TEST

JEE Mains PYQS Electromagnetic Induction (Physics Master Academy)

QUESTIONS

SECTIONS

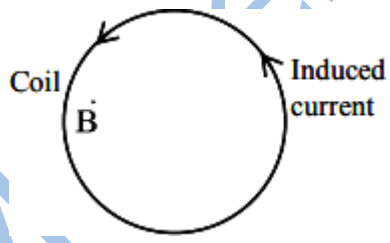
1. Section A - 24 Questions

Section 1 : Section A - 24 Questions

SECTION INSTRUCTIONS

This section contains 25 MCQs. +4 marks ofr every correct answer, - 1 mark for every incorrect answer.

1 A coil is placed in a magnetic keld $\vec{B}$ as shown below:



A current induced in the coil because $\vec{B}$ is

- outward and decreasing with time
- parallel to the plane of coil and decreasing with time
- outward and increasing with time
- parallel to the plane of coil and increasing with time

Correct: +4 · Incorrect: -1

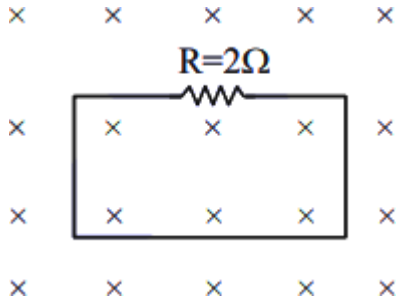
2 A circular coil of radius 8.0cm and 20 turns is rotated about its vertical diameter with an angular speed and 50 rad s^{-1} in a uniform horizontal magnetic keld of 3.0×10^{-2}T. The maximum emf induced the coil will be _ $\times10^{-2}$ volt (rounded off to the nerest integer).

- 45
- 50
- 55

○ 60

Correct: +4 · Incorrect: -1

3 In the given kgure the magnetic flux through the loop increases according to the relation $\phi_B(t) = 10t^2 + 20t$ where ϕ_B is in milliwebers and t is in seconds.
The magnitude of current through R = 2Ω resistor at t = 5 s is___mA.



○ 45

○ 50

○ 55

○ 60

Correct: +4 · Incorrect: -1

4 An aeroplane with its wing spread 10m, flying at speed of 180 km/h in a horizontal direction. The total intensity of earth's keld at that part is 2.5×10^{-4} Wb/m^2 and the angle of dip is 60°. The emf induced between the tips of the plane wings will be ___

○ 108.25 mV

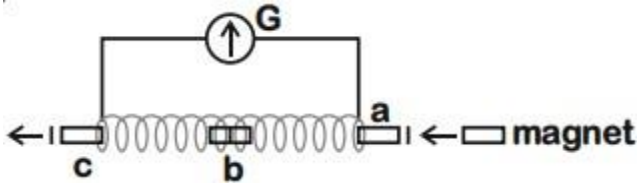
○ 88.37 mV

○ 62.50 mV

○ 54.125 mV

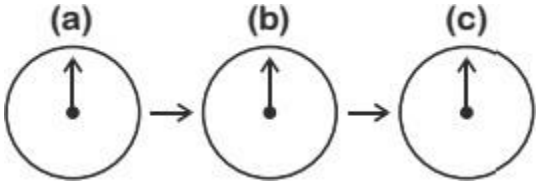
Correct: +4 · Incorrect: -1

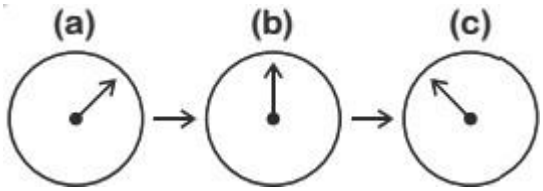
5 A small bar magnet is moved through a coil at constant speed from the one end to the other. Which of the following series of observations will be seen on the galvanometer G attached across the coil?

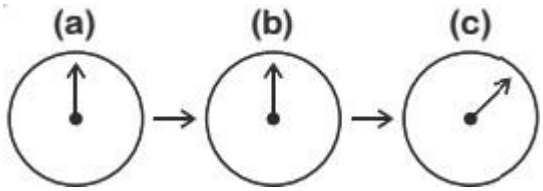


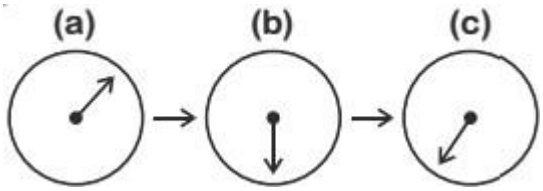
Three positions shown describe (1) the magnet's entry (2) magnet is completely inside and (3) magnet's exit.

