Ordinary Thinking

Objective Questions

Faraday's and Lenz's Law

1. In electromagnetic induction, the induced e.m.f. in a coil is independent of **[CPMT 1984]**
   (a) Change in the flux (b) Time
   (c) Resistance of the circuit (d) None of the above

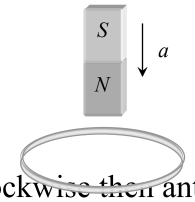
2. Lenz's law is consequence of the law of conservation of **[JIPMER 1997; CPMT 1990; RPMT 1997; MP PET 1999; MP PMT 2000, 03; RPET 2003; AFMC 2004]**
   (a) Charge (b) Momentum
   (c) Mass (d) Energy

3. In electromagnetic induction, the induced charge in a coil is independent of
   (a) Change in the flux (b) Time
   (c) Resistance in the circuit (d) None of the above

4. The magnetic flux through a circuit of resistance R changes by an amount $\Delta\phi$ in time Δt, Then the total quantity of electric charge Q, which passing during this time through any point of the circuit is given by **[Haryana CEE 1996; CBSE PMT 2004]**
   (a) $Q=\frac{\Delta\phi}{\Delta t}$ (b) $Q=\frac{\Delta\phi}{\Delta t}\times R$
   (c) $Q=-\frac{\Delta\phi}{\Delta t}+R$ (d) $Q=\frac{\Delta\phi}{R}$

5. A cylindrical bar magnet is kept along the axis of a circular coil. If the magnet is rotated about its axis, then **[CPMT 1983; BCECE 2004]**
   (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

6. A metallic ring is attached with the wall of a room. When the north pole of a magnet is brought near to it, the induced current in the ring will be **[AFMC 1993; MP PMT/PET 1998; Pb PET 2003]**



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

7. A coil having an area A_0 is placed in a magnetic field which changes from B_0 to $4B_0$ in a time interval t. The e.m.f. induced in the coil will be **[MP PET 1990]**
   (a) $\frac{3A_0B_0}{t}$ (b) $\frac{4A_0B_0}{t}$
   (c) $\frac{3B_0}{A_0t}$ (d) $\frac{4B_0}{A_0t}$

8. The magnetic flux linked with a coil is given by an equation ϕ (in *webers*) = $8t^2+3t+5$. The induced e.m.f. in the coil at the fourth second will be **[MP PET 1990]**
   (a) 16 *units* (b) 39 *units*
   (c) 67 *units* (d) 145 *units*

9. The current flowing in two coaxial coils in the same direction. On increasing the distance between the two, the electric current will **[MP PMT 1991]**
   (a) Increase
   (b) Decrease
   (c) Remain unchanged
   (d) The information is incomplete

10. A copper ring is held horizontally and a bar magnet is dropped through the ring with its length along the axis of the ring. The acceleration of the falling magnet while it is passing through the ring is **[CBSE PMT 1996; MP PET 1990, 99; CPMT 1991, 99; JIPMER 1997; CPMT 2003; MP PET/PMT 2001; KCET 2001; Kerala (Engg.) 2001]**
    (a) Equal to that due to gravity
    (b) Less than that due to gravity
    (c) More than that due to gravity
    (d) Depends on the diameter of the ring and the length of the magnet

11. A square coil $10^{-2} m^2$ area is placed perpendicular to a uniform magnetic field of intensity $10^3 Wb/m^2$. The magnetic flux through the coil is **[MP PMT 1990, 2001]**

(a) 10 *weber* (b) 10^{-5} *weber*
(c) 10^5 *weber* (d) 100 *weber*

12. A magnet is brought towards a coil (i) speedly (ii) slowly then the induced e.m.f./induced charge will be respectively **[RPMT 1997; MP PMT 2003]**

(a) More in first case / More in first case
(b) More in first case/Equal in both case
(c) Less in first case/More in second case
(d) Less in first case/Equal in both case

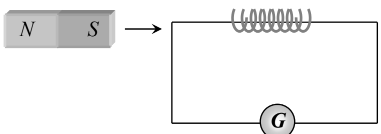
13. The direction of induced e.m.f. during electromagnetic induction is given by **[MP PET 1994, 96]**

(a) Faraday's law (b) Lenz's law
(c) Maxwell's law (d) Ampere's law

14. In a coil of area $10\ cm^2$ and 10 turns with a magnetic field directed perpendicular to the plane and is changing at the rate of 10^8 *gauss/second*. The resistance of the coil is 20 *ohm*. The current in the coil will be **[CPMT 1976]**

(a) 5 *amp* (b) 0.5 *amp*
(c) 0.05 *amp* (d) 5×10^8 *amp*

15. As shown in the figure, a magnet is moved with a fast speed towards a coil at rest. Due to this induced electromotive force, induced current and induced charge in the coil is E, I and Q respectively. If the speed of the magnet is doubled, the incorrect statement is **[MP PET 1995]**

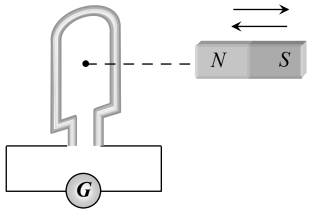


(a) E increases (b) I increases
(c) Q remains same (d) Q increases

16. A coil having 500 square loops each of side 10 *cm* is placed normal to a magnetic flux which increases at the rate of 1.0 *tesla/second*. The induced e.m.f. in volts is **[CPMT 1989, 90; DCE 2002]**

(a) 0.1 (b) 0.5
(c) 1 (d) 5

17. When a magnet is pushed in and out of a circular coil *C* connected to a very sensitive galvanometer *G* as shown in the adjoining diagram with a frequency ν, then



(a) Constant deflection is observed in the galvanometer
(b) Visible small oscillations will be observed in the galvanometer if ν is about 50 *Hz*
(c) Oscillations in the deflection will be observed clearly if $\nu = 1$ or 2 *Hz*
(d) No variation in the deflection will be seen if $\nu = 1$ or 2 *Hz*

18. 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 e.m.f. in the coil is **[MP PMT 1991; MH CET (Med.) 1999]**

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

19. A 50 turns circular coil has a radius of $3\ cm$, it is kept in a magnetic field acting normal to the area of the coil. The magnetic field B increased from 0.10 *tesla* to 0.35 *tesla* in 2 *milliseconds*. The average induced e.m.f. in the coil is **[MP PET 1994]**

(a) 1.77 *volts* (b) 17.7 *volts*
(c) 177 *volts* (d) 0.177 *volts*

20. A coil having an area $2m^2$ is placed in a magnetic field which changes from $1 Wb/m^2$ to $4 Wb/m^2$ in a interval of 2 *second*. The e.m.f. induced in the coil will be

[DPMT 1999; MP PET 2002]

(a) 4 V (b) 3 V

(c) 1.5 V (d) 2 V

21. A coil has 2000 turns and area of $70 cm^2$. The magnetic field perpendicular to the plane of the coil is $0.3 Wb/m^2$ and takes 0.1*sec* to rotate through 180^o. The value of the induced e.m.f. will be

[MP PET 1993; Similar to AIIMS 1997]

(a) $8.4 V$ (b) $84 V$

(c) $42 V$ (d) $4.2 V$

22. Two different loops are concentric and lie in the same plane. The current in the outer loop is clockwise and increasing with time. The induced current in the inner loop then, is

[MP PET 1993]

(a) Clockwise

(b) Zero

(c) Counter clockwise

(d) In a direction that depends on the ratio of the loop radii

23. According to Faraday's law of electromagnetic induction

[MP PET 1994]

(a) The direction of induced current is such that it opposes the cause producing it

(b) The magnitude of induced e.m.f. produced in a coil is directly proportional to the rate of change of magnetic flux

(c) The direction of induced e.m.f. is such that it opposes the cause producing it

(d) None of the above

24. The unit of magnetic flux is

[MP PMT 1994; MP PET 1995; AFMC 1998]

(a) $Weber/m^2$ (b) *Weber*

(c) *Henry* (d) *Ampere*/*m*

25. The north pole of a long horizontal bar magnet is being brought closer to a vertical conducting plane along the perpendicular direction. The direction of the induced current in the conducting plane will be [MP PMT 1994]

(a) Horizontal (b) Vertical

(c) Clockwise (d) Anticlockwise

26. The magnetic field in a coil of 100 turns and 40 *square cm* area is increased from 1 *Tesla* to 6 *Tesla* in 2 *second*. The magnetic field is perpendicular to the coil. The e.m.f. generated in it is [MP PMT 1994]

(a) $10^4 V$ (b) 1.2 V

(c) 1.0 V (d) $10^{-2} V$

27. The dimensions of magnetic flux are

[MP PMT 1994; CBSE PMT 1999]

(a) $MLT^{-2}A^{-2}$ (b) $ML^2T^{-2}A^{-2}$

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

28. Lenz's law gives [MP PMT 1994]

(a) The magnitude of the induced e.m.f.

(b) The direction of the induced current

(c) Both the magnitude and direction of the induced current

(d) The magnitude of the induced current

29. The north pole of a bar magnet is moved swiftly downward towards a closed coil and then second time it is raised upwards slowly. The magnitude and direction of the induced currents in the two cases will be of [MP PET 1996]

First case *Second case*

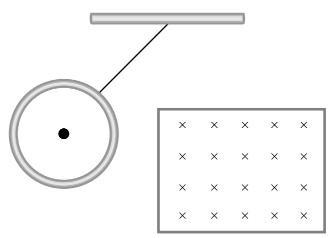
(a) Low value clockwise Higher value anticlockwise

(b) Low value clockwise Equal value anticlockwise

(c) Higher value clockwise Low value clockwise

(d) Higher value anticlockwiseLow value clockwise

30. A metallic ring connected to a rod oscillates freely like a pendulum. If now a magnetic field is applied in horizontal direction so that the pendulum now swings through the field, the pendulum will



(a) Keep oscillating with the old time period

(b) Keep oscillating with a smaller time period

(c) Keep oscillating with a larger time period

(d) Come to rest very soon

31. A circular coil of 500 turns of wire has an enclosed area of $0.1 m^2$ per turn. It is kept perpendicular to a magnetic field of induction 0.2 *T* and rotated by 180° about a diameter perpendicular to the field in 0.1 *sec*. How much charge will pass when the coil is connected to a galvanometer with a combined resistance of 50 *ohms* **[MP PET 1997]**

(a) 0.2 *C* (b) 0.4 *C*

(c) 2 *C* (d) 4 *C*

32. A coil of 100 *turns* and area 5 *square centimetre* 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]**

(a) $5 \times 10^{-3} Wb$ (b) $5 \times 10^{-5} Wb$

(c) $10^{-2} Wb$ (d) $10^{-4} Wb$

33. In a circuit with a coil of resistance 2 *ohms*, the magnetic flux changes from 2.0 *Wb* to 10.0 *Wb* in 0.2 second. The charge that flows in the coil during this time is **[MP PMT 1997]**

(a) 5.0 *coulomb* (b) 4.0 *coulomb*

(c) 1.0 *coulomb* (d) 0.8 *coulomb*

34. The direction of induced current is such that it opposes the very cause that has produced it. This is the law of **[MP PMT/PET 1998]**

(a) Lenz (b) Faraday

(c) Kirchhoff (d) Fleming

35. 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

36. 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 **[AMU 1995]**

(a) 2.5×10^{-7} *weber* (b) 6.31×10^{-6} *weber*

(c) 5.2×10^{-5} *weber* (d) 4.1×10^{-5} *weber*

37. 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 μ C 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*

38. 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

39. A magnetic field of 2×10^{-2} *T* 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 **[CBSE PMT 1992; CPMT 2001]**

