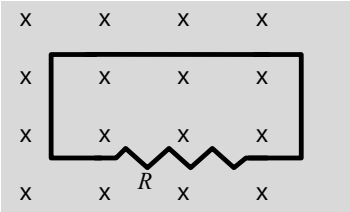
chapter 22 ELECTROMAGNETIC INDUCTION

◘ 1. The figure shows a uniform magnetic field that is normal to the plane of a conducting loop, which has a resistance R. Which one of the following changes will cause an induced current to flow through the resistor?



(a) decreasing the area of the loop
(b) decreasing the magnitude of the magnetic field
(c) increasing the magnitude of the magnetic field
(d) rotating the loop through 90° about an axis in the plane of the paper
(e) all of the above

◘ 3. A circular copper loop is placed perpendicular to a uniform magnetic field of 0.50 T. Due to external forces, the area of the loop decreases at a rate of 1.26×10^{-3} m^2/s. Determine the induced emf in the loop.

(a) 3.1×10^{-4} V
(b) 6.3×10^{-4} V
(c) 1.2×10^{-3} V
(d) 7.9×10^{-3} V
(e) 3.1 V

■ 4. A conducting loop has an area of 0.065 m^2 and is positioned such that a uniform magnetic field is perpendicular to the plane of the loop. When the magnitude of the magnetic field *decreases* to 0.30 T in 0.087 s, the average induced emf in the loop is 1.2 V. What is the initial value of the magnetic field?

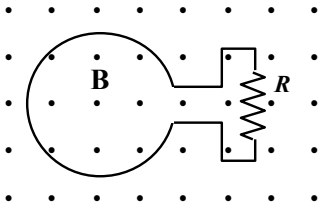
(a) 0.42 T
(b) 0.75 T
(c) 0.87 T
(d) 1.2 T
(e) 1.9 T

■ 5. The area of a 333-turn conducting coil is 7.85×10^{-3} m^2. The resistance of the coil is 10.4 Ω. If the coil is oriented as shown in a magnetic field **B**, at what rate in T/s should the magnitude of **B** change to induce a current of 2.50×10^{-3} A in the coil?

(a) 0.0155 T/s
(b) 0.0996 T/s
(c) 0.228 T/s
(d) 0.757 T/s
(e) 1.52 T/s

Questions 6 through 9 pertain to the situation described below:

The figure shows a uniform, 3.0-T magnetic field that is normal to the plane of a conducting, circular loop with a resistance of 1.5 Ω and a radius of 0.024 m. The magnetic field is directed out of the paper as shown. **Note**: The area of the non-circular portion of the wire is considered negligible compared to that of the circular loop.



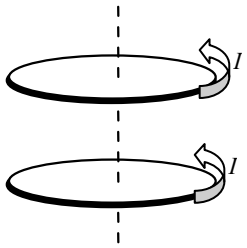
◘ 6. What is the magnitude of the average induced emf in the loop if the magnitude of the magnetic field is doubled in 0.4 s?
(a) 0.43 V (c) 0.014 V (e) 0.038 V
(b) 0.65 V (d) 0.027 V

■ 7. What is the average current around the loop if the magnitude of the magnetic field is doubled in 0.4 s?
(a) 2.8×10^{-3} A, clockwise (d) 9.0×10^{-3} A, clockwise
(b) 4.5×10^{-3} A, clockwise (e) 9.0×10^{-3} A, counterclockwise
(c) 4.5×10^{-3} A, counterclockwise

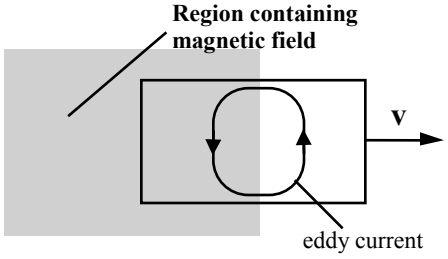
◘ 8. If the magnetic field is held constant at 3.0 T and the loop is pulled out of the region that contains the field in 0.2 s, what is the magnitude of the average induced emf in the loop?
(a) 8.6×10^{-3} V (c) 2.7×10^{-2} V (e) 6.4×10^{-2} V
(b) 9.8×10^{-2} V (d) 5.4×10^{-2} V

■ 9. If the magnetic field is held constant at 3.0 T and the loop is pulled out of the region that contains the field in 0.2 s, at what rate is energy dissipated in *R*?
(a) 1.8×10^{-2} W (c) 3.8×10^{-3} W (e) 4.9×10^{-4} W
(b) 3.6×10^{-2} W (d) 2.7×10^{-4} W

■ 12. Two conducting loops carry equal currents *I* in the same direction as shown in the figure. If the current in the upper loop suddenly drops to zero, what will happen to the current in the lower loop according to Lenz's law?
(a) The current in the lower loop will decrease.
(b) The current in the lower loop will increase.
(c) The current in the lower loop will not change.
(d) The current in the lower loop will also drop to zero.
(e) The current in the lower loop will reverse its direction.



◘ 13. A sheet of copper is pulled at constant velocity **v** from a region that contains a uniform magnetic field. At the instant shown in the figure, the sheet is partially in and partially out of the field. The induced emf in the sheet leads to the eddy current shown. Which one of the following statements concerning the direction of the magnetic field is true?
(a) The magnetic field points to the right.
(b) The magnetic field points to the left.
(c) The magnetic field points into the paper.
(d) The magnetic field points out of the paper.
(e) The direction of the magnetic field cannot be determined from the information given.



Section 22.9 Transformers

■ 14. The current in the secondary coil of a step-up transformer is 0.86 A when the current in the primary coil is 4.8 A. Determine the turns ratio, N_s/N_p, of the transformer.
(a) 5.6 (c) 0.24 (e) 0.12
(b) 4.1 (d) 0.18

□ 15. Which one of the following statements concerning transformers is false?
(a) Their operation makes use of mutual induction.
(b) They are an application of Faraday's and Lenz's laws.
(c) A transformer can function with either an ac current or a steady dc current.
(d) A transformer that steps down the voltage, steps up the current.
(e) A transformer that steps up the voltage, steps down the current.