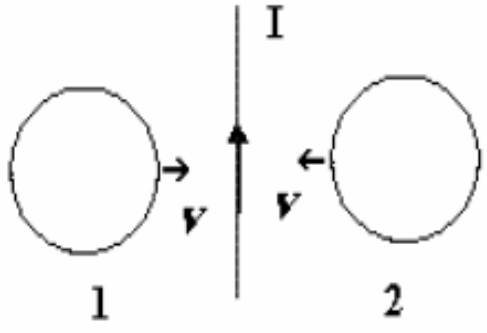
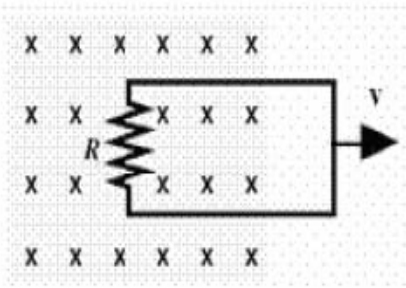
Old Exams Chapter 30

T081:

Q14. A long straight wire is in the plane of two circular conducting loops. The straight wire carries a constant current I in the direction shown in Fig 9. The circular loop 1 is moved to the right while the loop 2 is moved to the left with the same speed, v. The induced current directions in the circular loops 1 and 2 are respectively: (Ans: Clockwise , counterclockwise)



Q15. A circuit is pulled to the right at constant speed in a uniform magnetic field with a 16 N force as shown in Fig 10. As the circuit moves, a 6.0 A current flows through the 4.0 Ω resistor. With what speed does the circuit move? (Ans: 9.0 m/s)

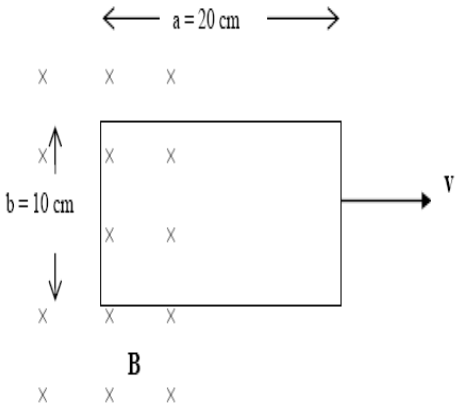


Q16. A 2.0 m long copper wire, with resistance 5.0 Ω, is shaped into a square loop and placed perpendicular to a uniform magnetic field that is increasing at the constant rate of 1.0×10^{-2} T/s. At what rate is thermal energy generated in the loop? (Ans: 1.3×10^{-6} W.)

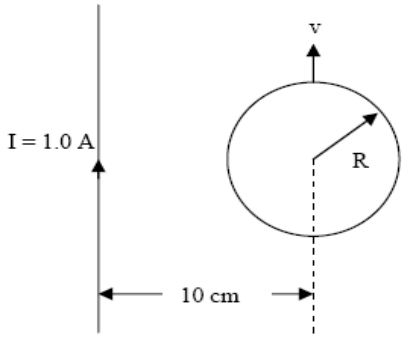
T072

Q28. A circular loop of radius R = 10 cm is placed so that its plane is perpendicular to a magnetic field that is increasing at a constant rate of 50 mT/s. What is the magnitude of the induced emf in the loop? (Ans: 1.6 mV)

Q29. Consider a rectangular conducting loop of length a = 20 cm and width b = 10 cm and resistance R = 10 Ω as shown in Fig. 1. The loop is moving out of a uniform magnetic field region, at a constant speed of 5.0 m/s. The magnetic field **B** is into the page and has a magnitude of 0.50 T. What is the magnitude and direction of the induced current? (Ans: 25 mA clockwise)

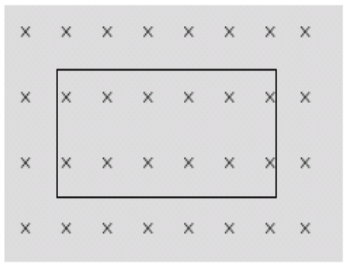


Q30. A very long straight wire is in the plane of a circular conducting loop of radius R = 2 cm as shown in Fig. 2. The wire carries a current of 1.0 A and has a resistance of 2.0 Ω. The circular loop starts moving parallel to the wire with a speed of 10 m/s as shown. The induced current during the motion of the loop is:
(Ans Zero)

