Electromagnetic Induction

Faraday's and Lenz's law

1. **A cylindrical bar magnet is kept along the axis of a circular coil. If the magnet is rotated along its axis, then**
   1) A current will be induced in the coil
   2) No current will be induced in the coil
   3) Only e.m.f. will be induced in the coil
   4) Both e.m.f. and current will be induced in the coil

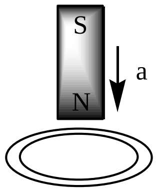
2. **If the flux of magnetic induction through each turn of a coil of resistance R and having N turns changes from φ_1 to φ_2 then the magnitude of the charge that passes through the coil is**

   1) $\frac{\varphi_2 - \varphi_1}{R}$ 2) $\frac{N(\varphi_2 - \varphi_1)}{R}$ 3) $\frac{\varphi_2 - \varphi_1}{NR}$ 4) $\frac{NR}{\varphi_2 - \varphi_1}$

3. **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**
   1) Equal to that due to gravity
   2) Less than that due to gravity
   3) More than that due to gravity
   4) Depends on the diameter of the ring and the length of the magnet

4. **A magnet is brought towards a coil (i) speedily (ii) Slowly, and then the induced e.m.f/induced charge will be respectively**
   1) More in first case/ more in first case 2) More in first case/ equal in both cases
   3) Less in first case/ more in second case 4) Less in first case/ equal in both cases

5. 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

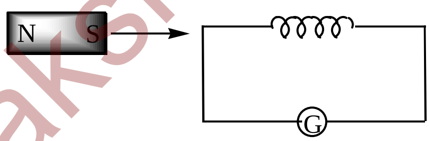


1) First clockwise then anticlockwise
2) In clockwise direction
3) In anticlockwise direction
4) First anticlockwise then clockwise

6. The current is flowing in two coaxial coils in the same direction. On increasing the distance between the two, the electric current in each coil will

1) Increase
2) Decrease
3) Remain uncharged
4) The information is incomplete

7. As shown in the figure, a magnet is moved with some speed towards a coil at rest. Due to this induced electromotive force, induced current and induced charges in the coil are E, I and Q respectively. If the speed of the magnet is doubled, the incorrect statement is



1) E increases
2) I increases
3) Q remains same
4) Q increases

8. 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

1) Clockwise
2) Zero
3) Counter clock wise
4) In a direction that depends on the ratio of the loop radii

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

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

2) The magnet moves with continuously decreasing velocity and ultimately comes to rest.

3) The magnet moves with continuosly increasing velocity but constant accelerating

4) The magnet moves with continuously increasing velocity and acceleration.

10. A magnet NS is suspended from a spring and while oscillates, the magnet moves in and out of the coil C. The coil is connected to a galvanometer G. Then as the magnet oscillates

1) G shows deflection to the left and right with constant amplitude

2) G shows deflection on one side

3) G shows no deflection

4) G shows deflection to the left and right but the amplitude steadily decreases.

11. An infinitely long cylinder is kept parallel to a uniform magnetic field B directed along positive z–axis. The direction of induced current as seen from the z axis will be

1) Clockwise of the +ve z axis
2) Anticlockwise of the +ve z axis
3) Zero
4) Along the magnetic field

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

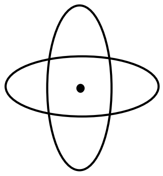
1) Is constant and is in the direction of the instaneous current

2) Is constant and is opposite to the direction of the instaneous current

3) Increases with time and is in the direction of the instaneous current

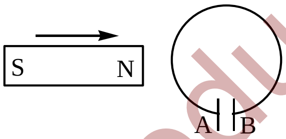
4) Increases with time and opposite to the direction of the instaneous current

13. Two coils of wires A and B are mutually at right angles to each other as shown in the figure. If the current in one coil is changed, then in the other coil



1) No current will be induced.
2) Current will be induced in clockwise direction.
3) Current will be induced in anti-clockwise direction.
4) Current will be induced depending on increasing or decreasing current.

