Task

{20} To build an electric DC motor out of simple materials.

Materials

- 1 D-cell battery
- 2 pieces of copper metal
- knife/scissors
- 1 m speaker wire
- 1 round magnet
- tape/glue/rubber band

Instructions (1 motor / 2 students)

A. Unwrap the wire and straighten out any bends. Leaving about 5 cm straight, wrap the wire around the battery (or a smaller circular shape) to form a coil (Figure 1).

B. Unwrap a small amount from the second end so that you now have about 5 cm of wire sticking out from either side (Figure 2).

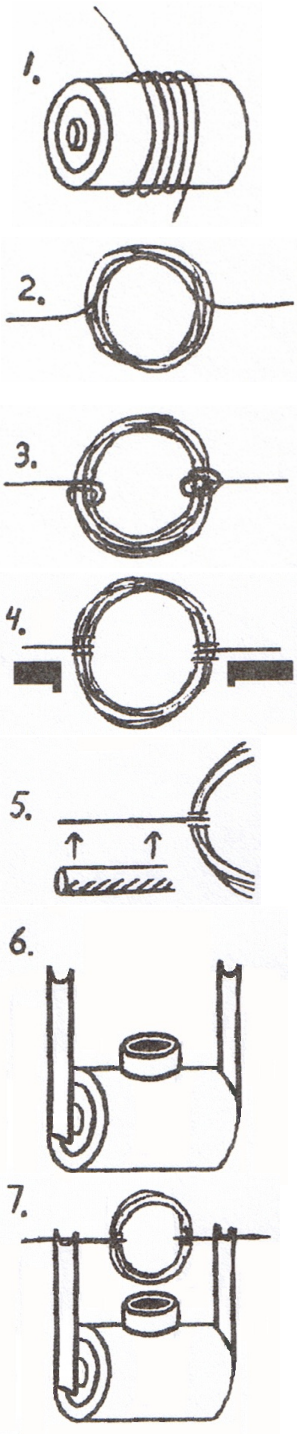
C. Wrap each end of the wire around the coil for two turns (Figure 3). This will keep the coil together. The two ends should stick out directly opposite of each other and should each be at least 2.5 cm long. Excess wire can be trimmed or wrapped around the coil as additional turns.

D. The wire is covered with an enamel coating for insulation. Hold the coil <u>vertically</u> and then rest one of the wire ends on a flat surface (Figure 4).

E. Using the edge of a knife or scissors, scrape the enamel coating off the entire <u>top half</u> of the wire end. Turn the coil slightly as you scrape so that the top half of the wire is scraped bare. Do not scrape the bottom half of the wire (the bottom half should still be insulated otherwise the coil of wire will become very hot very quickly). Repeat this for the second wire sticking out from the opposite end of the coil. The enamel is left on the bottom half of each wire (Figure 5).

F. Attach the copper metal supports (V-end up) to the ends of the D-cell battery with tape or a rubber band. Make sure the battery touches both metal supports (Figure 6). Attach the magnet to the top of the battery. Note: the flat sides of the round magnet are the N and S poles!

G. Set the coil ends into the V of the supports and your motor is ready to run. Give the armature a gentle spin (Figure 7). If it does not continue to turn, try the opposite direction. After the motor works, the very ends of the wire can be bent to help keep the coil centred. If the motor does not work, check to see if the shiny side of the wires are both facing up when the coil is vertical (Figure 5). Also, make sure the wire ends of the coil are centred (Figure 3).



Analyze & Evaluate (1 report / student)

{2} 1. What is the motor principle?

2. Imagine a <u>straight</u> current-carrying conductor is placed in a magnetic field.

{2} (a) What factors (2) will affect the direction of the force on the conductor?

{3} (b) What factors (3) will affect the magnitude of the force on the conductor?

{7} 3. With the aid of a properly labelled diagram(s) that shows the current flow, the magnetic field, and the forces on the coil, <u>explain</u> fully how your motor works? Start with the statement, "When the coil of wire is placed in the V of the supports, current flows around the circuit through the coil of wire creating an ..."

{3} 4. List three changes that you could make to improve the performance of your motor?

{5} 5. Imagine that a rectangular coil was used instead of a round coil. Would all four sides of the coil experience a force? Explain your answer with the aid of a diagram that includes (i) the coil, (ii) the magnetic field that the coil is experiencing (see F above), and (iii) the force(s) each section of the coil experiences.

{8} 6. The Motor Principle is often applied in many situations that have little to do with motors. <u>Explain</u> two of the technologies listed (or ones of your choosing - just get the teacher's approval first). In your explanation include some of the social and/or economic impacts (i.e. the pros and cons) of these same two technologies.

- particle accelerator
- mass spectrometers
- maglev trains
- magnetic resonance imaging