(a) 0.1 *sec* (b) 0.01 *sec*

(c) 1 *sec* (d) 20 *sec*

40. The total charge induced in a conducting loop when it is moved in magnetic field depends on **[CBSE PMT 1992; ISM Dhanbad 1994]**

(a) The rate of change of magnetic flux

(b) Initial magnetic flux only

(c) The total change in magnetic flux

(d) Final magnetic flux only

41. A rectangular coil of 20 turns and area of cross-section 25 *sq* cm has a resistance of 100 *ohm*. If a magnetic field which is perpendicular to the plane of the coil changes at the rate of 1000 *Tesla* per second, the current in the coil is **[CBSE PMT 1992; Very Similar to MHCET 2002; DPMT 2004]**

(a) 1.0 *ampere* (b) 50 *ampere*

(c) 0.5 *ampere* (d) 5.0 *ampere*

42. The north pole of a magnet is brought near a metallic ring. The direction of the induced current in the ring will be **[AIIMS 1999]**

(a) Clockwise (b) Anticlockwise

(c) Towards north (d) Towards south

43. Lenz's law applies to **[DCE 1999]**

(a) Electrostatics

(b) Lenses

(c) Electro-magnetic induction

(d) Cinema slides

44. If a coil of metal wire is kept stationary in a non-uniform magnetic field, then

(a) An e.m.f. is induced in the coil

(b) A current is induced in the coil

(c) Neither e.m.f. nor current is induced

(d) Both e.m.f. and current is induced

45. 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 2000; CPMT 2003; MP PET 2005]**

(a) 2 *volt* (b) 4 *volt*

(c) 8 *volt* (d) 16 *volt*

46. A coil has an area of 0.05 m^2 and it has 800 turns. It is placed perpendicularly in a magnetic field of strength $4 \times 10^{-5}\ Wb/m^2$, it is rotated through 90^o in 0.1 *sec*. The average e.m.f. induced in the coil is **[CPMT 2001]**

(a) 0.056 *V* (b) 0.046 *V*

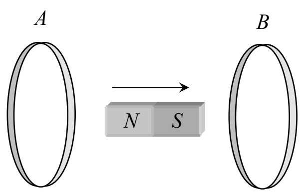
(c) 0.026 *V* (d) 0.016 *V*

47. A moving conductor coil in a magnetic field produces an induced e.m.f. This is in accordance with **[AFMC 1993; MH CET 2001, 03]**

(a) Amperes law (b) Coulomb law

(c) Lenz's law (d) Faraday's law

48. In the diagram shown if a bar magnet is moved along the common axis of two single turn coils *A* and *B* in the direction of arrow



(a) Current is induced only in *A* & not in *B*

(b) Induced currents in *A* & *B* are in the same direction

(c) Current is induced only in *B* and not in *A*

(d) Induced currents in *A* & *B* are in opposite directions

49. Magnetic flux ϕ (in *weber*) linked with a closed circuit of resistance 10 *ohm* varies with time *t* (in seconds) as **[BHU 2000]**

$$\phi = 5t^2 - 4t + 1$$

The induced electromotive force in the circuit at $t = 0.2$ *sec*. is

(a) 0.4 *volts* (b) – 0.4 *volts*

(c) – 2.0 *volts* (d) 2.0 *volts*

50. 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)

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

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

51. 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)

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

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

52. A magnet is dropped down an infinitely long vertical copper tube **[KCET 2002]**

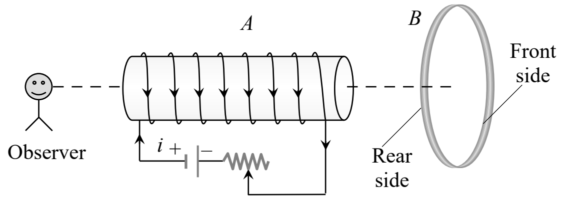
(a) The magnet moves with continuously increasing velocity and ultimately acquires a constant terminal velocity

(b) The magnet moves with continuously **[Kerala (Engg.) 2001]** 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

53. An aluminium ring *B* faces an electromagnet *A*. The current *I* through *A* can be altered



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

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

(c) If *I* increases, *A* will attract *B*

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

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

(a) – 40 *V* (b) 40 *V*

(c) 140 *V* (d) 300 *V*

55. A coil has 1,000 turns and 500 cm^2 as its area. The plane of the coil is placed at right angles to a magnetic induction field of $2 \times 10^{-5}\ Wb/m^2$. The coil is rotated through 180^o in 0.2 *seconds*. The average e.m.f. induced in the coil, in *milli-volts*, is **[EAMCET 2003]**

(a) 5 (b) 10

(c) 15 (d) 20

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

(a) Equal to zero

(b) Less than *g*

(c) Equal to *g*

(d) Equal to *g* in to beginning and then more than *g*

57. The magnetic flux linked with a vector area $\vec{A}$ in a uniform magnetic field $\vec{B}$ is

(a) $\vec{B} \times \vec{A}$ (b) *AB*

(c) $\vec{B} \cdot \vec{A}$ (d) $\frac{B}{A}$

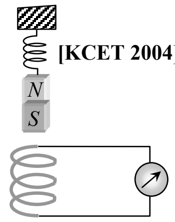
[Kerala PET 2002]

58. 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

59. 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 with constant amplitude

(b) *G* shows deflection on one side

(c) *G* shows no deflection.

[KCET 2003]

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

60. A coil having *n* turns and resistance *R* Ω is connected with a galvanometer of resistance $4R\Omega$. This combination is moved in time *t* *seconds* from a magnetic field W_1 *weber* to W_2 *weber*. The induced current in the circuit is **[AIEEE 2004]**

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

(c) $-\frac{(W_2 - W_1)}{Rnt}$ (d) $-\frac{n(W_2 - W_1)}{Rt}$

61. If a copper ring is moved quickly towards south pole of a powerful stationary bar magnet, then **[Pb. PMT 2004]**

(a) Current flows through the copper ring

(b) Voltage in the magnet increase

[BVP 2003]

(c) Current flows in the magnet

(d) Copper ring will get magnetised

62. The magnetic flux linked with coil, in weber is given by the equation, $\phi = 5t^2 + 3t + 16$. The induced emf in the coil in the fourth second is **[Pb. PMT 2004]**

(a) 10 *V* (b) 30 *V*

(c) 45 *V* (d) 90 *V*

63. The coil of area 0.1 m^2 has 500 turns. After placing the coil in a magnetic field of strength

[MP PET 2003]

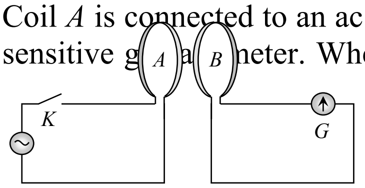
$4 \times 10^{-4}\ Wb/m^2$, if rotated through 90° in 0.1 s, the average emf induced in the coil is **[Pb. PET 2002]**

(a) 0.012 *V* (b) 0.05 *V*
(c) 0.1 *V* (d) 0.2 *V*

64. Magnetic flux in a circuit containing a coil of resistance 2Ω changes from 2.0 *Wb* to 10 *Wb* in 0.2 *sec*. The charge passed through the coil in this time is **[DPMT 2003]**

(a) 0.8 *C* (b) 1.0 *C*
(c) 5.0 *C* (d) 4.0 *C*

65. The diagram below shows two coils *A* and *B* placed parallel to each other at a very small distance. Coil *A* is connected to an ac supply. *G* is a very sensitive galvanometer. When the key is closed **[CPMT 1986]**



(a) Constant deflection will be observed in the galvanometer for 50 *Hz* supply
(b) Visible small variations will be observed in the galvanometer for 50 *Hz* input
(c) Oscillations in the galvanometer may be observed when the input ac voltage has a frequency of 1 to 2 *Hz*
(d) No variation will be observed in the galvanometer even when the input ac voltage is 1 or 2 *Hz*

66. An infinitely long cylinder is kept parallel to an uniform magnetic field B directed along positive *z* axis. The direction of induced current as seen from the *z* axis will be **[IIT-JEE (Screening) 2005]**

(a) Clockwise of the +*ve z* axis
(b) Anticlockwise of the +*ve z* axis
(c) Zero
(d) Along the magnetic field

67. In a magnetic field of 0.05*T*, area of a coil changes from $101\ cm^2$ to $100\ cm^2$ without changing the resistance which is 2Ω. The amount of charge that flow during this period is **[Orissa PMT 2005]**

(a) 2.5×10^{-6} *coulomb* (b) 2×10^{-6} *coulomb*
(c) 10^{-6} *coulomb* (d) 8×10^{-6} *coulomb*

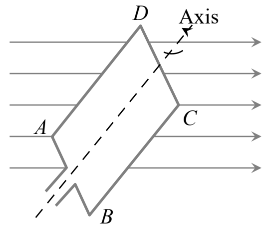
68. If a coil of 40 turns and area 4.0 cm^2 is suddenly removed from a magnetic field, it is observed that a charge of $2.0 \times 10^{-4}\ C$ flows into the coil. If the resistance of the coil is 80Ω, the magnetic flux density in Wb/m^2 is **[MP PET 2005]**

(a) 0.5 (b) 1.0
(c) 1.5 (d) 2.0

Motional EMI

1. A rectangular coil ABCD is rotated anticlockwise with a uniform angular velocity about the axis shown in diagram below. The axis of rotation of the coil as well as the magnetic field *B* are horizontal. The induced e.m.f. in the coil would be maximum when

[Haryana CEE 1996; MP PMT 1992, 94, 99]

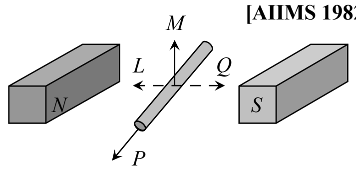


(a) The plane of the coil is horizontal
(b) The plane of the coil makes an angle of 45° with the magnetic field
(c) The plane of the coil is at right angles to the magnetic field
(d) The plane of the coil makes an angle of 30° with the magnetic field

2. A 10 *metre* wire kept in east-west falling with velocity 5 *m/sec* perpendicular to the field $0.3 \times 10^{-4}\ Wb/m^2$. The induced e.m.f. across the terminal will be **[MP PET 2000]**

(a) 0.15 *V* (b) 1.5 *mV*
(c) 1.5 *V* (d) 15.0 *V*

3. An electric potential difference will be induced between the ends of the conductor shown in the diagram, when the conductor moves in the direction **[AIIMS 1982; DPMT 2001]**



(a) P
(b) Q
(c) L
(d) M

4. 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 $0.2 \times 10^{-4}\, weber/m^2$ and the rails are separated by 1 *metre*

[IIT 1981; KCET 2001]

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

5. A conductor of 3 *m* in length is moving perpendicularly to magnetic field of 10^{-3} *tesla* with the speed of $10^2\, m/s$, then the e.m.f. produced across the ends of conductor will be

[MP PET 1990]

(a) 0.03 *volt* (b) 0.3 *volt*
(c) $3 \times 10^{-3}\, volt$ (d) 3 *volt*

6. When a wire loop is rotated in a magnetic field, the direction of induced e.m.f. changes once in each

[MP PMT 1991, 04]

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

7. An aeroplane in which the distance between the tips of wings is 50 *m* is flying horizontally with a speed of 360 *km/hr* over a place where the vertical components of earth magnetic field is $2.0 \times 10^{-4}\, weber/m^2$. The potential difference between the tips of wings would be

[CPMT 1990; MP PET 1991]

(a) 0.1 *V* (b) 1.0 *V*
(c) 0.2 *V* (d) 0.01 *V*

8. A copper disc of radius 0.1 *m* is rotated about its centre with 10 revolutions per second in a uniform magnetic field of 0.1 *Tesla* with its plane perpendicular to the field. The e.m.f. induced across the radius of disc is **[MH CET (Med) 2001]**

