according to the magnitude of t … first



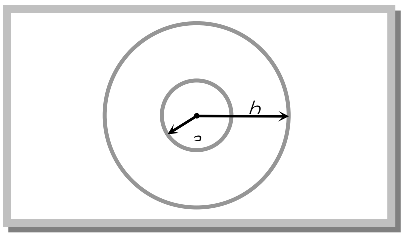
(a) $b > (d = e) < (a = c)$

(b) $b > (d = e) > (a = c)$

(c) $b < d < e < c < a$

(d) $b > (a = c) > (d = e)$

32. Two concentric and coplanar circular coils have radii a and b ($>> a$) as shown in figure. Resistance of the inner coil is R. Current in the outer coil is increased from 0 to i, then the total charge circulating the inner coil is



(a) $\frac{\mu_0 \pi i a^2}{2Rb}$

(b) $\frac{\mu_0 iab}{2R}$

(c) $\frac{\mu_0 ia}{2a} \frac{\pi b^2}{R}$

(d) $\frac{\mu_0 ib}{2\pi R}$

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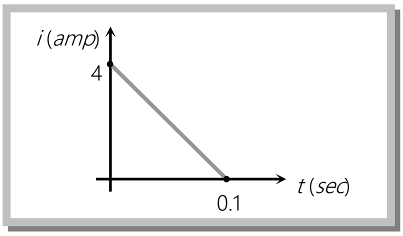
33. A rectangular loop of sides 8 *cm* and 2 *cm* having resistance of 1.6Ω is placed in a magnetic field of 0.3 *T* directed normal to the loop. The magnetic field is gradually reduced at the rate of 0.02 $T\,s^{-1}$. How much power is dissipated by the loop as heat

(a) $1.6\times10^{-10}\ W$ (b) $3.2\times10^{-10}\ W$ (c) $6.4\times10^{-10}\ W$ (d) $12.8\times10^{-10}\ W$

34. Some magnetic flux is changed from a coil of resistance 10 *ohm*. As a result an induced current is developed in it, which varies with time as shown in figure. The magnitude of change in flux through the coil in *webers* is



(a) 2

(b) 4

(c) 6

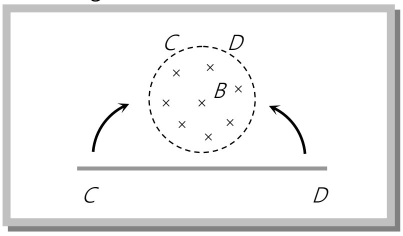
(d) 8

35. The magnetic flux linked with a coil is ϕ and the *emf* induced in it is *e*

(a) If $\phi = 0$, *e* must be zero (b) If $\phi \neq 0$, *e* cannot be zero

(c) If *e* is not 0, ϕ may or may not be 0 (d) None of the above is correct

36. The figure shows a straight wire lying in the plane of the paper and a uniform magnetic field perpendicular to the plane of the paper. The ends *C* and *D* are slowly turned to form a ring of radius *R* so that the entire magnetic field is confined in it. The *emf* induced in the ring is given by



(a) $\dfrac{\pi R^2 B}{2}$

(b) $\pi R^2 B$

(c) Zero

(d) None of these

37. A small coil is introduced between the poles of an electromagnet so that its axis coincides with the magnetic field direction. The number of turns is *n* and the cross sectional area of the coil is *A*. When the coil turns through 180° about its diameter, the charge flowing through the coil is *Q*. The total resistance of the circuit is *R*. What is the magnitude of the magnetic induction

(a) $\dfrac{QR}{nA}$ (b) $\dfrac{2QR}{nA}$ (c) $\dfrac{Qn}{2RA}$ (d) $\dfrac{QR}{2nA}$

38. A conducting loop of area 5.0 cm^2 is placed in a magnetic field which varies sinusoidally with time as $B = B_0 \sin\omega t$ where $B_0 = 0.20\ T$ and $\omega = 300\ s^{-1}$. The normal of the coil makes an angle of 60° with the field. Find the maximum *emf* induced in the coil and *emf* induced at $t = (\pi/900\ sec)$

(a) 0.15 *V*, 7.5×10^{-3} *V* (b) 0.15 *V*, zero (c) 0.015 *V*, zero (d) 0.015 *V*, 7.5×10^{-3} *V*

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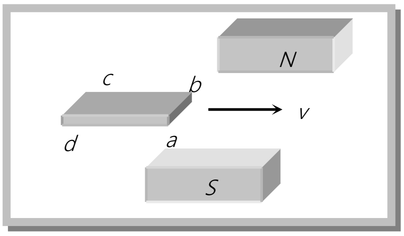
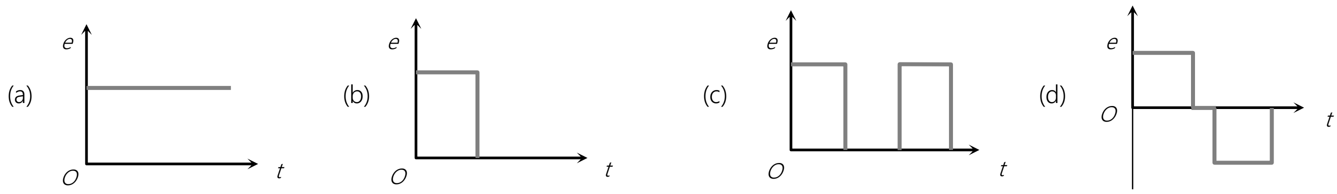
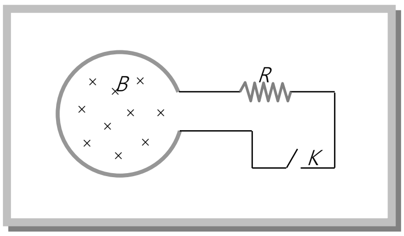
39. A horizontal loop *abcd* is moved across the pole pieces of a magnet as shown in fig. with a constant speed *v*. When the edge *ab* of the loop enters the pole pieces at time $t = 0$ *sec*. Which one of the following graphs represents correctly the induced *emf* in the coil





40. Shown in the figure is a circular loop of radius *r* and resistance *R*. A variable magnetic field of induction $B = B_0 e^{-t}$ is established inside the coil. If the key (*K*) is closed, the electrical power developed right after closing the switch is equal to



(a) $\frac{B_0^2 \pi r^2}{R}$

(b) $\frac{B_0 10 r^3}{R}$

(c) $\frac{B_0^2 \pi^2 r^4 R}{5}$

(d) $\frac{B_0^2 \pi^2 r^4}{R}$

Lenz's Law

Basic Level

41. When a bar magnet falls through a long hollow metal cylinder fixed with its axis vertical, the final acceleration of the magnet is

[MP PMT 1992; CPMT 1999; BVP 2003]

(a) Equal to g (b) Less than g but finite (c) Greater than g (d) Equal to zero

42. Lenz's law is based on [CPMT 1990; RPMT 1997, JIPMER 1997; RPET 2003; MP PET 1999, 2003]

(a) Conservation of charge (b) Conservation of momentum (c) Conservation of energy (d) Conservation of mass

43. A magnet is dropped down an infinitely long vertical copper tube

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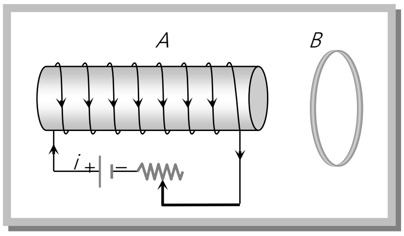
(a) The magnet moves with continuously increasing velocity and ultimately acquires a constant terminal velocity

(b) The magnet moves with continuously decreasing velocity and ultimately comes to rest

(c) The magnet moves with continuously increasing velocity but constant acceleration

(d) The magnet moves with continuously increasing velocity and acceleration

44. An aluminium ring *B* faces an electromagnet *A*. The current *i* through *A* can be altered [Kerala (Engg.) 2002]



(a) Whether *i* increases or decreases *B* will not experience any force

(b) If *i* decrease, *A* will repel *B*

(c) If *i* increase, *A* will attract *B*

(d) If *i* increases, *A* will repel *B*

45. Lenz's law is expressed by the following formula (here *e* = induced e.m.f., ϕ = magnetic flux in one turn and *N* = number of turns) [MP PET 2002]

(a) $e = -\phi \frac{dN}{dt}$ (b) $e = -N \frac{d\phi}{dt}$ (c) $e = -\frac{d}{dt}\left(\frac{\phi}{N}\right)$ (d) $e = N \frac{d\phi}{dt}$

46. When the current through a solenoid increases at a constant rate, the induced current [MNR 1992; UPSEAT 2000]

(a) Is a constant and is in the direction of the inducing current

(b) Is a constant and is opposite to the direction of the inducing current

(c) Increases with time and is in the direction of inducing current

(d) Increases with time and is opposite to the direction of inducing current

47. A metallic ring is attached with the wall of a room. When the north pole of a magnet is bought near to it, the induced current in the ring will be [AFMC 1993; MP PET/PMT 1998; AIIMS 1999]

(a) First clockwise then anticlockwise (b) In clockwise direction

(c) In anticlockwise direction (d) First anticlockwise then clockwise

48. Two circular, similar, coaxial loops carry equal currents in the same direction. If the loops are brought nearer, what will happen [MNR 1990; MP PMT 1995, 96]

(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

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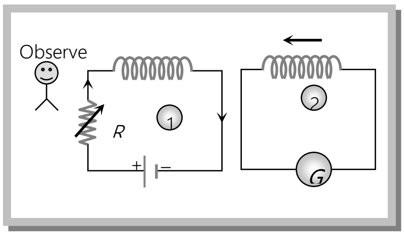
49. The current flows in a circuit as shown below. If a second circuit is brought near the first circuit then the current in the second circuit will be [RPET 1995]



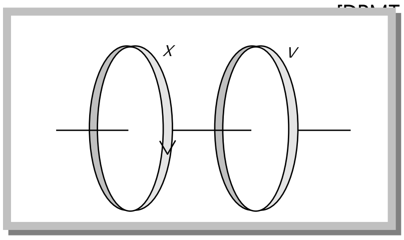
(a) Clock wise

(b) Anti clock wise

(c) Depending on the value of R_c

(d) None of the above

50. The two loops shown in the figure have their planes parallel to each other. A clockwise current flows in the loop x as viewed from x towards y. The two coils will repel each other if the current in the loop x is [DPMT 1995]



(a) Increasing

(b) Decreasing

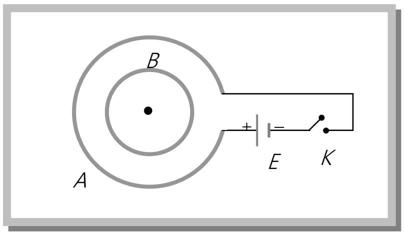
(c) Constant

(d) None of the above cases

51. Two different loops are concentric and lie in the same plane. The current in the outer loop is clockwise and increases with time. The induced current in the inner loop then is [MP PET 1993]

(a) Clockwise
(b) Zero
(c) Counterclockwise
(d) In a direction that depends on the ratio of the loop radii

52. As shown in the figure, when key K is closed, the direction induced current in B will be [MP PET 1993]



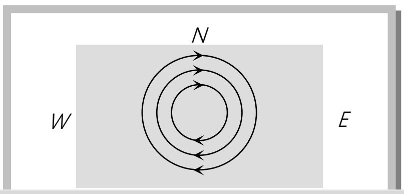
(a) Clockwise and momentary

(b) Anti-clockwise and momentary

(c) Clockwise and continuous

(d) Anti-clockwise and continuous

53. When a sheet of metal is placed in a magnetic field, which changes from zero to a maximum value, induced currents are set up in the direction as shown in the diagram. What is the direction of the magnetic field [AIIMS 1988]



(a) Into the plane of paper

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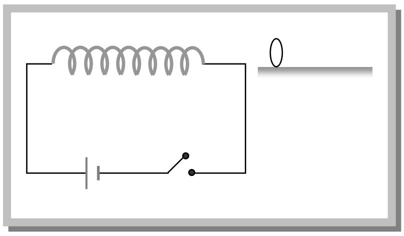
(b) East to west

(c) Out of the plane of paper

(d) North to south

54. Figure shows a horizontal solenoid connected to a battery and a switch. A copper ring is placed on a frictionless track, the axis of the ring being along the axis of the solenoid. As the switch is closed, the ring will



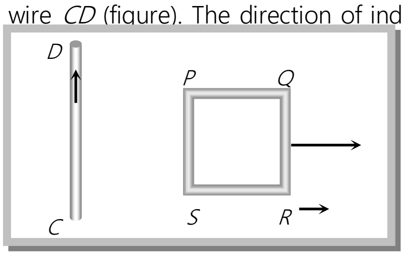
(a) Remain stationary

(b) Move towards the solenoid

(c) Move away from the solenoid

(d) Move towards the solenoid or away from it depending on which terminal (positive or negative) of the battery is connected to the left end of the solenoid