14. In the given figure, the north pole of a magnet is brought towards a closed loop containing a condenser. Positive charge will be produced on

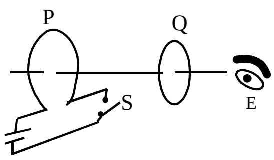


1) Plate A
2) Plate B
3) Both on plate A and plate B
4) Neither on plate A nor plate B

15. 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

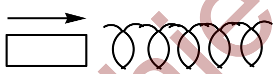
1) Remains stationary
2) Is attracted by the loop A
3) Is repelled by the loop A
4) Rotates about its centre of mass with centre of mass fixed

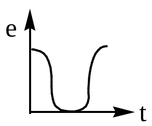
16. As shown in the figure, P and Q are two coaxial conducting loops seperated by some distance. When the switch S is closed a clockwise current Ip flows in P (as seen by E) and an induced current Iq1, flows in Q. The switch remains closed for a long time. When S is opened a current Iq2 flows in Q. Then the directions of Iq1 and Iq2 (as seen by E) are

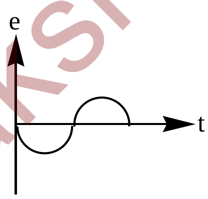


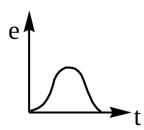
1) Respectively clockwise and Anti-clockwise
2) Both clockwise
3) Both Anti-clockwise
4) Respectively anti-clockwise and clockwise

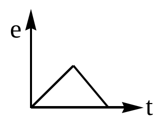
17. The variation of induced emf (e) with time (t) in a coil, if a short bar magnet is moved along its axis with a constant velocity is best represented as:



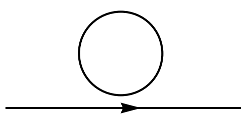
1) 

2) 

3) 

4) 

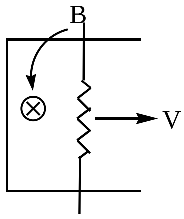
18. A current carrying wire is placed below a coil in its plane, with current flowing as shown. If the current increases



1) No current will be induced in the coil
2) An anticlockwise current will be induced in the coil
3) A clockwise current will be induced in the coil

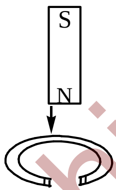
4) The current induced in the coil will be first anticlockwise and then clockwise

19. A conducting bar pulled with a constant speed v in a smooth conducting rail. The region has a steady magnetic field of induction B as shown in the figure. If the speed of the bar is doubled then the rate of heat dissipation will be



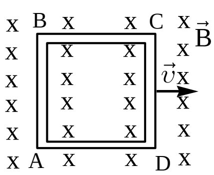
1) Constant
2) Quarter of the initial value
3) Four fold
4) Doubled

20. A magnet with its North Pole pointing down wards along the axis of an open ring as illustrated. As the magnet reaches close to the centre of the ring



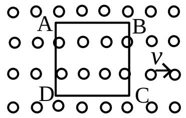
1) Its acceleration becomes greater than g
2) Its acceleration becomes less than g
3) Its acceleration remains equal to g
4) None of these

21. 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 field B constant in time and space, pointing perpendicular and into the plane of the loop exists everywhere. The current induced in the loop is



1) $\frac{Blv}{R}$ Clockwise
2) $\frac{Blv}{R}$ Anticlockwise
3) $\frac{2Blv}{R}$ Anticlockwise
4) Zero

22. 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 fig. An electric field is induced



1) In AD but not in BC
2) In BC but not in AD
3) Neither in AD nor in BC
4) In both AD and BC

23. A coil of 100 turns and area 5 square centimeter is placed in a magnetic field B = 0.2T. The normal to the plane of the coil makes an angle of 60^0 with the direction of the magnetic field. The magnetic flux linked with the coil is

1) 5×10^{-3} Wb 2) 5×10^{-5} Wb 3) 10^{-2} Wb 4) 10^{-4} Wb

24. A magnetic field of 2 x 10^{-2}T acts at right angles to a coil of area 100cm^2 with 50 turns. If the average emf induced in the coil is 0.1V when it is removed from the field in time t. The value of 't'is