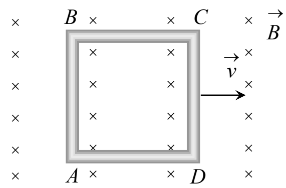
(a) $\frac{\pi}{10}\, V$ (b) $\frac{2\pi}{10}\, V$
(c) $\pi \times 10^{-2}\, V$ (d) $2\pi \times 10^{-2}\, V$

9. A metal conductor of length 1*m* rotates vertically about one of its ends at angular velocity 5 *radians per second.* If the horizontal component of earth's magnetic field is $0.2 \times 10^{-4}\, T$, then the e.m.f. developed between the two ends of the conductor is **[MP PMT 1992; AIEEE 2004]**

(a) $5\, mV$ (b) $5 \times 10^{-4}\, V$
(c) $50\, mV$ (d) $50\, \mu V$

10. 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 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

11. A player with 3 *m* long iron rod runs towards east with a speed of 30 *km/hr*. Horizontal component of earth's magnetic field is $4 \times 10^{-5}\, Wb/m^2$. If he is running with rod in horizontal and vertical positions, then the potential difference induced between the two ends of the rod in two cases will be

[MP PET 1993]

(a) Zero in vertical position and $1 \times 10^{-3}\, V$ in horizontal position
(b) $1 \times 10^{-3}\, V$ in vertical position and zero is horizontal position
(c) Zero in both cases
(d) $1 \times 10^{-3}\, V$ in both cases

12. A coil of area 80 *square cm* and 50 turns is rotating with 2000 *revolutions per minute* about an axis perpendicular to a magnetic field of 0.05 *Tesla*. The maximum value of the e.m.f. developed in it is **[MP PMT 1994]**

(a) 200π *volt* (b) $\frac{10\pi}{3}$ *volt*

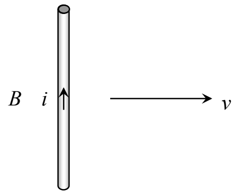
(c) $\frac{4\pi}{3}$ *volt* (d) $\frac{2}{3}$ *volt*

13. A conducting rod of length l is falling with a velocity v perpendicular to a uniform horizontal magnetic field B. The potential difference between its two ends will be **[MP PMT 1994]**

(a) $2Blv$ (b) Blv

(c) $\frac{1}{2}Blv$ (d) $B^2l^2v^2$

14. A conducting wire is moving towards right in a magnetic field B. The direction of induced current in the wire is shown in the figure. The direction of magnetic field will be **[MP PET 1995]**



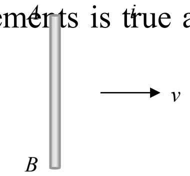
(a) In the plane of paper pointing towards right

(b) In the plane of paper pointing towards left

(c) Perpendicular to the plane of paper and down-wards

(d) Perpendicular to the plane of paper and upwards

15. The current carrying wire and the rod AB are in the same plane. The rod moves parallel to the wire with a velocity v. Which one of the following statements is true about induced emf in the rod



(a) End A will be at lower potential with respect to B

(b) A and B will be at the same potential

(c) There will be no induced e.m.f. in the rod

(d) Potential at A will be higher than that at B

16. A long horizontal metallic rod with length along the east-west direction is falling under gravity. The potential difference between its two ends will **[MP PMT 1997]**

(a) Be zero (b) Be constant

(c) Increase with time (d) Decrease with time

17. A two metre wire is moving with a velocity of 1 m/*sec* perpendicular to a magnetic field of 0.5 *weber*/m^2. The e.m.f. induced in it will be **[MP PMT/PET 1998; Pb PET 2003]**

(a) 0.5 *volt* (b) 0.1 *volt*

(c) 1 *volt* (d) 2 *volt*

18. 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 statement(s) from the following **[IIT JEE 1998]**

(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 of the rod and decreases towards its ends

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

19. A conducting wire is dropped along east-west direction, then **[RPMT 1997]**

(a) No emf is induced

(b) No induced current flows

(c) Induced current flows from west to east

(d) Induced current flows from east to west

20. The magnetic induction in the region between the pole faces of an electromagnet is 0.7 *weber*/m^2. The induced e.m.f. in a straight conductor 10 *cm* long, perpendicular to B and moving perpendicular both to magnetic induction and its own length with a velocity 2 *m/sec* is **[AMU (Med.) 1999]**

(a) 0.08 V (b) 0.14 V

(c) 0.35 V (d) 0.07 V

21. A straight conductor of length 0.4 m is moved with a speed of 7 *m/s* perpendicular to the magnetic field of intensity of 0.9 Wb/m^2. The induced e.m.f. across the conductor will be **[MH CET (Med.) 1999]**

(a) 7.25 V (b) 3.75 V

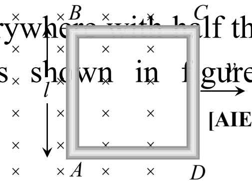
(c) 1.25 V (d) 2.52 V

22. 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

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

23. 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 **[AIEEE 2002]**



(a) Zero
(b) RvB
(c) VBl/R
(d) VBl

24. A wheel with ten metallic spokes each 0.50 m long is rotated with a speed of 120 rev/min in a plane normal to the earth's magnetic field at the place. If the magnitude of the field is 0.4 Gauss, the induced e.m.f. between the axle and the rim of the wheel is equal to **[AMU (Med.) 2002]**

(a) $1.256\times10^{-3}\ V$ (b) $6.28\times10^{-4}\ V$
(c) $1.256\times10^{-4}\ V$ (d) $6.28\times10^{-5}\ V$

25. A metal rod of length 2 m is rotating 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

26. 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/h*. 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

27. A horizontal straight conductor kept in north-south direction falls under gravity, then **[MP PMT 2003]**

(a) A current will be induced from South to North
(b) A current will be induced from North to South
(c) No induce e.m.f. along the length of conductor
(d) An induced e.m.f. is generated along the length of conductor

28. A rectangular coil of 300 turns has an average area of average area of $25\ cm\times10\ cm$ The coil rotates with a speed of 50 *cps* in a uniform magnetic field of strength $4\times10^{-2}\ T$ about an axis perpendicular of the field. The peak value of the induced e.m.f. is (in volt) **[KCET 2004]**

(a) 3000π (b) 300π
(c) 30π (d) 3π

29. A rod of length 20 cm is rotating with angular speed of 100 rps in a magnetic field of strength 0.5 T about it's one end. What is the potential difference between two ends of the rod **[Orissa PMT 2004]**

(a) 2.28 V (b) 4.28 V
(c) 6.28 V (d) 2.5 V

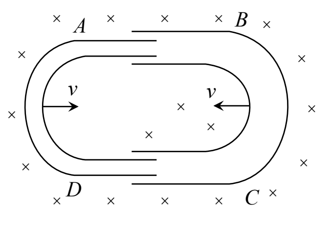
30. A circular metal plate of radius R is rotating with a uniform angular velocity ω with its plane perpendicular to a uniform magnetic field B. Then the emf developed between the centre and the rim of the plate is **[UPSEAT 2004]**

(a) $\pi\omega BR^2$ (b) ωBR^2
(c) $\pi\omega BR^2/2$ (d) $\omega BR^2/2$

31. A circular coil of mean radius of 7 cm and having 4000 turns is rotated at the rate of 1800 revolutions per minute in the earth's magnetic field (B = 0.5 gauss), the maximum e.m.f. induced in coil will be **[Pb. PMT 2003]**

(a) 1.158 V (b) 0.58 V
(c) 0.29 V (d) 5.8 V

32. One conducting U tube can slide inside another as shown in figure, maintaining electrical contacts between the tubes. The magnetic field B is perpendicular to the plane of the figure. If each tube moves towards the other at a constant sped v then the emf induced in the circuit in terms of B, l and v where l is the width of each tube, will be **[AIEEE 2005]**



(a) Zero
(b) $2Blv$

(c) Blv

(d) $-Blv$

33. The magnitude of the earth's magnetic field at a place is B_0 and the angle of dip is δ. A horizontal conductor of length *l* lying along the magnetic north-south moves eastwards with a velocity *v*. The emf induced across the conductor is **[Kerala PET 2005]**

(a) Zero (b) $B_0 l v \sin\delta$

(c) $B_0 l v$ (d) $B_0 l v \cos\delta$

Static EMI

1. The back e.m.f. induced in a coil, when current changes from 1 ampere to zero in one *milli-second*, is 4 *volts*, the self inductance of the coil is **[MP PET/PMT 1988]**

(a) 1 *H* (b) 4 *H*

(c) 10^{-3} *H* (d) 4×10^{-3} *H*

2. An e.m.f. of 5 *volt* is produced by a self inductance, when the current changes at a steady rate from 3 *A* to 2 *A* in 1 millisecond. The value of self inductance is **[CPMT 1982; MP PMT 1991; CBSE PMT 1993; AFMC 2002]**

(a) Zero (b) 5 *H*

(c) 5000 *H* (d) 5 *mH*

3. A 50 *mH* coil carries a current of 2 *ampere.* The energy stored in joules is **[MP PET/PMT 1988; MP PET 2005]**

(a) 1 (b) 0.1

(c) 0.05 (d) 0.5

4. 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*

5. Average energy stored in a pure inductance *L* when a current *i* flows through it, is **[MP PET/PMT 1988]**

(a) Li^2 (b) $2Li^2$

(c) $\frac{Li^2}{4}$ (d) $\frac{Li^2}{2}$

6. A solenoid has 2000 turns wound over a length of 0.30 *metre*. The area of its cross-section is $1.2\times10^{-3}\,m^2$. Around its central section, a coil of 300 turns is wound. If an initial current of 2 A in the solenoid is reversed in 0.25 *sec*, then the e.m.f. induced in the coil is **[NCERT 1982; MP PMT 2003]**

(a) $6\times10^{-4}\,V$ (b) $4.8\times10^{-3}\,V$

(c) $6\times10^{-2}\,V$ (d) 48 *mV*

7. A coil is wound as a transformer of rectangular cross-section. If all the linear dimensions of the transformer are increased by a factor 2 and the number of turns per unit length of the coil remain the same, the self inductance increased by a factor of **[AIIMS 1980]**

(a) 16 (b) 12

(c) 8 (d) 4

8. Two coils of self inductance L_1 and L_2 are placed closer to each other so that total flux in one coil is completely linked with other. If M is mutual inductance between them, then **[DCE 2002]**

(a) $M = L_1 L_2$ (b) $M = L_1 / L_2$

(c) $M = \sqrt{L_1 L_2}$ (d) $M = (L_1 L_2)^2$

9. The equivalent quantity of mass in electricity is

(a) Charge (b) Potential

(c) Inductance (d) Current

10. The momentum in mechanics is expressed as $m\times v$. The analogous expression in electricity is **[MP PMT 2003]**

(a) $I\times Q$ (b) $I\times V$

(c) $L\times I$ (d) $L\times Q$

11. In what form is the energy stored in an inductor

or

A coil of inductance *L* is carrying a steady current *i*. What is the nature of its stored energy **[CBSE PMT 1990, 92; MP PMT 1996, 2000, 02; Kerala PMT 2002]**

(a) Magnetic

(b) Electrical

(c) Both magnetic and electrical

(d) Heat

12. The coefficient of self inductance of a solenoid is 0.18 *mH*. If a crode of soft iron of relative permeability 900 is inserted, then the coefficient of self inductance will become nearly

