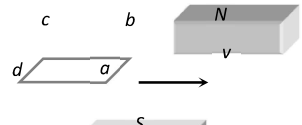
GPLUS EDUCATION

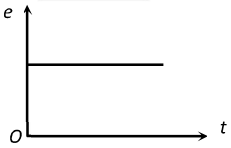
Date :
Time : **PHYSICS**
Marks :

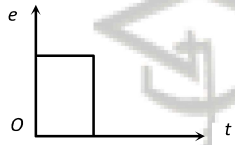
ELECTROMAGNETIC INDUCTION

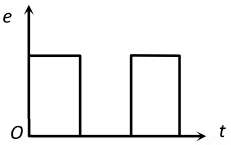
Single Correct Answer Type

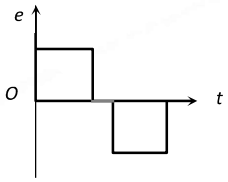
1. A wire of length 1 m is moving at a speed of $2ms^{-1}$ perpendicular to its length and in a homogenous magnetic field of 0.5 T. The ends of the wire are joined to a circuit of resistance 6 Ω. The rate at which work is being done to keep the wire moving at constant speed is
   a) $\frac{1}{12}\ W$ b) $\frac{1}{6}\ W$ c) $\frac{1}{3}\ W$ d) $1W$
2. A horizontal loop $abcd$ is moved across the pole pieces of a magnet as shown in fig. with a constant speed v. When the edge ab of the loop enters the pole pieces at time $t = 0\ sec$, which one of the following graphs represents correctly the induced emf in the coil



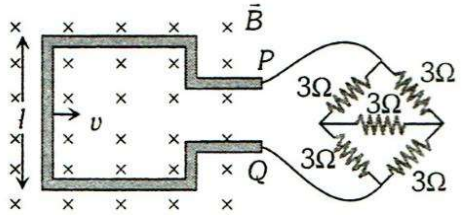
a) 

b) 

c) 

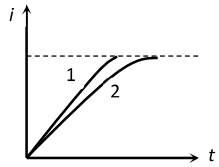
d) 

3. 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
   a) 50 V b) 70 V c) 100 V d) 40 V
4. Which of the following is not an application of eddy currents
   a) Induction furnace b) Galvanometer damping
   c) Speedometer of automobiles d) X-ray crystallography
5. Induced emf in the coil depends upon
   a) Conductivity of coil b) Amount of flux
   c) Rate of change of linked flux d) Resistance of coil
6. 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 steady current of $1mA$ in loop



   a) 1 cm/sec b) 2 cm/sec c) 3 cm/sec d) 4 cm/sec
7. When a certain circuit consisting of a constant e.m.f. E, an inductance L and a resistance R is closed, the current in it increases with time according to curve 1. After one parameter (E, L or R) is changed, the increase in current follows curve 2 when the circuit is closed second time. Which parameter was changed and in

what direction

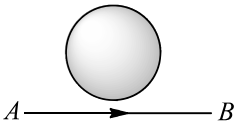


a) L is increased b) L is decreased c) R is increased d) R is decreased

8. The average power dissipation in pure inductance is

a) $\frac{1}{2}LI^2$ b) $2LI^2$ c) $\frac{1}{4}LI^2$ d) Zero

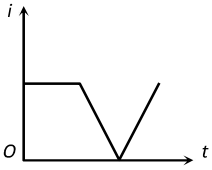
9. The current from A to B is increasing in magnitude. What is the direction of induced current, if any, in the loop shown in figure.



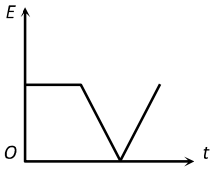
a) No current is induced b) Clock-wise current

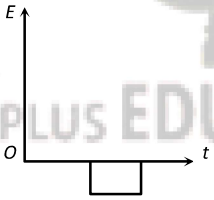
c) Anti-clock-wise current d) Alternating current

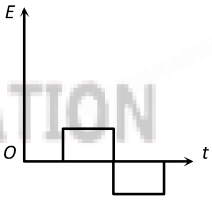
10. The current i in an induction coil varies with time t according to the graph shown

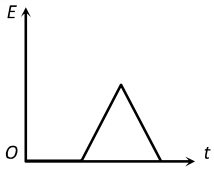


in figure. Which of the following graphs shows the induced emf (e) in the coil with time

a) 

b) 

c) 

d) 

11. A step-down transformer reduces the voltage of a transmission line from 2200 V to 220 V. The power delivered by it is 880 W and its efficiency is 88%. The input current is

a) 4.65 mA b) 0.045 A c) 0.45 A d) 4.65 A

12. A conducting wire is dropped along east-west direction, then

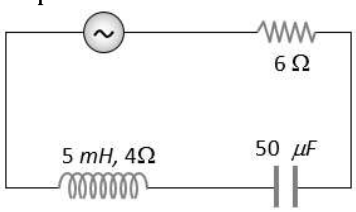
a) No emf is induced b) No induced current flows

c) Induced current flows from west to east d) Induced current flows from east to west

13. 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) $e = N\frac{d\phi}{dt}$

14. In the circuit shown below, the ac source has voltage $V = 20\cos(\omega t)$ volts with $\omega = 2000\ rad/sec$. The amplitude of the current will be nearest to



a) First clockwise then anticlockwise

b) In clockwise direction

c) In anticlockwise direction
d) First anticlockwise then clockwise

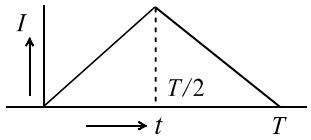
15. A motor having an armature of resistance 2Ω is designed to operate at 220 V mains. At full speed, it develops a back e.m.f. of 210 V. When the motor is running at full speed, the current in the armature is
a) $5A$ b) $105A$ c) $110A$ d) $215A$

16. 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
a) 120 V b) 80 V c) 200 V d) 300 V

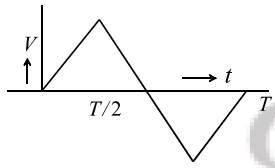
17. The time constant of an LR circuit represents the time in which the current in the circuit
a) Reaches a value equal to about 37% of its final value
b) Reaches a value equal to about 63% of its final value
c) Attains a constant value
d) Attains 50% of the constant value

18. A conducting circular loop is placed in a uniform magnetic field of induction B tesla with its plane normal to the field. Now, the radius of the loop starts shrinking at the rate $\left(\frac{dr}{dt}\right)$. Then, the induced emf at the instant when the radius is r,is
a) $\pi rB\left(\frac{dr}{dt}\right)$ b) $2\pi rB\left(\frac{dr}{dt}\right)$ c) $\pi r^2\left(\frac{dB}{dt}\right)$ d) $\left(\frac{\pi r^2}{2}\right)B\left(\frac{dr}{dt}\right)$

19. The current (I) in the inductance is varying with time according to the plot shown in figure



Which one of the following is the correct variation of voltage with time in the coil

a)


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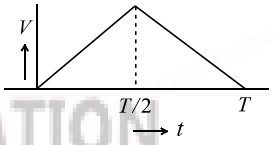

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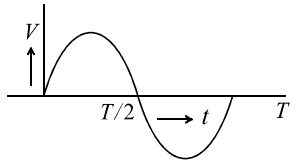

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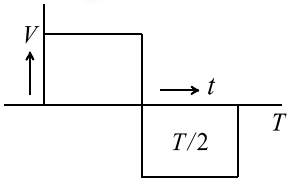


20. A transformer has 100 turns in the primary coil and carries 8 A current. If input power is one kilowatt, the number of turns required in the secondary coil to have 500V output will be
a) 100 b) 200 c) 400 d) 300

21. A circular coil of mean radius of 7 cm and having 400 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
a) 1.158 V b) 0.58 V c) 0.29 V d) 5.8 V

22. Consider the statements:
(I)If magnetic field, **B** =0, then magnetic flux is also zero.
(II)If magnetic flux, $\phi = 0$,then magnetic field is also zero.
a) (I)is true , (II) may be true
b) Both (I) and (II) are true
c) (I) may be true, (II) is true
d) (I) and (II) both are false

23. A circular coil and a bar magnet placed near by are made to move in the same direction. The coil covers a distance of 1 m in 0.5 sec and the magnet a distance of $2m$ in 1 sec. The induced emf produced in the coil
a) Zero
b) 1 V
c) 0.5 V
d) Cannot be determined from the given information

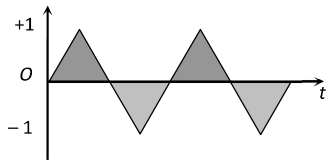
24. A cylindrical bar magnet is kept along the axis of a circular coil. If the magnet is rotated about its axis, then

a) A current will be induced in a coil
b) No current will be induced in a coil
c) Only an e.m.f. will be induced in the coil
d) An e.m.f and a current both will be induced in the coil

25. When power is drawn from the secondary coil of the transformer, the dynamic resistance
a) Increases b) Decreases c) Remains unchanged d) Changes erratically

26. 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
a) $2500V$ b) $25000V$ c) $2510V$ d) Zero

27. An alternating current of frequency 200 rad/sec peak value $1A$ as shown in the figure, is applied to the primary of a transformer. If the coefficient of mutual induction between the primary and the secondary is $1.5H$, the voltage induced in the secondary will be



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

28. 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
a) Zero b) $\frac{E}{R}$ c) $\frac{E}{L}$ d) $\frac{E}{\sqrt{L^2+R^2}}$

29. Current in a coil changes from 5 A to 10 A in 0.2 s. If the coefficient of self-induction is 10 H, then the induced emf is
a) 112 V b) 250 V c) 125 V d) 230 V

30. Choke coil works on the principle of
a) Transient current b) Self induction c) Mutual induction d) Wattless current

31. If rotational velocity of a dynamo armature is doubled, then induced e.m.f. will become
a) Half b) Two times c) Four times d) Unchanged

32. The particle accelerator that uses the phenomenon of electromagnetic induction is the
a) Cyclotron
b) Betatron
c) Van de Graff generator
d) Cockroft- Walton generator

33. The direction of induced current is such that it opposes the very cause that has produced it. This is the law of
a) Lenz b) Faraday c) Kirchhoff d) Fleming

34. In an AC generator, a coil with N turns, all of the same area A and total resistance R, rotates with frequency ω in a magnetic field B. The maximum value of emf generated in the coil is
a) $NABR\omega$ b) NAB c) $NABR$ d) $NAB\omega$

35. 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

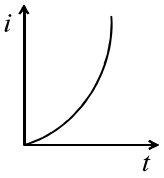
36. In a transformer 220 ac voltage is increased to 2200 $volts$. If the number of turns in the secondary are 2000, then the number of turns in the primary will be
a) 200 b) 100 c) 50 d) 20

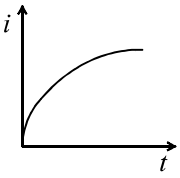
37. The coils of a step down transformer have 500 and 5000 turns. In the primary coil an ac of 4 $ampere$ at 2200 $volts$ is sent. The value of the current and potential difference in the secondary coil will be
a) 20 A, 220 V b) 0.4 A, 22000 V c) 40 A, 220 V d) 40 A, 22000 V

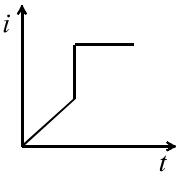
38. A coil is suspended in a uniform magnetic field, with the plane of the coil parallel to the magnetic lines of force. When a current is passed through the coil it starts oscillating; it is very difficult to stop. But if an

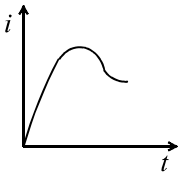
aluminium plate is placed near to the coil, it stops. This is due to
a) Development of air current when the plate is placed
b) Induction of electrical charge on the plate
c) Shielding of magnetic lines of force as aluminium is a paramagnetic material
d) Electromagnetic induction in the aluminium plate giving rise to electromagnetic damping

39. When a battery is connected across a series combination of self inductance L and Resistance R, the variation in the current i with time t is best represented by

a) 

b) 

c) 

d) 

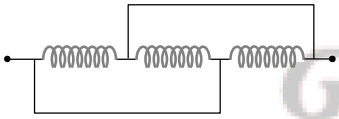
40. A wire of length 50 cm moves with a velocity of 300 m-min^{-1}, perpendicular to a magnetic field. If the emf induced in the wire is 2 V, the magnitude of the field in telsa is
a) 2 b) 5 c) 0.4 d) 0.8

41. The direction of induced e.m.f. during electromagnetic induction is given by
a) Faraday's law b) Lenz's law c) Maxwell's law d) Ampere's law

42. 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
a) 10 $volt$ b) 0.10 $volt$ c) 1.0 $volt$ d) 100 $volt$

43. An infinitely cylinder is kept parallel to an uniform magnetic field B directed along positive z axis. This direction of induced current as seen from the z axis will be
a) Clockwise of the +ve z axis b) Anticlockwise +ve z axis
c) Zero d) Along the magnetic field

44. Pure inductance of 3.0 H is connected as shown below. The equivalent inductance of the circuit is



a) 1 H b) 2 H c) 3 H d) 9 H

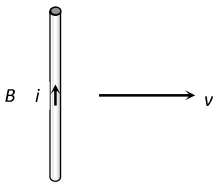
45. A coil of 100 $turns$ and area 5 $square\ centimeter$ is placed in a magnetic field B $=$ 0.2 T. The normal to the plane of the coil makes an angle of 60° with the direction of the magnetic field. The magnetic flux linked with the coil is
a) $5 \times 10^3\ Wb$ b) $5 \times 10^{-5} Wb$ c) $10^{-2} Wb$ d) $10^{-4} Wb$

46. 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)
a) 0.63 I_0 b) 0.50 I_0 c) 0.37 I_0 d) I_0

47. 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 conditions is correct
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

48. An AC generator of 220 V having internal resistance $r = 10\ \Omega$ and external resistance $R = 100\ \Omega$. What is the power developed in the external circuit
a) 484 W b) 400 W c) 441 W d) 369 W

49. 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



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

50. A square loop of wire, side length 10 cm is placed at angle of 45° with a magnetic field that changes uniformly from 0.1 T to zero in 0.7 s. The induced current in the loop (its resistance is 1 Ω)is
a) 1.0 mA b) 2.5 mA c) 3.5 mA d) 4.0 mA

51. 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
a) $1.256 \times 10^{-3} V$ b) $6.28 \times 10^{-4} V$ c) $1.256 \times 10^{-4} V$ d) $6.28 \times 10^{-5} V$