55. A square loop *PQRS* is carried away from a current carrying long straight conducting wire *CD* (figure). The direction of induced current in the loop will be



(a) Anticlockwise

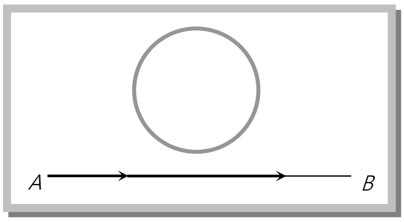
(b) Clockwise

(c) Some times clockwise sometimes anticlockwise

(d) Current will not be induced

Advance Level

56. An electron moves along the line *AB*, which lies in the same plane as a circular loop of conducting wires as shown in the diagram. What will be the direction of current induced if any, in the loop [MP PET 1989; AIIMS 1982, 2001; KCET 2003]



(a) No current will be induced

(b) The current will be clockwise

(c) The current will be anticlockwise

(d) The current will change direction as the electron passes by

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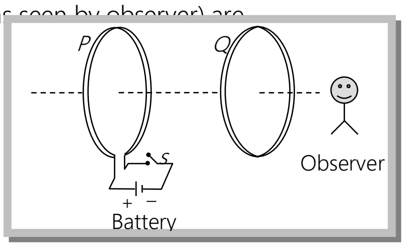
57. As shown in the figure, P and Q are two coaxial conducting loops separated by some distance. When the switch S is closed, a clockwise current i_P flows in P (as seen by observer) and an induced current i_{Q_1} flows in Q. The switch remain closed for a long time. When S is opened, a current i_{Q_2} flows in Q. Then the directions of i_{Q_1} and i_{Q_2} (as seen by observer) are



(a) Respectively clockwise and anticlockwise

(b) Both clockwise

(c) Both anticlockwise

(d) Respectively anticlockwise and clockwise

58. 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

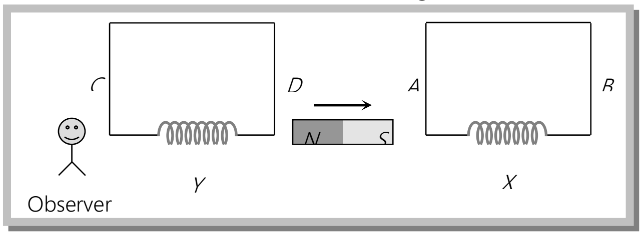
(a) Remain stationery

(b) Is attracted by the loop A

(c) Is repelled by the loop A

(d) Rotates about its CM with CM fixed

59. A magnet is moved in the direction indicated by an arrow between two coils AB and CD as shown in fig. What is the direction of the induced current in each coil



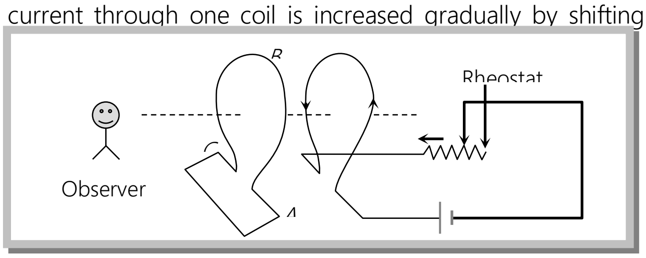
(a) A to B in coil X and C to D in coil Y

(b) A to B in coil X and D to C in coil Y

(c) B to A in coil X and C to D in coil Y

(d) B to A in coil X and D to C in coil Y

60. Figure shows two coils placed close to each other. When the current through one coil is increased gradually by shifting the position of the rheostat



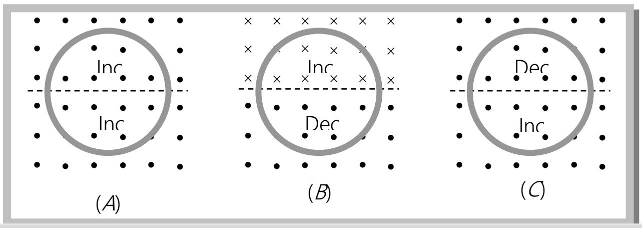
(a) A current flows along ABC in the other coil

(b) A current flows along CBA in the other coil

(c) No current flows in the other coil

(d) An alternating current flows in the other coil

61. The figure shows three situation in which identical circular conducting loops are in uniform magnetic field that are either increasing or decreasing in magnitude at identical rates. In each, the dashed line coincides with a diameter. Rank the situations according to the magnitude of the current induced in the loops, greatest first



(a) $i_A = i_B < i_C \quad (i_C \neq 0)$

(b) $i_A = i_B > i_C \quad (i_C = 0)$

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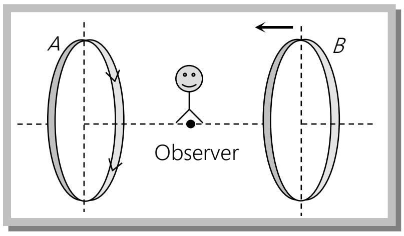
(c) $i_A > i_B > i_C \quad (i_C \neq 0)$

(d) $i_A < i_B < i_C \quad (i_C \neq 0)$

62. An observer O stands in between two coaxial circular loops along the common axis as shown in figure. As seen by the observer, coil A carries current in clockwise direction. Coil B has no current. Now, coil B is moved towards coil A. Find the direction of induced current in B as seen by the observer



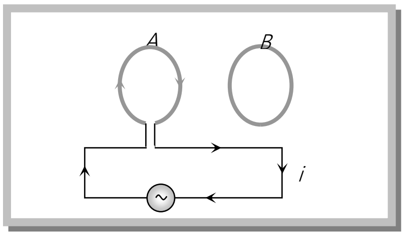
(a) Clockwise

(b) Anticlockwise

(c) No induced current

(d) Information is not sufficient

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



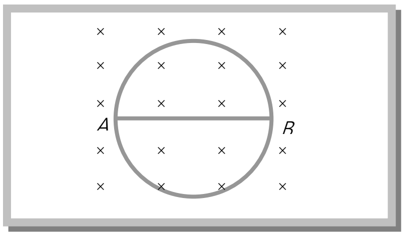
(a) There will be repulsion between A and B if i is increased

(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. If does not depend whether the current is increased or decreased

64. The radius of the circular conducting loop shown in figure is R. Magnetic field is decreasing at a constant rate α. Resistance per unit length of the loop is ρ. Then current in wire AB is (AB is one of the diameters)



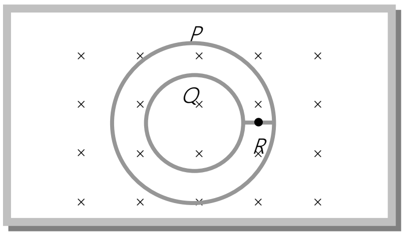
(a) $\frac{R\alpha}{2\rho}$ from A to B

(b) $\frac{R\alpha}{2\rho}$ from B to A

(c) $\frac{2R\alpha}{\rho}$ from A to B

(d) Zero

65. Figure shows plane figure made of a conductor located in a magnetic field along the inward normal to the plane of the figure. The magnetic field starts diminishing. Then the induced current



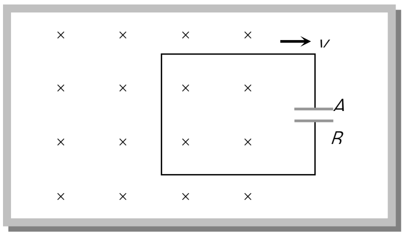
(a) At point P is anticlockwise

(b) At point *Q* is clockwise

(c) At point *Q* is zero

(d) At point *R* is Zero

66. A conducting loop having a capacitor is moving outward from the magnetic field then which plate of the capacitor will be positive



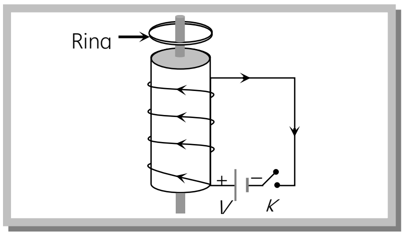
(a) Plate – *A*

(b) Plate – *B*

(c) Plate – *A* and Plate – *B* both

(d) None

67. A conducting ring is placed around the core of an electromagnet as shown in fig. When key *K* is pressed, the ring



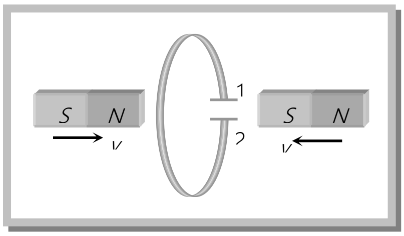
(a) Remain stationary

(b) Is attracted towards the electromagnet

(c) Jumps out of the core

(d) None of the above

68. The north and south poles of two identical magnets approach a coil, containing a condenser, with equal speeds from opposite sides. Then



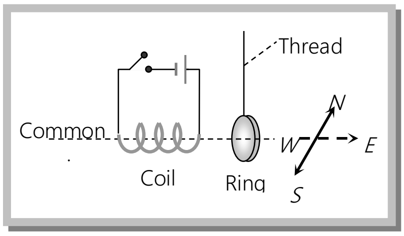
(a) Plate 1 will be negative and plate 2 positive

(b) Plate 1 will be positive and plate 2 negative

(c) Both the plates will be positive

(d) Both the plates will be negative

69. An aluminium ring hangs vertically from a thread with its axis pointing east-west. A coil is fixed near to the ring and coaxial with it. What is the initial motion of the aluminium ring when the current in the coil is switched on



(a) Remains at rest

(b) Moves towards *S*

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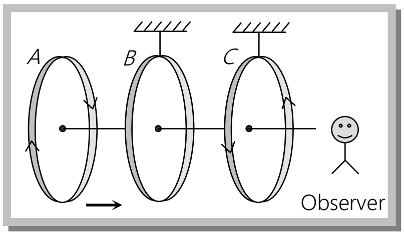
(c) Moves towards *W*

(d) Moves towards *E*

70. A bar magnet is dropped in a vertical copper tube, considering the air resistance as negligible, the magnet acquires a constant speed. If the tube is heated, then the terminal velocity will be

(a) Decrease (b) Increase (c) Remain unchanged (d) Data is incomplete

71. Three identical coils *A*, *B* and *C* are placed coaxially with their planes parallel to each other. The coils *A* and *C* carry equal currents in opposite direction as shown. The coils *B* and *C* are fixed and the coil *A* is moved towards *B* with a uniform speed, then



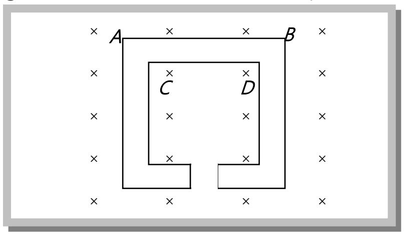
(a) There will be induced current in coil *B* which will be opposite to the direction of current in *A*

(b) There will be induced current in coil *B* in the same direction as in *A*

(c) There will be no induced current in *B*

(d) Current induced by coils *A* and *C* in coil *B* will be equal and opposite, therefore net current in *B* will be zero

72. A wire is bent to form the double loop shown in the figure. There is a uniform magnetic field directed into the plane of the loop. If the magnitude of this field is decreasing, current will flow from



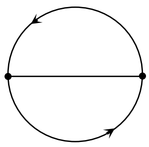
(a) *A* to *B* and *C* to *D*

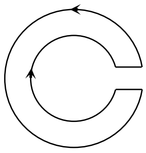
(b) *B* to *A* and *D* to *C*

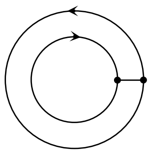
(c) *A* to *B* and *D* to *C*

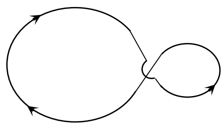
(d) *B* to *A* and *C* to *D*

73. The plane figures shown are located in a uniform magnetic field directed away the reader and diminishing. The direction of the current induced in the loops is shown in figure. Which one is the correct choice


(A)


(B)


(C)


(D)

(a) *A* (b) *B* (c) *C* (d) *D*

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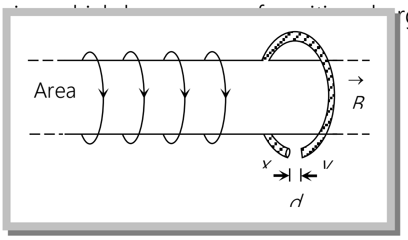
74. A highly conducting ring of radius R is perpendicular to and concentric with the axis of a long solenoid as shown in fig. The ring has a narrow gap of width d in its circumference. The solenoid has cross sectional area A and a uniform internal field of magnitude B_0. Now beginning at $t = 0$, the solenoid current is steadily increased to so that the field magnitude at any time t is given by $B(t) = B_0 + \alpha t$ where $\alpha > 0$. Assuming that no charge can flow across the gap, the end of ... rge and the magnitude of induced e.m.f. in the ring are respectively