(a) 5.4 *mH* (b) 162 *mH*
(c) 0.006 *mH* (d) 0.0002 *mH*

13. 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*

14. When the current in a coil changes from 8 *ampere* to 2 *ampere* in 3×10^{-2} *second*, the e.m.f. induced in the coil is $2\ volt$. The self inductance of the coil (in *millihenry*) is **[MNR 1991; UP SEAT 2000; Pb PET 2004]**

(a) 1 (b) 5
(c) 20 (d) 10

15. The mutual inductance between two coils is 1.25 *henry*. If the current in the primary changes at the rate of 80 *ampere/second*, then the induced e.m.f. in the secondary is **[MP PET 1990]**

(a) 12.5 *V* (b) 64.0 *V*
(c) 0.016 *V* (d) 100.0 *V*

16. A coil of wire of a certain radius has 600 turns and a self inductance of 108 *mH*. The self inductance of a 2nd similar coil of 500 turns will be **[MP PMT 1990]**

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

17. When the number of turns in a coil is doubled without any change in the length of the coil, its self inductance becomes **[MP PMT 1986; CBSE PMT 1992; Pb PET 2000]**

(a) Four times (b) Doubled
(c) Halved (d) Unchanged

18. The average e.m.f. induced in a coil in which the current changes from 2 *ampere* to 4 *ampere* in 0.05 *second* is 8 *volt*. What is the self inductance of the coil ? **[NCERT 1984; CPMT 1997; MP PMT 1999, 2003; UPSEAT 2000; RPMT 2000; Pb. PMT 2002; RPET 2003; DPMT 2005]**

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

19. If a current of 3.0 *amperes* flowing in the primary coil is reduced to zero in 0.001 *second*, then the induced e.m.f. in the secondary coil is 15000 *volts*. The mutual inductance between the two coils is **[MP PMT 1989, 91]**

(a) 0.5 *henry* (b) 5 *henry*
(c) 1.5 *henry* (d) 10 *henry*

20. An e.m.f. of 12 *volts* is induced in a given coil when the current in it changes at the rate of 48 *amperes per minute*. The self inductance of the coil is **[MP PMT 2000]**

(a) 0.25 *henry* (b) 15 *henry*
(c) 1.5 *henry* (d) 9.6 *henry*

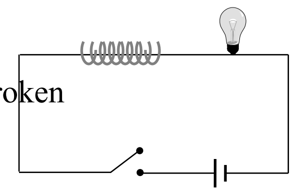
21. A closely wound coil of 100 turns and area of cross-section $1\ cm^2$ has a coefficient of self-induction 1 *mH*. The magnetic induction in the centre of the core of the coil when a current of 2*A* flows in it, will be **[MP PET 1992]**

(a) $0.022\ Wbm^{-2}$ (b) $0.4\ Wb\,m^{-2}$
(c) $0.8\ Wb\,m^{-2}$ (d) $1\ Wb\,m^{-2}$

22. Two circuits have coefficient of mutual induction of 0.09 *henry*. Average e.m.f. induced in the secondary by a change of current from 0 to 20 *ampere* in 0.006 *second* in the primary will be **[MP PET 1992]**

(a) 120 *V* (b) 80 *V*
(c) 200 *V* (d) 300 *V*

23. In the following circuit, the bulb will become suddenly bright if **[CBSE PMT 1989]**



(a) Contact is made or broken
(b) Contact is made
(c) Contact is broken
(d) Won't become bright at all

24. Two pure inductors each of self inductance *L* are connected in parallel but are well separated from each other. The total inductance is **[MP PET 1991; Pb. PMT 1999; BHU 1998, 05]**

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

25. A coil and a bulb are connected in series with a dc source, a soft iron core is then inserted in the coil. Then **[MP PMT 1990; RPET 2001]**

(a) Intensity of the bulb remains the same

(b) Intensity of the bulb decreases

(c) Intensity of the bulb increases

(d) The bulb ceases to glow

26. Self induction of a solenoid is **[MP PMT 1993]**

(a) Directly proportional to current flowing through the coil

(b) Directly proportional to its length

(c) Directly proportional to area of cross-section

(d) Inversely proportional to area of cross-section

27. Mutual inductance of two coils can be increased by **[MP PET 1994]**

(a) Decreasing the number of turns in the coils

(b) Increasing the number of turns in the coils

(c) Winding the coils on wooden core

(d) None of the above

28. The self inductance of a coil is 5 *henry*, a current of 1 *amp* change to 2 *amp* within 5 *second* through the coil. The value of induced e.m.f. will be **[MP PET 1994; Similar MP PET/PMT 1998; CBSE PMT 1990]**

(a) 10 *volt* (b) 0.10 *volt*

(c) 1.0 *volt* (d) 100 *volt*

29. The unit of inductance is **[MP PMT 1994, 95; MP PET 1997; MP PMT/PET 1998; RPET 2001]**

(a) *Volt/ampere* (b) *Joule/ampere*

(c) *Volt-sec/ampere* (d) *Volt-ampere/sec*

30. 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 *V* (b) – 1 *V*

(c) + 1 *mV* (d) – 1 *mV*

31. 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 **[MP PET 1995]**

(a) 5 (b) 1

(c) 2 (d) Zero

32. When current in a coil changes to 2 *ampere* from 8 *ampere* in 3×10^{-3} *second*, the e.m.f. induced in the coil is 2 *volt*. The self inductance of the coil in *millihenry* is **[MP PET 1995]**

(a) 1 (b) 5

(c) 20 (d) 10

33. An ideal coil of 10 *henry* is joined in series with a resistance of 5 *ohm* and a battery of 5 *volt*. 2 second after joining, the current flowing in *ampere* in the circuit will be **[MP PET 1995]**

(a) e^{-1} (b) $(1-e^{-1})$

(c) $(1-e)$ (d) e

34. 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 **[MP PET 1995]**

(a) 6.25 (b) 12.5

(c) 25 (d) 50

35. The inductance of a coil is $60\,\mu H$. A current in this coil increases from 1.0 *A* to 1.5 *A* in 0.1 *second*. The magnitude of the induced e.m.f. is **[MP PMT 1995]**

(a) $60 \times 10^{-6}\ V$ (b) $300 \times 10^{-4}\ V$

(c) $30 \times 10^{-4}\ V$ (d) $3 \times 10^{-4}\ V$

36. A circular coil of radius 5 *cm* has 500 turns of a wire. The approximate value of the coefficient of self induction of the coil will be **[MP PET 1996; Pb PET 2000]**

(a) 25 *millihenry* (b) 25×10^{-3} *millihenry*

(c) 50×10^{-3} *millihenry* (d) 50×10^{-3} *henry*

37. An e.m.f. of 100 *millivolts* is induced in a coil when the current in another nearby coil becomes 10 *ampere* from zero in 0.1 *second.* The coefficient of mutual induction between the two coils will be **[MP PET 1996; Kerala PMT 2004]**

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

38. In a coil of self inductance 0.5 *henry*, the current varies at a constant rate from zero to 10 *amperes* in 2 *seconds*. The e.m.f. generated in the coil is **[MP PMT 1996]**
(a) 10 *volts* (b) 5 *volts*
(c) 2.5 *volts* (d) 1.25 *volts*

39. A coil of self inductance 50 *henry* is joined to the terminals of a battery of e.m.f. 2 *volts* through a resistance of 10 *ohm* and a steady current is flowing through the circuit. If the battery is now disconnected, the time in which the current will decay to 1/*e* of its steady value is **[MP PMT 1996]**
(a) 500 *seconds* (b) 50 *seconds*
(c) 5 *seconds* (d) 0.5 *seconds*

40. The self inductance of a solenoid of length *L*, area of cross-section *A* and having *N* turns is **[MP PET 1997; MP PET 2003]**
(a) $\frac{\mu_0 N^2 A}{L}$ (b) $\frac{\mu_0 NA}{L}$
(c) $\mu_0 N^2 LA$ (d) $\mu_0 NAL$

41. The self inductance of a coil is *L*. Keeping the length and area same, the number of turns in the coil is increased to four times. The self inductance of the coil will now be **[MP PMT 1997]**
(a) $\frac{1}{4}L$ (b) *L*
(c) 4 *L* (d) 16 *L*

42. 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*

43. The energy stored in a 50 *mH* inductor carrying a current of 4 *A* will be **[MP PET 1999]**
(a) 0.4 *J* (b) 4.0 *J*
(c) 0.8 *J* (d) 0.04 *J*

44. The average e.m.f. induced in a coil in which a current changes from 0 to 2 *A* in 0.05 *s* is 8 *V*. The self inductance of the coil is **[CPMT 1999]**
(a) 0.1 *H* (b) 0.2 *H*
(c) 0.4 *H* (d) 0.8 *H*

45. 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

46. The SI unit of inductance, the henry, can be written as **[IIT JEE 1998]**
(a) *Weber/ampere* (b) *Volt-second/ampere*
(c) *Joule/(ampere)^2* (d) *Ohm-second*

47. A varying current in a coil changes from 10 *amp* to zero in 0.5 *sec*. If average EMF is induced in the coil is 220 *volts*, the self inductance of coil is **[EAMCET 1994; MH CET (Med.) 1999]**
(a) 5 *H* (b) 10 *H*
(c) 11 *H* (d) 12 *H*

48. Which of the following is wrong statement **[AMU 1995]**
(a) An emf can be induced between the ends of a straight conductor by moving it through a uniform magnetic field
(b) The self induced emf produced by changing current in a coil always tends to decrease the current
(c) Inserting an iron core in a coil increases its coefficient of self induction
(d) According to Lenz's law, the direction of the induced current is such that it opposes the flux change that causes it

49. A coil has an inductance of 2.5 *H* and a resistance of 0.5 *r*. If the coil is suddenly connected across a 6.0 *volt* battery, then the time required for the current to rise 0.63 of its final value is **[AMU 1995]**
(a) 3.5 *sec* (b) 4.0 *sec*
(c) 4.5 *sec* (d) 5.0 *sec*

50. When the number of turns and the length of the solenoid are doubled keeping the area of cross-section same, the inductance **[CBSE PMT 1993; MH CET 2000]**
(a) Remains the same (b) Is halved

(c) Is doubled (d) Becomes four times

51. A 100 *mH* coil carries a current of 1 *ampere*. Energy stored in its magnetic field is **[CBSE PMT 1992; KCET 1998]**

(a) 0.5 *J* (b) 1 *J*

(c) 0.05 *J* (d) 0.1 *J*

52. The mutual inductance of an induction coil is $5H$. In the primary coil, the current reduces from $5A$ to zero in $10^{-3}s$. What is the induced emf in the secondary coil **[RPET 1996]**

(a) $2500V$ (b) $25000V$

(c) $2510V$ (d) Zero

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

(a) Zero (b) Very large

(c) Infinity (d) Very small

54. What is the coefficient of mutual inductance when the magnetic flux changes by $2\times10^{-2}\,Wb$ and change in current is 0.01*A* **[BHU 1998; AIIMS 2002]**

(a) 2 *henry* (b) 3 *henry*

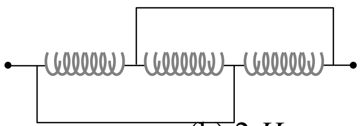
(c) $\frac{1}{2}$ *henry* (d) Zero

55. The current in a coil changes from 4 *ampere* to zero in 0.1 *s*. If the average e.m.f. induced is 100 *volt*, what is the self inductance of the coil **[MNR 1998]**

(a) $2.5\,H$ (b) $25\,H$

(c) $400\,H$ (d) $40\,H$

56. Pure inductance of 3.0 *H* is connected as shown below. The equivalent inductance of the circuit is **[MNR 1998; AIEEE 2002]**