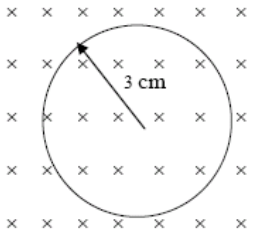


T071

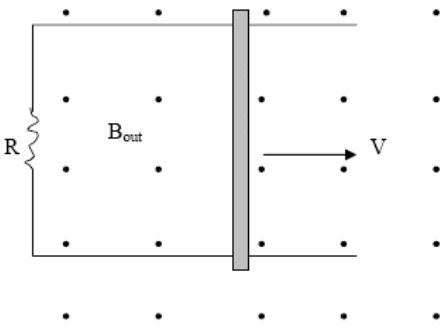
Q28. Fig. 1 shows a conducting loop that is placed perpendicular to an external magnetic field that points into the page. Which of the following changes will induce a counterclockwise current? (Ans: Increasing the magnitude of the magnetic field.)



Q29. In the Fig. 2 the magnetic field decreases from 1.0 T to 0.40 T in 1.2 s. A 3.0 cm radius conducting loop with a resistance of 0.010 Ω is perpendicular to **B**. What are the size and the direction of the current induced in the loop? (Ans: 140 mA and current is clockwise.)



Q30. A metal rod of length L = 5.0 cm moves at constant speed v on rails of negligible resistance that terminate in a resistance R = 0.2 Ω, as shown in the Fig. 3. A uniform and constant magnetic field B = 0.25 T is normal to the plane of the rails. The induced current is I= 2.0 A. Find the speed v. (Ans: 32 m/s)



T062

Q29. A 1.7-T uniform magnetic field makes an angle of 30^0 with the z axis. The magnetic flux through an area of 4.0-m^2 lying in the xy-plane is: (Ans:6.0 $T.m^2$)

Q30. A uniform magnetic filed B is perpendicular to a loop of an area 1.5 m^2. The resistance of the wire forming the loop is 2.50 Ω. At what rate must the magnitude of the magnetic field B change to induce a current of 0.3 A? (Ans: 0.5 T/s)

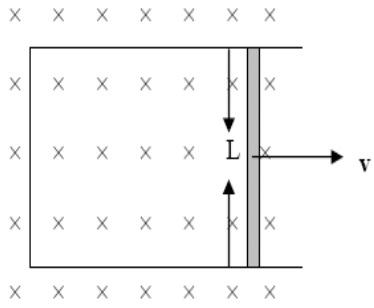
T061:

Q28. Each turn of a 150-turn coil, encloses an area of 0.8 m^2. What should be the rate of change of a magnetic field parallel to its axis in order to induce a current of 0.1 A in the coil? [The resistance of the coil is 600 Ohm] (Ans: 0.50 T/s.)

Q30. A constant magnetic flux of 4.0×10^{-5} Wb is maintained through a coil for 0.5 s. What emf is induced in the coil by this flux during that period? (Ans: Zero)

T-052

Q26. Figure 8 shows a metal rod of length 25 cm moving at a constant velocity along two parallel metal rails. If the magnetic field is 0.35 T into the page, and the induced emf is 15 mV, calculate the speed of the metal bar. (Ans: 14 cm/s.)



Q30. A long straight wire carries a current that increases at a rate of 6×10^4 A/s. The wire passes through the center of a circular loop of radius 5 cm, as shown in Figure 9. The induced *emf* in the loop is: (Ans: 0 mV)

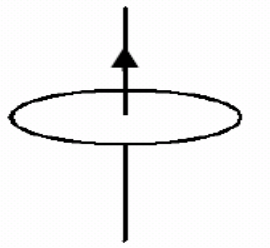


Figure 9

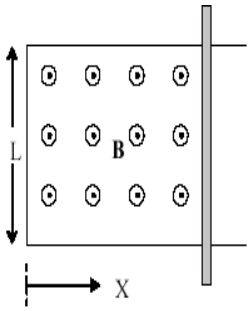
T051

Q2. A long solenoid has 10 turns per cm and carries a 4 A current. A circular loop with cross-sectional area = 8 cm 2 has 5 turns and lies within the solenoid with its axis parallel to the axis of the solenoid. Find the magnitude of the induced emf if the current increases 0 to 4 A in 0.1 s. (Ans: 4.0×10^{-4} V)

Q3. A 500 turns toroid has a radius of 5 cm. If the magnetic field inside the toroid is 0.04 T, the current passing through the toroid is. (Ans: 20 A)

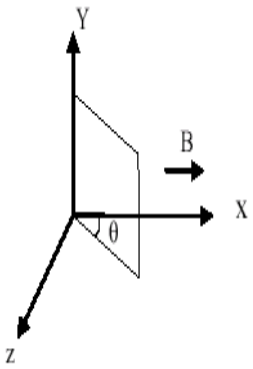
Q8. A flat circular coil has 80 turns of diameter 20 cm with a total resistance of 40 Ω. The plane of the coil is perpendicular to a uniform magnetic field. At what rate should the magnetic field change for the power dissipated in the coil to be 2 W? (Ans: 3.6 T/s)

Q19. A metal bar is free to move over a U-shaped metal rail, as shown in the figure 1. At t=0s, the external field is 0.4 T directed out of the page and is increasing at a rate of 0.2 T/s. What will be the velocity of the metal bar such that the induced emf will be zero at x = 5 cm and t = 0 ? Take L = 5 cm. (Ans: 0.025 m/s, along –x direction.)



