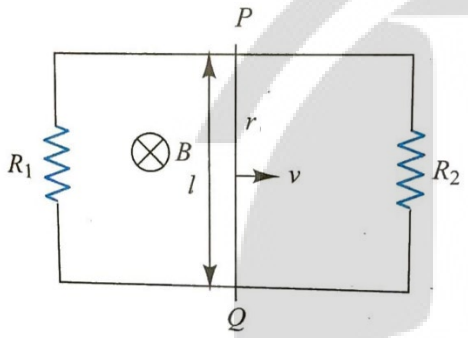
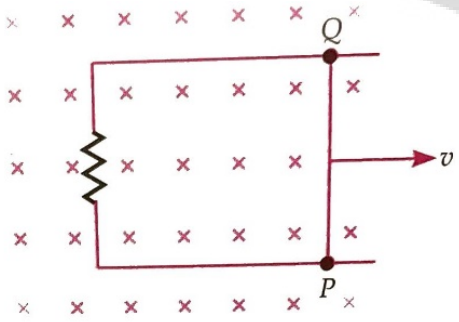
Ch—06 Electromagnetic Induction

Daily Practice Problem 04

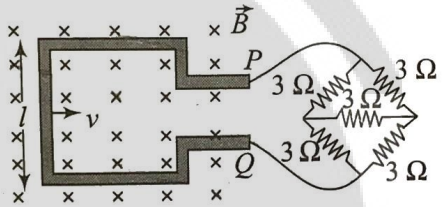
Q1. Figure shows rod PQ of mass m and resistance r moving on two fixed, resistance less, smooth conducting rails (closed on both sides by resistances R_1 and R_2). Find the current in the rod (at the instant its velocity is v).



Q2. A $0.5\ m$ long metal rod PQ completes the circuit as shown in Fig. The area of the circuit is perpendicular to the magnetic field of flux density $0.15\ T$. If the resistance of the total circuit is $3\ \Omega$, calculate the force needed to move the rod in the direction as indicated with a constant speed of $2\ ms^{-1}$.



Q3. A square metallic wire loop of side 0.1 m and resistance of 1Ω is moved with a constant velocity in a magnetic field of $2\ wb/m^2$ as shown in the figure. The magnetic field is perpendicular to a network of resistances. What should be the velocity to have a steady current of $1\ mA$ in loop?



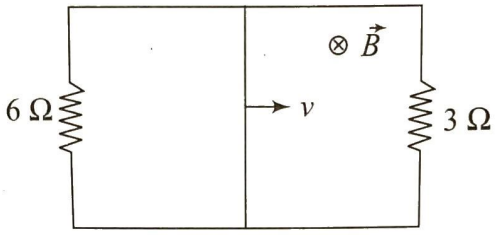
(a) 1 cm/sec

(b) 2 cm/sec

(c) 3 cm/sec

(d) 4 cm/sec

Q4. A rectangular loop with a sliding connector of length $l = 1.0\ m$ is situated in a uniform magnetic field $B = 2T$ perpendicular to the plane of loop. Resistance of connector is $r = 2\ \Omega$. Two resistances of 6Ω and 3Ω are connected as shown in the figure. The external force required to keep the connector moving with a constant velocity $v = 2\ m/s$ is



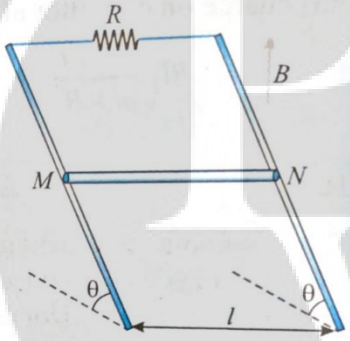
(a) 6 N

(b) 4 N

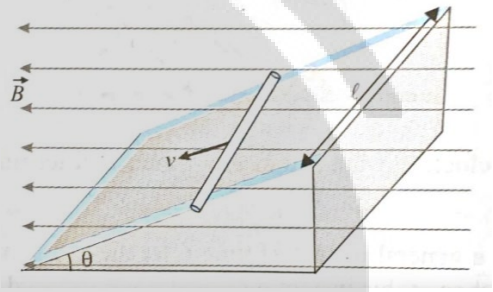
(c) 2 N

(d) 1 N

Q5. Two smooth conducting fixed parallel rails are inclined at an angle θ to the horizontal. The top end of the rails are connected with a resistance R. A straight horizontal conducting rod MN of length l, and mass m slides down on these rails as shown in figure. The system is located in a uniform magnetic field of induction B in vertically upward direction as shown in figure. The resistances of the bars, the rod and the sliding contacts are considered to be negligible. If the rod is released from rest, find the steady state velocity of the rod.



Q6. A rod of mass m, length l and resistance R is sliding down on a smooth inclined parallel rails with a constant velocity v. If a uniform horizontal magnetic field B exists, then find the value of B.



ANSWERS

1. $\frac{Blv}{r+\frac{R_1R_2}{R_1+R_2}}$

2. 0.00375 N

3. b

4. c

5. $v = \frac{mgRsin\theta}{B^2L^2\cos^2\theta}$

6. $\sqrt{\frac{mgR}{l^2vsin\theta}}$