(a) 1 *H* (b) 2 *H*

(c) 3 *H* (d) 9 *H*

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

(a) 2.66 *mH* (b) $2.66\times10^{-3}\,mH$

(c) 2.66 *H* (d) 0.266 *H*

58. If a current of 10 *A* flows in one second through a coil, and the induced e.m.f. is 10 *V*, then the self-inductance of the coil is **[CPMT 2000; Pb. PMT 2001; MH**

(a) $\frac{2}{5}H$ (b) $\frac{4}{5}H$

(c) $\frac{5}{4}H$ (d) 1 *H*

59. 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) $0.4\,\mu_0 Wb$

60. When the current through a solenoid increases at a constant rate, the induced current

(a) Is 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 the inducing current

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

61. If in a coil rate of change of area is 5 m^2/*milli second* and current become 1 *amp* from 2 *amp* in $2\times10^{-3}\,sec$ If magnitude of field is 1 *tesla* then self inductance of the coil is **[RPET 2000]**

(a) 2 *H* (b) 5 *H*

(c) 20 *H* (d) 10 *H*

62. The inductance of a solenoid 0.5 *m* long of cross-sectional area 20 cm^2 and with 500 turns is **[AMU (Med.) 2000]**

(a) 12.5 *mH* (b) 1.25 *mH*

(c) 15.0 *mH* (d) 0.12 *mH*

63. 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*

64. 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

(a) 0.25 *henry* (b) 1.5 *henry*

(c) 9.6 *henry* (d) 16.0 *henry*

65. An average induced e.m.f. of 1V appears in a coil when the current in it is changed from 10A 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

66. A coil of resistance 10 Ω and an inductance 5H is connected to a 100 *volt* battery. Then energy stored in the coil is **[Pb. PMT 2001; CPMT 2002]**

(a) 125 *erg* (b) 125 J
(c) 250 *erg* (d) 250 J

67. If a change in current of 0.01 A in one coil produces a change in magnetic flux of $1.2 \times 10^{-2}\,Wb$ in the other coil, then the mutual inductance of the two coils in henries is **[EAMCET 2001]**

(a) 0 (b) 0.5
(c) 1.2 (d) 3

68. Energy stored in a coil of self inductance 40mH carrying a steady current of 2 A is

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

69. 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 2L henry
(c) Becomes 4L *henry* (d) Becomes $\frac{L}{\sqrt{2}}$ *henry*

70. 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 PMT 2001]**

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

71. In a circular conducting coil, when current increases from 2 A to 18 A in 0.05 *sec*., the induced e.m.f. is 20 V. The self inductance of the coil is **[MP PET 2001]**

(a) 62.5 mH (b) 6.25 mH
(c) 50 mH (d) None of these

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

(a) 1 V (b) 1 μV
(c) 1 mV (d) 0.1 V

73. Which of the following is not the unit of self inductance **[AMU (Med.) 2001]**

(a) *Weber/Ampere* (b) *Ohm-Second*
(c) *Joule-Ampere* (d) *Joule* $Ampere^{-2}$

74. A coil of 100 turns carries a current of 5 mA and creates a 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

75. In circular coil, when no. of turns is doubled and resistance becomes $\frac{1}{4}th$ of initial, then inductance becomes **[Kerala (Engg.) 2001]** **[AIEEE 2002]**

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

76. The current in a coil of inductance 5 H decreases at the rate of 2 A/s. The induced e.m.f. is **[MH CET 2002]**

(a) 2 V (b) 5 V
(c) 10 V (d) – 10 V

77. The self-induced e.m.f. in a 0.1 H coil when the current in it is changing at the rate of 200 *ampere/second* is **[DPMT 2002]**

(a) $8 \times 10^{-4}\ V$ (b) $8 \times 10^{-5}\ V$
(c) $20\ V$ (d) $125\ V$

78. 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 PET 2002]**

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

79. 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*

80. The coefficient of mutual inductance of two coils is 6 *mH*. If the current flowing in one is 2 *ampere*, then the induced e.m.f. in the second coil will be **[BVP 2003]**

(a) 3 *mV* (b) 2 *mV*
(c) 3 *V* (d) Zero

81. 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) $\frac{E}{\sqrt{L^2+R^2}}$

82. Two coils are placed close to each other. The mutual inductance of the pair of coils depends upon **[AIEEE 2003]**

(a) The currents in the two coils
(b) The rates at which currents are changing in the two coils
(c) Relative position and orientation of the two coils
(d) The materials of the wires of the coils

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

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

84. A coil resistance 20Ω and inductance 5*H* is connected with a 100*V* battery. Energy stored in the coil will be **[MP PMT 2003]**

(a) 41.5 *J* (b) 62.50 *J*
(c) 125 *J* (d) 250 *J*

85. Why the current does not rise immediately in a circuit containing inductance

(a) Because of induced emf
(b) Because of high voltage drop
(c) Because of low power consumption
(d) Because of Joule heating

86. 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

87. The current in a coil decreases from 1 *A* to 0.2 *A*. In 10*sec*. Calculate the coefficient of self inductance. If induced emf is 0.4 *volt*. **[BCECE 2004]**

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

88. The current through choke coil increases form zero to 6*A* in 0.3 *seconds* 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*

89. The resistance and inductance of series circuit are 5Ω 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*

90. A coil of *N* = 100 turns carries a current *I* = 5 *A* and creates a magnetic flux $\phi = 10^{-5}\,Tm^{-2}$ per turn. The value of its inductance *L* will be **[UPSEAT 2004]**

(a) 0.05 *mH* (b) 0.10 *mH*
(c) 0.15 *mH* (d) 0.20 *mH*

91. Two identical induction coils each of inductance *L* joined in series are placed very close to each other such that the winding direction of one is exactly opposite to that of the other, what is the net inductance **[DCE 2003]**

(a) L^2 (b) 2*L*
(c) *L*/2 (d) Zero

[EAMCET 1994]

92. If the current 30 *A* flowing in the primary coil is made zero in 0.1 *sec*. The emf induced in the

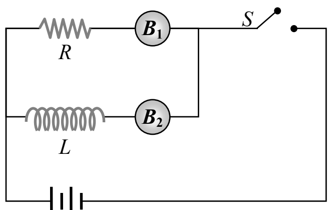
secondary coil is 1.5 *volt*. The mutual inductance between the coil is **[Pb PMT 2003]**

(a) 0.05 *H* (b) 1.05 *H*
(c) 0.1 *H* (d) 0.2 *H*

93. Eddy currents are used in **[AFMC 2004]**

(a) Induction furnace (b) Electromagnetic brakes
(c) Speedometers (d) All of these

94. The adjoining figure shows two bulbs B_1 and B_2 resistor *R* and an inductor *L*. When the switch S is turned off **[CPMT 1989]**



(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

95. In *L-R* circuit, for the case of increasing current, the magnitude of current can be calculated by using the formula **[MP PET 1994]**

(a) $I = I_0 e^{-Rt/L}$ (b) $I = I_0(1 - e^{-Rt/L})$
(c) $I = I_0(1 - e^{Rt/L})$ (d) $I = I_0 e^{Rt/L}$

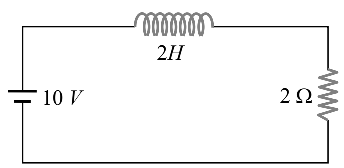
96. An inductance *L* and a resistance *R* are first connected to a battery. After some time the battery is disconnected but *L* and *R* remain connected in a closed circuit. Then the current reduces to 37% of its initial value in **[MP PMT 1994]**

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

97. In an *LR*-circuit, time constant is that time in which current grows from zero to the value (where I_0 is the steady state current) **[MP PMT/PET 1998; MP PET 2002]**

(a) $0.63\, I_0$ (b) $0.50\, I_0$
(c) $0.37\, I_0$ (d) I_0

98. In the figure magnetic energy stored in the coil is **[RPET 2000]**



(a) Zero (b) Infinite
(c) 25 *joules* (d) None of the above

99. 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)
(c) Zero (d) Oscillates
indefinitely

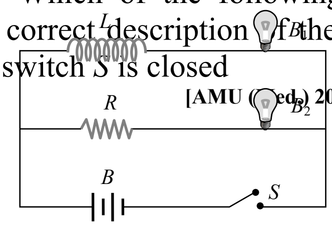
100. A coil of inductance 40 *henry* is connected in 0series with a resistance of 8 *ohm* and the combination is joined to the terminals of a 2 *volt* battery. The time constant of the circuit is **[MP PET 2000]**

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

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

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

102. 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 figure. 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 bright
(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

103. 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

104. A *LC* circuit is in the state of resonance. If $C = 0.1 \mu F$ and $L = 0.25$ *henry*. Neglecting ohmic resistance of circuit what is the frequency of oscillations **[BHU 2003; MP PMT 2005]**

(a) 1007 *Hz* (b) 100 *Hz*

(c) 109 *Hz* (d) 500 *Hz*

105. An oscillator circuit consists of an inductance of 0.5*mH* and a capacitor of 20 μF. The resonant frequency of the circuit is nearly **[Kerala PET 2002]**

(a) 15.92 *Hz* (b) 159.2 *Hz*

(c) 1592 *Hz* (d) 15910 *Hz*

106. A coil of inductance 300 *mH* and resistance 2Ω is connected to a source of voltage $2V$. The current reaches half of its steady state value in **[AIEEE 2005]**

(a) 0.15 *s* (b) 0.3 *s*

(c) 0.05 *s* (d) 0.1 *s*

107. A coil having an inductance of 0.5 *H* carries a current which is uniformly varying from zero to 10 ampere in 2 second. The e.m.f. (in volts) generated in the coil is **[Kerala PET 2005]**

(a) 10 (b) 5

(c) 2.5 (d) 1.25

108. The square root of the product of inductance and capacitance has the dimension of **[KCET 2005]**

(a) Length (b) Mass

(c) Time (d) No dimension

Application of EMI (Motor, Dynamo, Transformer...)

1. Which of the following does not depend upon the magnetic effect of some sort

(a) Moving coil galvanometer

(b) Hot wire ammeter

(c) Dynamo

(d) Electric motor

2. Use of eddy currents is done in the following except

(a) Moving coil galvanometer

(b) Electric brakes

(c) Induction motor

(d) Dynamo

3. Plane of eddy currents makes an angle with the plane of magnetic lines of force equal to

(a) 40^o (b) 0^o

(c) 90^o (d) 180^o

4. Which of the following is constructed on the principle of electromagnetic induction **[MP PMT 2002]**

(a) Galvanometer (b) Electric motor

(c) Generator (d) Voltmeter

5. A transformer is based on the principle of **[AIIMS 1998; AFMC 2005]**

(a) Mutual inductance (b) Self inductance

(c) Ampere's law (d) Lenz's law

6. Which of the following is not an application of eddy currents **[CBSE PMT 1989]**

(a) Induction furnace

(b) Galvanometer damping

(c) Speedometer of automobiles

(d) *X*-ray crystallography

7. The core of a transformer is laminated to reduce energy losses due to **[CBSE PMT 1990; Karnataka CET (Med.) 2001]**

(a) Eddy currents (b) Hysteresis

(c) Resistance in winding (d) None of these

8. 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

(b) Its magnet is very strong

(c) Its pointer is very light

(d) Its frame is made of abonite

9. The device that does not work on the principle of mutual induction is **[KCET 1994]**

(a) Induction coil (b) Motor

(c) Tesla coil (d) Transformer

10. Eddy currents are produced when **[CBSE PMT 1993; AFMC 2002]**

(a) A metal is kept in varying magnetic field

(b) A metal is kept in the steady magnetic field

(c) A circular coil is placed in a magnetic field

(d) Through a circular coil, current is passed

11. If rotational velocity of a dynamo armature is doubled, then induced e.m.f. will become **[MP PMT 1991; AIIMS 2000]**

