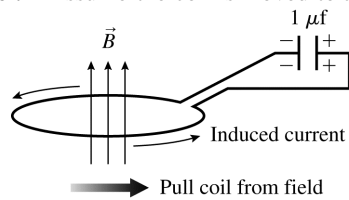


**33.50. Model:** Assume the coil is moved to a location where the magnetic field is zero.

**Visualize:**



The removal of the coil from the field will change the flux and produce an induced emf and corresponding induced current. The current will charge the capacitor.

**Solve:** The induced current is

$$I_{\text{coil}} = \frac{\mathcal{E}_{\text{coil}}}{R} = \frac{N}{R} \left| \frac{d\Phi}{dt} \right|$$

The definition of current is  $I = dq/dt$ . Consequently, the charge flow through the coil and onto the capacitor is given by

$$\frac{dq}{dt} = \frac{N}{R} \left| \frac{d\Phi}{dt} \right| \Rightarrow \frac{\Delta q}{\Delta t} = \frac{N}{R} \left| \frac{\Delta\Phi}{\Delta t} \right| \Rightarrow \Delta q = \frac{N}{R} |\Delta\Phi| = \frac{N}{R} |(\Phi_f - \Phi_i)|$$

We are only interested in the total charge that flows due to the change in flux and not the details of the time dependence. In this case, the flux is changed by physically pulling the coil out of the field. Since the coil is oriented for maximum flux, the initial flux through the coil is

$$\Phi_i = \pi r^2 B = \pi(0.0050 \text{ m})^2 (0.0010 \text{ T}) = 7.85 \times 10^{-8} \text{ Wb}$$

After being pulled from the field, the final flux is  $\Phi_f = 0 \text{ Wb}$ . The charge that flows onto the capacitor is

$$\Delta q = \frac{(10) |0 \text{ Wb} - 7.85 \times 10^{-8} \text{ Wb}|}{0.20 \ \Omega} = 3.93 \times 10^{-6} \text{ C} \Rightarrow \Delta V_c = \frac{\Delta q}{C} = \frac{3.93 \times 10^{-6} \text{ C}}{1.0 \times 10^{-6} \text{ F}} = 3.93 \text{ V}$$