Shiksha Classes Bhandara
CHAPTER TEST

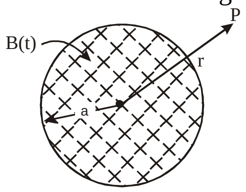
Subject : Physics **Topic : Electromagnetic Induction** **M.M. : 100**

Marking Scheme:

(i) Each question is allotted 4 (four) marks for each correct response.

(ii) ¼ (one fourth) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

Q.1 A uniform but time-varying magnetic field B (t) exists in a circular region of radius a and is directed into the plane of the paper, as shown. The magnitude of the induced electric field at point P at a distance r from the centre of the circular region :



(A) is zero (B) decreases as 1/r

(C) increases as r (D) decreases as $1/r^2$.

Q.2 A short-circuited coil is placed in a time-varying magnetic field. Electrical power is dissipated due to the current induced in the coil. If the number of turns were to be quadrupled and the wire radius halved, the electrical power dissipated would be –

(A) halved (B) the same

(C) doubled (D) quadrupled

Q.3 A coil having number of turns N and cross-sectional area A is rotated in a uniform magnetic field B with an angular velocity ω. The maximum value of the emf induced in it is –

(A) $\frac{NBA}{\omega}$ (B) NBAω

(C) $\frac{NBA}{\omega^2}$ (D) $NBA\omega^2$

Q.4 A series combination of an inductance (L) and a resistance (R) is connected to a battery of emf E. The final value of current depends on –

(A) L and R (B) E and R

(C) E and L (D) E, L and R

Q.5 A metal rod moves at a constant velocity in a direction perpendicular to its length. A constant, uniform magnetic field exists in space in a direction perpendicular to the rod as well as its velocity. Select the correct statement (s) from the following :

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

(B) There is an electric field in the rod

(C) The electric potential is highest at the center of the rod and decreases towards its ends

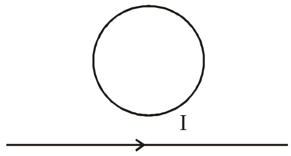
(D) The electric potential is lowest at the center of the rod and increases towards its ends.

Q.6 The mutual inductance of a pair of coils is 2H. If the current in of the coils changes from 10A to zero in 0.1s, the emf induced in the other coil is –

(A) 2V (B) 20V

(C) 0.2 V (D) 200 V

Q.7 A current-carrying wire is placed below a coil in its plane, with current flowing as shown. If the current increases –



(A) no current will be induced in the coil.

(B) an anticlockwise current will be induced in the coil

(C) a clockwise current will be induced in the coil

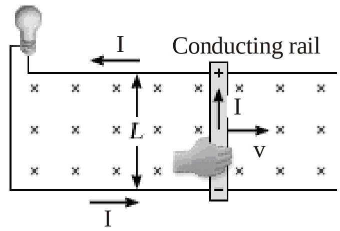
(D) the current induced in the coil will be first anticlockwise and then clockwise

Q.8 The back emf induced in a coil, when current changes from 1 ampere to zero in one milli-second, is 4 volts, the self inductance of the coil is.

(A) 1 henry (B) 4 henry

(C) 10^{-3} henry (D) 4×10^{-3} henry

Q.9 You have three light bulbs; bulb A has a resistance of 240Ω , bulb B has a resistance of 192Ω, and bulb C has a resistance of 144Ω. Each of these bulbs is used for the same amount of time in a setup like that in the figure. In each case the speed of the rod and the magnetic field strength are the same. Rank the setups in descending order, according to how much work the hand in the figure must do (largest amount of work first).



(A) A, B, C (B) A, C, B

(C) B, C, A (D) C, B, A

Q.10 Average energy stored in a pure inductance L when a current i flows through it, is.

(A) Li^2 (B) $2Li^2$

(C) $Li^2/4$ (D) $Li^2/2$

Q.11 In an ideal transformer, the voltage and the current in the primary are 200 volt and 2 amp. respectively. If the voltage in the secondary is 2000 volt. Then value of current in the secondary will be –

(A) 0.2 amp (B) 2 amp.

(C) 10 amp. (D) 20 amp.