1) 0.1s 2) 0.01s 3) 1s 4) 20s

25. The magnetic flux of 500 μ Wb passing through a 200 turn coil is reversed in 20x10^{-3} seconds. The average e.m.f. induced in the coil in volt is

1) 2.5 2) 5.0 3) 7.5 4) 10.0

26. 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 T The peak value of the emf generated is nearly

1) 786 kV 2) 440 kV 3) 220 kV 4) 157.1 kV

27. The wing span of an aero plane 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

1) 0.10 V 2) 0.15 V 3) 0.20 V 4) 0.30V

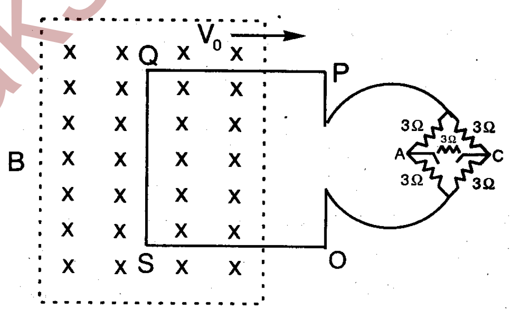
28. A copper disc of radius 0.1 m is rotated about its natural axis with 10 rps in a uniform magnetic field of 0.1 T with its plane perpendicular to the field. The emf induced across the radius of the disc is

1) $\pi\times10\,V$ 2) $2\pi\times10\,V$ 3) $\pi\times10^{-2}\,V$ 4) $2\pi\times10^{-2}\,V$

29. A wheel with 10 metallic spokes each 0.5m 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 G, the induced e.m.f. between the axle and the rim of the wheel equal to

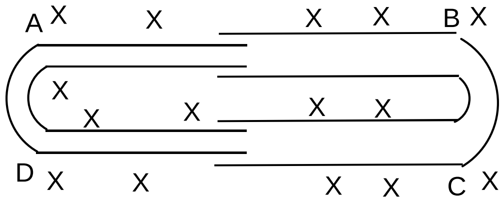
1) 1.256×10^{-3} V 2) 6.28×10^{-4} V 3) 1.256×10^{-4} V 4) 6.28×10^{-5}V

30. A square metal wire loop of side 10cm and resistance 1Ω is moved with a constant velocity v_0 in a uniform magnetic field of induction B = 2 Weber/m^2 as shown in the figure. The magnetic field lines are perpendicular to the plane of the loop (directed into the paper). The loop is connected to a network of resistors each of value 3Ω. The resistances of the lead wires OS and PQ are negligible. What should be the speed of the loop so as to have a steady current of 1 mA in the loop?



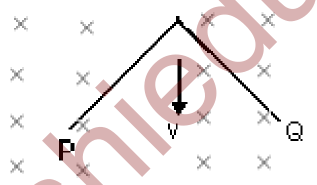
1) 0.02 m/s 2) 0.5 m/s 3) 2.5 m/s 4) 0.50 m/s

31. A conducting U–tube can slide inside another as shown in fig. maintaining electrical contacts between them. The magnetic field is perpendicular to plane of paper. If each tube move towards each other with constant speed υ, then emf induced in the circuit in terms of B, l and υ where l is the width of each tube.



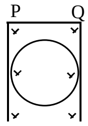
1) Zero 2) $2B\ell\upsilon$ 3) $B\ell\upsilon$ 4) $-B\ell\upsilon$

32. A wire of length '2l' is bent at mid point so that angle between the two halves is 60^0. If it moves as shown with velocity 'V' in a magnetic field 'B', the induced emf with be



1) Blv, P at high potential and Q at low potential
2) 2Blv, P at high potential and Q at low potential
3) Blv, Q at high potential and P at low potential
4) 2Blv, from Q at high potential and P at low potential.