(a) Half (b) Two times

(c) Four times (d) Unchanged

12. 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

13. The working of dynamo is based on principle of **[CPMT 1984]**

(a) Electromagnetic induction

(b) Conversion of energy into electricity

(c) Magnetic effects of current

(d) Heating effects of current

14. Choke coil works on the principle of **[MP PET/PMT 1988]**

(a) Transient current (b) Self induction

(c) Mutual induction (d) Wattless current

15. When the speed of a dc motor increases the armature current **[CPMT 1984, 85; MP PMT 2004]**

(a) Increases

(b) Decreases

(c) Does not change

(d) Increases and decreases continuously

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

(a) dc

(b) ac

(c) Fluctuating dc

(d) Half-wave rectified voltage

17. Which of the following statement is incorrect

(a) Both ac and dc dynamo have a field magnet

(b) Both ac and dc dynamo have an armature

(c) Both ac and dc dynamo convert mechanical energy into electrical energy

(d) Both ac and dc dynamo have slip rings

18. The coil of 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 condition is correct **[MP PET 1993]**

(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

19. Dynamo core is laminated because **[MP PET 1995]**

(a) Magnetic field increases

(b) Magnetic saturation level in core increases

(c) Residual magnetism in core decreases

(d) Loss of energy in core due to eddy currents decreases

20. Armature current in dc motor will be maximum when **[CPMT 1986, 88; MP PET 1995]**

(a) Motor has acquired maximum speed

(b) Motor has acquired intermediate speed

(c) Motor has just started moving

(d) Motor is switched off

21. The armature of dc motor has 20Ω resistance. It draws current of 1.5 ampere when run by 220 *volts* dc supply. The value of back e.m.f. induced in it will be **[MP PMT 1999]**

(a) 150 *V* (b) 170 *V*

(c) 180 *V* (d) 190 *V*

22. In an induction coil, the secondary e.m.f. is **[KCET 1994]**

(a) Zero during break of the circuit

(b) Very high during make of the circuit

(c) Zero during make of the circuit

(d) Very high during break of the circuit

23. 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 *cycles/sec* in a magnetic field of $0.2\ W/m^2$. The peak value of the emf generated is nearly [AMU 1995]

(a) 786 *kV* (b) 440 *kV*

(c) 220 *kV* (d) 157.1 *kV*

24. In a dc motor, induced e.m.f. will be maximum [RPMT 1997]

(a) When motor takes maximum speed

(b) When motor starts rotating

(c) When speed of motor increases

(d) When motor is switched off

25. 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

26. In an induction coil with resistance, the induced emf will be maximum when [RPMT 1996]

(a) The switch is put on due to high resistance

(b) The switch is put off due to high resistance

(c) The switch is put on due to low resistance

(d) The switch is put off due to low resistance

27. An electric motor operating on a 60 *V* dc supply draws a current of 10 *A*. If the efficiency of the motor is 50%, the resistance of its winding is

(a) 3Ω (b) 6Ω

(c) 15Ω (d) 30Ω

28. A device which converts electrical energy into mechanical energy is [KCET 2001]

(a) Dynamo (b) generator

(c) Electric motor (d) Induction coil

29. 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 PET 2002]

(a) 6Ω (b) 4Ω

(c) 2.9Ω (d) 3.1Ω

30. 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 [UPSEAT 2002]

(a) 5*A* (b) 105*A*

(c) 110*A* (d) 215*A*

31. Fan is based on [AFMC 2003]

(a) Electric Motor (b) Electric dynamo

(c) Both (d) None of these

32. A transformer is employed to [MP PET 1985; MP PMT 1993; RPET 1999]

(a) Obtain a suitable dc voltage

(b) Convert dc into ac

(c) Obtain a suitable ac voltage

(d) Convert ac into dc

33. What is increased in step-down transformer [MP PMT/PET 1998; CPMT 1999]

(a) Voltage (b) Current

(c) Power (d) Current density

34. The core of a transformer is laminated so that [CPMT 1985; MP PMT 1994, 2000, 02, 03; BHU 1999]

(a) Ratio of voltage in the primary and secondary may be increased

(b) Rusting of the core may be stopped

(c) Energy losses due to eddy currents may be reduced

(d) Change in flux is increased

35. [AMU (Engg) 2001] In transformer, core is made of soft iron to reduce [AIIMS 1998; UPSEAT 2001; AFMC 2005]

(a) Hysteresis losses

(b) Eddy current losses

(c) Force opposing electric current

(d) None of the above

36. The transformation ratio in the step-up transformer is

(a) 1

(b) Greater than one

(c) Less than one

(d) The ratio greater or less than one depends on the other factors

37. In a transformer 220 ac voltage is increased to 2200 *volts*. If the number of turns in the secondary are 2000, then the number of turns in the primary will be **[MP PET/PMT 1988]**

(a) 200 (b) 100

(c) 50 (d) 20

38. 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 loses must be equal to

[MP PMT 1984; KCET 2003]

(a) 5 *P* (b) 1.5 *P*

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

39. The primary winding of a transformer has 100 turns and its secondary winding has 200 turns. The primary is connected to an ac supply of 120 *V* and the current flowing in it is 10 A. The voltage and the current in the secondary are

[MP PMT 1991; DPMT 2004]

(a) 240 *V*, 5 *A* (b) 240 *V*, 10 *A*

(c) 60 *V*, 20 *A* (d) 120 *V*, 20 *A*

40. A step-down transformer is connected to 2400 *volts* line and 80 amperes of current is found to flow in output load. The ratio of the turns in primary and secondary coil is 20 : 1. If transformer efficiency is 100%, then the current flowing in primary coil will be

[MP PMT 1991]

(a) 1600 *A* (b) 20 *A*

(c) 4 *A* (d) 1.5 *A*

41. A loss free transformer has 500 turns on its primary winding and 2500 in secondary. The meters 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*

42. An ideal transformer has 100 turns in the primary and 250 turns in the secondary. The peak value of the ac is 28 *V*. The *r.m.s.* secondary voltage is nearest to **[MP PMT 1992]**

(a) 50 *V* (b) 70 *V*

(c) 100 *V* (d) 40 *V*

43. A transformer is employed to reduce 220 *V* to 11 *V*. The primary draws a current of 5 *A* and the secondary 90 *A*. The efficiency of the transformer is **[MP PMT 1992, 2001, 04]**

(a) 20% (b) 40%

(c) 70% (d) 90%

44. In a step-up transformer, the turn ratio is 1 : 2. A Leclanche cell (e.m.f. 1.5V) is connected across the primary. The voltage developed in the secondary would be

[MP PET 1992, 99; AIIMS 2000; MP PMT 2000; RPET 2001]

(a) 3.0 *V* (b) 0.75 *V*

(c) 1.5 *V* (d) Zero

45. 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

46. We can reduce eddy currents in the core of transformer

[MP PET 1993]

(a) By increasing the number of turns in secondary coil

(b) By taking laminated core

(c) By making step-down transformer

(d) By using a weak ac at high potential

47. A 100% efficient transformer has 100 turns in the primary and 25 turns in its secondary coil. If the current in the secondary coil is 4 amp, then the current in the primary coil is

[MP PMT 1990]

(a) 1 *amp* (b) 4 *amp*

(c) 8 *amp* (d) 16 *amp*

48. 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

49. In a lossless transformer an alternating current of 2 *amp* is flowing in the primary coil. The number of turns in the primary and secondary coils are 100 and 20 respectively. The value of the current in the secondary coil is **[MP PMT 1994]**

(a) 0.08 *A* (b) 0.4 *A*

(c) 5 *A* (d) 10 *A*

50. A transformer connected to 220 *volt* line shows an output of 2 *A* at 11000 *volt*. The efficiency is 100%. The current drawn from the line is **[MP PMT 1995]**

(a) 100 *A* (b) 200 *A*

(c) 22 *A* (d) 11 *A*

51. The coils of a step down transformer have 500 and 5000 turns. In the primary coil an ac of 4 *ampere* at 2200 *volts* is sent. The value of the current and potential difference in the secondary coil will be **[MP PET 1996]**

(a) 20 *A*, 220 *V* (b) 0.4 *A*, 22000 *V*

(c) 40 *A*, 220 *V* (d) 40 *A*, 22000 *V*

52. 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 **[MP PET 1997]**

(a) 4 *A* (b) 0.4 *A*

(c) 0.04 *A* (d) 0.2 *A*

53. A step up transformer connected to a 220 *V AC* line is to supply 22 *kV* for a neon sign in secondary circuit. In primary circuit a fuse wire is connected which is to blow when the current in the secondary circuit exceeds 10 *mA*. The turn ratio of the transformer is **[MP PET 1997]**

(a) 50 (b) 100

(c) 150 (d) 200

54. In a transformer the primary has 500 *turns* and secondary has 50 *turns*. 100 *volts* are applied to the primary coil, the voltage developed in the secondary will be **[MP PMT 1997]**

(a) 1 *V* (b) 10 *V*

(c) 1000 *V* (d) 10000 *V*

55. A transformer is used to **[MP PET 1999]**

(a) Change the alternating potential

(b) Change the alternating current

(c) To prevent the power loss in alternating current flow

(d) To increase the power of current source

56. A step-up transformer operates on a 230 *V* line and supplies a load of 2 *ampere*. The ratio of the primary and secondary windings is 1 : 25. The current in the primary is **[CBSE PMT 1998]**

(a) 15 *A* (b) 50 *A*

(c) 25 *A* (d) 12.5 *A*

57. 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*

58. The primary winding of transformer has 500 turns whereas its secondary has 5000 turns. The primary is connected to an ac supply of 20 *V*, 50 *Hz*. The secondary will have an output of **[CBSE PMT 1997; AIIMS 1999]**

(a) 200 *V*, 50 *Hz* (b) 2 *V*, 50 *Hz*

(c) 200 *V*, 500 *Hz* (d) 2 *V*, 5 *Hz*

59. A step-up transformer has transformation ratio of 3 : 2. What is the voltage in secondary if voltage in primary is 30 *V* **[BHU 1998; Pb. PMT 2004]**

(a) 45 *V* (b) 15 *V*

(c) 90 *V* (d) 300 *V*

60. In a transformer, the number of turns in primary coil and secondary coil are 5 and 4 respectively.

If 240 V is applied on the primary coil, then the ratio of current in primary and secondary coil is
[AFMC 1998; CPMT 2000; Pb. PET 2002]

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

61. A step-down transformer is connected to main supply 200V to operate a 6V, 30W bulb. The current in primary is
[AMU (Engg.) 1999]

(a) 3 A (b) 1.5 A
(c) 0.3 A (d) 0.15 A

62. The number of turns in primary and secondary coils of a transformer are 100 and 20 respectively. If an alternating potential of 200 *volt* is applied to the primary, the induced potential in secondary will be

(a) 10 V (b) 40 V
(c) 1000 V (d) 20,000 V

63. The ratio of secondary to primary turns is 9 : 4. If power input is P, what will be the ratio of power output (neglect all losses) to power input

(a) 4 : 9 (b) 9 : 4
(c) 5 : 4 (d) 1 : 1

64. Voltage in the secondary coil of a transformer does not depend upon. **[BHU 2000]**

(a) Voltage in the primary coil
(b) Ratio of number of turns in the two coils
(c) Frequency of the source
(d) Both (a) and (b)

65. A transformer has turn ratio 100/1. If secondary coil has 4 *amp* current then current in primary coil is **[RPET 2000]**

(a) 4 A (b) 0.04 A
(c) 0.4 A (d) 400 A

66. 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 A. 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*

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

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

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

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

69. In a transformer, number of turns in the primary are 140 and that in the secondary are 280. If current in primary is 4A then that in the **[RPET 1999]** secondary is **[AIEEE 2002]**

