Problem 29.1. A flat, rectangular coil consisting of 50 turns measures 25.0 cm by 30.0 cm. It is in a uniform, 1.20 T, magnetic field, with the plane of the coil parallel to the field. In 0.222 s, it is rotated so that the plane of the coil is perpendicular to the field. (a) What is the change in the magnetic flux through the coil due to this rotation? (b) Find the magnitude of the average emf induced in the coil during this rotation.

Problem 29.10. A rectangle measuring 30.0 cm by 40.0 cm is located inside a region of a spatially uniform magnetic field of 1.25 T, with the field perpendicular to the plane of the coil (Fig. 29.29). The coil is pulled out at a steady rate of 2.00 cm/s traveling perpendicular to the field lines. The region of field ends abruptly as shown. Find the emf induced in this coil when it is (a) all inside the field; (b) partly inside the field; (c) all outside the field.

Problem 29.21. In Fig. 29.37 a conducting rod of length \( L = 30.0 \) cm moves in a magnetic field \( \mathbf{B} \) of magnitude 0.450 T directed into the plane of the figure. The rod moves with speed \( v = 5.00 \) m/s in the direction show. (a) What is the potential difference between the ends of the rod? (b) Which point, \( a \) or \( b \), is at higher potential? (c) When the charges in the rod are in equilibrium, what are the magnitude and direction of the electric field within the rod? (d) When the charges in the rod are in equilibrium, which point, \( a \) or \( b \), has an excess of positive charge? (e) What is the potential difference across the rod if it moves (i) parallel to \( ab \) and (ii) directly out of the page?

Problem 29.25. The conducting rod \( ab \) shown in Fig. 29.38 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 moved toward the right with 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 \( \Omega \) (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 \( (I^2R) \).

Problem 29.28. A long, thin solenoid has 900 turns per meter and radius 2.50 cm. The current in the solenoid is increasing at a uniform rate of 60.0 A/s. What is the magnitude of the induced electric field at a point near the center of the solenoid and (a) 0.500 cm from the axis of the solenoid; (b) 1.00 cm from the axis of the solenoid?
Problem 29.53. A flexible, circular loop 6.50 cm in diameter lies in a magnetic field with magnitude 0.950 T, directed into the plane of the page, as shown in Fig. 29.46. The loop is pulled at the points indicated by the arrows, forming a loop of zero area in 0.250 s. (a) Find the average induced emf in the circuit. (b) What is the direction of the current in R: from a to b or from b to a? Explain your reasoning.