CBSE · CLASS 12 · PHYSICS

WORKSHEET-1

MAX. MARKS
10

TOPIC: 6.5 Lenz's Law and Conservation of Energy; 6.6 Motional Electromotive Force

Name: _____ Roll No.: _____ Date: _____

GENERAL INSTRUCTIONS

- Q.No. 1–6 carry 1 mark each and Q.No. 7–8 carry 2 marks each.

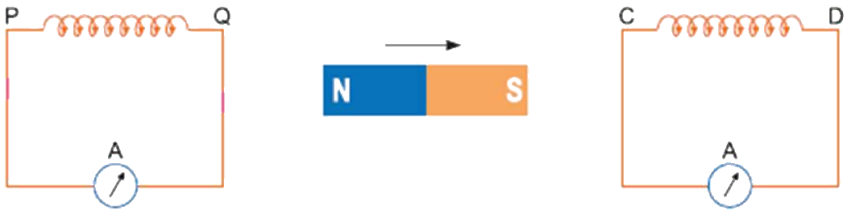
1. Two different loops are concentric and lie in the same plane. The current in the outer loop is clockwise and increasing with time. The induced current in the inner loop is [1]

(a) clockwise
(b) zero
(c) counter-clockwise
(d) in a direction that depends on the ratio of the loop radii

2. When the current through a solenoid increases at a constant rate, then the induced current [1]

(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 is opposite to the direction of the inducing current

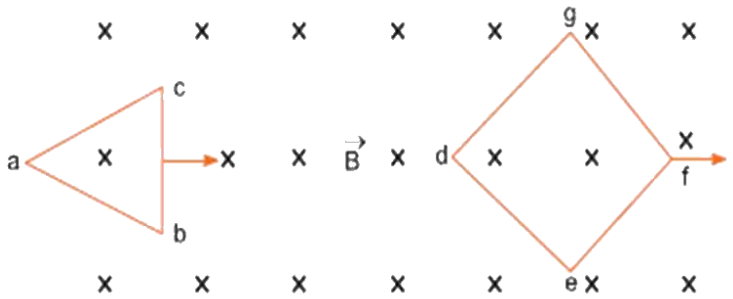
3. A bar magnet is moved in the direction indicated by the arrow between two coils *PQ* and *CD*. Predict the directions of induced current in each coil. [1]



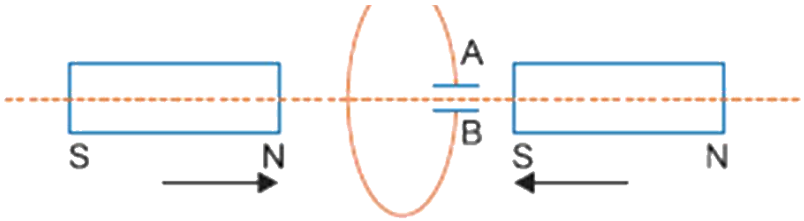
4. Predict the directions of induced currents in metal rings 1 and 2 lying in the same plane where current *I* in the wire is increasing steadily. [1]



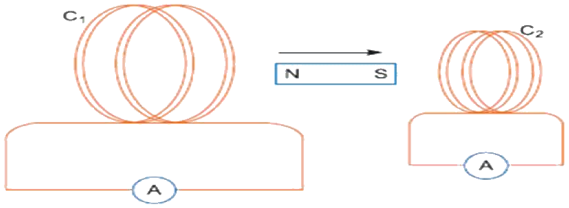
5. Two loops of different shapes are moved in the region of a uniform magnetic field pointing downward. The loops are moved in the directions shown by arrows. What is the direction of induced current in each loop? **[1]**



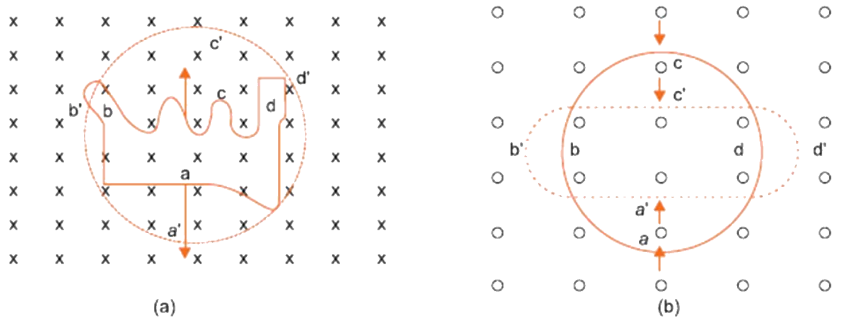
6. Predict the polarity of the capacitor *C* connected to the coil, which is situated between two bar magnets moving as shown in the figure. **[1]**



7. A magnet is quickly moved in the direction indicated by an arrow between two coils C_1 and C_2 as shown in the figure. What will be the direction of induced current in each coil as seen from the magnet? Justify your answer. **[2]**



8. Use Lenz's law to determine the direction of induced current in the situations described by the following figures. **[2]**



(a) A wire of irregular shape turning into a circular shape.
(b) A circular loop being deformed into a narrow straight wire.