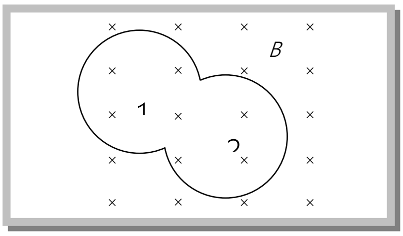
(a) $X, A\alpha$

(b) $X\ \pi R^2\alpha$

(c) $Y, \pi A^2\alpha$

(d) $Y, \pi R^2\alpha$

75. The induced e.m.f. in a circular conducting loop is E, when placed in a magnetic field decreasing at a steady rate of x *Tesla/sec*. If two such loops identical in all respect are cut and connect as shown in figure then the induced e.m.f. in the combined circuit will be



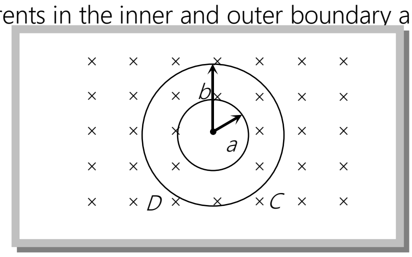
(a) E

(b) $2E$

(c) $\frac{E}{2}$

(d) 0

76. Plane figures made of thin wires of resistance $R = 50$ *milli ohm/metre* are located in a uniform magnetic field perpendicular into the plane of the figures and which decrease at the rate $dB/dt = 0.1\ m\ T/s$. Then currents in the inner and outer boundary are. (The inner radius $a = 10\ cm$ and outer radius $b = 20\ cm$)



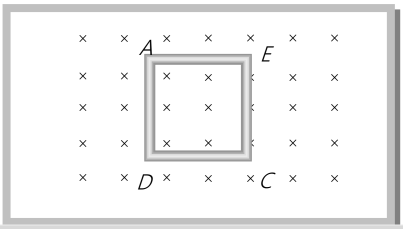
(a) $10^{-4}\ A$ (Clockwise), $2 \times 10^{-4}\ A$ (Clockwise)

(b) $10^{-4}\ A$ (Anticlockwise), $2 \times 10^{-4}\ A$ (Clockwise)

(c) $2 \times 10^{-4}\ A$ (clockwise), $10^{-4}\ A$ (Anticlockwise)

(d) $2 \times 10^{-4}\ A$ (Anticlockwise), $10^{-4}\ A$ (Anticlockwise)

77. A square coil $AECD$ of side 0.1 m is placed in a magnetic field $B = 2t^2$. Here t is in *seconds* and B is in *Tesla*. The magnetic field is into the paper. At time $t = 2\,sec$ induced electric field in DC is



(a) 0.05 V/m

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(b) Along *DC*

(c) Along *CD*

(d) 0.2 *V/m*

Motional EMI

Basic Level

78. A coil having n turns and resistance $R\Omega$ is connected with a galvanometer of resistance 4 $R\Omega$. 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 [AIEEE 2004]

(a) $-\frac{(W_2 - W_1)}{Rnt}$ (b) $-\frac{n(W_2 - W_1)}{5\,Rt}$ (c) $-\frac{(W_2 - W_1)}{5\,Rnt}$ (d) $-\frac{n(W_2 - W_1)}{Rt}$

79. A horizontal straight conductor (otherwise placed in a closed circuit) along east-west direction falls under gravity; then there is [Pb. (CET)1991; MP PET 1996; RPMT 1997; MP PMT 1997, 2003]

(a) No induced e.m.f. along the length (b) No induced current along the length

(c) An induced current from west to east (d) An induced current from east to west

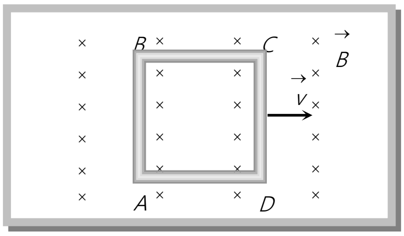
80. The wing span of an aeroplane is 20 *metre*. It is flying in a field, where the vertical component of magnetic field of earth is 5 × 10^{-5} *Tesla*, with velocity 360 *km/hr*. The potential difference produced between the blades will be [CPMT 2003]

(a) 0.10 *V* (b) 0.15 *V* (c) 0.20 *V* (d) 0.30 *V*

81. A metal rod of length 2 *m* is rotating about it's one end with an angular velocity of 100 *rad/sec* in a plane perpendicular to a uniform magnetic field of 0.3 *T*. The potential difference between the ends of the rod is [MP PET 2003]

(a) 30 *V* (b) 40 *V* (c) 60 *V* (d) 600 *V*

82. A conducting square loop of side *L* and resistance *R* moves in its plane with a uniform velocity *v* perpendicular to one of its sides. A magnetic induction *B* constant in time and space, pointing perpendicular and into the plane of the loop exists everywhere. The current induced in the loop is [IIT-JEE 1989; MP PET 1997; MP PMT 1996, 99; MP PMT 2002]



(a) $\frac{Blv}{R}$ clockwise

(b) $\frac{Blv}{R}$ anticlockwise

(c) $\frac{2Blv}{R}$ anticlockwise

(d) Zero

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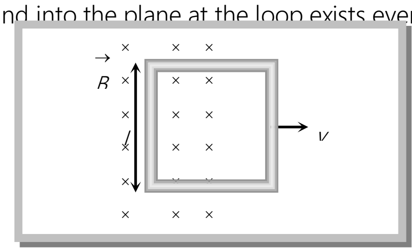
83. A conducting square loop of side l and resistance R moves in its plane with a uniform velocity v perpendicular to one of its sides. A magnetic induction B constant in time and space, pointing perpendicular and into the plane at the loop exists everywhere with half the loop outside the field, as shown in figure. The induced e.m.f. is



(a) Zero

(b) RvB

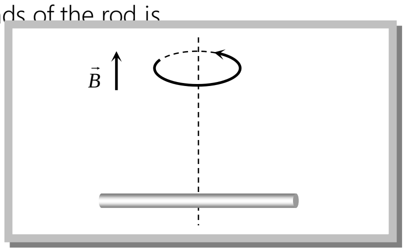
(c) vBl/R

(d) vBl

84. A coil of N turns and mean cross-sectional area A is rotating with uniform angular velocity ω about an axis at right angle to uniform magnetic field B. The induced e.m.f. E in the coil will be [MP PMT 2002]

(a) $NBA \sin\omega t$ (b) $NB\,\omega \sin\omega t$ (c) $NB/A \sin\omega t$ (d) $NBA\,\omega \sin\omega t$

85. A conducting rod of length $2l$ is rotating with constant angular speed ω about its perpendicular bisector. A uniform magnetic field $\vec{B}$ exists parallel to the axis of rotation. The e.m.f., induced between two ends of the rod is [MP PET 2001]



(a) $B\omega l^2$

(b) $\frac{1}{2}B\omega l^2$

(c) $\frac{1}{8}B\omega l^2$

(d) Zero

86. Two rails of a railway track insulated from each other and the ground are connected to a *milli voltmeter*. What is the reading of voltmeter when a train travels with a speed of 180 *km/hr* along the track. Given that the vertical component of earth's magnetic field is 0.2×10^{-4} *weber*/m^2 and the rails are separated by 1 *metre* [IIT -JEE1981; KCET 2001]

(a) 10^{-2} *volt* (b) 10^{-4} *volt* (c) 10^{-3} *volt* (d) 1 *volt*

87. A 10 *m* long copper wire while remaining in the east-west horizontal direction is falling down with a speed of 5.0 *m/s*. If the horizontal component of the earth's magnetic field = 0.3×10^{-4} *weber*/m^2, the e.m.f. developed between the ends of the wire is

[MP PET 2000]

(a) 0.15 *volt* (b) 1.5 *volt* (c) 0.15 *milli volt* (d) 1.5 *milli volt*

88. A wire of length 1 *m* is moving at a speed of 2 ms^{-1} perpendicular to its length and a homogeneous magnetic field of 0.5 *T*. The ends of the wire are joined to a circuit of resistance 6 Ω. The rate at which work is being done to keep the wire moving at constant speed is

[Roorkee 1999]

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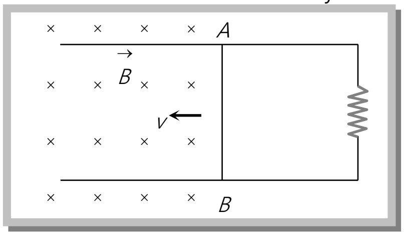
(a) $\frac{1}{12}W$ (b) $\frac{1}{6}W$ (c) $\frac{1}{3}W$ (d) 1 *W*

89. Consider the situation shown in the figure. The wire *AB* is slid on the fixed rails with a constant velocity. If the wire *AB* is replaced by semicircular wire, the magnitude of the induced current will [MP PMT 1999]



(a) Increase

(b) Remain the same

(c) Decrease

(d) Increase or decrease depending on whether the semicircle bulges towards the resistance or away from it

90. A straight line conductor of length 0.4 *m* is moved with a speed of 7 *m/sec* perpendicular to a magnetic field of intensity 0.9 *weber*/*m*^{2}. The induced e.m.f. across the conductor is [Roorkee 1982; CBSE 1995; UPSEAT 1999]

(a) 5.04 *V* (b) 1.26 *V* (c) 2.52 *V* (d) 25.2 *V*

91. 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 from the following

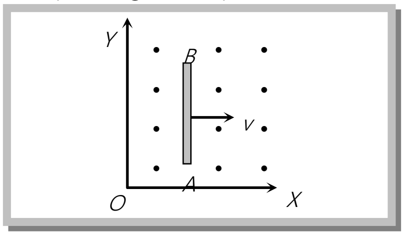
(a) The entire rod is at the same electric potential

(b) There is an electric field in the rod

(c) The electric potential is highest at the centre

(d) The electric potential is lowest at the centre of the rod and increases towards its ends

92. A conducting rod *AB* moves parallel to *X*-axis (fig) in a uniform magnetic field, pointing in the positive *z*-direction. The end *A* of the rod gets positively charged is this statement true [IIT-JEE 1987]



(a) Yes

(b) No

(c) Not defined

(d) Any answer is right

93. There is an aerial 1 *m* long in a car. It is moving from east to west with a velocity 100 *km*/*hr*. If the horizontal component of earth's magnetic field is 0.18×10^{-4} *weber/m*^{2}, the induced e.m.f. is nearly

(a) 0.50 *mV* (b) 0.25 *mV* (c) 0.75 *mV* (d) 1 *mV*

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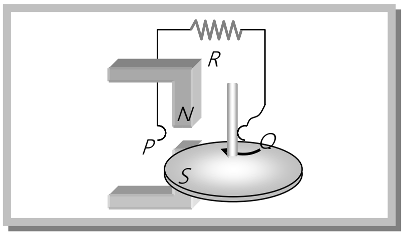
94. A metal disc rotates freely, between the poles of a magnet in the direction indicated. Brushes *P* and *Q* make contact with the edge of the disc and the metal axle. What current, if any, flows through *R*



(a) A current from *P* to *Q*

(b) A current from *Q* to *P*

(c) No current, because the e.m.f. in the disc is opposed by the back e.m.f.