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

70. A transformer has 100 turns in the primary coil and carries 8 A current. If input power is one kilowatt, the number of turns required in the **[DCE 1999]** secondary coil to have 500V output will be
[MP PET 2002]

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

71. 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

72. In a primary coil 5A current is flowing on 220 volts. In the secondary coil 2200V 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

73. A step up transformer has transformation ration 5 : 3. What is voltage in secondary if voltage in primary is 60 V
[Pb. PET 2000]

(a) 20 V (b) 60 V

(c) 100 V (d) 180 V

74. In a step up transformer, 220 V is converted into 200 V. The number of turns in primary coil is 600. What is the number of turns in the secondary coil **[DCE 2004]**

(a) 60 (b) 600

(c) 6000 (d) 100

75. The output voltage of a transformer connected to 220 *volt* line is 1100 *volt* at 1 *amp* current. Its efficiency is 100%. The current coming from the line is **[Pb. PET 2003]**

(a) 20 A (b) 10 A

(c) 11 A (d) 22 A

76. Quantity that remains unchanged in a transformer is

[MP PMT/PET 1998; AIIMS 1999; J & K CET 2005]

(a) Voltage (b) Current

(c) Frequency (d) None of the above

77. In a region of uniform magnetic induction $B = 10^{-2}$ *tesla*, a circular coil of radius 30 *cm* and resistance π^2 *ohm* is rotated about an axis which is perpendicular to the direction of B and which forms a diameter of the coil. If the coil rotates at 200 *rpm* the amplitude of the alternating current induced in the coil is

(a) $4\pi^2$ *mA* (b) 30 *mA*

(c) 6 *mA* (d) 200 *mA*

78. In a transformer, the number of turns in primary and secondary are 500 and 2000 respectively. If current in primary is 48 A, the current in the secondary is

[Orissa PMT 2004]

(a) 12 A (b) 24 A

(c) 48 A (d) 144 A

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

[Orissa PMT 2004]

(a) 5 J (b) 10 J

(c) 100 J (d) 1000 J

80. The turn ratio of a transformers is given as 2 : 3. If the current through the primary coil is 3 A, thus calculate the current through load resistance **[BHU 2005]**

(a) 1 A (b) 4.5 A

(c) 2 A (d) 1. 5 A

81. Core of transformer is made up of **[AFMC 2005]**

(a) Soft iron (b) Steel

(c) Iron (d) Alnico

82. The induction coil works on the principle of **[KCET 2005]**

(a) Self-induction (b) Mutual induction

(c) Ampere's rule (d) Fleming's right hand rule

83. A transformer with efficiency 80% works at 4 *kW* and 100 V. If the secondary voltage is 200 V, then the primary and secondary currents are respectively **[Kerala PMT 2005]**

(a) 40 A, 16 A (b) 16 A, 40 A

(c) 20 A, 40 A (d) 40 A, 20 A

84. In a step up transformer, if ratio of turns of primary to secondary is 1 : 10 and primary voltage is 230 V. If the load current is 2A, then the current in primary is

[Orissa PMT 2005]

(a) 20 A (b) 10 A

(c) 2 A (d) 1 A

85. If a coil made of conducting wires is rotated between poles pieces of the permanent magnet. The motion will generate a current and this device is called **[CBSE PMT 1990]** **[CPMT 2005]**

(a) An electric motor (b) An electric generator

(c) An electromagnet (d) All of above

86. A step-down transformer is used on a 1000 V line to deliver 20 A at 120 V at the secondary coil. If the efficiency of the transformer is 80% the current drawn from the line is .

[Kerala PET 2005]

(a) 3 A (b) 30 A

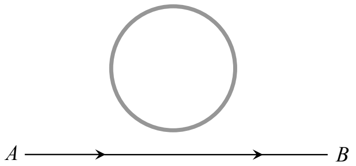
(c) 0.3 A (d) 2.4 A

CT Critical Thinking

Objective Questions

1. 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; UPSEAT 2005]



(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

2. A copper rod of length *l* is rotated about one end perpendicular to the magnetic field *B* with constant angular velocity ω. The induced e.m.f. between the two ends is

[MP PMT 1992; Orissa JEE 2003]

(a) $\frac{1}{2}B\omega l^2$
(b) $\frac{3}{4}B\omega l^2$
(c) $B\omega l^2$
(d) $2B\omega l^2$

3. Two different coils have self-inductance $L_1 = 8\,mH$, $L_2 = 2mH$. The current in one coil is increased at a constant rate. The current in the second coil is also increased at the same rate. At a certain instant of time, the power given to the two coils is the same. At that time the current, the induced voltage and the energy stored in the first coil are i_1, V_1 and W_1 respectively. Corresponding values for the second coil at the same instant are i_2, V_2 and W_2 respectively. Then **[IIT JEE 1994]**

(a) $\frac{i_1}{i_2} = \frac{1}{4}$
(b) $\frac{i_1}{i_2} = 4$ 8
(c) $\frac{W_2}{W_1} = 4$
(d) $\frac{V_2}{V_1} = \frac{1}{4}$

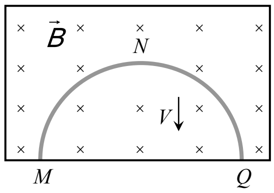
4. An e.m.f. of 15 *volt* is applied in a circuit containing 5 *henry* inductance and 10 *ohm* resistance. The ratio of the currents at time $t = \infty$ and at *t* = 1 *second* is **[MP PMT 1994]**

(a) $\frac{e^{1/2}}{e^{1/2}-1}$
(b) $\frac{e^2}{e^2-1}$
(c) $1-e^{-1}$
(d) e^{-1}

5. 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 **[MP PMT 1994; MP PET 2001]**

(a) R_1 / R_2
(b) R_2 / R_1
(c) R_1^2 / R_2
(d) R_2^2 / R_1

6. A thin semicircular conducting ring of radius *R* is falling with its plane vertical in a horizontal magnetic induction *B*. At the position *MNQ*, the speed of the ring is *V* and the potential difference developed across the ring is **[IIT JEE 1996]**

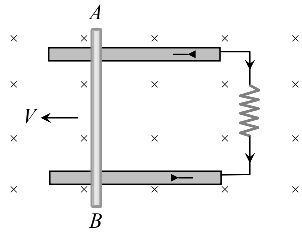


(a) Zero
(b) $Bv\pi R^2/2$ and *M* is at higher potential
(c) πRBV and *Q* is at higher potential
(d) 2*RBV* and *Q* is at higher potential

7. At a place the value of horizontal component of the earth's magnetic field *H* is $3 \times 10^{-5}\ Weber/m^2$. A metallic rod *AB* of length 2 *m* placed in east-west direction, having the end *A* towards east, falls vertically downward with a constant velocity of 50 *m/s*. Which end of the rod becomes positively charged and what is the value of induced potential difference between the two ends **[MP PET 1996]**

(a) End *A*, $3 \times 10^{-3}\ mV$
(b) End *A*, 3 *mV*
(c) End *B*, $3 \times 10^{-3}\ mV$
(d) End *B*, 3 *mV*

8. Consider the situation shown in the figure. The wire *AB* is sliding 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

9. A circular loop of radius R carrying current I lies in x-y plane with its centre at origin. The total magnetic flux through x-y plane is **[IIT-JEE 1999]**

(a) Directly proportional to I

(b) Directly proportional to R

(c) Directly proportional to R^2

(d) Zero

10. 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 **[IIT JEE 1999; UPSEAT 2003]**

(a) Remains stationary

(b) Is attracted by the loop-A

(c) Is repelled by the loop-A

(d) Rotates about its CM, with CM fixed

(CM is the centre of mass)

11. 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 $I_0 = 10A$ and ω = 100 π *radian/sec*. The maximum value of e.m.f. in the second coil is **[CBSE PMT 1998; Pb. PMT 2000]**

(a) 2π (b) 5π

(c) π (d) 4π

12. 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 **[IIT JEE 1998]**

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

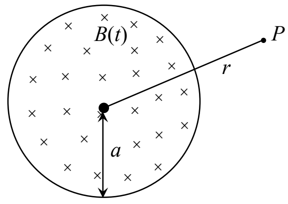
(c) L / l (d) L^2 / l

13. A wire of length 1 m is moving at a speed of 2ms^{-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]**

(a) $\frac{1}{12}W$ (b) $\frac{1}{6}W$

(c) $\frac{1}{3}W$ (d) $1W$

14. 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

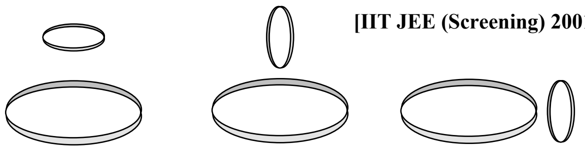
(d) Decreases as $\frac{1}{r^2}$

15. A coil of wire having finite inductance and resistance has a conducting ring placed coaxially within it. The coil is connected to a battery at time t = 0, so that a time-dependent current $I_1(t)$ starts flowing through the coil. If $I_2(t)$ is the current induced in the ring. and $B(t)$ is the magnetic field at the axis of the coil due to $I_1(t)$, then as a function of time (t > 0), the product $I_2(t)\,B(t)$ **[IIT-JEE (Screening) 2000]**

(a) Increases with time (b) Decreases with time

(c) Does not vary with time (d)

16. 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]**

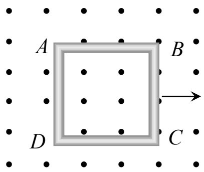


(A) (B) (C)

(a) Maximum in situation (A) (b)

(c) Maximum in situation (C) (d)

17. A metallic square loop $ABCD$ is moving in its own plane with velocity v in a uniform magnetic field perpendicular to its plane as shown in the figure. An electric field is induced **[IIT JEE (Screening) 2001]**



(a) In AD, but not in BC

(b) In BC, but not in AD

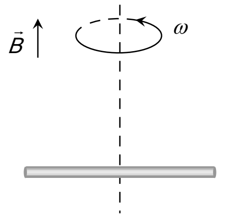
(c) Neither in AD nor in BC

(d) In both AD and BC

18. 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) $\frac{1}{8}B\omega l^2$

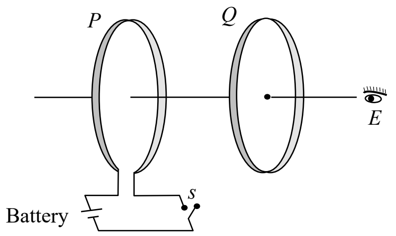
(d) Zero

19. An inductor of 2 *henry* and a resistance of 10 *ohms* are connected in series with a battery of 5 *volts*. The initial rate of change of current is **[MP PMT 2001]**

(a) 0.5 *amp/sec* (b) 2.0 *amp/sec*

(c) 2.5 *amp/sec* (d) 0.25 *amp/sec*

20. 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 *E*) and an induced current I_{Q_1} flows in *Q*. The switch remains 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 *E*) are



(a) Respectively clockwise and anticlockwise

(b) Both clockwise

(c) Both anticlockwise

(d) Respectively anticlockwise and clockwise

21. A short-circuited coil is placed in a time-varying magnetic field. Electrical power is dissipated due to the current induced in the coil. If the number of turns were to be quadrupled and the wire radius halved, the electrical power dissipated would be **[IIT-JEE (Screening) 2002]**

(a) Halved (b) The same

(c) Doubled (d) Quadrupled

22. A physicist works in a laboratory where the magnetic field is 2 *T*. She wears a necklace enclosing area 0.01 m^2 in such a way that the plane of the necklace is normal to the field and is having a resistance R = 0.01 Ω. Because of power failure, the field decays to 1 *T* in time 10^{-3} *seconds*. Then what is the total heat produced in her necklace ? (T = *Tesla*)