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WORKSHEET–2

MAX. MARKS 10

TOPIC: 6.6 Motional Electromotive Force

Name: _____ Roll No.: _____ Date: _____

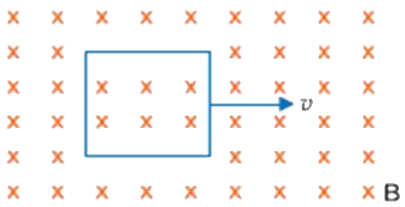
GENERAL INSTRUCTIONS

- Q.No. 1–2 carry 1 mark each, Q.No. 3 carries 2 marks and Q.No. 4–5 carry 3 marks each.

1. A thin circular ring of area A is held perpendicular to a uniform magnetic field of induction B. A small cut is made in the ring and a galvanometer is connected across its ends in such a way that the total resistance of the circuit is R. When the ring is suddenly squeezed to zero area, the charge flowing through the galvanometer is [1]

(a) BR/A **(b)** AB/R **(c)** ABR **(d)** B^2A/R^2

2. 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 as in the given figure. The current induced in the loop is [1]



(a) Blv/R, clockwise **(b)** Blv/R, anticlockwise

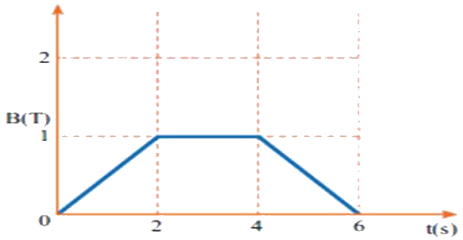
(c) $2Blv/R$, anticlockwise **(d)** zero

3. A ring of radius 2 m translates in its plane with a constant velocity of 5 m s^{-1}. A uniform magnetic field of 0.1 T exists in the space in a direction perpendicular to the plane of the ring. Consider different pairs of diametrically opposite points on the ring. [2]

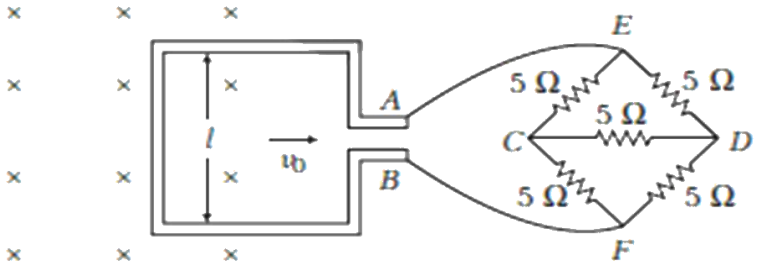
(i) Between which pair of points is the emf maximum? What is the value of this maximum emf?

(ii) What is the value of the minimum emf?

4. The magnetic field through a circular loop of wire 12 cm in radius and 8.5 Ω resistance changes with time as shown in the figure. The magnetic field is perpendicular to the plane of the loop. Calculate the induced current in the loop and plot it as a function of time. **[3]**



5. A square metal wire loop of side 20 cm and resistance 2 Ω is moved with a constant velocity v_0 in a uniform magnetic field of induction B = 1 Wb m^{-2}, as shown in the figure. The magnetic field lines are perpendicular to the plane of the loop. The loop is connected to a network of resistances, each of value 5 Ω. The resistances of the lead wires BF and AE are negligible. What should the speed of the loop be so as to have a steady current of 2 mA in the loop? Also determine the direction of the current in the loop. **[3]**



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WORKSHEET-3

MAX. MARKS 10

TOPIC: 6.7 Inductance: Self Inductance

Name: _____ Roll No.: _____ Date: _____

GENERAL INSTRUCTIONS

- Q.No. 1–4 carry 1 mark each and Q.No. 5–7 carry 2 marks each.

1. A metallic cylinder is held vertically and a small magnet is dropped along its axis. It will fall with [1]

(a) acceleration $a > g$ **(b)** acceleration $a < g$

(c) acceleration $a = g$ **(d)** constant velocity ($a = 0$)

2. An emf of 200 V is induced in a circuit when the current in the circuit falls from 5 A to 0 A in 0.1 second. The self-inductance of the circuit is [1]

(a) 3.5 H **(b)** 3.9 H **(c)** 4 H **(d)** 4.2 H

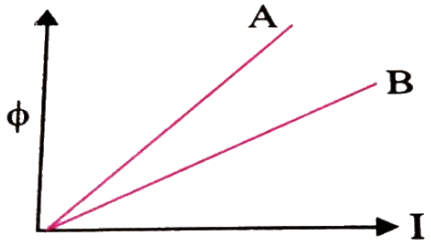
3. Two coils are made of the same wire and the same material. Coil A has twice the radius and the same number of turns as Coil B. The self-inductance of Coil A is [1]

