1. A long straight solenoid with a cross sectional area of 8.00 cm$^2$ is wound with 90 turns of wire per centimeter, and the windings carry a current of 0.350 A. A second winding of 12 turns encircles the solenoid at the center. The current in the solenoid is turned off such that the magnetic field of the solenoid becomes zero in 0.0400 s. What is the average induced emf in the second winding?

2. You are assigned the project of designing a generator of sinusoidal ac voltage with maximum voltage of 120 V. Besides plenty of wire, you have two strong magnets that can produce a constant uniform magnetic field of 1.5 T over a square area of 10.0 cm on a sided when they are 12.0 cm apart. The basic design should consist of a square coil turning in the uniform magnetic field. To have an acceptable coil resistance, the coil can have at most 400 loops. What is the minimum rotation rate (in rpm) of the coil so it will produce the required voltage?

3. A flexible circular loop 6.50 cm in diameter lies in a magnetic field with magnitude 1.35 T, directed into the plane of the page. 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.

4. A conducting rod with length $L = 0.200$ m, mass $m = 0.120$ kg, and resistance $R = 80.0$ $\Omega$ moves without friction on metal rails. A uniform magnetic field with magnitude $B = 1.50$ T is directed into the plane of the figure. The rod is initially at rest, and then a constant force with magnitude $F = 1.90$ N and directed to the right is applied to the bar. How many seconds after the force is applied does the bar reach a speed of 25.0 m/s?