○



○ 

○ 

○ 

Correct: +4 · Incorrect: -1

6 A uniform magnetic keld B exists in a direction perpendicular to the plane of a square loop made of a metal wire. The wire has a diameter of 4mm and a total length of 30cm. The magnetic keld changes with time at a steady rate dB/dt = 0.32 Ts^{-1}. The induced current in the loop is close to (Resistivity of the metal wire is 1.23×10^{-8} Ωm)

○ 0.43A

○ 0.61A

○ 0.34A

○ 0.53A

Correct: +4 · Incorrect: -1

7 A circular coil of radius 10cm is placed in a uniform magnetic keld of 3.0×10^{-5} T with its plane perpendicular to the keld initially. It is rotated at constant angular speed about an axis along the diameter of coil and perpendicular to magnetic keld so that it undergoes half of rotation in 0.2s. The maximum value of EMF induced (in μV) in the coil will be close to integer ___

○ 5

○ 10

- ○ 15
- ○ 20

Correct: +4 · Incorrect: -1

8 In a fluorescent lamp choke (a small transformer) 100V of reverse voltage is produced when the choke current changes uniformly from 0.25A to 0 in a duration of 0.025 ms. The self inductance of the choke (in mH) is estimated to be ___

- ○ 5
- ○ 10
- ○ 15
- ○ 20

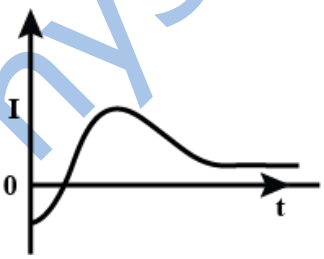
Correct: +4 · Incorrect: -1

9 Consider a circular coil of wire carrying constant current I, forming a magnetic dipole. The magnetic flux through an inknite plane that contains the circular coil and excluding the circular coil area is given by ϕ_i. The magnetic flux through the area of circular coil area is given by ϕ_0. Which of the following option is correct?

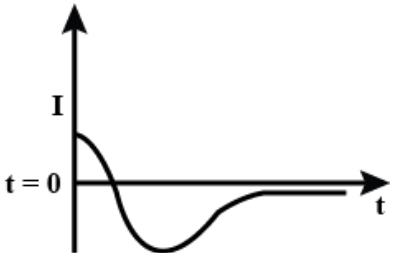
- ○ $_i = \phi_0$
- ○ $_i > \phi_0$
- ○ $_i < \phi_0$
- ○ $_i = -\phi_0$

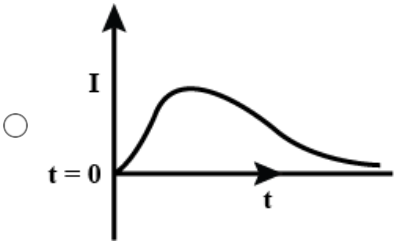
Correct: +4 · Incorrect: -1

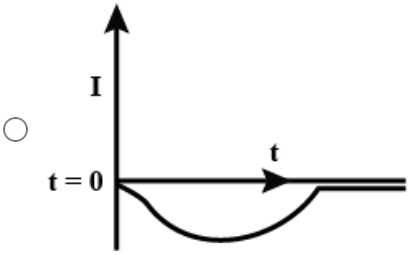
10 A very long solenoid of radius R is carrying a current $I(t) = kte^{-\omega t}$ $(k > 0)$, as a function of time $(t \geq 0)$. Counter clockwise current is taken to be positive. A circular conducting coil of radius 2R is placed in the equatorial plane of the solenoid and concentric with the solenoid. The current induced in the outer coil is correctly depicted, as a function of time by

- ○ 

- ○

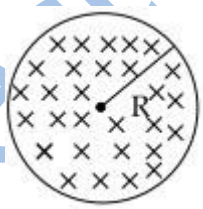




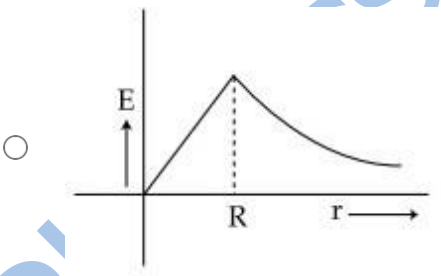


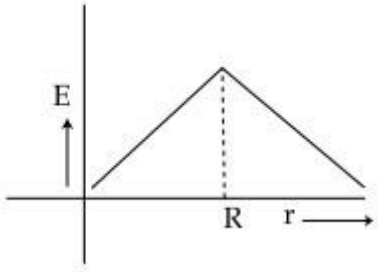
Correct: +4 · Incorrect: -1

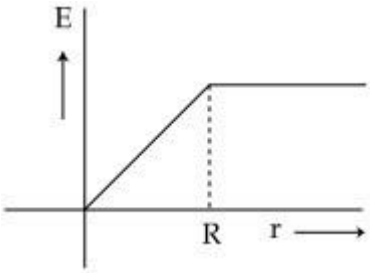
11 Figure shows a circular area of radius R where a uniform magnetic keld $\vec{B}$ is going into the plane of paper and increasing in magnitude at a constant rate.