52. Which type of losses donot occur in the transformer?
a) Iron losses b) Copper losses c) Mechanical losses d) Flux leakage

53. An 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
a) 20% b) 40% c) 70% d) 90%

54. The momentum in mechanics is expressed as $m \times V$. The analogous expression in electricity is
a) $i \times Q$ b) $i \times V$ c) $L \times i$ d) $L \times Q$

55. The equivalent inductance of two inductance is 2.4 $henry$ when connected in parallel and 10 $henry$ when connected in series. The difference between the two inductances is
a) 2 $henry$ b) 3 $henry$ c) 4 $henry$ d) 5 $henry$

56. There is a uniform magnetic field directed perpendicular and into the plane of the paper. An irregular shaped conducting loop is slowly changing into a circular loop in the plane of the paper. Then
a) Current is induced in the loop in the anticlockwise direction
b) Current is induced in the loop in the clockwise direction
c) AC is induced in the loop
d) No current is induced in the loop

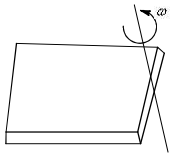
57. Lenz's law applies to
a) Electrostatics b) Lenses
c) Electro-magnetic induction d) Cinema slides

58. A coil of resistance 10 Ω and an inductance 5H is connected to a 100 $volt$ battery. Then energy stored in the coil is
a) 125 erg b) 125 J c) 250 erg d) 250 J

59. When the current changes from +2 A to -2 A in 0.05 s, an emf of 8 V is induced in a coil. The coefficient of self-induction of the coil is
a) 0.2 H b) 0.4 H c) 0.8 H d) 0.1 H

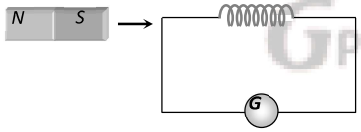
60. Magnetic flux linked with a coil is $\phi = 5t^2 + 2t + 3$, where $t$is second and ϕ is in weber. At time t=1 s, the value of induced emf in volt
a) 14 b) 1.2 c) 12 d) 6

61. A horizontal rod of length L rotates about a vertical axis with a uniform angular velocity ω. A uniform magnetic field B exists parallel to the axis of rotation. Then potential difference between the to ends of the rod is

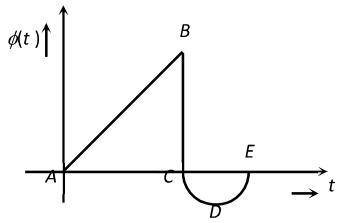


a) $\omega L^2 B$ b) $\omega^2 LB$ c) $\frac{1}{2}\omega L^2 B$ d) $\frac{1}{2}\omega^2 LB$

62. Which of the following is a wrong statement
    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
63. A transformer rated at 10k W is used to connect a 5 kV transmission line to a 240 V circuit. The ratio of turns in the windings of the transformer is
    a) 5 b) 20.8 c) 104 d) 40
64. 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
    a) $\frac{3A_0B_0}{t}$ b) $\frac{4A_0B_0}{t}$ c) $\frac{3B_0}{A_0t}$ d) $\frac{4B_0}{A_0t}$
65. If a charge 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 henry is
    a) 0 b) 0.5 c) 1.2 d) 3
66. 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



a) E increases b) I increases c) Q remains same d) Q increases
67. 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
68. A coil having 500 square loops each of side 10 cm is placed normal to a magnetic field which increases at the rate of 1 Wm^{-2}. The induced emf is
    a) 0.1 V b) 5.0 V c) 0.5 V d) 1.0 V
69. A coil and a bulb are connected in series with a dc source, a soft iron core is then inserted in the coil. Then
    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
70. The north pole of a long bar magnet was pushed slowly into a short solenoid connected to a galvanometer. The magnet was held stationary for a few seconds with the north pole in the middle of the solenoid and then withdrawn rapidly. The maximum deflection of the galvanometer was observed when the magnet was
    a) Moving towards the solenoid b) Moving into the solenoid
    c) At rest inside the solenoid d) Moving out of the solenoid
71. The graph shows the variation in magnetic flux $\phi(t)$ with time through a coil. Which of the statements given below is not correct



a) There is a change in the direction as well as magnitude of the induced emf between B and D
b) The magnitude of the induced emf is maximum between B and C
c) There is a change in the direction as well as magnitude of induced emf between A to C
d) The induced emf is not zero at B

72. Coefficient of coupling between two coils of self-inductances L_1 and L_2 is unity. It means
a) 50% flux of L_1 is linked with L_2 b) 100% flux of $L_1$is linked with L_2
c) $\sqrt{L_1}$ time of flux of L_1 is linked with L_2 d) None of the above

73. A small piece of metal wire is dragged across the gap between the pole pieces of a magnet in 0.5 second. The magnetic flux between the pole pieces is known to be $8 \times 10^{-4} Wb$. The emf induced in the wire is
a) 16 mV b) 1.6 V c) 1.6 mV d) 16 V

74. 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
a) 2.5 H b) 25 H c) 400 H d) 40 H

75. The magnetic flux linked with the coil varies with time as $\phi = 3t^2 + 4t + 9$. the magnitude of the induced emf at 2 s is
a) 9 V b) 16 V c) 3 V d) 4 V

76. A power transformer is used to step up an alternating e.m.f. of 220 V to 11 kV to transmit 4.4 kW of power. If the primary coil has 1000 turns, what is the current rating of the secondary? Assume 100% efficiency for the transformer
a) 4 A b) 0.4 A c) 0.04 A d) 0.2 A

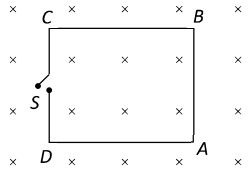
77. A rectangular loop of sides 10 cm and 5 cm with a cut is stationary between the pole pieces of an electromagnet. The magnetic field of the magnet is normal to the loop. The current feeding the electromagnet is reduced so that the field decreased from its initial value of 0.3 T at the rate of 0.02 Ω. If the cut is joined and the loop has a resistance of 2.0 Ω, the power dissipated by the loop as heat is
a) 5 nW b) 4 nW c) 3 nW d) 2 nW

78. Two coils are placed close to each other. The mutual inductance of the pair of coils depends upon
a) The rates at which currents are changing in the two coils
b) Relative position and orientation of the two coils
c) The materials of the wires of the coils
d) The currents in the two coils

79. 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
a) 0.05 mH b) 0.10 mH c) 0.15 mH d) 0.20 mH

80. A transformer works on the principle of
a) Magnetic effect of the electrical current b) Mutual induction
c) Electrical inertia d) Self induction

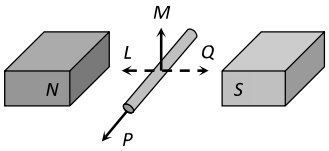
81. The magnetic field in the cylindrical region shown in figure increases at a constant rate of 20 mT/sec. Each side of the square lop $ABCD$ has a length of 1 cm and resistance of 4Ω. Find the current in the wire AB if the switch S is closed



a) 1.25×10^{-7} A, (anti-clockwise) b) 1.25×10^{-7} A, (clockwise)
c) 2.5×10^{-7} A, (anti-clockwise) d) 2.5×10^{-7} A, (clockwise)

82. A boat is moving due east in a region where the earth's magnetic field is 5.0×10^{-5} $NA^{-1}m^{-1}$ due north and horizontal. The boat carries a vertical aerial 2 m long. If the speed of the boat is $1.50ms^{-1}$, the magnitude of the induced emf in the wire of aerial is
a) 0.75 mV b) 0.50 mV c) 0.15 mV d) 1 mV

83. An electric potential difference will be induced between the ends of the conductor shown in the diagram, when the conductor moves in the direction



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

84. The inductance of a solenoid 0.5 m long of cross-sectional area 20 cm^2 and with 500 turns is
a) 12.5 mH b) 1.25 mH c) 15.0 mH d) 0.12 mH

85. In L-R circuit, for the case of increasing current, the magnitude of current can be calculated by using the formula
a) $I = I_0 e^{-Rt/L}$ b) $I = I_0(1 - e^{-Rt/L})$ c) $I = I_0(1 - e^{Rt/L})$ d) $I = I_0 e^{Rt/L}$

86. 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

87. An axle of truck is 2.5 m long. If the truck is moving due north at 30 ms^{-1} at a place where the vertical component of the earth's magnetic field is 90μT, the potential difference between the two ends of the axle is
a) 6.75 mV with west end positive b) 6.75 mV with east end positive
c) 6.75 mV with north end positive d) 6.75 mV with south end positive

88. The current is flowing in two coaxial coils in the same direction. On increasing the distance between the two, the electric current will
a) Increase b) Decrease
c) Remain unchanged d) The information is incomplete

89. 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
a) 0.15 s b) 0.3 s c) 0.05 s d) 0.1 s

90. A conducting ring of radius 1 $meter$ is placed in an uniform magnetic field B of $0.01telsa$ oscillating with frequency $100Hz$ with its plane at right angles to B. What will be the induced electric field
a) π $volt/m$ b) 2 $volt/m$ c) 10 $volt/m$ d) 62 $volt/m$

91. Mutual inductance of two coils can be increased by
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

92. According to phenomenon of mutual inductance
a) The mutual inductance does not dependent on geometry of the two coils involved
b) The mutual inductance depends on the intrinsic magnetic property , like relative permeability of the material
c) The mutual inductance is independent of the magnetic property of the material

d) Ratio of magnetic flux produced by the coil 1 at the place of the coil 2 and the current in the coil 2 will be different from that of the ratio defined by interchanging the coils

93. 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

a) $\frac{1}{4}L$ b) L c) $4\,L$ d) $16\,L$

94. A copper disc of radius 0.1 m is rotated about its centre with 20 rev $-$ s^{-1} 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

a) $\frac{\pi}{20}$V b) $\frac{\pi}{10}$V c) 20π mV d) 10π mV

95. 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 $\omega = 100\pi\ radian/sec$. The maximum value of e.m.f. in the second coil is

a) 2π b) 5π c) π d) 4π

96. If a copper ring is moved quickly towards south pole of a powerful stationary bar magnet, then

a) Current flows through the copper ring b) Voltage in the magnet increase
c) Current flows in the magnet d) Copper ring will get magnetised

97. To induce an e.m.f. in a coil, the linking magnetic flux

a) Must decrease b) Can either increase or decrease
c) Must remain constant d) Must increase

98. The two rails of a railway track insulated from each other and the ground are connected to a milli-voltmeter. What is the reading of the mV, when a train travels at a speed of 180 kmh^{-1} along the track, given that the horizontal components of earth's magnetic field is 0.2×10^{-4} Wbm^{-2} and the rails are separated by 1 m

a) 10^{-2} mV b) 10 mV c) 100 mV d) 1 m V

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

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

100. The self-inductance of the motor of an electric fan is 10 H. In order to impart maximum power at 50 Hz, it should be connected to a capacitance of

a) 4 μF b) 8 μF c) 1 μF d) 2 μF

101. A horizontal straight wire 10 m long extending from east to west is falling with a speed of 5.0 ms^{-1}, at right angles to the horizontal component of the earth's magnetic field of strength $0.30 \times 10^{-4} Wbm^{-2}$. the instantaneous value of the induced potential gradient in the wire, from west to east, is

a) $+1.5 \times 10^{-3}$ Vm^{-1} b) -1.5×10^{-3} Vm^{-1} c) $+1.5 \times 10^{-4}$ Vm^{-1} d) -1.5×10^{-4} Vm^{-1}

102. 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) $\frac{B}{A}$

103. 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

a) 0.08 V b) 0.14 V c) 0.35 V d) 0.07 V

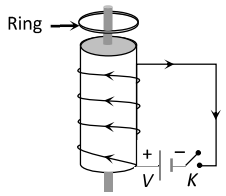
104. The self inductance of a solenoid of length L, area of cross-section A and having N turns is

a) $\frac{\mu_0 N^2 A}{L}$ b) $\frac{\mu_0 NA}{L}$ c) $\mu_0 N^2 LA$ d) $\mu_0 NAL$

105. 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 the beginning and then more than g

106. 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

107. When a rod of length l is rotated with angular velocity of ω in a perpendicular field of induction B, about one end, the emf across its ends is
a) $Bl^2\omega$ b) $\frac{Bl^2\omega}{2}$ c) $Bl\omega$ d) $\frac{Bl\omega}{2}$

108. Fan is based on
a) Electric Motor b) Electric dynamo c) Both d) None of these

109. The number of turns of primary and secondary coils of a transformer are 5 and 10 respectively and the mutual inductance of the transformer is 25 *henry*. Now the number of turns in the primary and secondary of the transformer are made 10 and 5 respectively. The mutual inductance of the transformer in *henry* will be
a) 6.25 b) 12.5 c) 25 d) 50

110. 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

111. If the current is halved in a coil, then the energy stored is how much times the previous value
a) $\frac{1}{2}$ b) $\frac{1}{4}$ c) 2 d) 4

112. A 50 mH coil carries a current of 2 A, the energy stored in joule is
a) 1 b) 0.05 c) 10 d) 0.1

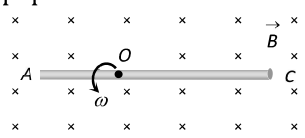
113. A coil has an area of 0.05 m^2 and it has 800 turns. It is placed perpendicularly in a magnetic field of strength $4 \times 10^{-5} Wb/m^2$, it is rotated through 90° in 0.1 *sec*. The average e.m.f. induced in the coil is
a) 0.056 V b) 0.046 V c) 0.026 V d) 0.016 V

114. A cylindrical bar magnet is kept along the axis of a circular coil. The magnet is rotated about its axis such that north pole faces the coil. The induced current in the coil
a) Is zero
b) Is clock-wise from magnet side
c) May be clock-wise or anti clock wise
d) Is anti-clock-wise from magnet side

115. A circular wire of radius r rotates about its own axis with angular speed ω in a magnetic field B perpendicular to its plane, then the induced emf is
a) $\frac{1}{2}Br\omega^2$ b) $Br\omega^2$ c) $2Br\omega^2$ d) Zero

116. Which of the following phenomena is utilised in the construction of mouth piece of a telephone now a days?
a) Thermo electric effect
b) Photo electric effect
c) Change of resistance with pressure
d) Electromagnetic induction