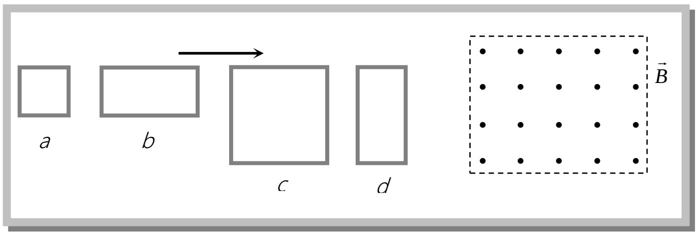
(d) No current, because no radial e.m.f. induced in the disc

Advance Level

95. In a uniform magnetic field of induction *B* a wire in the form of a semicircle of radius *r* rotates about the diameter of the circle with an angular frequency ω. The axis of rotation is perpendicular to the field. If the total resistance of the circuit is *R* the mean power generated per period of rotation is [AIEEE 2004]

(a) $\frac{(B\pi r\omega)^2}{2R}$ (b) $\frac{(B\pi r^2\omega)^2}{8R}$ (c) $\frac{B\pi r^2\omega}{2R}$ (d) $\frac{(B\pi r\omega^2)^2}{8R}$

96. The figure shows four wire loops, with edge lengths of either *L* or 2*L*. All four loops will move through a region of uniform magnetic field $\vec{B}$ (directed out of the page) at the same constant velocity. Rank the four loops according to the maximum magnitude of the e.m.f. induced as they move through the field, greatest first



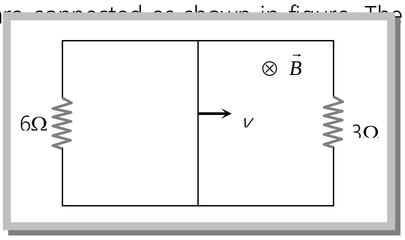
(a) $(e_c = e_d) < (e_a = e_b)$

(b) $(e_c = e_d) > (e_a = e_b)$

(c) $e_c > e_d > e_b > e_a$

(d) $e_c < e_d < e_b < e_a$

97. A rectangular loop with a sliding connector of length *l* = 1.0 *m* is situated in a uniform magnetic field *B* = 2*T* perpendicular to the plane of loop. Resistance of connector is *r* = 2Ω. 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* = 2*m/s* is



(a) 6 *N*

(b) 4 *N*

(c) 2 *N*

(d) 1 *N*

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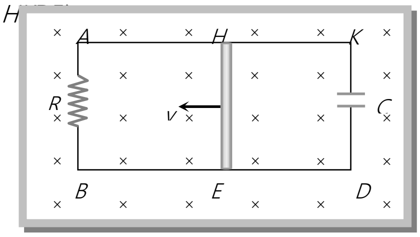
98. In the circuit shown in figure, a conducting wire *HE* is moved with a constant speed *v* towards left. The complete circuit is placed in a uniform magnetic field $\vec{B}$ perpendicular to the plane of circuit inwards. The current in *H*



(a) Clockwise

(b) Anticlockwise

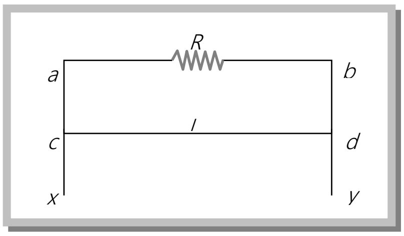
(c) Alternating

(d) Zero

99. The spokes of a wheel are made of metal and their lengths are of one *metre*. On rotating the wheel about its own axis in a uniform magnetic field of 5 × 10^{-5} *Tesla* normal to the plane of wheel, a potential difference of 3.14 *mV* is generated between the rim and the axis. The rotational velocity of the wheel is

(a) 63 *rev/s* (b) 50 *rev/s* (c) 31.4 *rev/s* (d) 20 *rev/s*

100. A wire *cd* of length *l* and mass *m* is sliding without friction on conducting rails *ax* and *by* as shown. The vertical rails are connected to each other with a resistance *R* between *a* and *b*. A uniform magnetic field *B* is applied perpendicular to the plane *abcd* such that *cd* moves with a constant velocity of



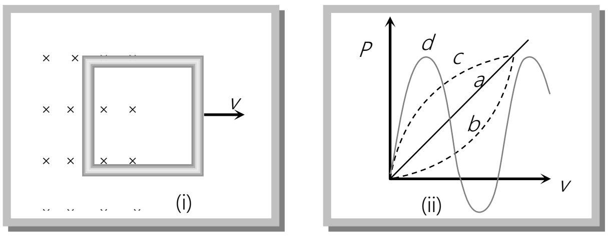
(a) $\frac{mgR}{Bl}$

(b) $\frac{mgR}{B^2l^2}$

(c) $\frac{mgR}{B^3l^3}$

(d) $\frac{mgR}{B^2l}$

101. Figure (i) shows a conducting loop being pulled out of a magnetic field with a speed *v*. Which of the four plots shows in figure (ii) may represent the power delivered by the pulling agent as a function of the speed *v*



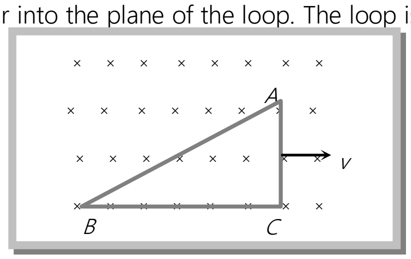
(a) a

(b) b

(c) c

(d) d

102. A right angled wire loop *ABC* is placed in a uniform magnetic field *B* perpendicular into the plane of the loop. The loop is moved with speed *v*. Which of the following statements is not true



(a) emf induced in *AB* is equal and opposite to emf induced in *AC*

(b) emf induced in *AB* is greater than emf induced in *AC*

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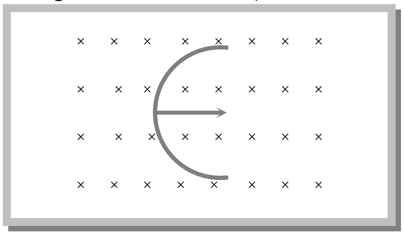
(c) Induced emf in BC is zero

(d) The net induced emf in the loop is zero

103. A straight wire of length L is bent into a semicircle. It is moved in a uniform magnetic field with speed v with diameter perpendicular to the field. The induced emf between the ends of the wire is



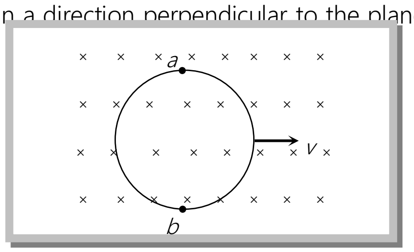
(a) BLv

(b) $2BLv$

(c) $2\pi BLv$

(d) $\frac{2BvL}{\pi}$

104. A copper ring of radius R moved with speed v. A uniform magnetic field B exists in a direction perpendicular to the plane of the ring. The induced emf between diametrically opposite point a, b as shown is



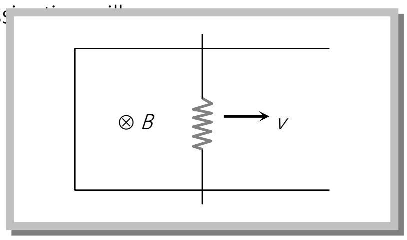
(a) 0

(b) $2BRv$

(c) $4BRv$

(d) BRv

105. A conducting bar 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 diss



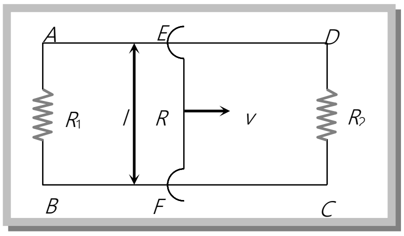
(a) Remain constant

(b) Become quarter of the initial value

(c) Become four fold

(d) Get doubled

106. A rectangular loop on which a connector EF of length l slides, is lying in a perpendicular magnetic field. The induction of magnetic field is B. The resistance of the connector is R. If the connector moves with a velocity v then the current flowing in it will be



(a) $\frac{Blv}{R_1 + R_2}$

(b) $\frac{Blv(R_1 + R_2)}{R_1 R_2}$

(c) $\frac{Blv}{R + \frac{R_1 R_2}{R_1 + R_2}}$

(d) None of these

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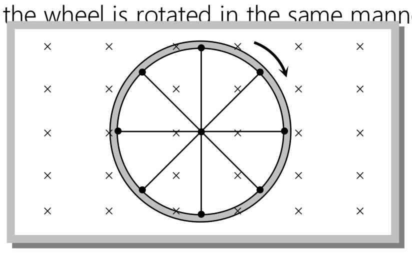
107. A wheel with N spokes is rotated in a plane perpendicular to the magnetic field of earth such that an emf e is induced between axle and rim of the wheel. In the same wheel, number of spokes is made 3 N and the wheel is rotated in the same manner in the same field then new emf is



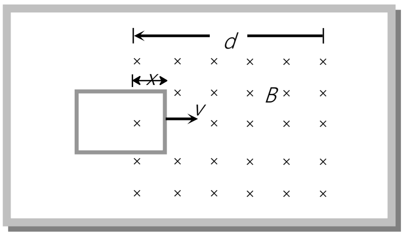
(a) $3e$

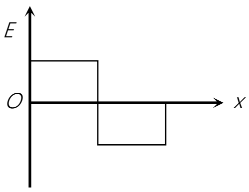
(b) $\frac{3}{2}e$

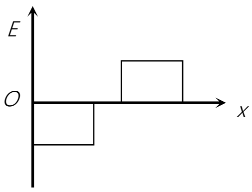
(c) $\frac{e}{3}$

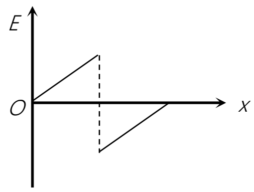
(d) e

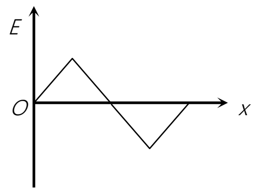
108. A rectangular loop is being pulled at a constant speed v, through a region of certain thickness d, in which a uniform magnetic field B is set up. The graph between position x of the right hand edge of the loop and the induced emf E will be



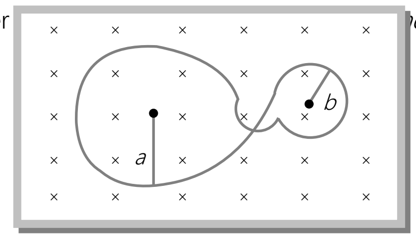
(a) 

(b) 

(c) 

(d) 

109. A plane loop shown in the figure is shaped in the form of figure with radii a = 20 cm and b = 10 cm is placed in a uniform magnetic field perpendicular into the loop's plane. The magnetic induction varies as $B = B_0 \sin\omega t$. where B_0 = 10 mT and ω = 100 rad/sec. Find the amplitude of the current induced in the loop if its resistance per *etre*. The inductance of the loop is negligible



(a) 10 *amp*

(b) 1 *amp*

(c) 0.1 *amp*

(d) 2 *amp*

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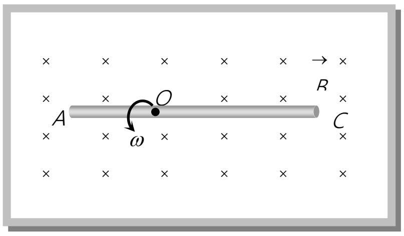
110. A conducting rod *AC* of length 4*l* is rotated about a point *O* in a uniform magnetic field $\vec{B}$ directed into the paper. *AO* = *l* and *OC* = 3*l*. Then



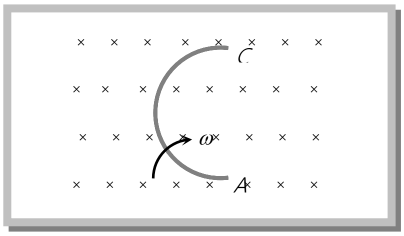
(a) $V_A - V_O = \frac{B\omega l^2}{2}$

(b) $V_O - V_C = \frac{7}{2}B\omega l^2$

(c) $V_A - V_C = 4B\omega l^2$

(d) $V_C - V_O = \frac{9}{2}B\omega l^2$

111. A thin wire *AC* shaped as a semicircle of diameter *D* = 20 *cm* rotates with a constant angular velocity ω = 100 *rad/s*. in a uniform magnetic field of induction *B* = 5 *mT* with $\vec{\omega} \parallel \vec{B}$ about the axis passing through *A* and perpendicular to *AC*. Find the voltage developed between *A* and *C*



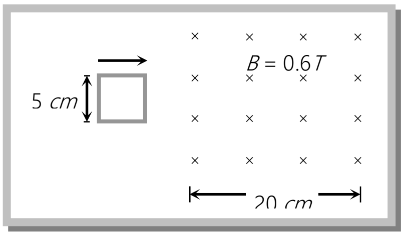
(a) 100 *mV*

(b) 10 *mV*

(c) 1 *mV*

(d) 1 *volt*

112. Figure shows a square loop of side 5 *cm* being moved towards right at a constant speed of 1 *cm/sec*. The front edge enters the 20 *cm* wide magnetic field at *t* = 0. Find the emf in the loop at *t* = 2*s* and *t* = 10 *s*



(a) 3×10^{-2} *V*, zero

(b) 3×10^{-2} *V*, 3×10^{-4}

(c) 3×10^{-4} *V*, 3×10^{-4}

(d) 3×10^{-4} *V*, zero

113. A metal rod of resistance *R* is fixed along a diameter of a conducting ring of radius *r*. There is a magnetic field of magnitude *B* perpendicular to the plane of the ring. The ring spins with an angular velocity ω about its axis. The centre of the ring is joined to its rim by an external wire *W*. The ring and *W* have no resistance. The current in *W* is

