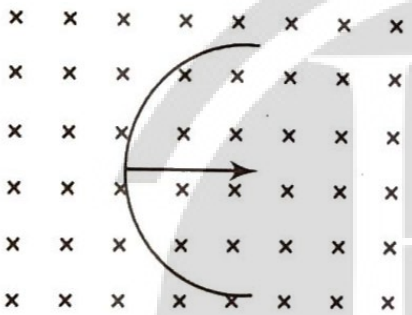
Ch—06 Electromagnetic Induction

Daily Practice Problem 03

Q1. A straight wire of length L is bent into a semicircle. It is moved in a uniform magnetic field with speed v with diameter perpendicular to the field. The induced emf between the ends of the wire is



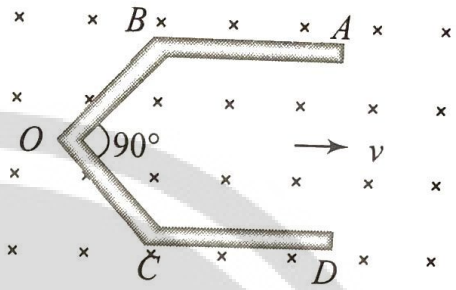
(a) BLv

(b) $2BLv$

(c) $2\pi BLv$

(d) $\frac{2BvL}{\pi}$

Q2. A conductor $ABOCD$ moves along its bisector with a velocity of $1\,m/s$ through a perpendicular magnetic field of $1\,wb/m^2$, as shown in the figure. If all the four sides are of $1\,m$ length each, then the induced emf between points A and D is



(a) 0

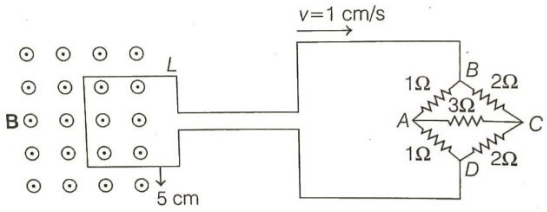
(b) 1.41 volt

(c) 0.71 volt

(d) None of the above

Q3. If a $10\,m$ long metallic bar moves in a direction at right angle to a magnetic field with a speed of $5.0\,ms^{-1}$, $25\,V$ emf is induced in it. Find the value of the magnetic field intensity.

Q4. The figure shows a square loop L of side $5\,cm$ which is connected to a network of resistances. The whole setup is moving towards right with a constant speed of $1\,cm\,s^{-1}$. At some instant, a part of L is in a uniform magnetic field of $1\,T$, perpendicular to the plane of the loop. If the resistance of L is $1.7\,\Omega$, the current in the loop at that instant will be close to

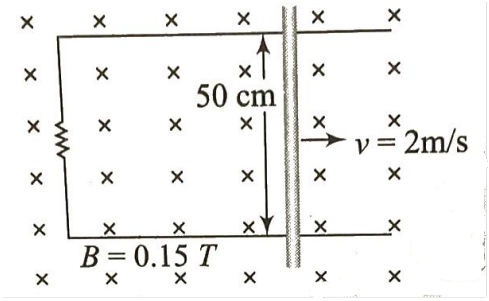


(a) 60 μA

(b) 170 μA

(c) 150 μA

(d) 115 μA



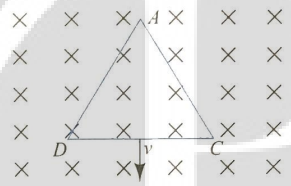
(a) $3.75 \times 10^{-3}\ N$

(b) $3.75 \times 10^{-2} N$

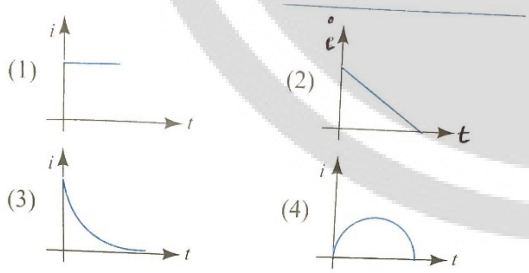
(c) $3.75 \times 10^{2}\ N$

(d) $3.7 \times 10^{-4}\ N$

Q5. An equilateral triangular loop ADC having some resistance is pulled with a constant velocity v out of a uniform magnetic field directed into the paper (figure). At time $t = 0$, side DC of the loop is at edge of the magnetic field

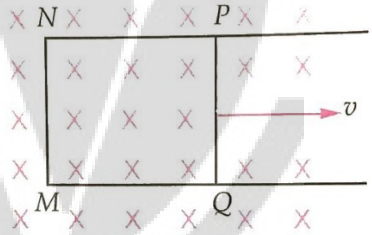


The induced current (i) versus time (t) graph will be as



Q6. As shown in the figure a metal rod makes contact and complete the circuit. The circuit is perpendicular to the magnetic field with $B = 0.15\ tesla$. If the resistance is 3Ω force needed to move the rod as indicated with a con speed of $2\ m/sec$ is

Q7. A rectangular loop $PQMN$ with movable arm PQ of length $10\ cm$ and resistance 2 is placed in a uniform magnetic field of $0.1\ T$ acting perpendicular to the plane of the loop as is shown in the figure.



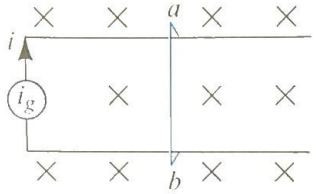
The resistances of the arms MN, NP and MQ are negligible. Calculate the

(i) emf induced in the arm PQ and

(ii) current induced in the loop when arm PQ is moved with velocity $20\ ms^{-1}$.

Q8. The current generator i_g, shown in figure, sends a constant current i through the circuit. The wire ab has a length l and mass m slide on the smooth, horizontal rails

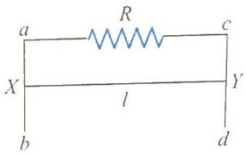
connected to i. The entire system lies in a vertical magnetic field B. The velocity of the wire as a function of time is



(a) $\frac{ilBt}{m}$ **(b)** $\frac{ilBt}{2m}$

(c) $\frac{2ilBt}{m}$ **(d)** $\frac{ilBt}{3m}$

Q9. A conducting wire xy of length l and mass m is sliding without friction on vertical conduction rails ab and cd as shown in figure. A uniform magnetic field B exists perpendicular to the plane of the rails, x moves with a constant velocity of



(a) $\frac{mgR}{Bl}$ **(b)** $\frac{mgR}{Bl^2}$

(c) $\frac{mgR}{B^2l^2}$ **(d)** $\frac{mgR}{B^2l}$

ANSWERS

1. d

2. b

3. 0.5 T

4. b

5. b

6. a

7. $0.2\,V, \quad 0.1\,V$

8. a

9. c