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

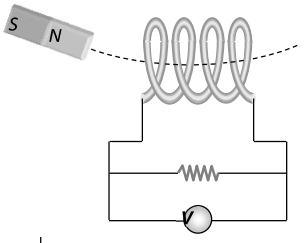


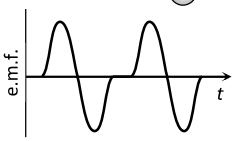
a) $V_A - V_O = \frac{B\omega l^2}{2}$ b) $V_O - V_C = \frac{7}{2}B\omega l^2$ c) $V_A - V_C = 4\,B\omega l^2$ d) $V_C - V_O = \frac{9}{2}B\omega l^2$

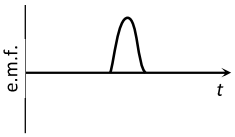
118. The north pole of a long horizontal bar magnet is being brought closer to a vertical conducting plane along the perpendicular direction. The direction of the induced current in the conducting plane will be
a) Horizontal b) Vertical c) Clockwise d) Anticlockwise

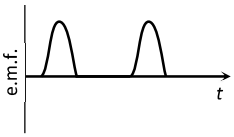
119. A varying current at the rate of 3 A/s in a coil generates an e.m.f. of 8 mV in a nearby coil. The mutual inductance of the two coils is
a) 2.66 mH b) $2.66 \times 10^{-3} mH$ c) 2.66 H d) 0.266 H

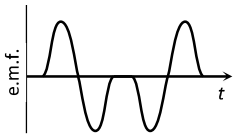
120. A magnet is made to oscillate with a particular frequency, passing through a coil as shown in figure. The time variation of the magnitude of e.m.f. generated across the coil during one cycle is



a) 

b) 

c) 

d) 

121. In a transformer the primary has 500 $turns$ and secondary has 50 $turns$. 100 $volts$ is applied to the primary coil, the voltage developed in the secondary will be
a) 1 V b) 10 V c) 1000 V d) 10000 V

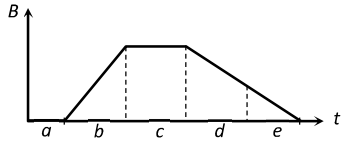
122. Armature current in dc motor will be maximum when
a) Motor has acquired maximum speed b) Motor has acquired intermediate speed
c) Motor has just started moving d) Motor is switched off

123. A short-circulated 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
a) Halved b) The same c) Doubled d) Quadrupled

124. A capacitor is fully charged with a battery. Then the battery is removed and a coil is connected with the capacitor in parallel, current varies as
a) Increases monotonically b) Decreases monotonically
c) Zero d) Oscillates indefinitely

125. In a dc motor, induced e.m.f. will be maximum
a) When motor takes maximum speed b) When motor starts rotating
c) When speed of motor increases d) When motor is switched off

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



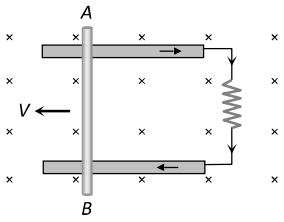
a) $b > (d = e) < (a = c)$ b) $b > (d = e) > (a = c)$
c) $b < d < e < c < a$ d) $b > (a = c) > (d = e)$

127. In an A.C. generator, when the plane of the armature is perpendicular to the magnetic field
a) Both magnetic flux and emf are maximum
b) Both magnetic flux and emf are zero
c) Both magnetic flux and emf are half of their respective maximum values
d) Magnetic flux is maximum and emf is zero

128. Induced potential in a coil is developed by change of magnetic flux from 1 wb to 0.1 wb in 0.1 second is
a) $1/9\ volt$ b) $0.09\ volt$ c) $1\ volt$ d) $9\ volt$

129. For a large industrial city with much load variations the DC generator should be
a) Series b) Shunt wound c) Mixed wound d) Any

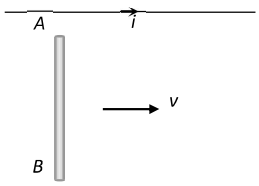
130. Consider the situation shown in the figure. The wire AB is sliding on the fixed rails with a constant velocity. If the wire AB is replaced by semicircular wire, the magnitude of the induced current will



a) Increase
b) Remain the same
c) Decrease
d) Increase or decrease depending on whether the semicircle bulge is towards the resistance or away from it

131. Voltage in the secondary coil of a transformer does not depend upon
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)

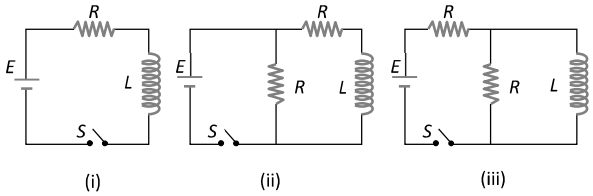
132. The current carrying wire and the rod AB are in the same plane. The rod moves parallel to the wire with a velocity v. Which one of the following statements is true about induced emf in the rod



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

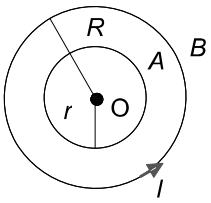
133. A copper disc of radius 0.1 m is rotated about its centre with 10 revolutions per second in a uniform magnetic field of 0.1 $tesla$ with its plane perpendicular to the field. The e.m.f. induced across the radius of disc is
a) $\frac{\pi}{10}\ V$ b) $\frac{2\pi}{10}\ V$ c) $\pi \times 10^{-2} V$ d) $2\pi \times 10^{-2} V$

134. In which of the following circuit is the current maximum just after the switch S is closed



a) (i) b) (ii) c) (iii) d) Both (ii) and (iii)

135. O is the centre of two coplanar concentric circular conductors, A and B, of radii r and R respectively as shown in the figure. Here, $r << R$. the mutual inductance of the system of the conductors can be given by



a) $\frac{\mu_0 \pi r^2}{2R}$ b) $\frac{\mu_0 \pi R^2}{2r}$ c) $\frac{\pi R^2}{\mu_0 r}$ d) $\frac{\mu_0 \pi r}{2R}$

136. Two identical coaxial circular loops carry current i each circulating in the clockwise direction. If the loops are approaching each other, then
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

137. The core of a transformer is laminated to reduce
a) Flux leakage b) Output power c) Hysteresis d) Eddy current

138. In circular coil, when no. of turns is doubled and resistance becomes $\frac{1}{4}th$ of initial, then inductance becomes
a) 4 $times$ b) 2 $times$ c) 8 $times$ d) No change

139. Lenz's law is statement of
a) Law of conservation of charge b) Law of conservation of current
c) Law of conservation of energy d) None of the above

140. A coil of area $100cm^2$ 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
a) 1 V b) 5 V c) 50 V d) Zero

141. Faraday's laws are consequence of conservation of
a) Energy b) Energy and magnetic field
c) Charge d) Magnetic field

142. Turn ratio is 1.25. The step up transformer operates at 230 V and current through secondary is 2 A. Then current in primary is
a) 25 A b) 100 A c) 50 A d) 20 A

143. 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
a) $1/2\ B\omega l^2$ b) $3/4\ B\omega l^2$ c) $B\omega l^2$ d) $2B\omega l^2$

144. A conducting rod of length l is moving in a transverse magnetic field of strength B with velocity v. The resistance of the rod is R. the current in the rod is
a) $\frac{Blv}{R}$ b) Blv c) Zero d) $\frac{B^2 v^2 l^2}{R}$

145. The current in a LR circuit builds up to $3/4^{th}$ of its steady state value in $4s$. The time constant of this circuit is
a) $\frac{1}{\ln 2}s$ b) $\frac{2}{\ln 2}s$ c) $\frac{3}{\ln 2}s$ d) $\frac{4}{\ln 2}s$

146. The square root of the product of inductance and capacitance has the dimension of
a) Length b) Mass c) Time d) No dimension

147. An electric motor runs a DC source of emf 200V and draws a current of 10A. If the efficiency is 40%, then the resistance of the armature is
a) 5Ω b) 12 Ω c) 120 Ω d) 160 Ω

148. A circular ring of diameter 20 cm has a resistance of 0.01Ω. The charge that will flow through the ring if it

is turned from a position perpendicular to a uniform magnetic field of 2.0 T to a position to the field is about

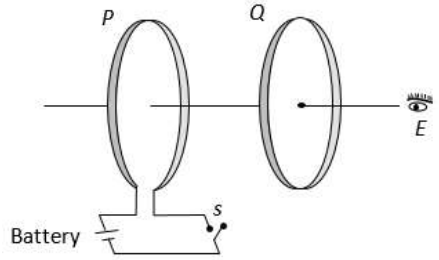
a) 63 C b) 0.63 C c) 6.3 C d) 0.063 C

149. The magnitude of magnetic induction for a current carrying toroid of uniform cross-section is

a) Uniform over the whole cross-section b) Maximum on the outer edge

c) Maximum on the inner edge d) Maximum at the center of cross-section

150. 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

151. There is an arial 1 m long in a car. It is moving from east to west with a velocity of 100 kmh^{-1}. If the horizontal component of earth's magnetic field is 0.18 gauss, this induced emf is nearly

a) 0.5 mV b) 0.25 mV c) 0.75 mV d) 1 mV

152. What should be the value of self inductance of an inductor that should be connected to 220 V, 50 Hz supply so that a maximum current of 0.9 A flows through it?

a) 11 H b) 2 H c) 1.1 H d) 5 H

153. A straight conductor of length $4m$ moves at a speed of $10m/s$. When the conductor makes an angle of 30° with the direction of magnetic field of induction of 0.1 $wb.m^2$ then induced emf is

a) 8 V b) 4 V c) 1 V d) 2 V

154. What is the self inductance of a solenoid of length 31.4 cm, area of cross-section 10^{-3}m^2 and total number of turns 10^3?

a) 4 mH b) 4 H c) 40 H d) 0.4 H

155. A magnet is brought towards a coil (i) speedly (ii) slowly, then the induced e.m.f/induced charge will be respectively

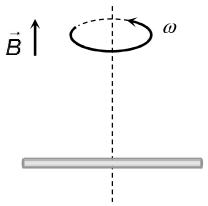
a) More in first case/More in first case b) More in first case/Equal in both cases

c) Less in first case/More in second case d) Less in first case/Equal in both cases

156. The output voltage of a transformer connected to 220 $volt$ line is 1100 $volt$ at 2 amp current. Its efficiency is 100%. The current coming from the line is

a) 20 A b) 10 A c) 11 A d) 22 A

157. 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



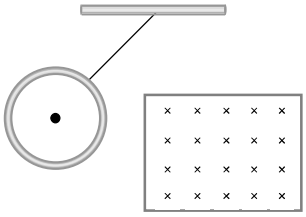
a) $B\omega l^2$ b) $\frac{1}{2}B\omega l^2$ c) $\frac{1}{8}B\omega l^2$ d) Zero

158. When a metallic plate swings between the poles of magnet
   a) No effect on the plate
   b) Eddy currents are set up inside the plate and the direction of the current is along the motion of the plate
   c) Eddy currents are set up inside the plate and the direction of the current oppose the motion of the plate
   d) Eddy currents are set up inside the plate

159. When a wire loop is rotated in a magnetic field, the direction of induced e.m.f. changes one in each
   a) 1/4 revolution b) 1/2 revolution c) 1 revolution d) 2 revolution

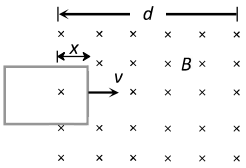
160. In an ideal transformer the number of turns of primary and secondary coil is given as 100 and 300 respectively. If the power input is 60 W, the power output is
   a) 100 W b) 300 W c) 180 W d) 60 W

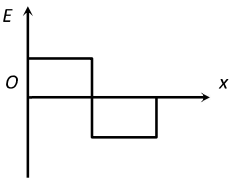
161. A metallic ring connected to a rod oscillates freely like a pendulum. If now a magnetic field is applied in horizontal direction so that the pendulum now swings through the field, the pendulum will

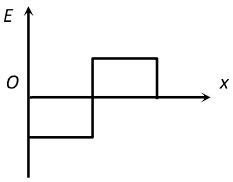


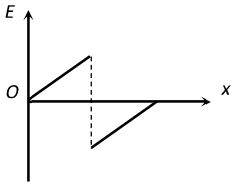
   a) Keep oscillating with the old time period b) Keep oscillating with a smaller time period
   c) Keep oscillating with a larger time period d) Come to rest very soon

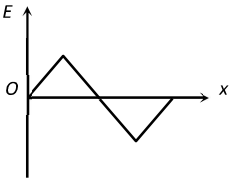
162. A rectangular loop is being pulled at a constant speed v, through a region of certain thickness d, in which a uniform magnetic field B is set up. The graph between position x of the right hand edge of the loop and the induced emf E will be



a) 

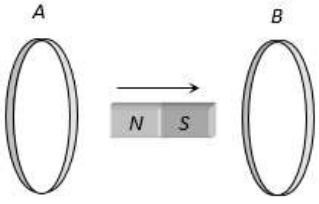
b) 

c) 

d) 

163. A square loop of side 22 cm is converted into circular loop in 0.4s. A uniform magnetic field of 0.2 T directed normal to the loop then the emf induced in the loop is
   a) $6.6 \times 10^{-3}\ V$ b) $6.6 \times 10^{-5}\ V$ c) $4.6 \times 10^{-4}\ V$ d) $4.60 \times 10^{-8}\ V$

164. 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

165. A transformer is used to light a 100 W and 110 V lamp from a 220 V mains. If the main current is 0.5 A, the efficiency of the transformer is approximately
a) 30% b) 50% c) 90% d) 10%

166. 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
a) $RL\ sec$ b) R/L sec c) L/R sec d) $1/LR$ sec

167. In a coil rate of change of area is 5 $m^2/milli\ second$ and current between becomes 1 amp from 2 amp in $2 \times 10^{-3}\ sec$. If magnitude of field is 1 $tesla$ inductance of the coil is
a) 2 H b) 5 H c) 20 H d) 10 H

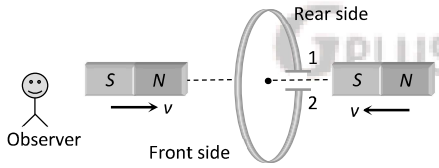
168. The alternating voltage induced in the secondary coil of a transformer is mainly due to
a) A varying electric field b) A varying magnetic field
c) The vibrations of the primary coil d) The iron core of the transformer

169. A solenoid has 2000 turns wound over a length of 0.30 m. The area of its cross-section is $1.2 \times 10^{-3}m^2$. Around its central section a coil of 300 turns is wound. If an initial current of 2 A in the solenoid is reversed in 0.25s, the emf induced in the coil is
a) 48 V b) 4.8 V c) 4.8×10^{-1} V d) 4.8×10^{-2}V