(a) Zero (b) $\frac{Br^2\omega}{2R}$ (c) $\frac{Br^2 v}{R}$ (d) $\frac{2Br^2\omega}{R}$

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114. An emf of 100 *millivolts* is induced in a coil when the current in another nearby coil becomes 10 *A* from zero to 0.1 *sec*. The coefficient of mutual induction between the two coils will be [Kerala PMT 2004]

(a) 1 *mH* (b) 10 *mH* (c) 100 *mH* (d) 1000 *mH*

115. The current through choke coil increases from zero to 6*A* in 0.3 *sec* and an induced *e.m.f.* of 30 *V* is produced. The inductance of the coil of choke is [MP PMT 2004]

(a) 5 *H* (b) 2.5 *H* (c) 1.5 *H* (d) 2 *H*

116. The dimensional formula for inductance is [KCET 2004]

(a) ML^2TA^{-2} (b) $ML^2T^{-2}A^{-2}$ (c) $ML^2T^{-2}A^{-1}$ (d) $ML^2T^{-1}A^{-2}$

117. Energy stored in a coil of self inductance 40 *mH* carrying a steady current of 2 *A* is [Kerala (Engg.) 2003]

(a) 0.8 *J* (b) 8 *J* (c) 0.08 *J* (d) 80 *J*

118. When the current changes from +2*A* to –2*A* in 0.05 *second*, an e.m.f. of 8 volt is induced in a coil. The coefficient of self induction of the coil is [AIEEE 2003]

(a) 0.1 *H* (b) 0.2 *H* (c) 0.4 *H* (d) 0.8 *H*

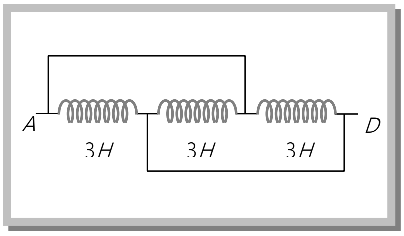
119. Two circuits have mutual inductance of 0.1 *H*. What average e.m.f. is induced in one circuit when the current in the other circuit changes from 0 to 20 *A* in 0.02 *s* [Kerala (Engg.) 2002]

(a) 240 *V* (b) 230 *V* (c) 100 *V* (d) 300 *V*

120. An air core solenoid has 1000 turns and is one *metre* long. Its cross-sectional area is 10 cm^2. Its self inductance is [JIPMER 2002]

(a) 0.1256 *mH* (b) 12.56 *mH* (c) 1.256 *mH* (d) 125.6 *mH*

121. The inductance between *A* and *D* is [MNR 1998; AIEEE 2002]



(a) 3.66 *H*

(b) 9 *H*

(c) 0.66 *H*

(d) 1 *H*

122. In circular coil, when number of turns is doubled and resistance becomes $\frac{1}{4}$th of initial, then inductance becomes [AIEEE 2002]

(a) 4 times (b) 2 times (c) 8 times (d) No change

123. What is self-inductance of coil which produces 5 *V* when the current changes from 3 *amperes* to 2 *amperes* in one *millisecond* [CPMT 1982; MP PMT 1991; CBSE 1993; AFMC 2002]

(a) 5000 *henry* (b) 5 *milli henry* (c) 50 *henry* (d) 5 *henry*

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124. A coil of 100 turns carries a current of 5 *mA* and creates a total magnetic flux of 10^{-5} *weber*. The inductance is [Orissa JEE 2002]

(a) 0.2 *mH* (b) 2.0 *mH* (c) 0.02 *mH* (d) None of these

125. The coefficient of mutual inductance, when magnetic flux changes by 2×10^{-2} *wb* and current changes by 0.01 *A* is

[BHU 1998; EAMCET 2001; AIIMS 2002]

(a) 2*H* (b) 3*H* (c) 4*H* (d) 8*H*

126. An inductor stores energy in [CBSE 1990, 92I; DPMT 1997; MP PMT 1996, 2002; Kerala PMT 2002]

(a) Its electric field (b) Its coil

(c) Its magnetic field (d) Both in magnetic and electric field

127. A coil of $R = 10\ \Omega$ and $L = 5\ H$ is connected to a 100 *V* battery, then energy stored is [CPMT 2002]

(a) 100 *J* (b) 400 *J* (c) 250 *J* (d) 500 *J*

128. An average induced e.m.f. of 1 *V* appears in a coil when the current in it is changed from 10 *A* in one direction to 10 *A* in opposite direction in 0.5 *sec*. Self-inductance of the coil is [CPMT 2001]

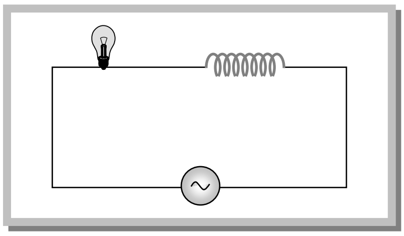
(a) 25 *mH* (b) 50 *mH* (c) 75 *mH* (d) 100 *mH*

129. The SI unit of inductance, the henry can not be written as

[MP PMT 1994, 95; MP PET 1997; IIT-JEE1998; MP PET/PMT 1998; RPET 2001]

(a) *weber ampere*$^{-1}$ (b) *volt second ampere*$^{-1}$ (c) *joule ampere*$^{-2}$ (d) *ohm second*$^{-1}$

130. If a soft iron rod inserted into inductive coil then intensity of bulb will be



(a) Increases

(b) Decreases

(c) Unchanged

(d) Cannot say anything

131. Find out the e.m.f. produced when the current changes from 0 to 1*A* in 10 *second* given, $L = 10\ \mu H$ [DCE 2001]

(a) 1 *V* (b) 1 μV (c) 1 *mV* (d) 1 *V*

132. A solenoid of length *l metre* has self inductance *L henry*. If number of turns are doubled, its self inductance [MP PMT 2001]

(a) Remains same (b) Becomes 2*L* henry (c) Becomes 4*L henry* (d) Becomes $\frac{L}{\sqrt{2}}$ *henry*

133. 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} *weber* and with *B* it is 9.0×10^{-5} *weber*. The mutual inductance of the system is [MP PET 2001]

(a) 2×10^{-5} *henry* (b) 3×10^{-5} *henry* (c) 4×10^{-5} *henry* (d) 6×10^{-5} *henry*

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134. The inductance of a closed-packed coil of 400 turns is 8 *mH*. A current of 5 *mA* is passed through it. The magnetic flux through each turn of the coil is [Roorkee 2000]

(a) $\frac{1}{4\pi}\mu_0 Wb$ (b) $\frac{1}{2\pi}\mu_0 Wb$ (c) $\frac{1}{3\pi}\mu_0 Wb$ (d) $0.4\,\mu_0 Wb$

135. A varying current at the rate of 3 *A/s* in coil generates an e.m.f. of 8 *mV* in a near by coil. The mutual inductance of the two coils is [Pb. PMT 2000]

(a) 2.66 *mH* (b) 2.66×10^{-3} *mH* (c) 2.66 *H* (d) 0.266 *H*

136. The equivalent inductance of two inductances is 2.4 *henry* when connected in parallel and 10 *henry* when connected in series. The difference between the two inductances is [MP PMT 2000]

(a) 2 *henry* (b) 3 *henry* (c) 4 *henry* (d) 5 *henry*

137. An e.m.f. of 12 *volt* is produced in a coil when the current in it changes at the rate of 45 *amp/minute*. The inductance of the coil is [MP PET 2000]

(a) 0.25 *henry* (b) 1.5 *henry* (c) 9.6 *henry* (d) 16.0 *henry*

138. The current passing through a choke coil of 5 *henry* is decreasing at the rate of 2 *ampere/sec*. The e.m.f. developing across the coil is

[CPMT 1982; MP PMT 1990; AIIMS 1997; MP PET 1999]

(a) 10 *V* (b) – 10 *V* (c) 2.5 *V* (d) – 2.5 *V*

139. The coefficient of mutual inductance between two coils *A* and *B* depends upon [CPMT 1992; CPMT 1993; BCECE 1999]

(a) Medium between coils (b) Separation between coils (c) Both *A* and *B* (d) None of *A* and *B*

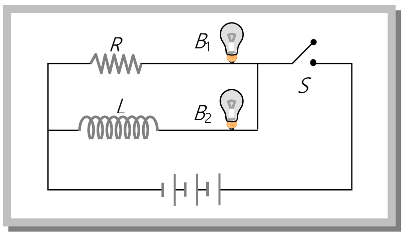
140. If the current is halved in a coil then the energy stored is how much times the previous value [CPMT 1999]

(a) $\frac{1}{2}$ (b) $\frac{1}{4}$ (c) 2 (d) 4

141. The self inductance of a straight conductor is [KCET 1998]

(a) Zero (b) Very large (c) Infinity (d) Very small

142. Figure shows two bulbs B_1 and B_2, resistor *R* and an inductor *L*. When the switch *S* is turned off [CPMT 1998]



(a) Both B_1 and B_2 die out promptly

(b) Both B_1 and B_2 die out with some delay

(c) B_1 dies out promptly but B_2 with some delay

(d) B_2 dies out promptly but B_1 with some delay

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143. The mutual inductance between a primary and secondary circuits is 0.5 *H*. The resistances of the primary and the secondary circuits are 20 *ohms* and 5 *ohms* respectively. To generate a current of 0.4 *A* in the secondary, current in the primary must be changed at the rate of **[MP PMT 1997]**

(a) 4.0 *A/s* (b) 16.0 *A/s* (c) 1.6 *A/s* (d) 8.0 *A/s*

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

(a) 6.25 (b) 12.5 (c) 25 (d) 50

145. The current flowing in a coil of self inductance 0.4 *mH* is increased by 250 *mA* in 0.1 *sec*. The e.m.f. induced will be **[MP PMT 1994]**

(a) + 1 *volt* (b) – 1 *volt* (c) + 1 *mV* (d) – 1 *mV*

146. When two inductors L_1 and L_2 are connected in parallel, the equivalent inductance is **[AFMC 1994]**

(a) $L_1 + L_2$ (b) Between L_1 and L_2 (c) Less than both L_1 and L_2 (d) None of the above

147. A wire coil carries the current *i*. The potential energy of the coil does not depend upon **[MP PET 1993]**

(a) The value of *i* (b) The number of turns in the coil

(c) Whether the coil has an iron core or not (d) The resistance of the coil

148. A coil of wire of a certain radius has 600 turns and a self-inductance of 108 *mH*. The self-inductance of a second similar coil of 500 turns will be **[MP PMT 1990; Pb. CET 1992]**

(a) 74 *mH* (b) 75 *mH* (c) 76 *mH* (d) 77 *mH*

149. A coil is wound on a frame of rectangular cross-section. If all the linear dimensions of the frame are increased by a factor of 2 and the number of turns per unit length of the coil remains the same, the self-inductance increases by a factor of

(a) 4 (b) 8 (c) 16 (d) 32

150. The current through an inductor of 1 *H* is given by $I = 3\ t \sin t$. The voltage across the inductor of 1 *H* is

(a) $3 \sin t + 3 \cos t$ (b) $3 \cos t + t \sin t$ (c) $3 \sin t + 3t \cos t$ (d) $3t \cos t - 3 \sin t$

151. The coefficients of self induction of two coils are L_1 and L_2. To induce an e.m.f. of 25 volt in the coils change of current of 1*A* has to be produced in 5 second and 50*ms* respectively. The ratio of their self inductances $L_1 : L_2$ will be

(a) 1 : 5 (b) 200 : 1 (c) 100 : 1 (d) 50 : 1

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152. The resistance and inductance of series circuit are 5 Ω and 20 *H* respectively. At the instant of closing the switch, the current is increasing at the rate 4 *A-s*. The supply voltage is [MP PMT 2004]

(a) 20 *V* (b) 80 *V* (c) 120 *V* (d) 100 *V*

153. Two circular coils have their centres at the same point. The mutual inductance between them will be maximum when their axes [MP PMT 2004]

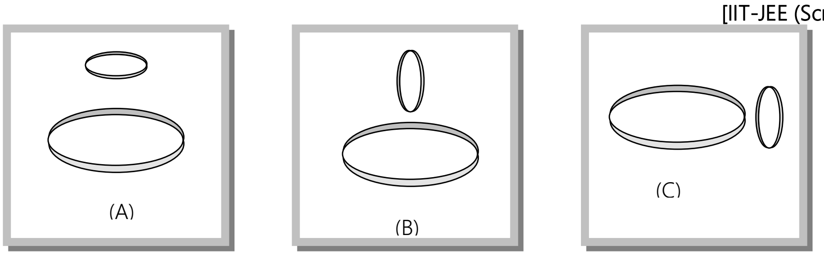
(a) Are parallel to each other (b) Are at 60° to each other