33. A vertical ring of radius r and resistance R falls vertically. It is in contact with two vertical rails which are joined at the top. The rails are without friction and resistance. There is a horizontal uniform magnetic field of magnitude *B* perpendicular to the plane of the ring and the rails. When the speed of the ring is, the current in the section PQ is



1) Zero   2) $\frac{2Br\upsilon}{R}$ 3) $\frac{4Br\upsilon}{R}$ 4) $\frac{8Br\upsilon}{R}$

34. A thin circular ring of area A is held perpendicular to a uniform magnetic field of induction B. A small cut is made in the ring and a galvanometer is connected across the ends such that the total resistance of the circuit is R. When the ring is suddenly squeezed to zero area, the charge flowing through the galvanometer is

1) BR/A   2) BA/R   3) ABR   4) 2BA/R

35. Magnetic flux ϕ (in Weber) linked with a closed circuit of resistance 10 ohm varies with time t (in seconds) as $\phi = 5t^2 - 4t + 1$ the induced electromotive forc ein the circuit at t = 0.2 sec is

1) –19 V   2) – 1 V   3) 2 V   4) 10 V

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

1) $\frac{n(W_2 - W_1)}{5Rt}$ 2) $\frac{W_2 - W_1}{5Rnt}$ 3) $\frac{n(W_2 - W_1)}{Rt}$ 4) $\frac{(W_2 - W_1)}{nRt}$

37. 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 x 10^{-5} Wb/m^2. If he is running with rod in horizontal and vertical posistions, then the potential difference induced between the two ends of the rod in two cases will be

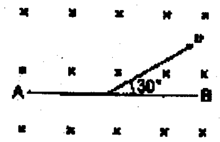
1) Zero in vertical position and $1X10^{-3}$ V in horizontal position

2) $1X10^{-3}$V in vertical position and zero in horizontal position

3) Zero in both the cases

4) $1X10^{-3}$ in both the cases

38. A conducting rod AB of length 1 = 1 m is moving at a velocity = 4 m/s making an angle 30^0 with its length. A uniform mangetic field B = 2T exists in a direction perpendicular to the plane of motion. Then

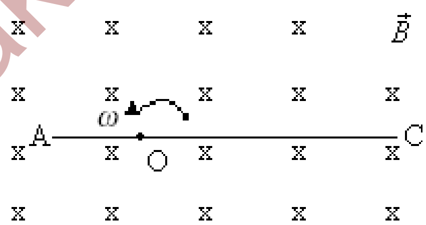


1) $V_A - V_B = 8V$ 2) $V_A - V_B = 4V$ 3) $V_B - V_A = 8V$ 4) $V_B - V_A = 4V$

39. A copper rod of mass m slides under gravity on two smooth parallel rails *l* distance apart and set at an angle θ to the horizontal. At the bottom, the rails are joined by a resistance R. There is a uniform magnetic field perpendicular to the plane of the rails. The terminal velocity of the rod is

1) $\frac{mgR\cos\theta}{B^2\ell^2}$ 2) $\frac{mgR\sin\theta}{B^2\ell^2}$ 3) $\frac{mgR\tan\theta}{B^2\ell^2}$ 4) $\frac{mgR\cot\theta}{B^2\ell^2}$

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



1) $V_A - V_0 = \frac{B\omega l^2}{2}$ 2) $V_0 - V_C = \frac{9}{2}B\omega l^2$ 3) $V_A - V_C = B\omega l^2$ 4) $V_A - V_C = \frac{9}{2}B\omega l^2$

Key

1) 2	2) 2	3) 2	4) 2	5) 3	6) 1	7) 4	8) 3	9) 1
10) 4	11) 3	12) 2	13) 1	14) 1	15) 3	16) 4	17) 2	18) 3
19) 3	20) 3	21) 4	22) 4	23) 1	24) 1	25) 4	26) 4	27) 1
28) 3	29) 4	30) 1	31) 2	32) 3	33) 4	34) 2	35)3	36)1
37) 2	38) 2	39) 2	40) 4					