(a) half of B **(b)** same as B **(c)** twice of B **(d)** four times of B

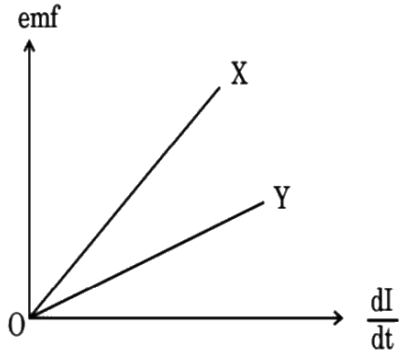
4. An inductor coil of inductance L is divided into two equal parts and both parts are connected in parallel. The net inductance is [1]

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

5. A plot of magnetic flux (φ) versus current (I) is shown in the figure for two inductors A and B. Which of the two has the larger value of self-inductance? Why? [2]



6. The figure shows the variation of induced emf as a function of rate of change of current for two identical solenoids X and Y. One is air-cored and the other is iron-cored. Which one of them is iron-cored? Why? **[2]**



7. The self-inductance of an air-core inductor increases from 0.01 mH to 10 mH on introducing an iron core into it. What is the relative permeability of the core used? **[2]**

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WORKSHEET-4

MAX. MARKS
10

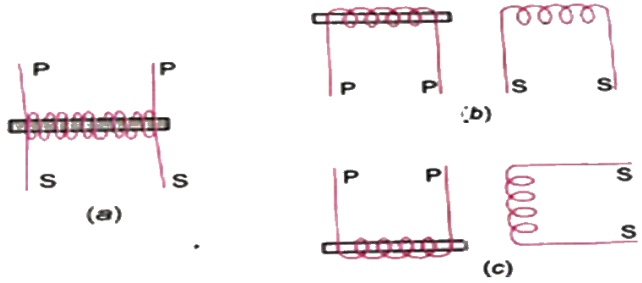
TOPIC: 6.7 Inductance: Mutual Inductance

Name: _____ Roll No.: _____ Date: _____

ANSWER THE FOLLOWING

- Q.No. 1 carries 1 mark and Q.No. 2–4 carry 3 marks each.

1. In which of the cases shown in the figure will the mutual inductance of two coils be **(i)** maximum and **(ii)** minimum, if the number of turns remains the same in each case? [1]



2. The figure shows two long coaxial solenoids, each of length l. The outer solenoid has an area of cross-section A_1 and number of turns per unit length n_1; the corresponding values for the inner solenoid are A_2 and n_2. Write the expressions for the self-inductances L_1, L_2 of the two coils and their mutual inductance M. Show that $M < \sqrt{(L_1 L_2)}$. [3]



3. A coil of N turns and area A is rotated at a constant angular speed ω in a uniform magnetic field B and connected to a resistor R. Deduce the expression for [3]
(i) the maximum emf induced in the coil,
(ii) the power dissipated in the coil.

4. The currents flowing in two coils of self-inductance L_1 = 16 mH and L_2 = 12 mH are increasing at the same rate. If the power supplied to the two coils is equal, find the ratio of **(i)** induced voltages, **(ii)** the currents and **(iii)** the energies stored in the two coils at a given instant. [3]

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WORKSHEET-5

MAX. MARKS 10

TOPIC: AC Generator

Name: _____ Roll No.: _____ Date: _____

ANSWER THE FOLLOWING

- Q.No. 1–2 carry 2 marks each and Q.No. 3–4 carry 3 marks each.

1. An AC generator consists of a coil of 100 turns and cross-sectional area of 3 m^2, rotating at a constant angular speed of 60 rad s^{-1} in a uniform magnetic field of 0.04 T. The resistance of the coil is 500 Ω. Calculate **(i)** the maximum current drawn from the generator and **(ii)** the maximum power dissipation of the coil. **[2]**

2. A conducting rod held horizontally along the East–West direction is dropped from rest from a certain height near the Earth's surface. Why should there be an induced emf across the ends of the rod? Draw a plot showing the instantaneous variation of emf as a function of time from the instant it begins to fall. **[2]**

3. A rectangular coil of dimensions 0.10 m × 0.05 m, consisting of 1000 turns, rotates about an axis parallel to its long side, making 3600 rpm. Find the instantaneous value of the emf induced with the coil at 30° to the field of magnitude 100 gauss. **[3]**

4. An a.c. generator consists of a coil of 50 turns and area 2.5 m^2 rotating at an angular speed of 60 rad s^{-1} in a uniform magnetic field B = 0.3 T between two fixed pole pieces. The resistance of the circuit including that of the coil is 500 Ω. **[3]**
(i) Find the maximum current drawn from the generator.
(ii) What will be the orientation of the coil with respect to the magnetic field to have (a) maximum, (b) zero magnetic flux?
(iii) Would the generator work if the coil were stationary and instead the pole pieces rotated together with the same speed as above?

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