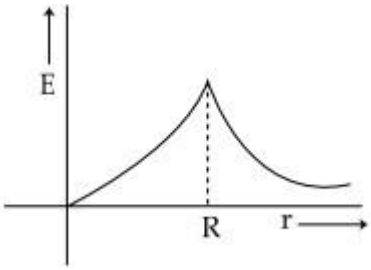


In that case, which of the following graphs, drawn schematically correctly shows the variation of the induced electric keld E(r)?









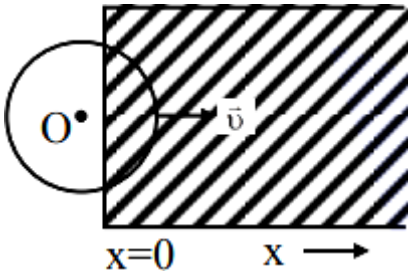
Correct: +4 · Incorrect: -1

12 A coil is suspended in a uniform magnetic keld, 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 difkcult to stop. But if an aluminium plate is placed near to the coil, it stops. This is due to

- development of air current when the plate is placed
- induction of electrical charge on the plate
- shielding of magnetic lines of force as aluminium is a paramagnetic material
- electromagnetic induction in the aluminium plate giving rise to the electromagnetic damping

Correct: +4 · Incorrect: -1

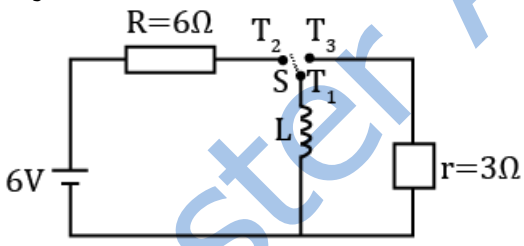
13 A constant magnetic keld of 1T is applied in the x > 0 region. A metallic circular ring of radius 1m is moving with a constant velocity of 1m/s along the x axis. At t = 0s, the centre O of the ring is x = - 1m. What will be value of the emf in the ring at t = 1s? (Assume the velocity of the ring does not change)



- 1 V
- 2π V
- 2 V
- 0 V

Correct: +4 · Incorrect: -1

14 Consider an electrical circuit containing a two way switch 'S". Initially S is open and then T_1 is connected to T_2. As the current in R = 6Ω attains a maximum value of steady state level, T_1 is connected from T_2 and immediately connected to T_3. Potential drop across r = 3Ω resistor immediately after T_1 is connected to T_3 is_V. (Round off to the nearest integer).



- 1
- 2
- 3
- 4

Correct: +4 · Incorrect: -1

15 The total number of turns and cross section area in a solenoid is kxed. However, its length L is varies by adjusting the separation between windings. The inductance of solenoid will be proportional to

- L
- L^2
- $1/L^2$

- 1/L

Correct: +4 · Incorrect: -1

16 A 10m long horizontal wire extends from North East to South West. It is falling with a speed of 5.0 ms^{-1} at right angles to the horizontal component of the earth's magnetic keld, of 0.3×10^{-4} Wb/m^2. The value of the induced emf in wire is:

- 1.5×10^{-3}V
- 1.1×10^{-3}V
- 2.5×10^{-3}V
- 0.3×10^{-3}V

Correct: +4 · Incorrect: -1

17 There are two long coaxial solenoids of same length l. The inner and outer coils have radii r_1 and r_2 and number of turns per unit length n_1 and $n_2$respectively. The ratio of mutual inductance to the self inductance of the inner coil is

- $\frac{n_1}{n_2}$
- $\frac{n_2}{n_1}.\frac{r_1}{r_2}$
- $\frac{n_2}{n_1}.\frac{r_2^2}{r_1^2}$
- $\frac{n_2}{n_1}$

Correct: +4 · Incorrect: -1

18 A solid metal cube of edge of length 2cm is moving in a positive y direction at a constant speed o 6m/s. There is a uniform magnetic keld of 0.1T in the positive z direction. The potential difference between the two faces of the cube perpendicular to the x axis is

