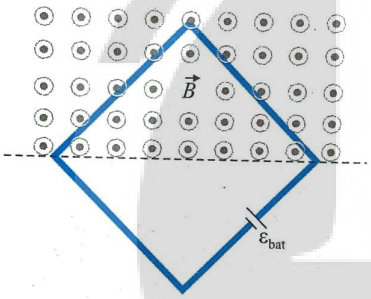
Ch—06 Electromagnetic Induction

Daily Practice Problem 02

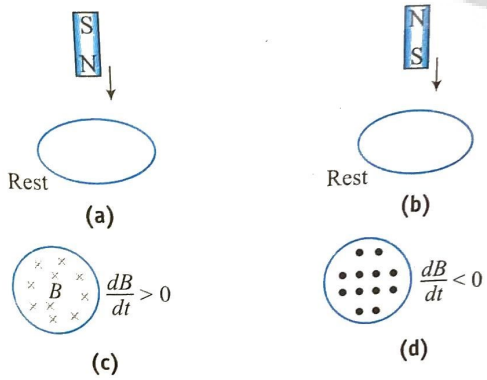
Q1. A square wire loop with side $L = 1.0\,m$ sides is perpendicular to a uniform magnetic field, with half the area of the loop in the field as shown in figure. The resistance of the loop is $35\ \Omega$ and the loop contains an ideal battery with emf $\epsilon = 6.0\,V$. If the magnitude of the field varies with time according to $B = 5.0 - 2.0t$, with B in teslas and t in seconds, what are



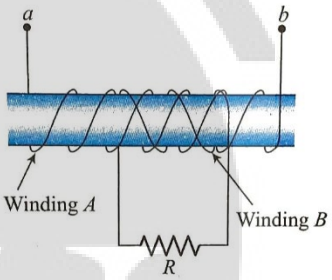
(a) the net emf in the circuit and

(b) the direction of the (net) current around the loop?

Q2. Identify the direction of induced current as seen from the above in the following cases.



Q3. A cardboard tube is wrapped with two windings of insulated wire wound in opposite directions as shown in figure. Terminals a and b of winding A may be connected to a battery through a reversing switch. State whether the induced current in the resistor R is from left to right or from right to left in the following circumstances.



(a) The current in winding A is from a to b and is increasing.

(b) The current in winding A is from b to a and is decreasing.

(c) The current in winding A is from b to a and is increasing.

Q4. A current $I = 3.36\,(1 + 2t) \times 10^{-2}\ A$ increases at a steady state in a long straight wire. A small circular loop of radius $10^{-3}\ m$ has its plane parallel to the wire and is placed at a distance of $1\,m$ from the wire. The resistance of loop is $8.4 \times 10^{-4}\ \Omega$ Find the approximate value of induced current in the loop.

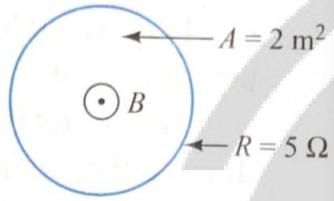
(a) $5.024 \times 10^{-11}\ A$

(b) $3.8 \times 10^{-11}\ A$

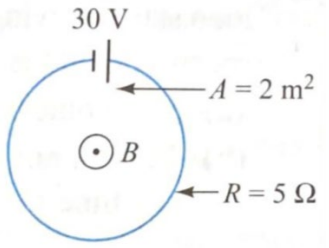
(c) $2.75 \times 10^{-11}\ A$

(d) $1.23 \times 10^{-11}\ A$

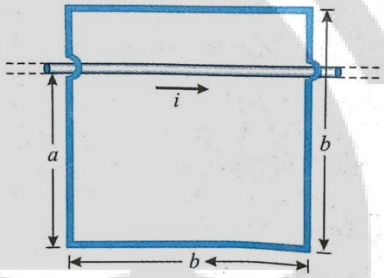
Q5. Figure shows a coil placed in a decreasing magnetic field applied perpendicular to the plane of the coil. The magnetic field is decreasing at a rate of $10\ T\ s^{-1}$. Find out current in magnitude and direction of current.



Q6. Figure shows a coil placed in a magnetic field decreasing at a rate of $10\ T\ s^{-1}$. There is also a source of emf $30\ V$ in the coil. Find the magnitude and direction of the current in the coil.



Q7. A wire loop with $a = 10.0\ cm$ and $b = 15.0\ cm$ and a long straight wire is arranged as shown in figure. The current in the wire is changing according with a relation $i = 5.0t^2 - 10.0t$, where i is in amperes and t is in seconds.



(a) Find the emf in the square loop at $t = 4.0\ s$.

(b) What is the direction of the induced current in the loop?

ANSWERS

1.(a) $7V$

(b) $0.2\ A$

2.(a) anticlockwise

(b) clockwise

(c) anticlockwise

(d) anticlockwise

3.(a) right to left

(b) right to left

(c) left to right

4. a

5. $4A$, anticlockwise

6. $2A$, clockwise

7.(a) $4.16 \times 10^{-7}\ V$

(b) counterclockwise