T042

Q26. A square coil of side 20 cm is rotating about the y-axis. It is oriented as shown in the figure 2. The external field is B = 0.5 T along the positive x-axis. What is the change in the magnetic flux through the coil if the angle changes from 37^o to 53^o ? (Ans: –4 mWb.)



Q29 A small circular loop of area 0.50 cm^2 is placed in the plane of, and concentric with, a large circular loop of radius 2.0 m. The current in the large loop is changed uniformly from +100 A to –100 A in a time of 0.50 s. Find the emf induced in the small loop in this time interval (Assume the field is uniform through the smaller loop). (Ans: $6.3\text{x}10^{-9}$ V.)

Q30 A long straight wire is in the plane of a circular conducting loop as shown in figure 9. The straight wire carries a constant current I in the direction shown. The circular loop starts moving to the left. The induced current in the circular loop is: (Ans: counter clockwise.)

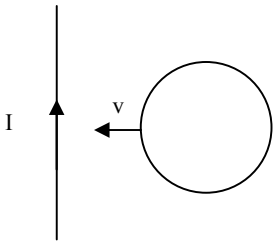


Figure 9

T041

Q1 A circular wire loop, of an area 0.10 m^2, is initially oriented so that its plane is perpendicular to a 0.40 T magnetic field. When the loop is rotated so that its plane is parallel to the field, a 25 V average potential difference is induced across the loop. The time (in seconds) required to make this rotation of the loop is (Ans: 1.6×10^{-3})

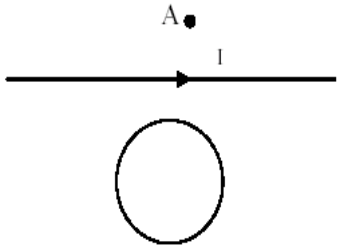
Q2 A 2.0 m long copper wire, with resistance 5.0 Ω, is formed into a square loop and placed perpendicular to a uniform magnetic field that is increasing at the constant rate of 10.0 mT/s, at what rate is thermal energy generated in the loop? (Ans: 1.3×10^{-6} W.)

T032

Q1 A 400-turn coil of total resistance 6.0 Ω has a cross sectional area of 30 cm^2. How rapidly should a magnetic field parallel to the coil axis change in order to induce a current of 0.3 A in the coil? (Ans: 1.5 T/s.)

Q2 A circular wire loop of area 0.5 m^2 is perpendicular to a magnetic field of 0.8 T. If the coil is removed completely from the field in 0.1 s, the average emf induced in the loop has a magnitude (Ans: 4.0 V.)

Q3 A long straight wire carrying a constant current I is in the plane of a circular conducting loop as shown in figure (9). If the wire is moved away from the loop toward point A, the current induced in the loop is (Ans: clockwise.)



T031

Q1 A long straight wire is in the plane of a rectangular conducting loop as shown in Figure 8. The straight wire carries an increasing current "i" in the direction The current in the rectangular is: (Ans: counter clockwise.)

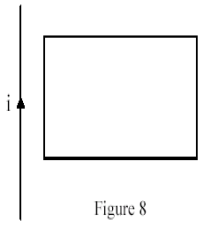
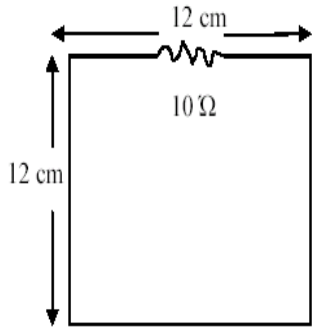


Figure 8

Q2 The circuit shown in figure 9 is in a uniform magnetic field that is into the page and is decreasing in the magnitude at the rate of 150 T/s. The current in the circuit is: (Ans: 0.22 A.)



Q3 Figure 10 shows a bar moving to the right on two conducting rails. To make an induced current in the direction indicated, a constant magnetic field in region "A" should be in what direction? (Ans: Into the page.)