170. Work of electric motor is
a) To convert ac into dc b) To convert dc into ac
c) Both (a) and (b) d) To convert ac into mechanical work

171. A rectangular coil of 300 turns has an average area of 25 cm ×10cm. The coil rotates with a speed of 50 cps in uniform magnetic field of strength 4×10^{-2}T about an axis perpendicular to the field. The peak value of the induced emf is (in volt)
a) 300π b) 3000 π c) 3 π d) 30 π

172. 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

173. Magnetic flux of 10μWb is linked with a coil, when a current of 2 mA flows through through it. What is the self inductance of the coil?
a) 10 mH b) 5 mH c) 15 mH d) 20 mH

174. Two coils of self inductances $2mH$ and $8mH$ are placed so close together that the effective flux in one coil is completely linked with the other. The mutual inductance between these coil is
a) 4 mH b) 16 mH c) 10 mH d) 6 mH

175. A transformer is used to
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

176. 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
a) e^{-1} b) $(1 - e^{-1})$ c) $(1 - e)$ d) e

177. The mutual inductance between two coils is 1.25 $henry$. If the current in the primary changes at the rate of

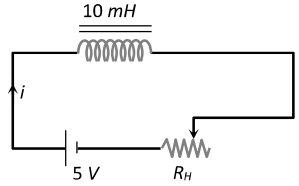
80 $ampere/second$, then the induced e.m.f. in the secondary is

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

178. The primary and secondary coils of a transformer have 50 and 1500 turns respectively. If the magnetic flux ϕ linked with the primary coil is given by $\phi = \phi_0 + 4t$, where ϕ is in weber, t is time in second and $\phi_0$is a constant, the output voltage across the secondary coil is

a) 90 V b) 120 V c) 220 V d) 30V

179. 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



a) $i = 0.5\ A$ b) $i > 0.5\ A$ c) $i < 0.5\ A$ d) $i = 0$

180. 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

a) 3 A b) 30 A c) 0.3 A d) 2.4 A

181. A uniformly wound solenoid coil of self-inductance 1.8×10^{-4}H and resistance 6Ω is broken up into two identical coils. These identical coils are then connected in parallel across a 12 V battery of negligible resistance. The time constant for the current in the circuit is

a) 0.1×10^{-4}s b) 0.2×10^{-4}s c) 0.3×10^{-4}s d) 0.4×10^{-4}s

182. 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

a) 0.5 amp/sec b) 2.0 amp/sec c) 2.5 amp/sec d) 0.25 amp/sec

183. A hundred turns of insulated copper wire are wrapped around an iron cylinder of area $1 \times 10^{-3}\ m^2$ and are connected to a resistor. The total resistance in the circuit is 10 $ohms$. If the longitudinal magnetic induction in the iron changes from 1 $weber\ m^{-2}$, in one direction to 1 $weber\ m^{-2}$ in the opposite direction, how much charge flows through the circuit

a) $2 \times 10^{-2}C$ b) $2 \times 10^{-3}C$ c) $2 \times 10^{-4}C$ d) $2 \times 10^{-5}C$

184. The net magnetic flux through any closed surface, kept in a magnetic field is

a) Zero b) $\frac{\mu_0}{4\pi}$ c) $4\pi\mu_0$ d) $\frac{4\mu_0}{\pi}$

185. Whenever a magnet is moved either towards or away from a conducting coil, an emf is induced, the magnitude of which is independent of

a) The strength of the magnetic field b) The speed with which the magnet is moved

c) The number of turns is the coil d) The resistance of the coil

186. A transformer of efficiency 90% draws an input power of 4 kW. An electrical appliance connected across the secondary draws a current of 6 A. The impedance of the device is

a) 60 Ω b) 50 Ω c) 80 Ω d) 100 Ω

187. 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

a) $\frac{2}{5}H$ b) $\frac{4}{5}H$ c) $\frac{5}{4}H$ d) 1 H

188. 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

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

189. A small piece of metal wire is dragged across the gap between the poles of a magnet in 0.4 s. If change in magnetic flux in the wire is 8×10^{-4} Wb, then emf induced in the wire is

a) 8×10^{-3} V b) 6×10^{-3} V c) 4×10^{-3} V d) 2×10^{-3} V

190. The flux linked with circuit is given by $\phi = t^3 + 3t - 7$. The graph between time ($x-$axis) and induced emf ($y-$axis) will be a
   a) Straight line through the origin
   b) Straight line with positive intercept
   c) Straight line with negative intercept
   d) Parabola not through the origin

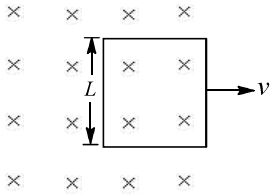
191. The oscillating frequency of a cyclotron is 10 MHz. If the radius of its dees is 0.5 m, the kinetic energy of a proton, which is accelerated by the cyclotron is
   a) 10.2 MeV
   b) 2.55 MeV
   c) 20.4 MeV
   d) 5.1 MeV

192. 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
   a) 150 V
   b) 170 V
   c) 180 V
   d) 190 V

193. A rectangular, a square, a circular and an elliptical loop, all in the $(x-y)$ plane, are moving out of a uniform magnetic field with a constant velocity $\vec{V} = v\,\vec{i}$. The magnetic field is directed along the negative z-axis direction. The induced emf, during the passage of these loops, out of the field region, will not remain constant for
   a) The rectangular, circular and elliptical loops
   b) The circular and the elliptical lops
   c) Only the elliptical loop
   d) Any of the four loops

194. 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
   a) End $A, 3 \times 10^{-3} mV$
   b) End $A, 3\ mV$
   c) End $B, 3 \times 10^{-3}\ mV$
   d) End $B, 3\ mV$

195. 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 with part of the loop outside the field, as shown in figure. The induced emf is



   a) BvR
   b) vBL/R
   c) vBL
   d) $BLv/2$

196. The magnetic flux across a loop of resistance 10Ω is given by $\phi = 5t^2 - 4t + 1$ weber. How much current is induced in the loop after 0.2 sec
   a) 0.4 A
   b) 0.2 A
   c) 0.04 A
   d) 0.02 A

197. 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 $9.0 \times 10^{-5} weber$. The mutual inductance of the system is
   a) $2 \times 10^{-5} henry$
   b) $3 \times 10^{-5} henry$
   c) $4 \times 10^{-5} henry$
   d) $6 \times 10^{-5} henry$

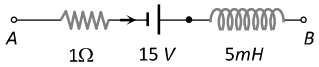
198. The transformation ratio in the step-up transformer is
   a) One
   b) Greater than one
   c) Less than one
   d) The ratio greater or less than one depends on the other factors

199. A conducting circular loop is placed in a uniform magnetic field 0.04 T with its plane perpendicular to the magnetic field. The radius of the loop starts shrinking at 2 mm/s. The induced emf in the loop when the radius is 2 cm is
   a) 3.2 $\pi\mu V$
   b) 4.8 $\pi\mu V$
   c) 0.8 $\pi\mu V$
   d) 1.6 $\pi\mu V$

200. When the number of turns and the length of the solenoid are doubled keeping the area of cross-section same, the inductance

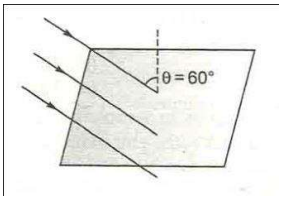
a) Remains the same b) Is halved c) Is doubled d) Becomes four times

201. 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

202. A square loop of wire of side 5 cm is lying on a horizontal table. An electromagnet above and to one side of the loop is turned on, causing a uniform magnetic field down-wards at an angle of 60° to the vertical as shown in figure. The magnetic induction is 0.50 T. The average induced emf in the loop, if the field increases from zero to its final value in 0.2 s is



a) 5.4×10^{-3} V b) 3.12×10^{-3} V c) 0 d) 25.0×10^{-3} V

203. The total charge, induced in a conducting loop, when it is moved in a magnetic field depends on

a) Rate of change of magnetic on b) Initial magnetic flux only

c) Total change in magnetic flux and resistance d) Final magnetic flux only

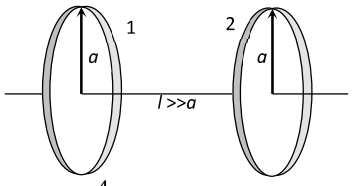
204. A 10 $metre$ wire kept in east-west direction is falling with velocity $5m/sec$ perpendicular to the field $0.3 \times 10^{-4} Wb/m^2$. The induced e.m.f. across the terminal will be

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

205. A circular coil of 500 turns of wire has an enclosed area of 0.1 m^2 per turn. It 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 $ohms$

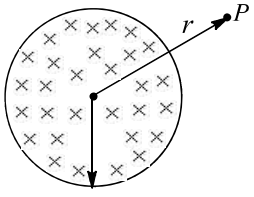
a) 0.2 C b) 0.4 C c) 2 C d) 4 C

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



a) $\frac{\mu_0 \pi a^4}{8l^3}$ b) $\frac{\mu_0 \pi a^4}{4l^3}$ c) $\frac{\mu_0 \pi a^4}{6l^3}$ d) $\frac{\mu_0 \pi a^4}{2l^3}$

207. 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 in figure. The magnitude of induced electric filed at point P at a distance r from the centre of the circular region



a) Is zero b) Decrease as $1/r$ c) Increases as r d) Decreases $1/r^2$

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

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

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

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

d) The magnet moves with continuously increasing velocity and acceleration

209. Lenz's law gives

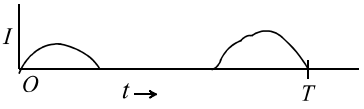
a) The magnitude of the induced e.m.f. b) The direction of the induced current

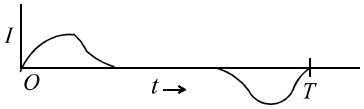
c) Both the magnitude and direction of the induced current d) The magnitude of the induced current

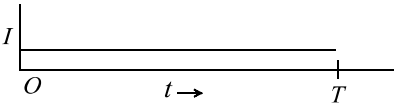
210. The ratio of secondary to primary turns is 9 : 4. If power input is P, what will be the ratio of power output (neglect all losses) to power input

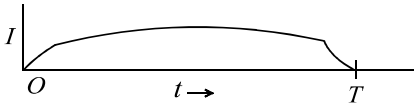
a) 4 : 9 b) 9 : 4 c) 5 : 4 d) 1 : 1

211. A metallic ring is dropped down, keeping its plane perpendicular to a constant and horizontal magnetic field. The ring enters the region of magnetic field at $t = 0$ and completely emerges out at $t = Tsec$. The current in the ring varies as

a) 

b) 

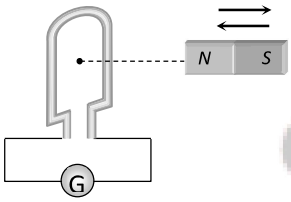
c) 

d) 

212. 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

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

213. When a magnet is pushed in and out of a circular coil C connected to a very senstitive galvanometer G as shown in the adjoining diagram with a frequency v, then



a) Constant deflection is observed in the galvanometer

b) Visible small oscillations will be observed in the galvanometer if v is about 50 Hz

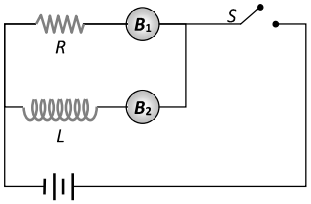
c) Oscillations in the deflection will be observed clearly if $v = 1$ or 2 Hz

d) No variation in the deflection will be seen if $v = 1$ or 2 Hz

214. 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

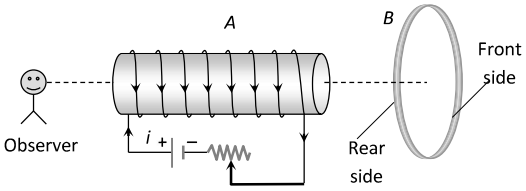
215. The adjoining figure shows two bulbs B_1 and B_2, resistor R and an inductor L. When the switch S is turned off



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

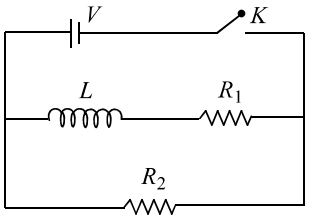
216. An aluminium ring B faces an electromagnet A. The current I through A can be altered



a) Whether I increases or decreases, B will not experience any force
b) If I decreases A will attract B
c) If I increases, A will attract B
d) If I increases, A will repel B

217. 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) $NBA\ \omega \sin \omega t$

218. In the circuit shown below, the key K is closed at $t = 0$. The current through the battery is



a) $\frac{V(R_1+R_2)}{R_1R_2}$ at $t = 0$ and $\frac{V}{R_2}$ at $t = \infty$
b) $\frac{V(R_1+R_2)}{\sqrt{R_1^2R_2^2}}$ at $t = 0$ and $\frac{V}{R_2}$ at $t = \infty$
c) $\frac{V}{R_2}$ at $t = 0$ and $\frac{V(R_1+R_2)}{R_1R_2}$ at $t = \infty$
d) $\frac{V}{R_2}$ at $t = 0$ and $\frac{V(R_1+R_2)}{\sqrt{R_1^2R_2^2}}$ at $t = \infty$

219. The resistance and inductance of series circuit are 5Ω and $20H$ respectively. At the instant of closing the switch, the current is increasing at the rate $4A/s$. The supply voltage is
a) 20 V b) 80 V c) 120 V d) 100 V

220. 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
a) 3 mV b) 2 mV c) 3 V d) Zero

221. 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
a) 0.5 $henry$ b) 5 $henry$ c) 1.5 $henry$ d) 10 $henry$

222. The ratio of secondary to the primary turns in a transformer is 3 : 2. If the power output be P, then the input power neglecting all losses must be equal to
a) 5 P b) 1.5 P c) P d) $\frac{2}{5}P$

223. 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
a) 1 : 10 b) 10 : 1 c) 1 : 1 d) 11 : 1

224. The number of turns of the primary and the secondary coils of a transformer are 10 and 100 respectively. The primary voltage and the current are given as 2 V and 1 A. Assuming the efficiency of the transformer as 90%, the secondary voltage and the current respectively are
a) $20V$ and $0.1A$ b) $0.2V$ and $1A$ c) $20V$ and 0.09 A d) 0.2 V and 0.9 A

225. 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
a) 1 $millihenry$ b) 10 $millihenry$ c) 100 $millihenry$ d) 1000 $millihenry$