- 12 mV
- 6 mV
- 1 mV
- 2 mV

Correct: +4 · Incorrect: -1

19 A boat is moving due east in a region where the earth magnetic keld is 5.0×10^{-5} NA^{-1} m^{-1} due north and horizontal. The boat carries a vertical aerial 2m long. If the speed of boat is 1.50 ms^{-1}, the magnitude of the induced emf in the wire of aerial is

- 0.75 mV
- 0.50 mV
- 0.15 mV
- 1 mV

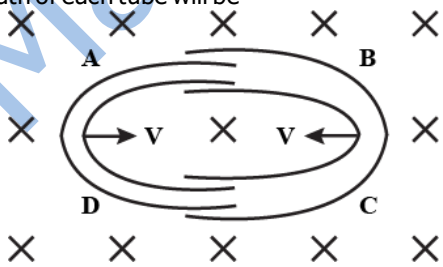
Correct: +4 · Incorrect: -1

20 A horizontal straight wire 20m long extending from east to west falling with a speed of 5.0 m/s. at right angles to the horizontal component of the earth's magnetic keld 0.30×10^{-4} Wb/m^2. The instantaneous value of the emf induced in the wire will be

- 3 mV
- 4.5 mV
- 1.5 mV
- 6.0 mV

Correct: +4 · Incorrect: -1

21 On conducting U tube can slide inside another as shown in kgure, Maintaining electrical contacts between the tubes. The magnetic keld B is perpendicular to the plane for the kgure. If each tube moves towards the other at a constant speed v, then the emf induced in the circuit in the terms of B, l and v where l is the width of each tube will be



- - B/v
- B/v
- 2 B/v
- zero

Correct: +4 · Incorrect: -1

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

- 5 mV
- 50 μV
- 5 μV
- 50 mV

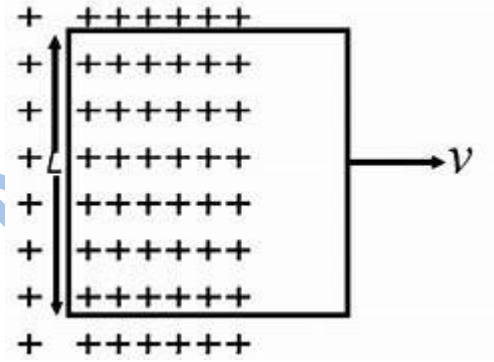
Correct: +4 · Incorrect: -1

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

- the rates at which currents are changing in the two coils
- relative position and orientation of the two coils
- the materials of the wires of the coils
- the currents in the two coils

Correct: +4 · Incorrect: -1

24 A conducting square loop of side L and resistance R moves in its place with a uniform velocity v perpendicular to one of its sides. A magnetic induction B constant in time and space, pointing perpendicular and into the plane at the loop exists everywhere with half the loop outside the keld, as shown in kgure. The induced emf is



- zero
- RvB
- vBL/R
- vBL

Correct: +4 · Incorrect: -1

TEST

JEE Mains PYQS Electromagnetic Induction (Physics Master Academy)

ANSWERS

SECTIONS

1. Section A - 24 Questions

Section 1 : Section A - 24 Questions

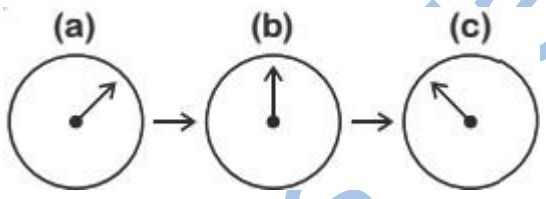
1 outward and decreasing with time

2 60

3 60

4 108.25 mV

5



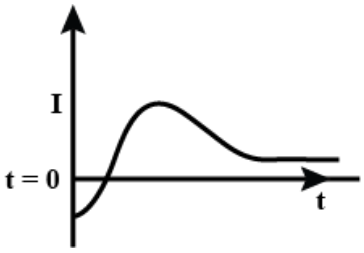
6 0.61A

7 15

8 10

9 $_{i} = -\phi_{0}$

10



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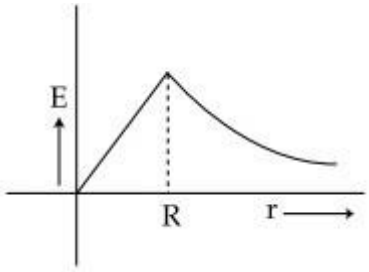

12 electromagnetic induction in the aluminium plate giving rise to the electromagnetic damping

13 2 V

14 3

15 1/L

16 1.5×10^{-3}V

17 $\frac{n_2}{n_1}$

18 12 mV

19 1 mV

20 3 mV

21 2 B/v

22 50 μV

23 relative position and orientation of the two coils

24 vBL

FOR FULL SOLUTIONS VISIT OUR APP.