Hints

23. $\phi = NBA\cos\theta$

$\phi = 100\times 0.2\times 5\times 10^{-4}\times\frac{1}{2}$

$\phi = 5\times 10^{-3}\ wb$

24. $e = \frac{NBA}{t}$

$0.1 = \frac{50\times 2\times 10^{-2}\times 100\times 10^{-4}}{t}$

t = 0.1 s

25. $e = \frac{2NBA}{t}$

$e = \frac{2 \times 200 \times 500 \times 10^{-6}}{20 \times 10^{-3}} = 10$ Volt

26. e = BAN ω ($\omega = 2\pi f$)

e = 0.2 x 0.25 x 10^{-6} x 5000 x 2 x 3.14 x 100

e = 157.1 x 10^{3} V = 157.1 kv

27. p. d = B l V

= 5 x 10^{-5} x 20 x 360 x $\frac{5}{18}$ = 0.1 volt.

28. $e = \frac{1}{2} Br^2 \omega \quad = \frac{1}{2} Br^2 2\pi f$

= 0.1 x 0.01 x π x 10 = π x10^{-2} volt

29. $e = \frac{1}{2} B\ell^2 \omega = \frac{1}{2} B\ell^2 \, 2\pi f$

e = 0.4 x 10^{-4} x 0.25 x 3.14 x $\frac{120}{60}$

e = 6.28 x 10^{-5} v

30. $e = i R = B \ell v$

1 x 10^{-3} x 4 = 2 x 10^{-1} v

v = 0.02 m/s

31. Induced emf is in same direction.

$\therefore e = e_1 + e_2$

$e = B\ell V + B\ell V = 2B\ell V$

32. $e = 2 B \ell V \sin 30$

$e = B \ell V$

Q at higher potential than P

33. $i = 4\frac{B\ell V}{R}$ but $\ell = 2r$

$\therefore i = \frac{8Brv}{R}$

34. $e = -\frac{B(A_2 - A_1)}{R}$

$e = \frac{BA}{R}$

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

$e = -\frac{d\phi}{dt} = -10t + 4$

But t = 0.2 so e = 2 volts.

36. $i = \frac{NBA}{(R_1 + R_2)t} = \frac{n(W_2 - W_1)}{5Rt}$

37. In vertical

$e = B_H \ell v$

$e = 4\times10^{-5}\times3\times30\times\frac{5}{18} = 10^{-3}$ V.

In horizontal $e = B_V l_V = 0$

38. $V_A - V_B = B\ell V sin\theta$

$= 2 \times 1 \times 4 \times \frac{1}{2} = 4$ volts.

39. $F_{up} = F_{down}$

$Bil \sin 90 = mg \sin\theta$

$B\left(\frac{1}{R}B\ell V\right)\ell = mg\sin\theta$

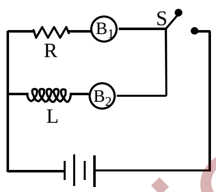
$$V = \frac{mg\,R\sin\theta}{B^2\ell^2}$$

40. $V_0 - V_C = \frac{1}{2}BL^2\omega$ $\qquad L = 3\ell$

$$V_0 - V_C = \frac{9}{2}B\,\ell^2\,\omega$$

Self and Mutual Induction

1. The adjoining figure shows two bulbs B_1 and B_2 resistor R and an inductor L. When the switch S is turned off



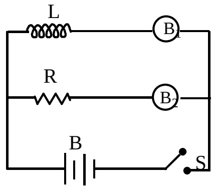
1) Both B_1 and B_2 die out promptly

2) Both B_1 and B_2 die out with some delay

3) B_1 dies out promptly but B_2 with some delay

4) B_2 dies out promptly but B_1 with some delay

2. 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?



1) The bulb B_2 lights up earlier than B_1 and finally both the bulbs shine equally bright

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

3) B_2 lights up earlier and finally B_1 shines brighter than B_2

4) B_1 and B_2 light up together with equal brigtness all the time

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

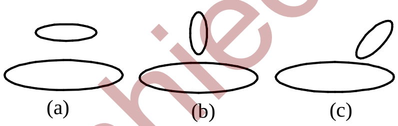
1) The currents in the two coils.

2) The rates at which the currents are changing in the two coils.

3) Relative position and orientation of the two coils.

4) The materials of the wires of the coils.