226. 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

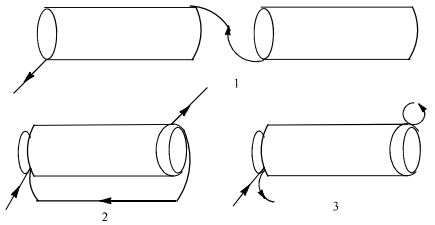
227. A square coil of $10^{-2}\ m^2$ area is placed perpendicular to a uniform magnetic field of intensity $10^3\ Wb/m^2$. The magnetic flux through the coil is
a) $10\ weber$ b) $10^{-5} weber$ c) $10^5 weber$ d) $100\ weber$

228. 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 $5 \times 10^{-5} tesla$, with velocity $360\ km/h$. The potential difference produced between the blades will be
a) $0.10\ V$ b) $0.15\ V$ c) $0.20\ V$ d) $0.30\ V$

229. A coil having an area $2m^2$ is placed in a magnetic field which changes from $1Wb/m^2$ to $4Wb/m^2$ in an interval of $2\ second$. The e.m.f. induced in the coil will be
a) $4\ V$ b) $3\ V$ c) $1.5\ V$ d) $2\ V$

230. If a current of $5\ A$ in a coil of self inductance $2\ mH$ is cut off in time $0.1\ s$, the induced emf in the coil is
a) $0.1\ V$ b) $0.01\ V$ c) $0.2\ V$ d) $0.02\ V$

231. There are two solenoids of same length and inductance L but their diameters differ to the extent that one can just fit into the other. They are connected in three different ways in series. (1) They are connected in series but separated by large distance, (2) they are connected in series with one inside the other and senses of the turns coinciding, (3) both are connected in series with one inside the other with senses of the turns opposite as depicted in figures 1, 2 and 3 respectively. The total inductance of the solenoids in each of the case 1, 2 and 3 are respectively



a) $0, 4L_0, 2L_0$ b) $4L_0, 2L_0, 0$ c) $2L_0, 0, 4L_0$ d) $2L_0, 4L_0, 0$

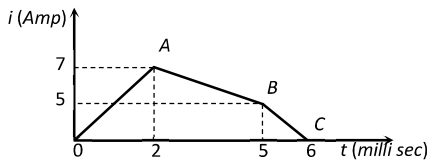
232. Fleming's left and right hand rule are used in
a) DC motor and AC generator b) DC generator and AC motor
c) DC motor and DC generator d) Both rules are same, any one can be used

233. What is increased in step-down transformer
a) Voltage b) Current c) Power d) Current density

234. In a coil when current changes from 10A to 2A in time 0.1s, induced emf is 3.28 V. what is self –inductance of coil?
a) 4 H b) 0.4 H c) 0.04 H d) 5 H

235. 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) $16.0\ henry$

236. The current through a 4.6 H inductor is shown in the following graph. The induced emf during the time interval $t = 5\ milli - sec$ to $6\ milli - sec$ will be



a) $10^3 V$ b) $-23 \times 10^3\ V$ c) $23 \times 10^3\ V$ d) Zero

237. A solenoid is 1.5 m long and its inner diameter is 4.0 cm. It has three layers of windings of 1000 turns each and carries a current of 2.0 $amperes$. The magnetic flux for a cross-section of the solenoid is nearly
a) $2.5 \times 10^{-7}\ weber$ b) $6.31 \times 10^{-6}\ weber$ c) $5.2 \times 10^{-5}\ weber$ d) $4.1 \times 10^{-5}\ weber$

238. 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 ac

239. The device that does not work on the principle of mutual induction is
a) Induction coil b) Motor c) Tesla coil d) Transformer

240. A step-up transformer has transformation ratio of 3 : 2. What is the voltage in secondary if voltage in primary is 30 V
a) 45 V b) 15 V c) 90 V d) 300 V

241. Two solenoids of equal number of turns have their lengths and the radii in the same ratio 1 : 2. The ratio of their self inductances will be
a) 1 : 2 b) 2 : 1 c) 1 : 1 d) 1 : 4

242. The magnetic flux through a circuit of resistance R changes by an amount $\Delta\phi$ in time Δt. The total independent of quantity of electric charge Q which passes during this time through any point of the circuit is given by
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) $Q = \frac{\Delta\phi}{\mathrm{R}}$

243. Two coils are placed close to each other. The mutual inductance of the pair of coils depends upon
a) The rates at which currents are changing in the two coils
b) Relative position and orientation of the two coils
c) The materials of the wires of the coils
d) The currents in the two coils

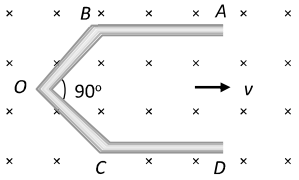
244. A current $I = 10\sin(100\,\pi t)\,A$ is passed in first coil, which induces a maximum emf of 5 πV in second coil. The mutual inductance between the coils is
a) 5 mH b) 10 mH c) 15 mH d) 20 mH

245. 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

246. A coil has 1,000 turns and 500 cm^2as its area. The plane of the coil is placed at right angles to a magnetic induction field of 2×10^{-5}Wbm^{-2}. The coil is rotated through 180°in 0.2 s. the average emf induced in the coil, in mV, is
a) 5 b) 10 c) 15 d) 20

247. 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
a) $\pi\omega BR^2$ b) ωBR^2 c) $\pi\omega BR^2/2$ d) $\omega BR^2/2$

248. 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

249. A coil of inductance 40 $henry$ is connected in series with a resistance of 8 ohm and the combination is joined to the terminals of a 2 $volt$ battery. The time constant of the circuit is
a) 40 $seconds$ b) 20 $seconds$ c) 8 $seconds$ d) 5 $seconds$

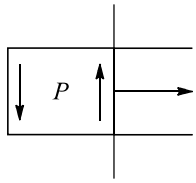
250. A long solenoid has 500 turns. When a current of 2 ampere is passed through it, the resulting magnetic flux linked with each turn of the solenoid is $4 \times 10^{-3} Wb$. The self-inductance of the solenoid is
a) 1.0 henry b) 4.0 henry c) 2.5 henry d) 2.0 henry

251. 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

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

252. A movable wire is moved to the right crossing an anti-clock-wise induced current, figure. The direction of magnetic induction in the region P points



a) To the right b) To the left

c) Up the paper d) Down into the paper

253. The flux associated with coil changes from 1.35 Wb to 0.79 Wb within $\frac{1}{10}$ s. Then the charge produced by the earth coil, if resistance of coil is 7 Ω is

a) 0.08 C b) 0.8 C c) 0.008 C d) 8 C

254. A 220-volt input is supplied to a transformer. The output circuit draws a current of 2.0 ampere at 440 volts. If the efficiency of the transformer is 80%, the current drawn by the primary windings of the transformer is

a) 5.0 ampere b) 3.6 ampere c) 2.8 ampere d) 2.5 ampere

255. When a low flying aircraft passes over head, we sometimes notice a slight shaking of the picture on our TV screen. This is due to

a) Diffraction of the signal received from the antenna.

b) Interference of the direct signal received by the antenna with the weak signal reflected by the passing aircraft.

c) Change of magnetic flux occuring due to the passage of aircraft

d) Vibration created by the passage of aircraft

256. The current through a coil of self inductance $L = 2$ mH is given by $I = t^2e^{-t}$ at time. t. How long it will take to make the e.m.f. zero

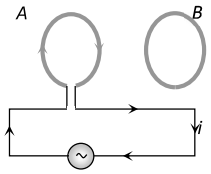
a) 1 s b) 2 s c) 3 s d) 4 s

257. A circular loop of radius R, carrying current I lies in xy −plane with its centre at origin. The total magnetic flux through xy-plane is

a) Directly proportional or R b) Directly proportional or I

c) Inversely proportional to I d) Zero

258. Two circular coils A and B are facing each other as shown in figure. When the current i through A is altered



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

b) There will be attraction between A and B if i is increased

c) There will be neither attraction nor repulsion when i is changed

d) Attraction or repulsion between A and B depends on the direction of current. It does not depend whether the current is increased or decreased

259. According to Lenz's law of electromagnetic induction

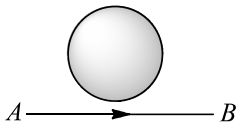
a) The induced emf is not in the direction opposing the change in magnetic flux.

b) The relative motion between the coil and magnet produces change in magnetic flux

c) Only the magnet should be moved towards coil

d) Only the coil should be moved towards magnet

260. Current from A and B in the straight wire is decreasing. The direction of induced current in the loop, is



a) Clock-wise b) Anti-clock-wise c) Changing d) Nothing can be said

261. A long horizontal metallic rod with length along the east-west direction is falling under gravity. The potential difference between its two ends will

a) Be zero b) Be constant c) Increase with time d) Decrease with time

262. A rectangular loop of length l and breadth b is placed at distance of x from infinitely long wire carrying current i such that the direction of current is parallel to breadth. If the loop moves away from the current wire in a direction perpendicular to it with a velocity v, the magnitude of the emf in the loop is (μ =permeability of free space)

a) $\frac{\mu_0 iv}{2\pi x}\left(\frac{1+b}{b}\right)$ b) $\frac{\mu_0 i^2 v}{4\pi^2 x}\log\left(\frac{b}{l}\right)$ c) $\frac{\mu_0 ilbv}{2\pi x(l+x)}$ d)

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

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

264. 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

a) 10 b) 5 c) 2.5 d) 1.25

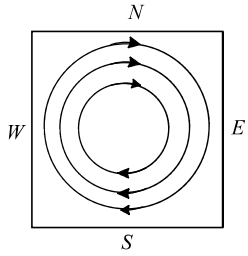
265. In a step-up transformer the voltage in the primary is 220 V and the current is 5A. The secondary voltage is found to be 22000V. The current in the secondary (neglect losses) is

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

266. 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

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

267. When a sheet of metal is placed in a magnetic field, which changes from zero to a maximum value, the induced currents are set up in the direction shown in figure. What is the direction of magnetic field.



a) Into the plane of the paper b) Out of the plane f the paper

c) West to East d) South to North

268. Which of the following is constructed on the principle of electromagnetic induction

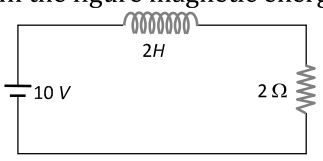
a) Galvanometer b) Electric motor c) Generator d) Voltmeter

269. 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

270. In the figure magnetic energy stored in the coil is



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

271. A 50 Hz ac current of peak value 2 A flows through one of the pair of coils. If the mutual inductance

between the pair of coils is 150 mH, then the peak value of voltage induced in the second coil is

a) 30 π V b) 60 π V c) 15 π V d) 300 π V

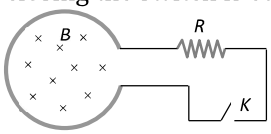
272. The current through choke coil increases from zero to 6 A in 0.3 $seconds$ and an induced e.m.f. of 30 V is produced. The inductance of the coil of choke is

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

273. In a circuit with a coil 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

a) 5.0 $coulomb$ b) 4.0 $coulomb$ c) 1.0 $coulomb$ d) 0.8 $coulomb$

274. 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

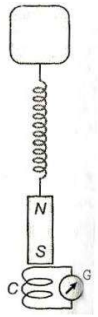


a) $\frac{B_0^2 \pi r^2}{R}$ b) $\frac{B_0 10 r^3}{R}$ c) $\frac{B_0^2 \pi^2 r^4 R}{5}$ d) $\frac{B_0^2 \pi^2 r^4}{R}$

275. Energy associated with a moving charge is due to

a) Electric field b) Magnetic field c) Both (a) and (b) d) None of these

276. A magnet N-S is suspended from a spring and when 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



a) G shows no deflection

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

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

d) G shows deflection on one side

277. In an induction coil with resistance, the induced emf will be maximum when

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

278. 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 magnetic north-south moves eastwards with a velocity v. The emf induced across the conductor is

a) Zero b) $B_0 lv \sin\delta$ c) $B_0 lv$ d) $B_0 lv \cos\delta$

279. In an oscillations of L-C circuit, the maximum charge on the capacitor is Q. The charge on the capacitor, when the energy is stored equally between the electric and magnetic field is

a) $\frac{Q}{2}$ b) $\frac{Q}{\sqrt{2}}$ c) $\frac{Q}{\sqrt{3}}$ d) $\frac{Q}{3}$

280. A current passing through a coil of self inductance of 2mH changes at the rate of 20mAs^{-1}. The emf induced in the coil is

a) 10 μV b) 40 μV c) 10 mV d) 40 mV

281. The induction coil works on the principle of

a) Self-induction b) Mutual induction

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

282. 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

a) 1007 Hz b) 100 Hz c) 109 Hz d) 500 Hz

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

a) 0.5 A b) 0.1 A c) 2 A d) 1 A

284. The wing span of an aeroplane is 36 m. If the plane is flaying at 400 kmh^{-1}, the emf induced between the wings tips is (assume $V = 4 \times 10^{-5}\ T$)

a) 16 V b) 1.6 V c) 0.16 V d) 0.016 V

285. Electric fields induced by changing magnetic fields are

a) Conservative

b) Non-conservative

c) May be conservative or non-conservative depending on the condition

d) Nothing can be said

286. 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

a) 25 $millihenry$ b) $25 \times 10^{-3} millihenry$ c) $50 \times 10^{-3} millihenry$ d) $50 \times 10^{-3} millihenry$

287. What is the coefficient of mutual inductance when the magnetic flux changes by $2 \times 10^{-2} Wb$ and change in current in $0.01A$

a) 2 $henry$ b) 3 $henry$ c) $\frac{1}{2} henry$ d) Zero

288. Two coaxial solenoids are made by winding thin insulated wire over a pipe of cross-sectional area $A = 10\text{cm}^2$ and length=20 cm. If one of the solenoids has 300 turns and the other 400 turns , their mutual inductance is ($\mu_0 = 4\pi \times 10^{-7}\text{TmA}^{-1}$)

a) $2.4\pi \times 10^{-5}$H b) $4.8\pi \times 10^{-4}$H c) $4.8\pi \times 10^{-5}$H d) $2.4\pi \times 10^{-4}$H

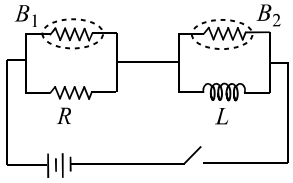
289. 2m long wire is moved with a velocity 1ms^{-1} in a magnetic field of intensity 0.5 Wbm^{-2} in direction perpendicular to the field. The emf induced in it will be

a) 2 V b) 1 V c) 0.1V d) 0.5 V

290. If coil is open then L and R become

a) $\infty, 0$ b) $0, \infty$ c) ∞, ∞ d) $0, 0$

291. If the switch in the following circuit is turned off, then



a) The bulb B_1 will go out immediately whereas B_2 after sometimes

b) The bulb B_2 will go out immediately whereas B_1 after sometime

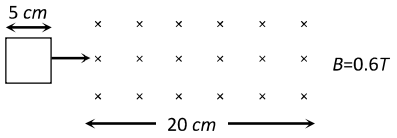
c) Both B_1 and B_2 will go out immediately

