O P JINDAL SCHOOL, SAVITRINAGAR

ASSIGNMENT

CLASS XII PHYSICS

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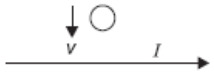
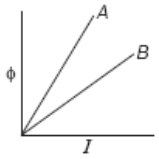
21 Predict the direction of induced current in a metal ring when the ring is moved towards a straight conductor with constant speed v. The conductor is carrying current I in the direction shown in the figure. 1



ANS: Clockwise.

22 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 larger value of selfinductance? 1

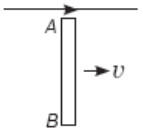


ANS: $L = \frac{\phi}{I}$ The more is the slope, the more is the value of self-inductance. Hence, inductor A has larger value.

23 The motion of copper plate is damped when it is allowed to oscillate between the two poles of a magnet. What is the cause of this damping? 1

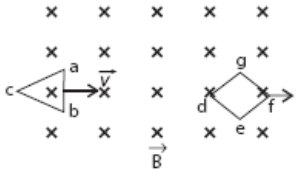
ANS: Eddy currents.

24 A wire and a rod *AB* are in the same plane. The rod moves parallel to the wire with the velocity *v*, then which end of the rod is at higher potential? 1



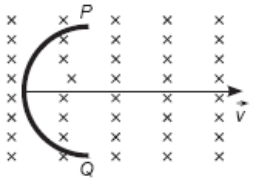
ANS: End *A* will be at higher potential.

25 Two loops of different shapes are moved in a region of uniform magnetic field in the directions marked by arrows as shown in the figure. What is the direction of the induced current in each loop? 1



ANS: (i) Anticlockwise
(ii) Clockwise

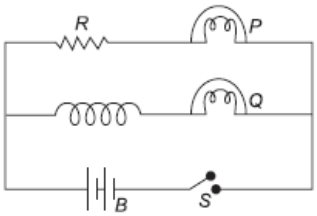
26 A semicircular conductor of radius R is moved in uniform magnetic field $\vec{B}$ as shown. Determine emf induced in it. 2



Which end is at higher potential?

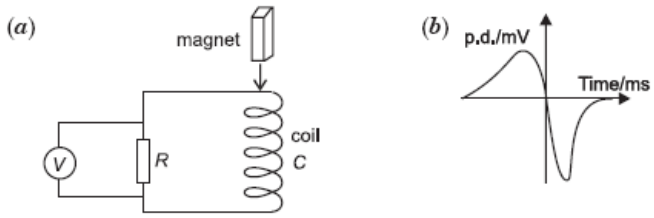
ANS: $e = B(2R)v$
According to the right-hand screw rule, P will be at higher potential.

27 The given figure shows an inductor L and resistor R connected in parallel to a battery B through a switch S. The resistance of R is the same as that of the coil that makes L. Two identical bulbs, P and Q are put in each arm of the circuit as shown in the figure. When S is closed, which of the two bulbs will light up earlier? Justify your answer. 2



ANS: When switch *S* is closed, bulb *P* will light up earlier. Bulb *P* is connected in series with a resistor. So, the current in bulb *P* will instantly rise to its steady value. On the other hand, bulb *Q* is in series with an inductor. On closing the switch *S*, current in bulb *Q* will grow exponentially to its steady value which will be the same as for bulb *P*. This is due to the production of induced emf in the inductor. However, the steady state value of current will be the same in both the bulbs.

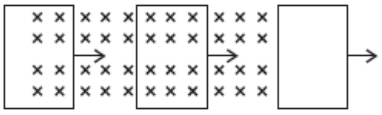
28 A bar magnet M is dropped so that it falls vertically through the coil C. The graph obtained for voltage produced across the coil vs time is shown in figure (b).
(i) Explain the shape of the graph.
(ii) Why is the negative peak longer than the positive peak? 2



ANS: (i) A magnet is moving towards the coil. Magnetic flux increases non-uniformly because the motion of the magnet is accelerated, an emf is induced. It increases, till the magnet reaches just above the coil. At this point, the emf attains its peak value.
While the magnet moves through the coil, the magnetic flux starts decreasing. With the flux, the induced emf also decreases and emf reduces to zero. Now, the magnet starts withdrawing itself from the coil. During this period, the magnetic flux again increases through the coil. Thus, the emf induced also increases, but this time opposite in the direction. The induced emf

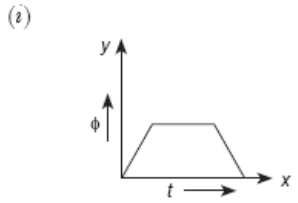
attains its maximum value, the moment magnet just comes out of the coil. After this, the magnet moves away from the coil. Thus, the magnetic flux through the coil decreases. The emf in the coil starts decreasing till it is reduced to zero.
(ii) The relative speed of recession of the magnet from the coil is more than the relative speed of approach of the magnet towards the coil. This is the reason why the negative peak is longer than the positive peak.

29 A uniform magnetic field exists normal to the plane of the paper over a small region of space. A rectangular loop of wire is slowly moved with a uniform velocity across the field as shown in figure. 2

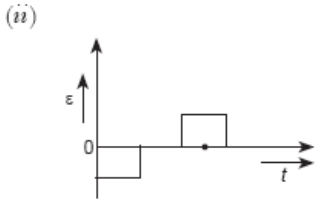


Draw the graph showing the variation of
(i) magnetic flux linked with the loop and
(ii) the induced emf in the loop with time.

ANS:

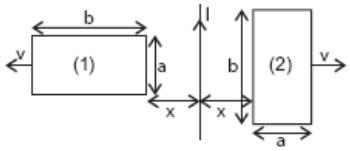


Variation of magnetic flux linked with the loop



Variation of induced emf in the loop with time

30 The figure shows two identical rectangular loops (1) and (2), placed on a table along with a straight line current carrying conductor between them. 2



(i) What will be the directions of the induced currents in the loops when they are pulled away from the conductor with same velocity v?

(ii) Will the emf induced in the two loops be equal? Justify your answer.

ANS: (i) (a) Magnetic field on the L.H.S. of the current carrying wire is

$B_1 = \frac{\mu_0 I}{2\pi x}$ directed outwards.

As the coil moves to the left with velocity v, magnetic flux through it decreases. Induced emf is developed in such a way that it opposes the change. Thus the current will flow anticlockwise in the loop.

(b) Flux decreases as the coil (2) moves so current will flow clockwise in the loop.

(ii) Induced emf, $\varepsilon = -\frac{d\phi}{dt} = -\frac{d(BA)}{dt}$, therefore, the rate of change of the magnetic flux in coil 2 is more due to more change in area per second and hence the emf induced in coil 2 is more than that of coil 1.