(c) Are at 45° to each other (d) Are perpendicular to each other

154. Two conducting circular loops of radii R_1 and R_2 are placed in the same plane with their centres coinciding. If $R_1 >> R_2$, the mutual inductance *M* between them will be directly proportional to

(a) R_1, R_2 (b) $\frac{1}{(R_1R_2)}$ (c) $\frac{R_1^2}{R_2}$ (d) $\frac{R_2^2}{R_1}$

155. Two circular coils can be arranged in any of the three situations shown in the figure. Their mutual inductance will be [IIT-JEE (Screening) 2001]



(a) Maximum in situation (A)

(b) Maximum in situation (B)

(c) Maximum in situation (C)

(d) The same in all situations

156. Two coils have a mutual inductance 0.005 *H*. The current changes in the first coil according to equation $i = i_0 \sin \omega t$ where $i_0 = 10$ *A* and $\omega = 100\ \pi$ *rad/sec*. The maximum value of e.m.f. in the second coil is [CBSE 1998; Pb. PMT 2000]

(a) 2π (b) 5π (c) 8π (d) 12π

157. If in a coil rate of change of area is $\frac{5\ metre^2}{milli\ second}$ and current become 1 *amp* form 2 *amp* in 2×10^{-3} *sec*. If magnitude field is 1 *Tesla* then self inductance of the coil is

(a) 2 *H* (b) 5 *H* (c) 20 *H* (d) 10 *H*

158. A small square loop of wire of side *l* is placed inside a large square loop of wire of side *L* ($L > l$). The loop are coplanar and their centre coincide. The mutual inductance of the system is proportional to

(a) l / L (b) l^2 / L (c) L / l (d) L^2 / l

159. Two coils are at fixed locations. When coil 1 has no current and the current in coil 2 increases at the rate 15.0 *A/s* the e.m.f. in coil 1 in 25.0 *mV*, when coil 2 has no current and coil 1 has a current of 3.6 *A*, the flux linkage in coil 2 is

(a) 16 *mWb* (b) 10 *mWb* (c) 4.00 *mWb* (d) 6.00 *mWb*

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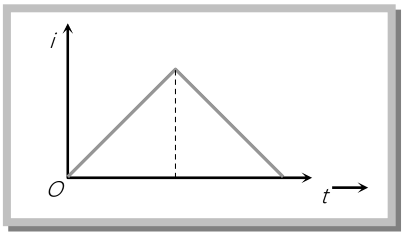
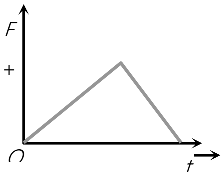
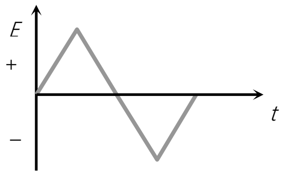
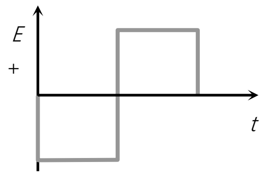
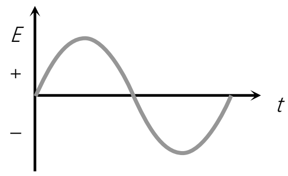
160. The current i in an inductance coil varies with time, t according to the graph shown in fig. Which one of the following plots shows the variation of voltage in the coil with time [CBSE 1994]



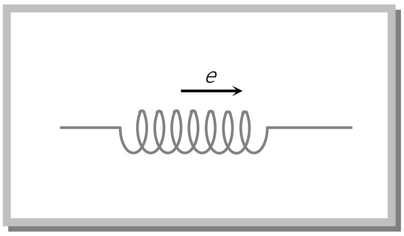
(a)


(b)


(c)


(d)


161. The figure shows an e.m.f. e induced in a coil. Which of the following can describe the current through the coil



(a) Constant and right wards

(b) Increasing and right ward

(c) Decreasing and right ward

(d) Decreasing and left ward

162. Two coils A and B have coefficient of mutual inductance $M = 2H$. The magnetic flux passing through coil A changes by 4 *weber* in 10 *seconds* due to the change in current in B. Then

(a) Change in current in B in this time interval is 0.5 A

(b) The change in current in B in this time interval is 2 A

(c) The change in current in B in this time interval is 8 A

(d) A change in current of 1 A in coil A will produce a change in flux passing through B by 4 *weber*

163. The coefficient of mutual inductance of two circuits A and B is 3 *mH* and their respective resistances are 10 *ohm* and 4 *ohm*. How much current should change in 0.02 *second* in the circuit A, so that the induced current in B should be 0.006 *ampere*

(a) 0.24 *amp* (b) 1.6 *amp* (c) 0.18 *amp* (d) 0.16 *amp*

164. The current in a coil varies *w.r.t.* 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

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(a) 0.14 V (b) 0.12 V (c) 0.11 V (d) 0.13 V

165. Self inductances of two coils connected in series are 0.01 and 0.03 H. if the windings in the coils are in opposite sense and M =0.01 H, then the resultant self-inductance will be

(a) 2H (b) 0.2 H (c) 0.02 H (d) Zero

166. One-third length of a uniformly wound solenoid of length l, area of cross section A and turns per unit length n is filled with a material of permeability μ_1. While the rest is filled with a material of permeability μ_2. The self inductance of solenoid is

(a) $\frac{1}{3}(\mu_1+2\mu_2)n^2lA$ (b) $\frac{1}{3}(\mu_1+2\mu_2)n^2lA$ (c) $\frac{1}{4}(\mu_1+3\mu_2)n^2lA$ (d) $\frac{1}{4}(\mu_2+3\mu_1)n^2lA$

167. A circuit having a self inductance of 1.0 H carries a current of 2.0 A. To avoid sparking when the circuit is broken, a capacitor which can with stand 400 V is employed. The minimum capacitance of the capacitor connected across the switch should be

(a) 1.25 μF (b) 25μF (c) 50μF (d) 150μF

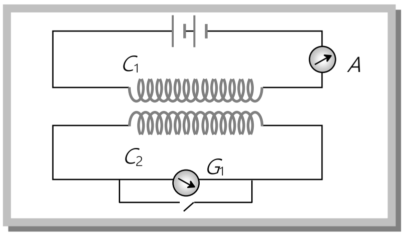
168. Through an induction coil of L = 0.2 H, an ac current of 2 *ampere* is passed first with frequency f_1 and then with frequency f_2. The ratio of the maximum value of induced e.m.f. (e_1/e_2) in the coil, in the two cases is

(a) f_1/f_2 (b) f_2/f_1 (c) $(f_1/f_2)^2$ (d) 1 : 1

169. How much length of a very thin wire is required to obtain a solenoid of length l_0 and inductance L

(a) $\sqrt{\frac{2\pi Ll_0}{\mu_0}}$ (b) $\sqrt{\frac{4\pi Ll_0}{\mu_0^2}}$ (c) $\sqrt{\frac{4\pi Ll_0}{\mu_0}}$ (d) $\sqrt{\frac{8\pi Ll_0}{\mu_0}}$

170. In following figure when key is pressed the ammeter A reads i *ampere*. The charge passing in the galvanometer circuit of total resistance R is Q. The mutual inductance of the two coils is



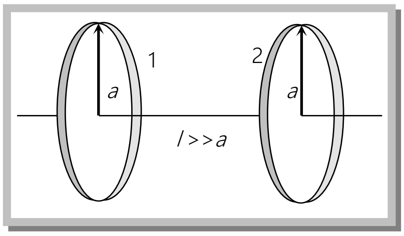
(a) Q/R

(b) QR

(c) QR/i

(d) i/QR

171. What is the mutual inductance of a two-loop system as shown with centre separation l



(a) $\frac{\mu_0\pi a^4}{8l^3}$

(b) $\frac{\mu_0\pi a^4}{4l^3}$

(c) $\frac{\mu_0\pi a^4}{6l^3}$

(d) $\frac{\mu_0\pi a^4}{2l^3}$

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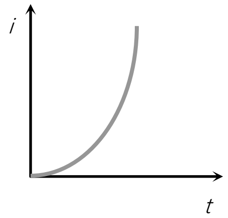
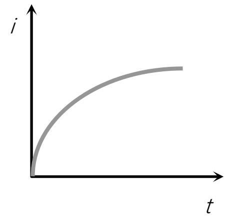
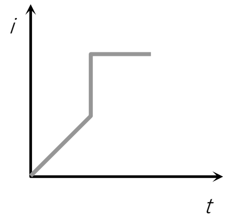
LR and LC circuits with dc source

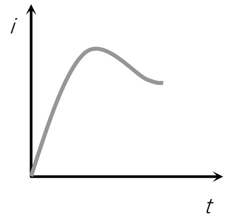
Basic Level

172. When a battery is connected across a series combination of self inductance *L* and resistance *R*, the variation in the current *i* with time *t* is best represented by [MP PET 2004]

(a) 

(b) 

(c) 

(d) 

173. A condenser of capacity 20 μF us first charged and then discharged through a 10 *mH* inductance. Neglecting the resistance of the coil, the frequency of the resulting vibrations will be [J & K CET 2004]

(a) 365 *cycle/sec* (b) 356 *cycles/sec* (c) 365×10^3 *cycles/sec* (d) 3.56 *cycles/sec*

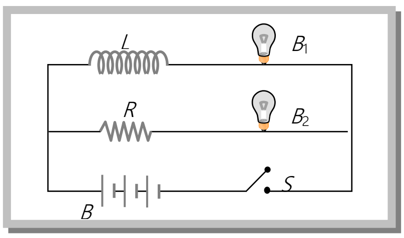
174. An *L*-*R* circuit has a cell of e.m.f. *E*, which is switched on at time *t* = 0. The current in the circuit after a long time will be [MP PET 2003]

(a) Zero (b) $\frac{E}{R}$ (c) $\frac{E}{L}$ (d) $\frac{E}{\sqrt{L^2 + R^2}}$

175. The time constant of an *LR* circuit represents the time in which the current in the circuit [MP PMT 2002]

(a) Reaches a value equal to about 37% of its final value
(b) Reaches a value equal to about 63% of its final value
(c) Attains a constant value
(d) Attains 50% of the constant value

176. An inductor, *L* a resistance *R* and two identical bulbs, B_1 and B_2 are connected to a battery through a switch *S* as shown in the fig. The resistance *R* is the same as that of the coil that makes *L*. Which of the following statements gives the correct description of the happenings when the switch *S* is closed [AMU (Med.) 2002]



(a) The bulb B_2 lights up earlier than B_1 and finally both the bulbs shine equally brig

(b) B_1 light up earlier and finally both the bulbs acquire equal brightness

(c) B_2 lights up earlier and finally B_1 shines brighter than B_2

(d) B_1 and B_2 light up together with equal brightness all the time

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177. A coil of inductance 40 *henry* is connected in series with a resistance of 8 *ohm* and the combination is joined to the terminals of a 2 *volt* battery. The time constant of the circuit is [MP PET 2000]

(a) 40 seconds (b) 20 seconds (c) 8 seconds (d) 5 seconds

178. A capacitor is fully charged with a battery. Then the battery is removed and coil is connected with the capacitor in parallel current varies as [RPET 2000; DCE 2000]

(a) Increases monotonically (b) Decreases monotonically (c) Zero (d) Oscillates indefinitely

179. In an *L-R* circuit, time constant is that time in which current grows from zero to the value, where i_0 is the steady state current [MP PET/ PMT 1998]

(a) $0.63\, i_0$ (b) $0.50\, i_0$ (c) 0.371 (d) i_0

180. 5 *cm* long solenoid having 10 *ohm* resistance and 5 *mH* inductance is joined to a 10 *volt* battery. At steady state the current through the solenoid in *ampere* will be

(a) 5 (b) 1 (c) 2 (d) Zero

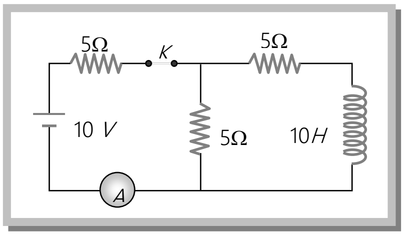
181. A coil has an inductance of 2.5 *henry* and a resistance of 0.5 *ohm*. If the coil is suddenly connected across 6.0 *volt* battery, then the time required for the current to rise to 0.63 of its final value is [PMT (AMU) 1995]

(a) 3.5 *sec* (b) 4.0 *sec* (c) 4.5 *sec* (d) 5.0 *sec*

182. An inductance *L* and a resistance *R* are first connected to a battery. After some time the battery is disconnected but *L* and *R* remain connected in a closed circuit. Then current reduces to 37% of its initial value in [MP PMT 1994]

