

## EXPERIMENTAL GOAL

Your goal is to construct a working electric motor out of a few pieces of wire and a magnet.

## PROCEDURAL COMMENTS

The first step in constructing this motor is to use the pliers to bend the thick wires into the shapes shown in the diagram on the reverse side of this page. Make sure when you are bending the rotor support wires that the notch in which the rotor will ride is fairly deep.

The next step is to wind the rotor coil. Leaving about 2.5 inches (10 cm) of one end straight and free as a “tail”, start winding the wire into a flat coil around a finger, a pair of fingers, or some other useful form. The coil may be rectangular, circular, or oval (whatever you think will work best). Wind whatever integer number of *complete* turns you think will be best, as long as after completing the last turn, the wire has returned to the point where you began winding the coil and you have at least 3.5 inches (12.5 cm) of wire left. Then bend the remaining tail so that it goes straight across the center of the coil to the opposite side of the rotor coil, as shown in the coil close-up (helps ensure that each side of the coil has the same number of wires in it and thus is balanced). Wrap this tail several times around the coil wires at that end to bind them into a bundle. Similarly, wrap the other tail several times around the wires at its end to bind them into a bundle.

Now place one tail so that it lies flat on some part of the wood of the base, and while holding coil so that its plane is vertical, use the razor to scrape the insulation off of the uppermost half of the tail’s circumference along the tail’s entire length. Then turn the rotor around so that the other tail is on the wood and the scraped part of the first tail faces upward. Then scrape the insulation off of the the uppermost half-circumference of the second tail in the same way. It is very important that the scraped part of the wires faces the same direction!

Now make sure that the rotor tail wires are straight and point along a common line that goes through the plane of the coil. It helps to bend the tail wire (as shown in the closeup of the rotor coil shown below) so that it emerges from the coil as if it were coming out of the *center* of the bundle of wires. Then place the rotor coil on the rotor supports so that the tails fit into the support notches. Adjust the rotor coil and its tails until it is sufficiently well-balanced so that it turns freely and does not seem to have a very strongly preferred orientation.

Finally, place the magnet below the rotor and place a D-cell between the rotor support wires. You may have to nudge or flick the rotor to get it turning .

## ISSUES TO PONDER

Once you have your motor working, write out an explanation of how it works in your lab notebook, drawing on the ideas in sections E8.2 and E8.3 in the text. In particular, explain why you scrape insulation off only *one* side of the wire. Then use your explanation to predict what will happen if you (1) you turn the magnet upside down, and (2) if you reverse the battery. Your grader will ask you questions related to these issues.

