CHAPTER 20 Review

ELECTRICITY FROM MAGNETISM

Review Questions

1. Suppose you have two circuits. One consists of an electromagnet, a dc emf source, and a variable resistor that permits you to control the strength of the magnetic field. In the second circuit, you have a coil of wire and a galvanometer. List three ways that you can induce a current in the second circuit.

2. Explain how Lenz's law allows you to determine the direction of an induced current.

3. What four factors affect the magnitude of the induced emf in a coil of wire?

4. If you have a fixed magnetic field and a length of wire, how can you increase the induced emf across the ends of the wire?

Conceptual Questions

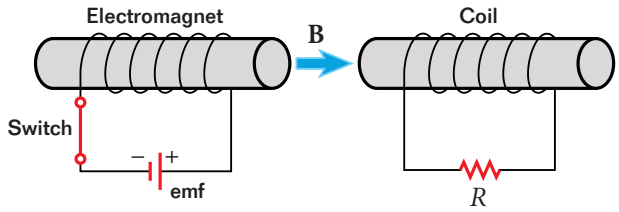
5. Rapidly inserting the north pole of a bar magnet into a coil of wire connected to a galvanometer causes the needle of the galvanometer to deflect to the right. What will happen to the needle if you do the following?
   - **a.** pull the magnet out of the coil
   - **b.** let the magnet sit at rest in the coil
   - **c.** thrust the south end of the magnet into the coil

6. Explain how Lenz's law illustrates the principle of energy conservation.

7. Does dropping a strong magnet down a long copper tube induce a current in the tube? If so, what effect will the induced current have on the motion of the magnet?

8. Two bar magnets are placed side by side so that the north pole of one magnet is next to the south pole of the other magnet. If these magnets are then pushed toward a coil of wire, would you expect an emf to be induced in the coil? Explain your answer.

9. An electromagnet is placed next to a coil of wire in the arrangement shown below. According to Lenz's law, what will be the direction of the induced current in the resistor *R* in the following cases?
   - **a.** The magnetic field suddenly decreases after the switch is opened.
   - **b.** The coil is moved closer to the electromagnet.



Practice Problems

For problems 10–12, see Sample Problem A.

10. A flexible loop of conducting wire has a radius of 0.12 m and is perpendicular to a uniform magnetic field with a strength of 0.15 T, as in figure **(a)** below. The loop is grasped at opposite ends and stretched until it closes to an area of 3×10^{-3} m^2, as in figure **(b)** below. If it takes 0.20 s to close the loop, find the magnitude of the average emf induced in the loop during this time.

11. A rectangular coil 0.055 m by 0.085 m is positioned so that its cross-sectional area is perpendicular to the direction of a magnetic field, *B*. If the coil has 75 turns and a total resistance of 8.7 Ω and the field decreases at a rate of 3.0 T/s, what is the magnitude of the induced current in the coil?