(a) *RL sec* (b) $\left(\frac{R}{L}\right) sec$ (c) $\left(\frac{L}{R}\right) sec$ (d) $\left(\frac{1}{LR}\right) sec$

183. In the circuit shown below what is the reading of the ammeter just after closing the key



(a) 1 *A*

(b) 2 *A*

(c) (4/3) *A*

(d) (3/4) *A*

184. In the above question, what will be the reading of the ammeter long time after closing the key

(a) 1 *A* (b) 2 *A* (c) (4/3) *A* (d) (3/4) *A*

Advance Level

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185. A coil of inductance 8.4 *mH* and resistance 6Ω is connected to a 12 *V* battery. The current in the coil is 1.0 *A* at approximately the time

[IIT-JEE 1999; UPSEAT 2003]

(a) 500 *sec* (b) 20 *sec* (c) 35 *milli sec* (d) 1 *milli sec*

186. An inductor of 2 *H* and a resistance of 10 *ohm* are connected to a battery of 5 *V* in series. The initial rate of change of current is

[MP PET 2002; MP PET 2001]

(a) 0.5 *A/sec* (b) 2.0 *A/sec* (c) 2.5 *A/sec* (d) 0.25 *A/sec*

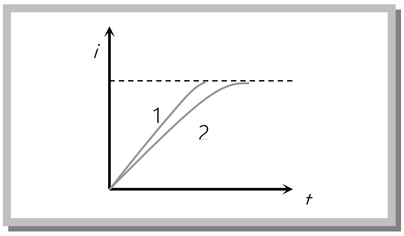
187. A solenoid has an inductance of 60 *henry* and a resistance of 30 Ω. If it is connected to a 100 volt battery, how long will it take for the current to reach $\frac{e-1}{e} = 63.2\%$ of its final value [MP PET 2000]

(a) 1 second (b) 2 seconds (c) *e* seconds (d) 2*e* seconds

188. A solenoid of 10 *henry* inductance and 2 *ohm* resistance, is connected to a 10 *volt* battery. In how much time the magnetic energy will be reduced to 1/4th of the maximum value [IIT-JEE 1996]

(a) 3.5 *sec* (b) 2.5 *sec* (c) 5.5 *sec* (d) 7.5 *sec*

189. When a certain circuit consisting of a constant e.m.f. *E* an inductance *L* and a resistance *R* is closed, the current in, it increases with time according to curve 1. After one parameter (*E*, *L* or *R*) is changed, the increase in current follows curve 2 when the circuit is closed second time. Which parameter was changed and in what direction



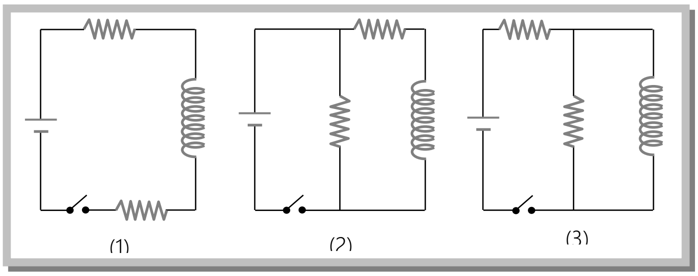
(a) *L* is increased

(b) *L* is decreased

(c) *R* is increased

(d) *R* is decreased

190. The figure shows three circuits with identical batteries, inductors, and resistors. Rank the circuits according to the current through the battery (i) just after the switch is closed and (ii) a long time later, greatest first



(a) (i) $i_2 > i_3 > i_1$ $(i_1 = 0)$ (ii) $i_2 > i_3 > i_1$

(b) (i) $i_2 < i_3 < i_1$ $(i_1 \neq 0)$ (ii) $i_2 > i_3 > i_1$

(c) (i) $i_2 = i_3 = i_1$ $(i_1 = 0)$ (ii) $i_2 < i_3 < i_1$

(d) (i) $i_2 = i_3 > i_1$ $(i_1 \neq 0)$ (ii) $i_2 > i_3 > i_1$

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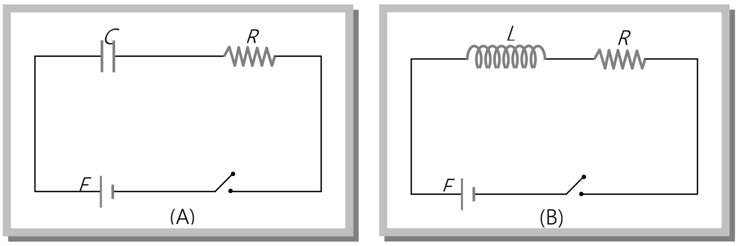
191. Two circuits 1 and 2 are connected to identical dc source each of e.m.f. 12 *V*. Circuit 1 has a self inductance $L = 10$ *H* and circuit 2 has a self inductance $L_2 = 10$ *mH*. The total resistance of each circuit is 48 Ω. The ratio of steady current in circuit 1 and 2, ratio of energy consumed in circuits 1 and 2 to build up the current to steady state value and the ratio of the power dissipated by circuits 1 and 2 after the steady state is reached are respectively

(a) $\frac{1000}{1}, \frac{1000}{1}, \frac{1000}{1}$ (b) $\frac{100}{1}, \frac{10}{1}, \frac{1}{1}$ (c) $\frac{1}{1}, \frac{1000}{1}, \frac{1}{1}$ (d) $\frac{10}{1}, \frac{10}{1}, \frac{10}{1}$

192. The switches in figure (A) and (B) are closed at $t = 0$ and re-opened after a long time at $t = t_0$



(1) The charge on *C* just after $t = 0$ is *EC*

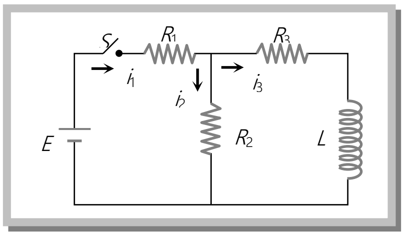
(2) The charge on *C* long after $t = 0$ is *EC*

(3) The current in *L* long after $t = t_0$ is *E/R*

(4) The current in *L* just before $t = t_0$ is *E/R*

(a) Both (1) and (2) (b) Both (2) and (3) (c) Only (4) (d) Both (2) and (4)

193. In the circuit shown in adjoining fig $E = 10$ *V*, $R_1 = 1\,\Omega$ $R_2 = 2\Omega$, $R_3 = 3\Omega$ and $L = 2H$ calculate the value of current i_1, i_2 and i_3 immediately after switch *S* is closed



(a) 3.3 *amp*, 3.3 *amp*, 3.3 *amp*

(b) 3.3 *amp*, 3.3 *amp*, 0 *amp*

(c) 3.3 *amp*, 0 *amp*, 0 *amp*

(d) 3.3 *amp*, 3.3 *amp*, 1.1 *amp*

194. The inductance of a solenoid is 5 *henery* and its resistance is 5Ω. If it is connected to a 10 *volt* battery then time taken by the current to reach 9/10th of its maximum will be

(a) 4.0 *s* (b) 2.3 *s* (c) 1.4 *s* (d) 1.2 *s*

195. A solenoid of inductance 50 *mH* and resistance 10 Ω is connected to a battery of 6 *V*. The time elapsed before the current acquires half of its steady-state value will be

(a) 3.01 *s* (b) 3.02 *s* (c) 3.03 *s* (d) 3.5 *ms*

196. In series with 20 *ohm* resistor a 5 *henry* inductor is placed. To the combination an e.m.f. of 5 *volt* is applied. What will be the rate of increase of current at $t = 0.25$ second

(a) 2.01 *A/s* (b) 3 *A/s* (c) 0.368 *A/s* (d) Zero

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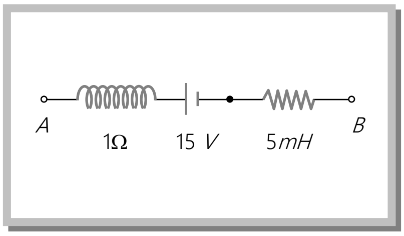
197. At t = 0, an inductor of zero resistance is joined to a cell of e.m.f. E through a resistance. The current increases with a time constant τ. The e.m.f. across the coil after time t is

(a) Et/τ (b) $E e^{-t/\tau}$ (c) $E e^{-2t/\tau}$ (d) $E(1-e^{-t/\tau})$

198. The network shown in the figure is a part of a complete circuit. If at a certain instant the current i is 5 A and is decreasing at the rate of $10^3 A/s$ then $V_A - V_B$ is



(a) 5 V

(b) 10 V

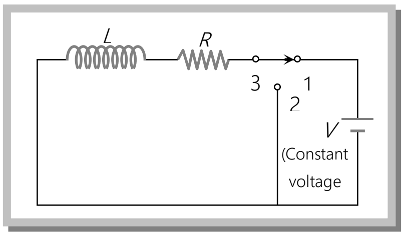
(c) 15 V

(d) 20 V

199. An ideal conductor L is connected in series with a resistor R. A battery is connected to the circuit. In the steady state the energy stored in the coil is 40 J and rate of generation of heat in the resistor is 320 $J\,s^{-1}$. The time constant of the circuit is

(a) 1.0 ms (b) 0.25 s (c) 1.0 s (d) 3.0 s

200. In the circuit shown, how soon will the coil current reach η fraction of the steady-state value



(a) $\frac{L}{R}$

(b) $\frac{L}{R}\ln\frac{\eta}{(1-\eta)}$

(c) $\frac{L}{R}\ln\frac{1}{(1-\eta)}$

(d) $\frac{L}{R}\ln(1-\eta)$

Application of EMI (Eddy currents, dc motor, ac generator/Dynamo, dc generator)

201. When the speed of a dc motor increase the armature current [MP PET 2004]

(a) Increases (b) Decreases

(c) Does not change (d) Increases and decreases continuously

202. Fan is based on [AFMC 2003]

(a) Electric motor (b) Electric dynamo (c) Both (d) None of these

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203. An electric motor operates on a 50 *volt* supply and a current of 12 *A*. If the efficiency of the motor is 30%, what is the resistance of the winding of the motor [Kerala (Engg.) 2002]

(a) 6 Ω (b) 4 Ω (c) 2.9 Ω (d) 3.1 Ω

204. The starter motor of a car draws a current i = 300 *A* from the battery of voltage 12 *V*. If the car starts only after 2 minutes, what is the energy drawn from the battery

(a) 3 *kJ* (b) 30 *kJ* (c) 7.2 *kJ* (d) 432 *kJ*

205. A motor having an armature of resistance 2Ω is designed to operate at 220 *V* mains. At full speed, it develops a back e.m.f. of 210 *V*. When the motor is running at full speed, the current in the armature is

(a) 5 *A* (b) 105 *A* (c) 110 *A* (d) 215 *A*

206. The working of a dynamo is based on the principle of [CPMT 1996; MP PMT 2002]

(a) Heating effect of current (b) Magnetic effect of current

(c) Chemical effect of current (d) Electromagnetic induction

207. The coil of a dynamo is rotating in a magnetic field. The developed induced e.m.f. changes and the number of magnetic lines of force also changes. Which of the following conditions is correct [AFMC 1997]

(a) Lines of force minimum but induced e.m.f. is zero (b) Lines of force maximum but induced e.m.f. is zero

(c) Lines of force maximum but induced e.m.f. is not zero (d) Lines of force maximum but induced e.m.f. is also maximum

208. Work of electric motor is [RPMT 1997]

(a) To convert *ac* into *dc* (b) To convert *dc* into *ac*

(c) Both (a) and (b) (d) To convert *ac* into mechanical work

209. The armature current in a dc motor is maximum when the motor has [CPMT 1988; Pb. PMT 1996]

(a) Picked up maximum speed (b) Just started (c) Intermediate speed (d) Just been switched off

210. The number of turns in the coil of an ac generator is 5000 and the area of the coil is 0.25 m^2; the coil is rotated at the rate of 100 cycle per *second* in a magnetic field of 0.2 $weber/m^2$. The pack value of the e.m.f. generated is nearly

(a) 786 *kV* (b) 440 *kV* (c) 220 *kV* (d) 157.1 *kV*

211. The pointer of a dead-beat galvanometer gives a steady deflection because [MP PMT 1994]

(a) Eddy currents are produced in the conducting frame over which the coil is wound

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(b) Its magnet is very strong

(c) Its pointer is very light

(d) Its frame is made of abonite

212. Which of the following is not an application of eddy currents [CBSE 1989]

(a) Induction furnace (b) Galvanometer damping

(c) Speedometer of automobiles (d) *X*-ray crystallography

213. The back e.m.f. in a dc-motor is maximum when [CPMT 1988]

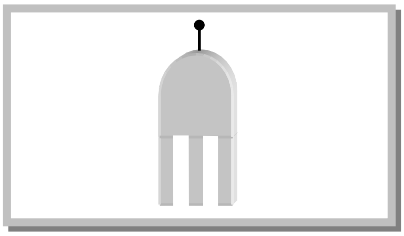
(a) The motor has picked up maximum speed (b) The motor has just started moving