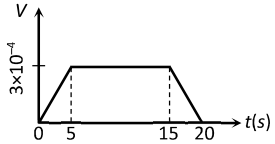
d) Both B_1 and B_2 will go out after sometime

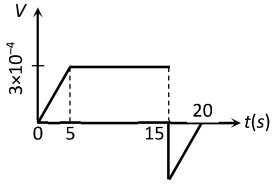
292. Average energy stored in a pure inductance L when a current i flows through it, is

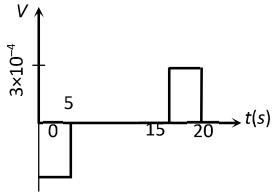
a) Li^2 b) $2Li^2$ c) $\frac{Li^2}{4}$ d) $\frac{2i^2}{2}$

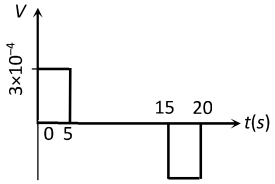
293. A square loop of side 5 cm enters a magnetic field with 1 cms^{-1}. The front edge enters the magnetic field at $t = 0$ then which graph best depicts emf



a) 

b) 

c) 

d) 

294. The self induced emf in a coils of 0.4 henry self inductance when current in it is changing at the rate of $50As^{-1}$, is

a) 8×10^{-4}V b) 8×10^{-3}V c) 200 V d) 500 V

295. A rectangular coil of 20 turns and area of cross-section 25 *sqcm* has 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

a) 1.0 *ampere* b) 50 *ampere* c) 0.5 *ampere* d) 5.0 *ampere*

296. Energy required to establish a current of 4 A in a coil of self-inductance L=200mH is

a) 0.16 J b) 0.18 J c) 0.40 J d) 1.6 J

297. 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

a) 10^4 *V* b) 1.2 *V* c) 1.0 *V* d) 10^{-2} *V*

298. 5 *cm* long solenoid having 10 *ohm* resistance and 5 *mH* inductance is joined to a 10 *volt* battery. At steady state the current through the solenoid in *ampere* will be

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

299. In a choke coil, the resistance X_L and resistance R are such that

a) $X_L = R$ b) $X_L \gg R$ c) $X_L \ll R$ d) $X_L = \infty$

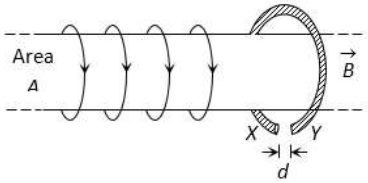
300. A small square loop wire of side l is placed inside a large squre loop of side $L(L >> l)$. If the loops are coplanar and their centres coincide, the mutual induction of the system is directly proportional to

a) $\frac{L}{l}$ b) $\frac{l}{L}$ c) $\frac{L^2}{l}$ d) $\frac{l^2}{L}$

301. 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

a) Magnetic b) Electrical
c) Both magnetic and electrical d) Heat

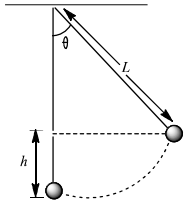
302. A highly conducting ring of radius R is perpendicular to and concentric with the axis of a long solenoid as shown in fig. The ring has a narrow gap of width d in its circumference. The solenoid has cross sectional area A and a uniform internal field of magnitude B_0. Now beginning at $t = 0$, the solenoid current is steadily increased so that the field magnitude at any time t is given by $B(t) = B_0 + \alpha t$ where $a > 0$. 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) $Y, \pi R^2\alpha$

303. A simple pendulum with bob of mass m and conducting wire of length L swings under gravity through an angle 2 θ. The earth's magnetic field component in the direction perpendicular to swing is *B*. Maximum

potential difference induced across the pendulum is



a) $2\,BL\sin\left(\frac{\theta}{2}\right)(gL)^{1/2}$ b) $BL\sin\left(\frac{\theta}{2}\right)(gL)$ c) $BL\sin\left(\frac{\theta}{2}\right)(gL)^{3/2}$ d) $BL\sin\left(\frac{\theta}{2}\right)(gL)^{2}$

304. Find out the e.m.f. produced when the current changes from 0 to 1 A in 10 $second$, given $L = 10\ \mu H$
a) 1 V b) 1 μV c) 1 mV d) 0.1 V

305. 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
a) 15 A b) 50 A c) 25 A d) 12.5 A

306. Two concentric coils each of radius equal to 2π cm are placed at right angles to each other. 3 A and 4 A are the currents flowing in each coil respectively. The magnetic induction in Wb/m^2 at the centre of the coils will be
$(\mu_0 = 4\pi \times 10^{-7} Wb/Am)$
a) 12×10^{-5} b) 10^{-5} c) 5×10^{-5} d) 7×10^{-5}

307. 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
a) 0.25 $henry$ b) 15 $henry$ c) 1.5 $henry$ d) 9.6 $henry$

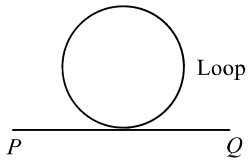
308. A step down transformer, transforms a supply line voltage of 2200 V into 220 V. The primary coil has 5000turns. The efficiency and power transmitted by the transformer are 90% and 8 kW respectively. Then the power supplied is
a) 9.89 kW b) 8.89 kW c) 88.9 kW d) 889 kW

309. An average induced e.m.f. of 1V appears in a coil when the current in it is changed from 10A in opposite direction in 0.5 sec. Self-inductance of the coil is
a) 25 mH b) 50 mH c) 75 mH d) 100 mH

310. When a circular coil of radius 1 m and 100 turns is rotated in a horizontal uniform magnetic field, the peak value of emf induced is 100 V. the coil is unwound and then rewound into a circular coil of radius 2 m. If it is rotated now, with the same speed, under similar conditions, the new peak value of emf developed is
a) 50 V b) 25 V c) 100 V d) 200 V

311. In 0.1 s, the current in a coil increases from 1A to 1.5 A. If inductance of coil is 60mH, then induced current in external resistance of 3Ω will be
a) 1 A b) 0.5 A c) 0.2 A d) 0.1 A

312. An electron moves along the line PQ which lies in the same plane as a circular loop of conducting wire as shown in figure. What will be the direction of the induced current in the loop?



a) Anticlockwise b) Clockwise
c) Alternating d) No current will be induced

313. 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
a) 0 b) 60 V c) 0.6 V d) 6.0 V

314. The horizontal component of the earth's magnetic field at a place is $3 \times 10^{-4}\ T$ and the dip is $\tan^{-1}\left(\frac{4}{3}\right)$. A metal rod of length 0.25 m placed in the north-south position and is moved at a constant speed of 10 cm/s

towards the east. The emf induced in the rod will be

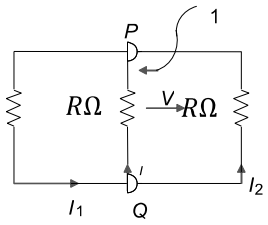
a) Zero b) 1 μV c) 5 μV d) 10 μV

315. Flux ϕ (in weber) in a closed circuit of resistance 20Ω varies with time t (in second) according to equation $\phi = 6t^2 - 5t + 1$.

The magnitude of the induced current at t=0.25 s is

a) 1.2 A b) 0.8 A c) 0.6 A d) 0.1 A

316. A rectangular loop has a sliding connector PQ of length l and resistance R Ω and it is moving with a speed v as shown. The set-up is placed in a uniform magnetic field going into the plane of the paper. The three currents I_1, I_2 and I are



a) $I_1 = -I_2 = \frac{Blv}{R}, I = \frac{2Blv}{R}$

b) $I_1 = I_2 = \frac{Blv}{3R}, I = \frac{2Blv}{3R}$

c) $I_1 = I_2 = I = \frac{Blv}{R}$

d) $I_1 = I_2 = \frac{Blv}{6R}, I = \frac{Blv}{3R}$

317. Three solenoid coils of same dimension, same number of turns and same number of layers of winding are taken. Coil 1 with inductance L_1 was wound using a Mn wire of resistance $11\Omega m^{-1}$;Coil 2 with inductance L_2 was wound using the similar wire but the direction of winding was reversed in each layer; Coil 3 with inductance $L_3$was wound using a superconducting wire. The self-inductance of the Coils L_1, L_2, L_3 are

a) $L_1 = L_2 = L_3$ b) $L_1 = L_2;\ L_3 = 0$ c) $L_1 = L_3;\ L_2 = 0$ d) $L_1 > L_2 > L_3$

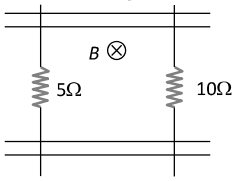
318. In an induction coil, the secondary e.m.f. is

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

319. In a magnetic field of $0.05T$, area of a coil changes from $101cm^2$ to $100cm^2$ without changing the resistance which is 2Ω. The amount of charge that flow during this period is

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

320. A pair of parallel conducting rails lie at right angles to a uniform magnetic field of 2.0 T as shown in the fig. Two resistors 10 Ω and 5 Ω are to slide without friction along the rail. The distance between the conducting rails is 0.1 m. Then



a) Induced current $= \frac{1}{150} A$ directed clockwise if 10 Ω resistor is pulled to the right with speed 0.5 ms^{-1} and 5Ω resistor is held fixed

b) Induced current $= \frac{1}{300} A$ directed anti-clockwise if 10 Ω resistor is pulled to the right with speed 0.5 ms^{-1} and 5Ω resistor is held fixed

c) Induced current $= \frac{1}{300} A$ directed clockwise if 5 Ω resistor is pulled to the left at 0.5 ms^{-1} and 10Ω resistor is held at rest

d) Induced current $= \frac{1}{150} A$ directed anti-clockwise if 5 Ω resistor is pulled to the left at 0.5 ms^{-1} and 10Ω resistor is held at rest

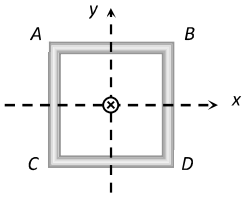
321. The number of turns in primary and secondary coils of a transformer is 50 and 200 respectively. If the current in the secondary coil is 4A, then the current in the secondary coil is

a) 1A b) 2 A c) 4 A d) 5 A

322. A six pole generator with fixed field excitation developes an emf of 100 V, when operating at 1500 rpm. At what speed must it rotate to develop 120 V?

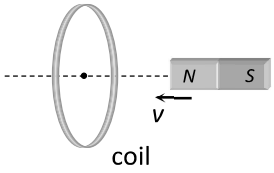
a) 1200 rpm b) 1800 rpm c) 1500 rpm d) 400 rpm

323. A square coil $ABCD$ lying in $x-y$ plane with it's centre at origin. A long straight wire passing through origin carries a current $i = 2t$ in negative z-direction. The induced current in the coil is



a) Clockwise b) Anticlockwise c) Alternating d) Zero

324. In the following figure, the magnet is moved towards the coil with a speed v and induced emf 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) $2e$ c) $e/2$ d) $4e$

325. 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

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

326. A solenoid 60 mm long has 50 turns on it and is wound on an iron rod of 7.5 mm radius. Find the flux through the solenoid when the current in it is 3A. The relative permeability of iron is 600

a) 1.66 Wb b) 1.66 nWb c) 1.66 mWb d) 1.66 μWb

327. Two identical circular loops of metal wire are lying on a table. Loop A carries a current which increases with time. In response, the loop B

a) Is attracted by the loop B b) Is repelled by the loop A

c) Remains stationary d) None of the above

328. A step-down transformer is connected to main supply $200V$ to operate a $67V, 30W$ bulb. The current in primary is

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

329. 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

a) Zero in vertical 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

330. 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

a) 500 $seconds$ b) 50 $seconds$ c) 5 $seconds$ d) 0.5 $seconds$

331. A metal conductor of length 1 m rotates vertically about one of its ends at angular velocity 5 rad/s. If the

horizontal component of earth's magnetic field is 0.2×10^{-4}T, then the emf developed between the ends of the conductor is

a) 5 μV b) 5 mV c) 50 μV d) 50 mV

332. 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

a) An electric motor b) An electric generator c) An electromagnet d) All of the above

333. The efficiency of transformer is very high because

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

334. 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

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 $\mu_0 Wb$

335. The inductance of a coil is $L = 10$ H and resistance $R = 5\Omega$. If applied voltage of battery is 10 V and it switches off in 1 millisecond, find induced emf of inductor

a) 2×10^4 V b) 1.2×10^4 V c) 2×10^{-4} V d) None of these

336. An inductor having coefficient of self induction 40mH. What is the energy stored in it when a current of 2 A is passed through it?