[Orissa JEE 2002]

(a) 10 *J* (b) 20 *J*

(c) 30 *J* (d) 40 *J*

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

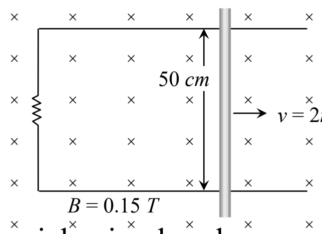
[IIT-JEE (Screening) 1999; UPSEAT 2003]

(a) 500 *sec* (b) 20 *sec*

(c) 35 *milli sec* (d) 1 *milli sec*

24. As shown in the figure a metal rod makes contact and complete the circuit. The circuit is perpendicular to the magnetic field with $B = 0.15\,tesla$ If the resistance is 3Ω, force needed to move the rod as indicated with a constant speed of $2m/sec$ is

[IIT JEE (Screening) 2002]



(a) $3.75\times10^{-3}N$

(b) $3.75\times10^{-2}N$

(c) $3.75\times10^{2}N$

(d) $3.75\times10^{-4}N$

25. Two identical coaxial circular loops carry current *i* each circulating in the clockwise direction. If the loops are approaching each other, then **[MP PMT 1995, 96]**

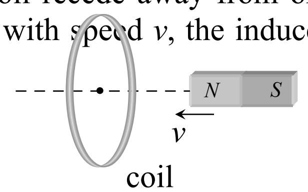
(a) Current in each loop increases

(b) Current in each loop remains the same

(c) Current in each loop decreases

(d) Current in one-loop increases and in the other it decreases

26. In the following figure, the magnet is moved towards the coil with a speed *v* and induced *emf* is *e*. If magnet and coil recede away from one another each moving with speed *v*, the induced *emf* in the coil will be



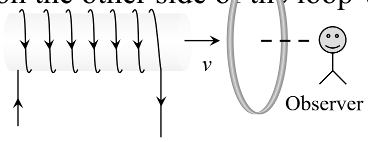
(a) *e*

(b) 2*e*

(c) *e*/2

(d) 4*e*

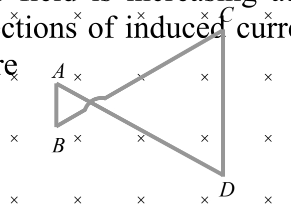
27. A current carrying solenoid is approaching a conducting loop as shown in the figure. The direction of induced current as observed by an observer on the other side of the loop will be



(a) Anticlockwise (b) Clockwise

(c) East (d) West

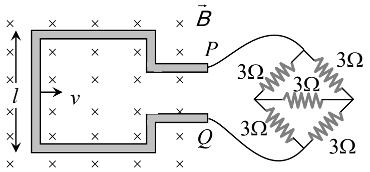
28. A conducting wire frame is placed in a magnetic field which is directed into the paper. The magnetic field is increasing at a constant rate. The directions of induced current in wires AB and CD are



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

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

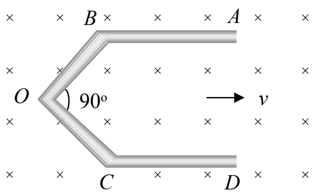
29. A square metallic wire loop of side 0.1 m and resistance of 1Ω is moved with a constant velocity in a magnetic field of 2 wb/m^2 as shown in figure. The magnetic field is perpendicular to the plane of the loop, loop is connected to a network of resistances. What should be the velocity of loop so as to have a steady current of 1mA in loop



(a) 1 cm/sec (b) 2 cm/sec

(c) 3 cm/sec (d) 4 cm/sec

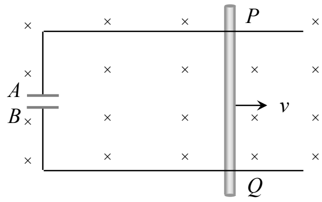
30. A conductor $ABOCD$ moves along its bisector with a velocity of 1 m/s through a perpendicular magnetic field of 1 wb/m^2, as shown in fig. If all the four sides are of 1m length each, then the induced emf between points A and D is



(a) 0 (b) 1.41 $volt$

(c) 0.71 $volt$ (d) None of the above

31. A conducting rod PQ of length L = 1.0 m is moving with a uniform speed v = 2 m/s in a uniform magnetic field $B = 4.0\ T$ directed into the paper. A capacitor of capacity C = 10 μF is connected as shown in figure. Then



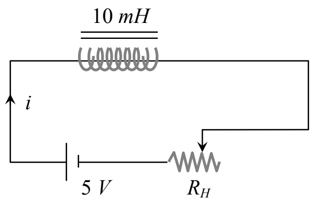
(a) $q_A = +\,80\ \mu C$ and $q_B = -\,80\ \mu C$

(b) $q_A = -\,80\ \mu C$ and $q_B = +\,80\ \mu C$

(c) $q_A = 0 = q_B$

(d) Charge stored in the capacitor increases exponentially with time

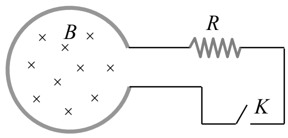
32. The resistance in the following circuit is increased at a particular instant. At this instant the value of resistance is 10Ω. The current in the circuit will be now



(a) $i = 0.5\ A$ (b) $i > 0.5\ A$

(c) $i < 0.5\ A$ (d) $i = 0$

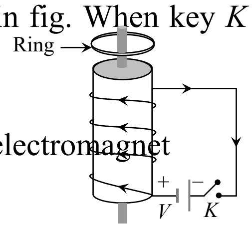
33. Shown in the figure is a circular loop of radius r and resistance R. A variable magnetic field of induction $B = B_0 e^{-t}$ is established inside the coil. If the key (K) is closed, the electrical power developed right after closing the switch is equal to



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

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



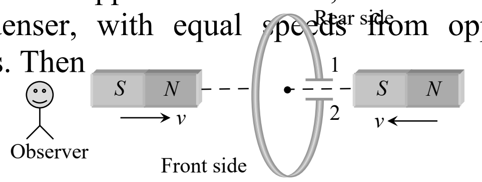
(a) Remain stationary

(b) Is attracted towards the electromagnet

(c) Jumps out of the core

(d) None of the above

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



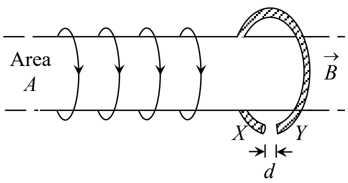
(a) Plate 1 will be negative and plate 2 positive

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

(c) Both the plates will be positive

(d) Both the plates will be negative

36. 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 ring which has excess of positive charge and the magnitude of induced e.m.f. in the ring are respectively



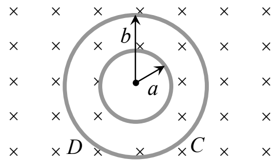
(a) $X, A\alpha$

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

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

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

37. 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)



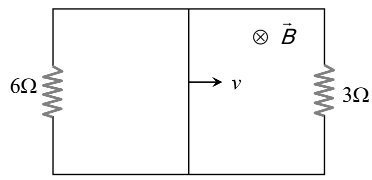
(a) 10^{-4} A (Clockwise), 2×10^{-4} A (Clockwise)

(b) 10^{-4} A (Anticlockwise), 2×10^{-4} A (Clockwise)

(c) 2×10^{-4} A (clockwise), 10^{-4} A (Anticlockwise)

(d) 2×10^{-4} A (Anticlockwise), 10^{-4} A (Anticlockwise)

38. A rectangular loop with a sliding connector of length l = 1.0 m is situated in a uniform magnetic field $B = 2T$ 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 $v = 2m/s$ is



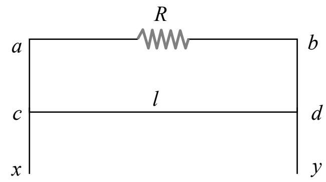
(a) 6 N

(b) 4 N

(c) 2 N

(d) 1 N

39. 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



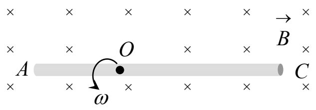
(a) $\frac{mgR}{Bl}$

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

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

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

40. 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) $V_A - V_C = 4 B\omega l^2$

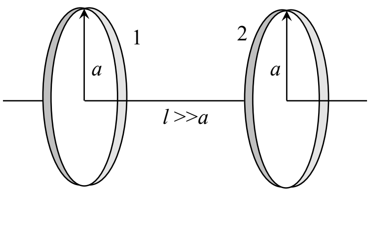
(d) $V_C - V_O = \frac{9}{2} B\omega l^2$

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

(a) $\sqrt{\frac{2\pi L l_0}{\mu_0}}$ (b) $\sqrt{\frac{4\pi L l_0}{\mu_0^2}}$

(c) $\sqrt{\frac{4\pi L l_0}{\mu_0}}$ (d) $\sqrt{\frac{8\pi L l_0}{\mu_0}}$

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



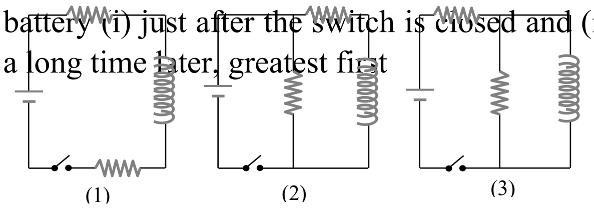
(a) $\frac{\mu_0 \pi a^4}{8 l^3}$

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

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

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

43. 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



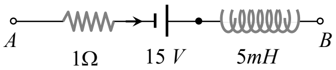
(a) (i) $i_2 > i_3 > i_1$ $(i_1 = 0)$ (ii) $i_2 > i_3 > i_1$

(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) $i_2 > i_3 > i_1$

44. 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*

45. A 50 *volt* potential difference is suddenly applied to a coil with $L = 5 \times 10^{-3}$ *henry* and $R = 180\, ohm$. The rate of increase of current after 0.001 *second* is **[MP PET 1994]**

(a) 27.3 *amp/sec* (b) 27.8 *amp/sec*

(c) 2.73 *amp/sec* (d) None of the above

46. The current in a *LR* circuit builds up to $\frac{3}{4}$*th* of its steady state value in $4s$. The time constant of this circuit is **[Roorkee 2000]**

(a) $\frac{1}{\ln 2} s$ (b) $\frac{2}{\ln 2} s$

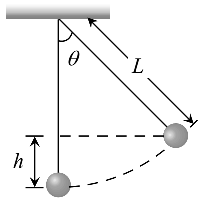
(c) $\frac{3}{\ln 2} s$ (d) $\frac{4}{\ln 2} s$

47. A conducting ring of radius 1 *meter* is placed in an uniform magnetic field *B* of 0.01*Telsa* oscillating with frequency 100*Hz* with its plane at right angles to *B*. What will be the induced electric field **[AIIMS 2005]**

(a) $\pi\, volt/m$ (b) $2\, volt/m$

(c) $10\, volt/m$ (d) $62\, volt/m$

48. A simple pendulum with bob of mass *m* and conducting wire of length *L* swings under gravity through an angle 2θ. The earth's magnetic field component in the direction perpendicular to swing is *B*. Maximum potential difference induced across the pendulum is **[MP PET 2005]**



(a) $2BL\sin\left(\frac{\theta}{2}\right)(gL)^{1/2}$

(b) $BL\sin\left(\frac{\theta}{2}\right)(gL)$

(c) $BL\sin\left(\frac{\theta}{2}\right)(gL)^{3/2}$

(d) $BL\sin\left(\frac{\theta}{2}\right)(gL)^2$