(c) The speed of the motor is still on the increase (d) The motor has just been switched off

214. To reduce the loss of energy as heat due to eddy currents, the soft iron core is laminated. The angle between the plane of these sheets and the magnetic induction should be

(a) Zero (b) 45^o (c) 60^o (d) 90^o

215. A copper strip having slots cut in it is used as the bob of a simple pendulum. The copper strip passes between the pole pieces of a strong magnet. The magnetic field is perpendicular to the plane of vibration. Which of the following statements is correct



(a) There are no oscillations

(b) The oscillations are free oscillations

(c) The oscillations are weakly damped

(d) The oscillations are heavily damped

216. A metallic piece is dropped freely form some height. Its temperature increases, because of

(a) The eddy, currents in the metallic piece due to the earth's magnetism

(b) The resisting force due to the earth's atmosphere

(c) Eddy currents and resisting force both

(d) Gravitational force

217. The essential difference between a *dc* dynamo and an *ac* dynamo is that

(a) *ac* has an electromagnet but *dc* has a permanent magnet (b) *ac* will generate a higher voltage

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(c) *ac* has slip rings but the *dc* has a commutator
(d) *ac* has a coil wound on soft iron, but the *dc* is wound on copper

218. To transmit electrical energy from a generator to a distant consumers

(a) High voltage and low current are transmitted
(b) High voltage and high current are transmitted
(c) Low voltage and low current are transmitted
(d) Low voltage and high current are transmitted

219. The output of a dynamo using a splitting commutator is

(a) *dc*
(b) *ac*
(c) Fluctuating *dc*
(d) Half-wave rectified voltage

220. Dynamo is a device for converting

(a) Electrical energy into mechanical energy
(b) Mechanical energy into electrical energy
(c) Chemical energy into mechanical energy
(d) Mechanical energy into chemical energy

Transformer

221. A step down transformer reduces 220 *V* to 11 *V*. The primary draws 5*A* current and secondary supplies 90*A*. The efficiency of the transformer is [MP PMT 1992, 2001; EAMCET 2001; MP PET 2004]

(a) 90%
(b) 33%
(c) 20%
(d) 44%

222. The core of a transformer is laminated so that

[AIIMS 1991; BHU 1999; RPET 1999; KCET (Med.) 2001; MP PMT 1994; 2000, 02, 03]

(a) The ratio of voltage in the secondary to that in the primary may be increased
(b) Energy losses due to eddy currents may be minimized
(c) The weight of the transformer may be reduced
(d) Rusting of the core may be prevented

223. The ratio of secondary to the primary turns in a transformer is 3 : 2. If the power output be *P*, then the input power neglecting all losses must be equal to [MP PMT 1984; KCET 2003]

(a) 5 *P*
(b) 1.5 *P*
(c) *P*
(d) $\frac{2}{5}P$

224. In a primary coil 5*A* current is flowing on 220 *volts*. In the secondary coil 2200 *V* voltage produces. Then ratio of number of turns in secondary coil and primary coil will be [RPET 2003]

(a) 1 : 10
(b) 10 : 1
(c) 1 : 1
(d) 11 : 1

225. An ideal transformer has 500 and 5000 turn in primary and secondary windings respectively. If the primary voltage is connected to a 6V battery then the secondary voltage is [Orissa JEE 2003]

(a) 0
(b) 60 *V*
(c) 0.6 *V*
(d) 6.0 *V*

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226. In a transformer, number of turns in the primary are 140 and that in the secondary are 280. If current in primary 4 *A* then that in the secondary is [AIEEE 2002]

(a) 4 *A* (b) 2 *A* (c) 6 *A* (d) 10 *A*

227. In a step-up transformer the voltage in the primary is 220 *V* and the current is 5 *A*. The secondary voltage is found to be 22000 *V*. The current in the secondary (neglect losses) is [Kerala (Engg.) 2002]

(a) 5 *A* (b) 50 *A* (c) 500 *A* (c) 0.05 *A*

228. A transformer has 100 turns in the primary coil and carries 8 *A* current. If input power is one *kilowatt*, the number turns required in the secondary coil to have 500 *V* output will be [MP PMT 2002]

(a) 100 (b) 200 (c) 400 (d) 300

229. Large transformers, when used for some time, become hot and are cooled by circulating oil. The heating of transformer is due to [MP PET 2001]

(a) Heating effect of current alone
(b) Hysteresis loss along
(c) Both the hysteresis loss and heating effect of current
(d) None of the above

230. In a transformer, the number of turns of primary coil and secondary coil are 5 and 4 respectively. If 220 *V* is applied on the primary coil, then the ratio of primary current to the secondary current is [AFMC 1998; CPMT 2000; BHU 2001]

(a) 4 : 5 (b) 5 : 4 (c) 5 : 9 (d) 9 : 5

231. The ratio of number of turns of primary coil to secondary coil in a transformer is 1 : 2. If a cell of 1.5 *volts* is connected across primary coil, the emf across secondary coil is

(a) 0.75 *V* (b) 1.5 *V* (c) 0 *V* (d) 6 *V*

232. Output voltage of a transformer does not depend upon [BHU 2000]

(a) Number of turns in secondary coil
(b) Input voltage
(c) Number of turns in primary coil
(d) ac frequency

233. In a step-up transformer the turn ratio is 1 : 10. A resistance of 200 *ohm* connected across the secondary is drawing a current of 0.5 *amp*. What is the primary voltage and current [MP PET 2000]

(a) 50 *V*, 1 *amp* (b) 10 *V*, 5 *amp* (c) 25 *V*, 4 *amp* (d) 20 *V*, 2 *amp*

234. The number of turns in the primary coil of a transformer is 200 and the number of turns in the secondary coil is 10. If 240 *volt* ac is applied to the primary, the output from the secondary will be [BHU 1997; JIPMER 2000]

(a) 48 *V* (b) 24 *V* (c) 12 *V* (d) 6 *V*

235. The primary winding of a transformer has 500 turns and its secondary has 5000 turns. If primary is connected to ac supply of 20 *V* and 50 *Hz*, then secondary will have an output of [CBSE 1999; AIIMS 1999]

(a) 2 *V* and 5 *Hz* (b) 2 *V* and 50 *Hz* (c) 200 *V* and 50 *Hz* (d) 200 *V* and 500 *Hz*

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236. A transformer is used to [MP PET 1999]

(a) Change the alternating potential (b) Change the alternating current

(c) Both alternating current and alternating voltage (d) To increase the power of current source

237. A step up transformer operates on a 230 *volt* line and supplies to a load of 2 *amp*. The ratio of turns in primary to secondary windings is 1 : 25. Determine the primary current [AIIMS 1989; CBSE 1998; MP PMT 1996]

(a) 12.5 *amp* (b) 50 *amp* (c) 8.8 *amp* (d) 25 *amp*

238. A step down transformer a supply line voltage of 2200 *volt* into 220 *volt*. The primary coil has 5000 turns. The efficiency and power transmitted by the transformer are 90% and 8 *kilowatt* respectively. Then the number of turns in the secondary is

[IIT-JEE 1996; Roorkee 1997]

(a) 5000 (b) 50 (c) 500 (d) 5

239. The number of turns in the primary and secondary coils of a transformer are 1000 and 3000 respectively. If 80 *volt* ac is applied to the primary coil of the transformer, then the potential difference per turn of the secondary coil would be [CPMT 1990, 91]

(a) 240 *volt* (b) 2400 *volt* (c) 24 *volt* (d) 0.08 *volt*

240. In a transformer, the coefficient of mutual inductance between the primary and the secondary coil is 0.2 *henry*. When the current changes by 5 *ampere/second* in the primary, the induced e.m.f. in the secondary will be [MP PMT 1989]

(a) 5 *V* (b) 1 *V* (c) 25 *V* (d) 10 *V*

241. A power transformer is used to step up an alternating e.m.f. of 220 *V* to 11 *kV* to transmit 4.4 *kW* of power. If the primary coil has 1000 turns, what is the current rating of the secondary ? Assume 100% efficiency for the transformer

(a) 4 *amp* (b) 0.4 *amp* (c) 0.04 *amp* (d) 0.2 *amp*

242. The alternating voltage induced in the secondary coil of a transformer is mainly due to [MP PET 1992; MP PMT 1996]

(a) A varying electric field (b) A varying magnetic field

(c) The vibrations of the primary coil (d) The iron core of the transformer

243. A loss free transformer has 500 turns on its primary winding and 2500 in secondary. The metres of the secondary indicate 200 *volts* at 8 *amperes* under these conditions. The voltage and current in the primary is [MP PMT 1996]

(a) 100 *V*, 16 *A* (b) 40 *V*, 40 *A* (c) 160 *V*, 10 *A* (d) 80 *V*, 20 *A*

244. The efficiency of transformer is very high because [MP PET 1994]

(a) There is no moving part in a transformer (b) It produces very high voltage

(c) It produces very low voltage (d) None of the above

245. A soft iron core is used in a transformer because it has [RPMT 1993]

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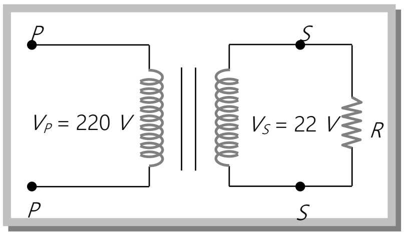
(a) Low permeability and low susceptibility (b) Low permeability and high susceptibility

(c) High permeability and low susceptibility (d) High permeability and high susceptibility

246. An ideal transformer has 100 turns in the primary and 250 turns in the secondary. The peak value of the input ac voltage is 28 *V*. The *r.m.s.* secondary voltage is nearest to

(a) 50 *V* (b) 70 *V* (c) 100 *V* (d) 40 *V*

247. In the adjoining figure, the value of current in the primary will be $R = 220\Omega$ [RPMT 1986]



(a) 1 *A*

(b) 0.1 *A*

(c) 0.01 *A*

(d) 1 *mA*

248. An alternating current is flowing in the primary of a transformer whose equation is given by $i = \sin 200\,t$. If the coefficient of mutual induction between the primary and the secondary is 1.5 *H*, the peak value of voltage in the secondary will be

(a) 300 *V* (b) 191 *V* (c) 220 *V* (d) 471 *V*

249. An ac source has got an internal resistance of $10^4\Omega$. What should be the secondary to primary turns ratio of a transformer to match the source to a load of resistance 10Ω

(a) $\frac{1}{10}$ (b) $\frac{1}{10\sqrt{10}}$ (c) $\frac{1}{100}$ (d) $\frac{1}{1000}$

250. A current of 5000 *A* is flowing at 220 *V* in the primary coil of a transformer. The voltage across the secondary is 11000 *V* and 10% power is lost. What is the current through the secondary

(a) 9 *A* (b) 90 *A* (c) 900 *A* (d) 9000 *A*

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Answer Sheet

Assignment (Basic & Advance Level)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
a	d	d	b	c	a	c	a	a	b	c	c	b	b	a	d	a	a	b	c
21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
b	b	a	b	d	a	d	c	b	b	b	a	c	a	c	c	d	d	d	d
41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
d	c	a	d	b	b	c	b	b	a	c	b	c	c	b	d	d	c	d	b
61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
b	a	a	d	d	a	c	b	d	b	a	c	d	a	b	a	d	b	c	a
81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
c	d	d	d	d	c	d	b	b	c	b	a	a	a	b	b	c	d	d	b
101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120
b	b	d	b	c	c	d	b	b	c	b	d	d	a	c	b	c	a	c	c
121	122	123	124	125	126	127	128	129	130	131	132	133	134	135	136	137	138	139	140
d	a	b	b	a	c	c	a	d	b	b	c	b	a	a	a	d	a	c	b
141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
a	c	a	c	d	c	d	b	b	c	c	b	a	d	a	b	d	b	d	c
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180
c	b	d	a	c	a	b	a	c	c	d	b	b	b	b	c	d	d	a	b
181	182	183	184	185	186	187	188	189	190	191	192	193	194	195	196	197	198	199	200
d	c	a	c	d	c	b	a	a	a	c	d	b	b	d	c	b	c	b	c
201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220
b	a	c	d	a	d	b	d	b	d	a	d	a	a	c	c	c	a	c	b
221	222	223	224	225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240
a	b	c	b	a	b	c	c	c	a	c	d	b	c	c	c	b	c	d	b
241	242	243	244	245	246	247	248	249	250										
b	b	b	a	d	a	c	a	b	b										

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