**29.19** • Using Lenz's law, determine the direction of the current in resistor *ab* of **Fig. E29.19** when (a) switch *S* is opened after having been closed for several minutes; (b) coil *B* is brought closer to coil *A* with the switch closed; (c) the resistance of *R* is decreased while the switch remains closed.

29.21 • A small, circular ring is inside a larger loop that is connected to a battery and a switch (**Fig. E29.21**). Use Lenz's law to find the direction of the current induced in the small ring (a) just after switch *S* is closed; (b) after *S* has been closed a long time; (c) just after *S* has been reopened after it was closed for a long time.
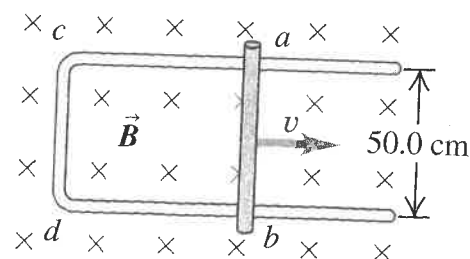
Figure E29.21
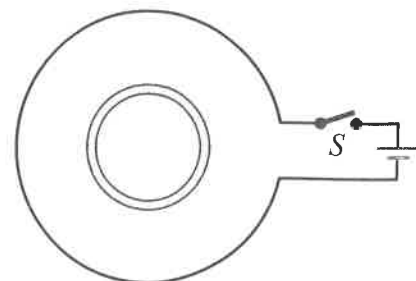
29.22 • A circular loop of wire with radius $r = 0.0480$ m and resistance $R = 0.160\ \Omega$ is in a region of spatially uniform magnetic field, as shown in **Fig. E29.22**. The magnetic field is directed out of the plane of the figure. The magnetic field has an initial value of 8.00 T and is decreasing at a rate of $dB/dt = -0.680$ T/s. (a) Is the induced current in the loop clockwise or counterclockwise? (b) What is the rate at which electrical energy is being dissipated by the resistance of the loop?

Figure E29.22
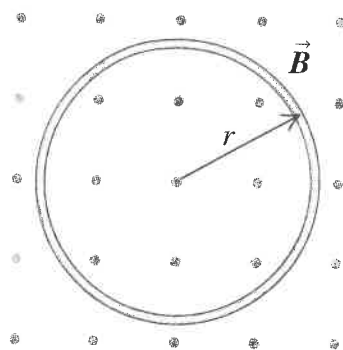
29.29 • The conducting rod *ab* shown in **Fig. E29.29** makes contact with metal rails *ca* and *db*. The apparatus is in a uniform magnetic field of 0.800 T, perpendicular to the plane of the figure. (a) Find the magnitude of the emf induced in the rod when it is moving toward the right with a speed 7.50 m/s. (b) In what direction does the current flow in the rod? (c) If the resistance of the circuit *abdc* is 1.50 Ω (assumed to be constant), find the force (magnitude and direction) required to keep the rod moving to the right with a constant speed of 7.50 m/s. You can ignore friction. (d) Compare the rate at which mechanical work is done by the force (Fv) with the rate at which thermal energy is developed in the circuit (I^2R).

Figure E29.29