4. Two circular coils can be arranged in any of the three situations shown in the figure. Their mutual inductance will be



1) Maximum in situation (a)

2) Maximum in situation (b)

3) Maximum in situation (c)

4) The same in all situations

5. A coil of self-inductance L is placed in an external magnetic field (no current flows in the coil). The total magnetic flux linked with the coil is ϕ. The magnetic field energy stored in the coil is

1) Zero

2) $\frac{\phi^2}{2L}$

3) $\frac{\phi^2}{L}$

4) $\frac{2\phi^2}{L}$

6. [A]: Self inductance of a coil depends on area of cross section of the coil.

[R]: A system cannot have mutual Inductance without having self inductance.

1) Both Assertion and Reason are true and Reason is correct explanation of Assertion.

2) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

3) Assertion is true but Reason is false.

4) Both Assertion and Reason are false.

7. [A]:Mutual inductance between two coils depends on distance between the coils.

[R]:Mutual inductance between two coils depends on geometric shape of the coils.

1) Both Assertion and Reason are true and Reason is correct explanation of Assertion.

2) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

3) Assertion is true but Reason is false.

4) Both Assertion and Reason are false.

8. [A]:Mutual inductance between two circular coils is maximum when angle between the axis of the coils is 0°.

[R]:Mutual inductance between two circular coils is independent of the medium between the two coils.

1) Both Assertion and Reason are true and Reason is correct explanation of Assertion.

2) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

3) Assertion is true but Reason is false.

4) Both Assertion and Reason are false.

9. [A]: Self inductance of the coil is proportional to the current passing through it.

[R]: An inductance is said to be ideal if it has no resistance.

1) Both Assertion and Reason are true and Reason is correct explanation of Assertion.

2) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

3) Assertion is true but Reason is false.

4) Assertion is false but Reason is true.

10. [A]:Mutual inductance between two coils depends on the current passing through the primary coil.

[R]:When a steady current is passing through the spiral coil its self inductance is zero.

1) Both Assertion and Reason are true and Reason is correct explanation of Assertion.

2) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

3) Assertion is true but Reason is false.

4) Both Assertion and Reason are false.

11. [A]: Self inductance of a straight conductor is zero.

[R]: The role of self-inductance in a circuit is equivalent to Inertia.

1) Both Assertion and Reason are true and Reason is correct explanation of Assertion.

2) Both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

3) Assertion is true but Reason is false.

4) Both Assertion and Reason are false.

12. An e.m.f of 5 volt is produced by a self inductance, when the current changes at a steady rate from 3A to 2A in 1 millisecond. The value of self inductance is

1) Zero 2) 5H 3) 5000H 4) 5 mH

13. If a change in current of 0.01A in one coil produces a change in magnetic flux of $2x10^{-2}$ Weber in the other coil, then the mutual inductance of the two coils in henry is

1) 0 2) 0.5 3) 2 4) 3

14. A 50 mH coil carries a current of 2 ampere. The energy stored in joules is

1) 1 2) 0.1 3) 0.05 4) 0.5

15. 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 transformers are made 10 and 5 respectively. The mutual inductance of the transformer (in Henry) will be:

1) 6.25 2) 12.5 3) 25 4) 50

16. A small square loop of wire of each side *l* is kept inside a large square loop of wire of each side 'L' (L > > *l*). The loops are coplanar and their centers coincide. The mutual inductance of the system is proportional to (current i in the outer loop)

1) l/L 2) $\frac{l^2}{L}$ 3) L/l 4) $\frac{L^2}{l}$

17. Two different coils have self - inductances L_1 = 8 mH and L_2 = 2 mH. The current in one coil is also increased at the same constant rate. At a certain instant of time, the power given to the two coils is the same. At the time, the current, the induced voltage and he energy stored in the first coil are i_1, V_1 and W_1 respectively. Corresponding values for the second coi at the same instant are i_1, V_2 and W_2 respectively. Then

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

1) a, d are true 2) c, d are true 3) a, c, d are true 4) Only b is true

KEY

1) 3 2) 3 3) 3 4) 1 5) 2 6) 2 7) 2 8) 3 9) 4 10) 4

11) 2 12) 4 13) 3 14) 2 15) 3 16) 2 17) 3

HINTS

12. $e=-L\frac{di}{dt}$

$5=-L\frac{(2-3)}{10^{-3}} \Rightarrow L=5\times10^{-3}H$

L = 5 mH.