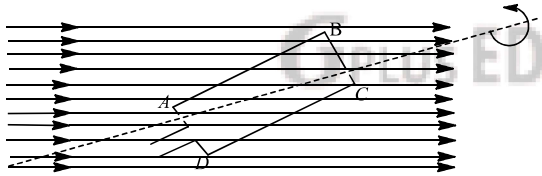
a) 40mJ b) 80mJ c) 20mJ d) 100mJ

337. Two circular coils have their centres at the same point. The mutual inductance between them will be maximum when their axes

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

338. A rectangular $ABCD$which is rotated at a constant angular velocity about an horizontal as shown in the figure. The axis of rotation of the coil as well as the magnetic field B are horizontal. Maximum current will flow in the circuit when the plane of the coil is



a) Inclined at 30° to the magnetic field b) Perpendicular to the magnetic field

c) Inclined at 45° to the magnetic field d) Parallel to the magnetic field

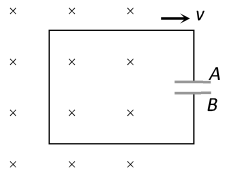
339. The self inductance of a straight conductor is

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

340. 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

a) 10 $volts$ b) 5 $volts$ c) 2.5 $volts$ d) 1.25 $volts$

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



a) Plate $-A$ b) Plate $-B$

c) Plate $-A$ and Plate $-B$ both d) None

342. A metal conductor of length 1 m rotates vertically about one of its ends at angular velocity 5 rad s^{-1}. If the horizontal component of earth's magnetic field is 0.2×10^{-4} T, then the emf developed between the two ends of the conductor is

a) 5 μV b) 50 μV c) 5 mV d) 50 mV

343. According to Faraday's law of electromagnetic induction
   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 magnate flux
   c) The direction of induced e.m.f. is such that it opposes the cause producing it
   d) None of the above

344. 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
   a) 200 V, 50 Hz b) 2 V, 50 Hz c) 200 V, 500 Hz d) 2 V, 5 Hz

345. An aeroplane in which the distance between the tips of the wings in 50 m is flying horizontally with a speed of 360 kmh^{-1} over a place where the vertical component of earth's magnetic field is 2×10^{-4} Wbm^{-2}. The potential difference between the tips of the wings would be
   a) 0.1 V b) 1.0 V c) 0.2 V d) 0.01 V

346. 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
   a) 100 V, 16 A b) 40 V, 40 A c) 160 V, 10 A d) 80 V, 20 A

347. An electric motor operates on a 50 $volt$ supply and a current of 12A. If the efficiency of the motor is 30%, what is the resistance of the winding of the motor
   a) 6Ω b) 4Ω c) 2.9Ω d) 3.1Ω

348. 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 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

349. In transformer, core is made of soft iron to reduce
   a) Hysteresis losses b) Eddy current losses
   c) Force opposing electric current d) None of the above

350. 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
   a) 1 A b) 4.5 A c) 2 A d) 1.5 A

351. A coil of 1000 turns is wound on a book and this book is lying on the table. The vertical component of earth's magnetic field is 0.6×10^{-4} T and the area of the coil is 0.05 m^{-2}. The book is turned over once about a horizontal axis is 0.1 s. This average emf induced in the coil is
   a) 0.03 V b) 0.06 V c) Zero d) 0.6 V

352. An aircraft with a wing-span of 40 m files with a speed of 1080 $km\ h^{-1}$ in the eastward direction at the constant altitude in the northern hemisphere, where the vertical component of earth's magnetic field is $1.75 \times 10^{-5} T$. Then the emf that develops between the tips of the wings is
   a) 0.5 V b) 0.35 V c) 0.21 V d) 2.1 V

353. The turn ratio of a transformer is 1:2. An electrolytic DC cell of emf 2 V is connected to its primary. The output voltage across transformer is
   a) Zero b) 4 V c) 2.4 V d) 12 V

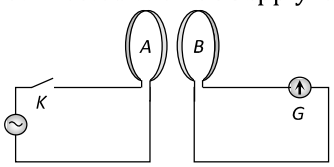
354. The north pole of a magnet is brought near a metallic ring. The direction of the induced current in the ring will be
   a) Clockwise b) Anticlockwise c) Towards north d) Towards south

355. Induction furnace is based on the heating effect of
   a) Electric field b) Eddy current c) Magnetic field d) Gravitational field

356. Self induction of a solenoid is

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

357. 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

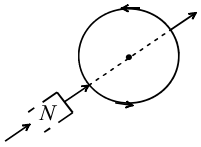


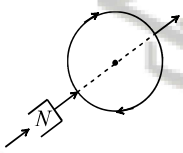
a) Constant deflection will be observed in the galvanometer for 50 Hz supply
b) Visible small variations will be observed in the galvanometer for 50 Hz input
c) Oscillations in the galvanometer may be observed when the input ac voltage has a frequency of 1 to 2 Hz
d) No variation will be observed in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

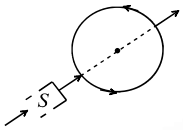
358. In a region of uniform magnetic induction $B = 10^{-2}\ tesla$, a circular coil of radius 30 cm and resistance π^2 ohm is rotated about an axis which is perpendicular to the direction of B and which forms a diameter of the coil. If the coil rotates at 200 rpm the amplitude of the alternating current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

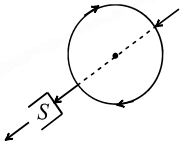
a) $4\,\pi^2\ mA$ b) $30\ mA$ c) $6\ mA$ d) $200\ mA$

359. Which of the following figure correctly depicts the Lenz's law. The arrows show the movement of the labelled pole of a bar magnet into a closed circular loop and the arrows on the circle show the direction of the induced current

a) 

b) 

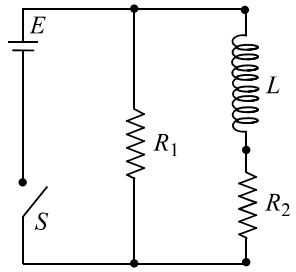
c) 

d) 

360. A conducting circular loop is placed in a uniform magnetic field, $B = 0.25\ T$ with its plane perpendicular to the loop. The radius of the loop is made to shrink at a constant rate of $1 mms^{-1}$. The induced e.m.f. when radius is $2cm$, is

a) $2\ \mu V$ b) $2\pi\mu V$ c) $\pi\mu V$ d) $\frac{\pi}{2}\mu V$

361. An inductor of inductance $L = 400mH$ and resistors of resistances $R_1 = 2\Omega$ and $R_2 = 2\Omega$ are connected to a battery of emf $12V$ as shown in the figure. The internal resistance of the battery is negligible. The switch S is closed at $t = 0$. The potential drop across L as a function of time is



a) $6e^{-5t}V$ b) $\frac{12}{t}e^{-3t}V$ c) $6\left(1-e^{\frac{-t}{0.2}}\right)V$ d) $12e^{-5t}V$

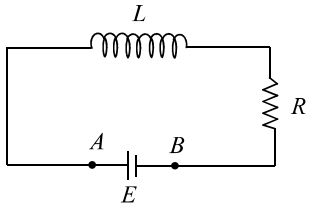
362. In step-up transformer, relation between number of turns in primary (N_p) and number of turns is secondary (N_s) coils is

a) N_s is greater than N_p b) N_p is greater than N_s c) N_s is equal to N_p d) $N_p = 2N_s$

363. 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

a) Zero b) 5 H c) 5000 H d) 5 mH

364. An inductor ($L = 100$ mH), a resistor (R $= 100\Omega$) and a battery ($E = 100V$) are initially connected in series as shown in the figure. After a long time the battery is disconnected after short circuiting the points A and B. The current in the circuit 1 ms after the short circuit is



a) e A b) 0.1 A c) 1 A d) $1/e$ A

365. 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

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

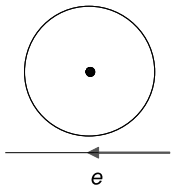
366. A transformer has an efficiency of 80%. It is connected to a power input of 5kW at 200 V. If the secondary voltage is 250 V, the primary and secondary currents are respectively

a) 25 A, 20 A b) 20 A, 16 A c) 25 A, 16 A d) 40 A, 25 A

367. 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

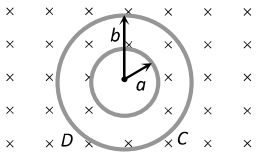
a) 6.55 T b) 5.66 T c) 0.655 T d) 0.566 T

368. Near a circular loop of conducting wire as shown in the figure an electron moves along a straight line. The direction of the induced current if any in the loop is



a) Variable b) Clockwise c) Anticlockwise d) Zero

369. 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 $dB/dt = 0.1\ m\ T/s$. The current in the inner and outer boundary are inner radius $a = 10\ cm$ and outer radius $b = 20\ cm$)



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

370. A metal of radius 100 cm is rotated at a constant angular speed of 60 rads^{-1} in a plane at right angles to an external field of magnetic induction 0.05 Wbm^{-2}. The emf induced between between the centre and a point on the rim will be

a) 3 V b) 1.5 V c) 6 V d) 9 V

371. 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

a) $M = L_1L_2$ b) $M = L_1/L_2$ c) $M = \sqrt{L_1L_2}$ d) $M = (L_1L_2)^2$

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

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

373. Lenz's law of electromagnetic induction corresponds to the

a) Law of conservation of charge b) Law of conservation of energy

c) Law of conservation of momentum d) Law of conservation of angular momentum

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

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

a) $10\ J$ b) $20\ J$ c) $30\ J$ d) $40\ J$

376. A coil having n turns and resistance $R\ \Omega$ is connected with a galvanometer of resistance $4R\ \Omega$. This combination is moved in time t sec from a magnetic field W_1 wb to W_2 wb. The induced current in the circuit is

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

377. A circular coil has 500 turns of wire and its radius is 5 cm. The self inductance of the coil is

a) 25×10^{-3}mH b) 25 mH c) 50×10^{-3}H d) 50×10^{-3}mH

378. A coil of Cu wire (radius-r, self inductance-L) is bent in two concentric turns each having radius $\frac{r}{2}$. The self inductance now

a) $2L$ b) L c) $4L$ d) $L/2$

379. A coil having 500 turns of square shape each of side 10 cm is placed normal to magnetic field which is increasing at 1 Ts^{-1}. The induced emf is

a) 0.1 V b) 0.5 V c) 1 V d) -5 V

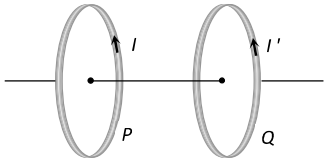
380. A closely wound coil of 100 turns and area of cross-section 1 cm^2 has a coefficient of self-induction 1 mH. The magnetic induction in the centre of the core of the coil when a current of $2A$ flows in it, will be

a) 0.022 Wbm^{-2} b) 0.4 Wbm^{-2} c) 0.8 Wbm^{-2} d) 1 Wbm^{-2}

381. A coil of area 80 $square\ cm$ and 50 turns is rotating with 2000 $revolutions\ per\ minute$ about an axis perpendicular to a magnetic filed of 0.05 $tesla$. The maximum value of the e.m.f. developed in it is

a) $200\ \pi\ volt$ b) $\frac{10\pi}{3} volt$ c) $\frac{4\pi}{3} volt$ d) $\frac{2}{3} volt$

382. Two coils P and Q are placed co-axially and carry current I and I' respectively



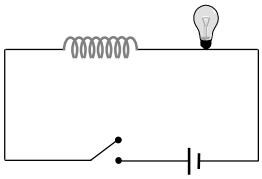
a) If $I' = 0$ and P moves towards Q, a current in the same direction as I is induced in Q

b) If $I = 0$ and Q moves towards P, a current opposite in direction to that of I' is induced in P

c) When $I \neq 0$ and $I' \neq 0$ are in the same direction, then two coil tend to move apart

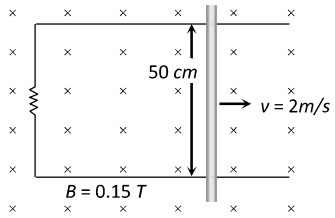
d) None of the above

383. In the following circuit, the bulb will become suddenly bright if



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

384. As shown in the figure a metal rod makes contact and completes 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



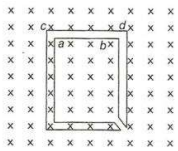
a) $3.75 \times 10^{-3}\ N$
b) $3.75 \times 10^{-2}\ N$
c) $3.75 \times 10^{2}\ N$
d) $3.75 \times 10^{-4}\ N$

385. 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) $16\ amp$

386. 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?
a) L^2
b) $2L$
c) $L/2$
d) Zero

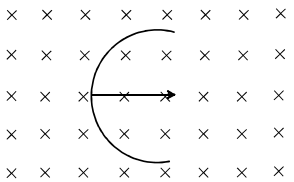
387. Core of transformer is made up of
a) Soft iron
b) Steel
c) Iron
d) Alnico

388. The figure shows certain wire segments joined together to form a coplanar loop. The loop is placed in a perpendicular magnetic field in the direction going into the plane of the figure. The magnitude of the field increases with time. I_1 and I_2 are the currents in the segments ab and cd. Then,



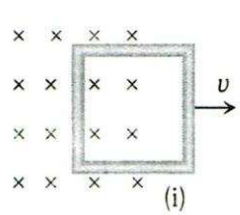
a) $I_1 > I_2$
b) $I_1 < I_2$
c) I_1 is in the direction ba and $I_2$is in the direction cd
d) I_1 is in the direction ab and $I_2$is in the direction dc

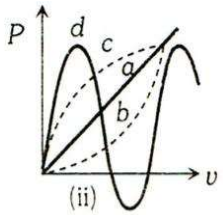
389. A straight wire of length L is bent into a semicircle. It is moved in a uniform magnetic field with speed v with diameter perpendicular to the field. The induced emf between the ends of the wire is



a) BLv
b) $2BLv$
c) $2\pi BLv$
d) $\frac{2BvL}{\pi}$

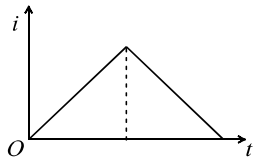
390. Figure (i) shows a conducting loop being pulled out of a magnetic field with a speed v. Which of the four plots shown in figure (ii) may represent the power delivered by the pulling agent as a function of the speed v

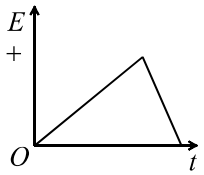


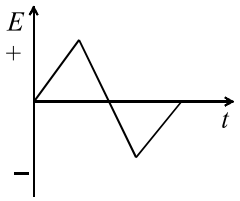


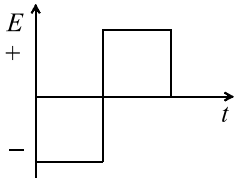
a) a b) b c) c d) c'

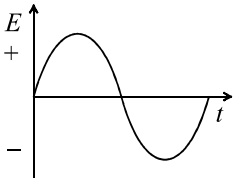
391. The current i in an inductance coil varies with time t according to the graph shown in fig. Which one of the following plots shows the variation of voltage in the coil with time



a) 

b) 

c) 

d) 

392. The number of turns in the coil of an ac generator is 5000 and the area of the coil is $0.25m^2$. 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

393. If the coefficient of mutual induction of the primary and secondary coils of an induction coils is 5 H and current of 10 A is cut-off in 5×10^{-4}s, the emf inducted (in volt) in the secondary coil is
a) 5×10^4 b) 1×10^5 c) 25×10^5 d) 5×10^6

394. 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
a) 3.5 sec b) 4.0 sec c) 4.5 sec d) 5.0 sec

395. Two similar circular loops carry equal currents in the same direction. On moving coils further apart, the electric current will
a) Increase in both b) Decrease in both
c) Remain unaltered d) Increases in one and decreases in the second

396. A varying magnetic flux linking a coil is given by $\phi - X\,t^2$. If at time t=3 s, the emf induced is 9V, then the value of $X$is
a) 0.66 Wbs^{-2} b) 1.5 Wbs^{-2} c) -0.66 Wbs^{-2} d) -1.5 Wbs^{-2}