Q.12 The magnetic flux through a coil varies with time as $\phi=5t^2+6t+9$.The ratio of emf at t = 3s to t = 0s will be

(A) 1 : 9 (B) 1 : 6

(C) 6 : 1 (D) 9 : 1

Q.13 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 the coil is approximately

(A) 0.1 μ_0Wb (B) 0.2 μ_0 Wb

(C) 1.0 μ_0 Wb (D) 2.0 μ_0Wb

Q.14 The magnetic flux through each turn of a 100 turn coil is $(t^3 - 2t) \times 10^{-3}$ Wb, where t is in second. The induced emf at t = 2 s is

(A) – 4V (B) – 1V

(C) +1V (D) + 4V

Q.15 A coil of radius 1 cm and or turns 100 is placed in the middle of a long solenoid of radius 5 cm and having 5 turns/cm. The mutual induction in millihenry will be-

(A) 0.0316 (B) 0.063

(C) 0.105 (D) Zero

Q.16 A magnetic field is perpendicular to the plane of a flat coil. Since the magnitude of the field is increasing, an emf will be induced in the coil unless something is done to prevent it. Except for one option, all of the following are possible options that could be used to keep the emf at the zero level. Which option could not be used?

(A) Decrease the area of the coil.

(B) Increase the angle between the field and the normal to the plane of the coil.

(C) Simultaneously decrease the area of the coil and increase the angle between the field and the normal to the plane of the coil.

(D) Reduce the time interval during which the magnitude of the field increases.

Q.17 A small magnet is along the axis of a coil and its distance from the coil is 80 cm. In this position the flux linked with the coil are 4×10^{-5} weber turns. If the coil is displaced 40 cm towards the magnet in 0.08 second, then the induced emf produced in the coil will be-

(A) 0.5 mV (B) 1 mV

(C) 7 mV (D) 3.5 mV

Q.18 Given only the values for the area of a flat surface and the magnetic flux through the surface, it is possible to calculate –

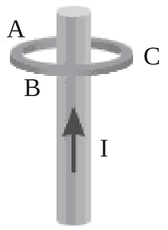
(A) the magnitude of the magnetic field that passes through the surface.

(B) the magnitude of the magnetic field component parallel to the surface.

(C) the magnitude of the magnetic field component perpendicular to the surface.

(D) no information about the magnetic field that passes through the surface.

Q.19 A long, vertical, straight wire carries a current I. The wire is perpendicular to the plane of a circular metal loop and passes through the center of the loop (figure). The loop is allowed to fall and maintains its orientation with respect to the straight wire while doing so. In what direction does the current induced in the loop flow?



(A) There is no induced current.

(B) Around the loop from A to B to C to A

(C) Around the loop from C to B to A to C

(D) None of these

Q.20 An air-plane with 20m wing spread is flying at $250 ms^{-1}$ straight south parallel to the earth's surface. The earth's magnetic field has a horizontal component of 2×10^{-5} Wb m^{-2} and the dip angle is 60º. Calculate the induced emf between the plane tips is:

(A) 0.174 V (B) 0.173 V

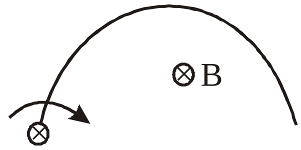
(C) 1.173 V (D) 0.163 V

For Q.21-Q.25 :

The answer to each question is a NUMERICAL VALUE.

Q.21 A coil of inductance 8.4 mH and resistance 6Ω is connected to a 12 V battery. The current in the coil is 1.0 A at approximately the time (in ms).

Q.22 A semicircular wire of radius R is rotated with constant angular velocity ω about an axis passing through one end and perpendicular to the plane of the wire. There is a uniform magnetic field of strength B. The induced emf between the ends is $X \times B\omega R^2$. Find the value of X.



Q.23 When the current i n a certain inductor coil is 5.0 A and is increasing at the rate of 10.0 A/s, the potential difference across the coil is 140V. When the current is 5.0 A and decreasing at the rate of 10.0 A/s, the potential difference is 60V. The self inductance (in H) of the coil is –

Q.24 A circular coil is radius 5 cm has 500 turns of a wire. The approximate value of the coefficient of self induction (in mH) of the coil will be-

Q.25 A wire of fixed lengths is wound on a solenoid of length ℓ and radius r. Its self inductance is found to be L. Now if same wire is wound on a solenoid of length $\ell/2$ and radius r/2, then the self inductance (in L) will be –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