13. $\phi = Mi$

2 x 10^{-2} = M x 0.01

M = 2H

14. U = $\frac{1}{2}Li^2$

$=\frac{1}{2}\times50\times10^{-3}\times4=0.1J$

15. $e \propto N_1N_2$

So remains constant.

16. $B \propto \frac{\ell^2}{L}$

17. $\frac{i_1}{i_2} = \frac{e_2}{e_1}, \frac{e_1}{e_2} = \frac{L_1}{L_2}$ and $U = \frac{1}{2} L i^2$

So a, c, d are true.

Application of EMI (Motor, Dynamo, Transformer)

1. Use of eddy currents is used in the following except

(a) Moving Coil Galvanometer

(b) Electric Brakes

(c) Induction Motor

(d) Dynamo

2. Which of the following is constructed on the principle of electromagnetic induction?

(a) Galvanometer (b) Electric motor

(c) Generator (d) Voltmeter

3. A transformer is based on the principle of

(a) Mutual Inductance (b) Self Inductance

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

4. The core of a transformer is laminated to reduce energy losses due to

(a) Eddy Currents (b) Hysteresis (c) Resistance in Winding (d) None of these

5. The device that does not work on the principle of mutual induction is

(a) Induction Coil (b) Motor

(c) Tesla Coil (d) Transformer

6. Eddy currents are produced when

(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

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

(a) dc

(b) ac

(c) Fluctuating dc

(d) Half-wave rectified voltage

8. 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.

9. Dynamo core is laminated because

(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

10. 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

(a) 786 kV (b) 440 kV

(c) 220 kV (d) 157.1 kV

11. A transformer is employed to

(a) Obtain a suitable dc voltage (b) Convert dc into ac

(c) Obtain a suitable ac voltage (d) Convert ac into dc

12. What is increased in step-down transformer?

(a) Voltage (b) Current

(c) Power (d) Current density

13. The core of a transformer is laminated so that

(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

14. 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

(a) 200 (b) 100

(c) 50 (d) 20

15. 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

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

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

16. 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

(a)1600 A (b) 20 A

(c) 4 A (d) 1.5 A

17. 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

(a) 1 amp (b) 4 amp

(c) 8 amp (d) 16 amp

18. 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

(a) 100 A (b) 200 A

(c) 22 A (d) 11 A

19. Induction furnaces work on the principle of

(a) Self induction

(b) Mutual induction

(c) Eddy currents

(d) Hysteresis

20. A transformer changes 220V to 22V. If the current in the primary and secondary coils are 10A and 70A respectively then its efficiency will be

(a) 70% (b) 20 % (c) 30% (d) 80%

KEY

1) d	2)c	3)a	4)a	5)c	6)a	7)c	8)d	9)d	10) d
11) c	12) b	13) c	14) a	15) a	16) c	17) a	18) a	19) c	20) a

HINTS

14. $\frac{V_p}{V_s} = \frac{N_p}{N_s} \Rightarrow N_p = \left(\frac{220}{2200}\right)2000 = 200$

17. For 100% efficient transformer

$$V_s i_s = V_p i_p \Rightarrow \frac{V_s}{V_p} = \frac{i_p}{i_s} = \frac{N_s}{N_p} \Rightarrow \frac{i_p}{4} = \frac{25}{100} \Rightarrow i_p = 1\ A$$

18. $\frac{V_s}{V_p} = \frac{i_p}{i_s} \Rightarrow i_p = \frac{11000 \times 2}{220} = 100\ A$

20. $\eta = \frac{P_2}{P_1} \times 100 = \frac{V_2 i_2}{V_1 i_1} \times 100 = \frac{22 \times 70}{220 \times 10} \times 100 = 70\%$