397. A moving conductor coil in a magnetic field produces an induced e.m.f. This is in accordance with
a) Ampere's law b) Coulomb's law c) Lenz's law d) Faraday's law

398. A 16 μF capacitor is charged to a 20 volt potential. The battery is then disconnected and pure 40 mH coil is connected across the capacitor so that LC oscillations are setup. The maximum current in the coil is
a) 0.2 A b) 40 mA c) 2 A d) 0.4 A

399. A solenoid has an inductance of 60 $henry$ 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
a) 1 $second$ b) 2 $seconds$ c) e $seconds$ d) $2e$ $seconds$

400. Two pure inductors each of self inductance L are connected in parallel but are well separated from each other. The total inductance is
a) $2L$ b) L c) $\frac{L}{2}$ d) $\frac{L}{4}$

401. The charge which will flow through a 200 Ω galvanometer connected to a 400 Ω circular coil of 1000 turns

wound on a wooden stick 20 mm in diameter, if a magnetic field B = 0.012 T parallel to the axis of the stick decreased suddenly to zero is

a) 6.3 μC b) 63 μC c) 0.63 μC d) 630 μC

402. If the number of turns in a coil becomes doubled, then it self inductance will be

a) Double b) Halved c) Four times d) Unchanged

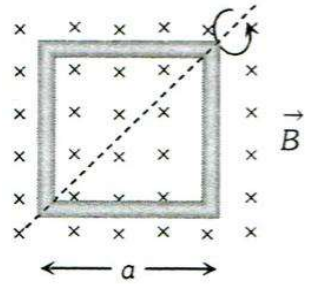
403. The north pole of a bar magnet is moved swiftly downward towards a closed coil and then second time it is raised upwards slowly. The magnitude and direction of the induced current in the two cases will be of

	First case	*Second case*
a)	Low value clockwise	Higher value anticlockwise
b)	Low value clockwise	Higher value anticlockwise
c)	Higher value anticlockwise	Low value clockwise
d)	Higher value anticlockwise	Low value clockwise

404. 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 2.0×10^{-4}C flows into the coil. If the resistance of the coil is 80Ω, the magnetic flux density in Wbm^{-2} is…….

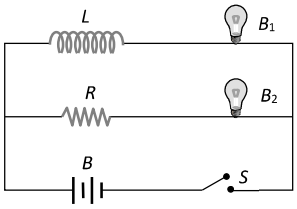
a) 0.5 b) 1.0 c) 1.5 d) 2.0

405. A square loop of side a is rotating about its diagonal with angular velocity ω in a perpendicular magnetic field $\vec{B}$. It has 10 turns. The $e.m.f.$ induced is



a) $B_a^2 \sin \omega t$ b) $B_a^2 \cos \omega t$ c) $5\sqrt{2}\, Ba^2$ d) $10\, Ba^2 \omega \sin \omega t$

406. 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



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

407. A current of 5 A is flowing at 220 V in the primary coil of a transformer. If the voltage produced in the secondary coil is 2200 V and 50% of power is lost, then the current in secondary will be

a) 2.5 A b) 5 A c) 0.25 A d) 0.5 A

408. A horizontal straight wire 20 m long extending from east to west is falling with a speed of $5.0 ms^{-1}$,at right angles to the horizontal component of the earth's magnetic field $0.030 \times 10^{-4} Wbm^{-2}$. the instantaneous value of the emf induced in the wire will be

a) 6.0 mV b) 3 mV c) 4.5 mV d) 1.5 mV

409. The energy stored in an inductor of self inductance L henry carrying a current of 1 A is

a) $L^2 I$ b) $-LI^2$ c) $\frac{1}{2} LI^2$ d) $\frac{1}{2} L^2 I$

410. 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
a) 10 V b) -10 V c) 2.5 V d) -2.5 V

411. A solenoid is placed inside another solenoid, the length of both being equal carrying same magnitude of current. The parameters like radius and number of turns are in the ratio 1 : 2 for the two solenoids. The mutual inductance on each other would be
a) $M_{12} = M_{21}$ b) $M_{12} = 2M_{21}$ c) $2M_{12} = M_{21}$ d) $M_{12} = 4M_{21}$

412. 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
a) 27.3 amp/sec b) 27.8 amp/sec c) 2.73 amp/sec d) None of the above

413. 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 to 0.35 T in 2 millisecond. The average induced emf in the coil is
a) 1.77 V b) 17.7 V c) 177 V d) 0.177 V

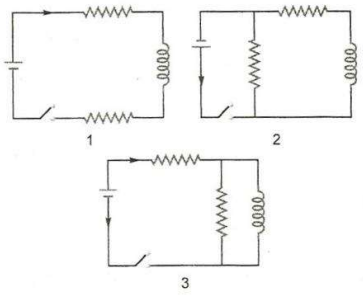
414. A circular coil of diameter 21 cm is placed in a magnetic field of induction 10^{-4} T. the magnitude of flux linked with coil when the plane of coil makes an angle 30° with the field is
a) 1.44×10^{-6} Wb b) 1.732×10^{-6} Wb c) 3.1×10^{-6} Wb d) 4.2×10^{-6} Wb

415. Two parallel rails of a railways track insulated from each other and with the ground are connected to a millivoltmeter. The distance between the rails is one metre. A train is travelling with a velocity of 72 km-h^{-1} along the track. The reading of the millivotmeter (in mV) is : (Vertical component of the earth's magnetic induction is 2×10^{-5}T)
a) 1.44 b) 0.72 c) 0.4 d) 0.2

416. Quantity that remains unchanged in a transformer is
a) Voltage b) Current c) Frequency d) None of these

417. A square coil of side 25 cm having 1000 turns is rotated with a uniform speed in a magnetic field about an axis perpendicular to the direction of the field. At an instant t, the emf induced in the coil is e=200sin $100\pi t$. The magnetic induction is
a) 0.50 T b) 0.02 T c) 10^{-3} T d) 0.01 T

418. The figure shows three circuits with identical batteries, inductors and resistances. Rank the circuits according to the currents through the battery just after the switch is closed, greatest first



a) $i_2 > i_3 > i_1$ b) $i_2 > i_1 > i_3$ c) $i_1 > i_2 > i_3$ d) $i_1 > i_3 > i_2$

419. A transformer is often filled with oil. The oil used should have
a) Low viscosity b) High dielectric strength
c) Low boiling point d) High thermal conducting

420. 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 secondary is
a) 4 A b) 2 A c) 6 A d) 10 A

421. The number of turns in primary coil of a transformer is 20 and the number of turns in the secondary is 10. If the voltage across the primary is 220 V, what is the voltage across the secondary?
a) 110 V b) 130 V c) 190 V d) 310 V

422. A short solenoid of length 4 cm, radius 2 cm and 100 turns is placed inside and on the axis of a long

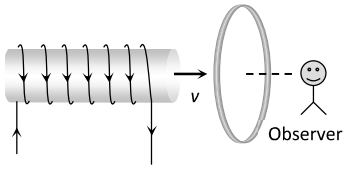
solenoid of length 80 cm and 1500 turns. A current of 3 A flows through the short solenoid. The mutual inductance of two solenoids is

a) 2.96×10^{-4}H b) 5.3×10^{-5}H c) 3.52×10^{-3}H d) 8.3×10^{-5}H

423. A step up transformer connected to a 220 V AC line is to supply 22 kV 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

a) 50 b) 100 c) 150 d) 200

424. 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

425. When the speed of a dc motor increases the armature current

a) Increases b) Decreases

c) Does not change d) Increases and decreases continuously

426. A helicopter rises vertically with a speed of 100 ms^{-1}. If helicopter has length 10 m and horizontal component of earth's magnetic field is 5×10^{-3} Wbm^{-2},then the induced emf between the tip of nose and tail of helicopter is

a) 50 V b) 0.5 V c) 5 V d) 25 V

427. A coil self inductance $L = 0.04$ H and resistance $R = 12\ \Omega$, connected to 220 V, 50Hz supply, what will be the current flow in the coil?

a) 11.7 A b) 12.7 A c) 10.7 A d) 14.7 A

428. A generator at a utility company produces 100 A of current at 4000 V. The voltage is stepped up to 240000 V by a transformer before it is sent on a high voltage transmission line. The current in transmission line is

a) 3.67 A b) 2.67 A c) 1.67 A d) 2.40 A

429. In a uniform magnetic field of induction$B$, a wire in the form of semicircle of radius r rotates about the diameter of the circle with angular frequency ω. If the total resistance of the circuit is R, the mean power generated per period of rotation is

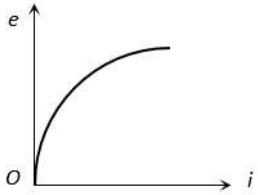
a) $\frac{B\pi r^2\omega}{2R}$ b) $\frac{(B\pi r^2\omega)^2}{5\,Rt}$ c) $\frac{(B\pi r\omega)^2}{2\,R}$ d) $\frac{(B\pi r\omega^2)^2}{8\,R}$

430. 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

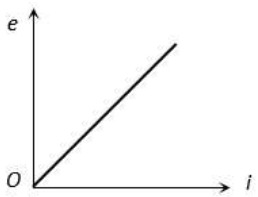
a) 3.0 V b) 0.75 V c) 1.5 V d) Zero

431. For previous objective, which of the following graphs is correct

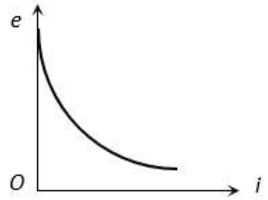
a)



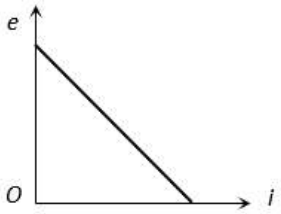
b)



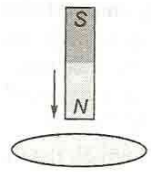
c)



d)



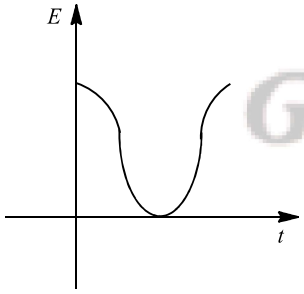
432. A copper ring having a cut such as not to form a complete loop is held horizontally ad a bar magnet is dropped through the ring with its length along the axis of the ring, figure. The acceleration of the falling magnet is



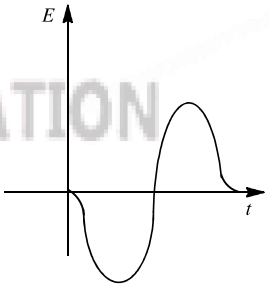
a) G b) Less than g c) More than g d) Zero

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

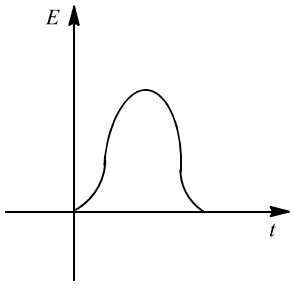
a)



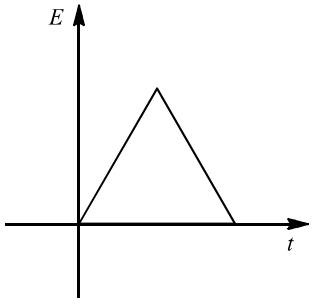
b)



c)



d)



434. A magnetic field of $2 \times 10^{-2} T$ 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

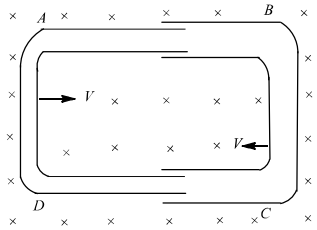
a) 0.1 sec b) 0.01 sec c) 1 sec d) 20 sec

435. Self-inductance of a coil is 50 mH. A current of 1 A passing through the coil reduces to zero at steady rate in 0.1 sec., the self-induced emf is

a) 5 volts b) 0.05 volts c) 50 volts d) 0.5 volts

436. 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 speed 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



a) Blv b) $-Blv$ c) Zero d) $2\,Blv$

437. If in a coil rate of change of area is $\frac{5\ metre^2}{milli\ second}$, current becomes 1 amp form 2 amp in $2\times10^{-3}sec$ magnetic field is 1 $tesla$, then self inductance of the coil is

a) $2H$ b) $5\ H$ c) $20\ H$ d) $10\ H$

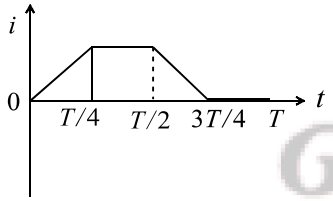
438. The magnitude of the earth's magnetic field at a place is B_0 and the angle of dip is δ. A horizontal conductor of length l, lying north-south, moves eastwards with a velocity v. The emf induced across the rod is

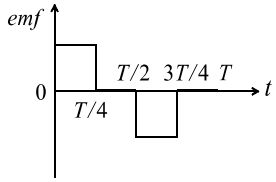
a) Zero b) B_0lv c) $B_0lv\sin\delta$ d) $B_0lv\cos\delta$

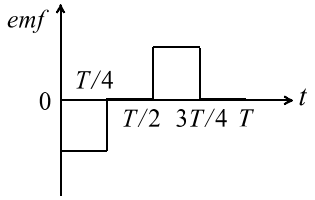
439. Two different loops are concentric and lie in the same plane. The current in the outer loop is clockwise and increasing with time. The induced current in the inner loop then, is

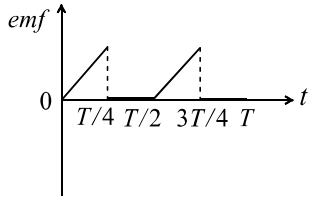
a) Clockwise
b) Zero
c) Counter clockwise
d) In a direction that depends on the ratio of the loop radii

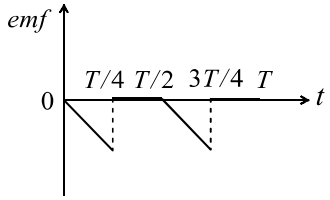
440. The current i in a coil varies with time as shown in the figure. The variation of induced emf with time would be



a)


b)


c)


d)


441. A loop of area 0.1 m^2 rotates with a speed of 60 rps perpendicular to a magnetic field of 0.4 T. If there are 100 turns in the loop, maximum voltage induced in the loop is

a) 15.07 V b) 1507 V c) 250 V d) 150 V

442. The pointer of a dead-beat galvanometer gives a steady deflection because

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