Short Circuits and Fuses

Activity 11

Key Concepts

1. A short circuit is created when accidental contact occurs between wires of opposite polarity in a circuit before the electricity reaches the intended appliance (load).

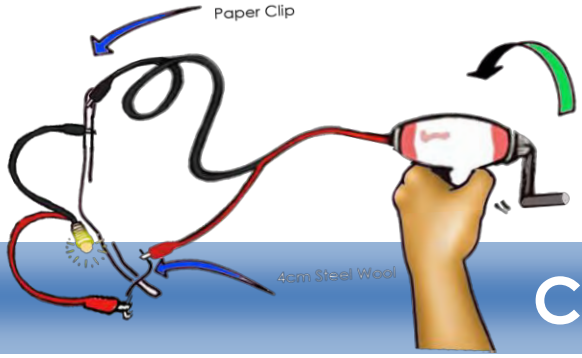
2. Short circuits offer very little resistance to the flow of electricity (Ohm's Law again), so wires will get hot and could start a fire.

3. Fuses are designed to melt when they get hot, thereby shutting down the dangerously overheated circuits.

Teaching Tips

1. Demonstrate how broken or worn insulation in electric cords can cause short circuits.

2. Explain why replacing blown fuses with copper pennies is a very dangerous practice.



Materials

GENECON with output cord
1 Bulb (3.8V, .3A) in socket with leads
- *1 Paper clip*
- *4 cm strand of steel wool, medium grade*

Procedures

1. Connect the bulb to the output cord of the GENECON in the usual manner. Disconnect **one** of the leads connecting the bulb and insert a 4 cm strand of medium steel wool, completing the circuit again. Have one student generate enough current to light the bulb brightly. Then have another student lay a straightened out paper clip across the two leads from the bulb for a few seconds (see sketch). What happened to the brightness of the bulb? (Caution: You are creating a **short circuit**. Do not touch the steel wool wire as it will get quite hot.) Remove the paper clip. The bulb should return to a normal brightness.)

2. Repeat the shorting-out process, as above, but continue it for a few more seconds. The steel wool wire should get red hot and then burn through, breaking the circuit. By turning off the circuit, the steel wool wire is functioning similar to a **fuse** which protects appliances and wiring in overheated circuits.

Current Detector

Activity 12

Key Concepts

1. The flow of electricity through a wire conductor produces a magnetic field around the wire. **(Oersted's Law)**

2. The needle of a compass is a permanent magnet. The deflection of the needle in this activity is a result of an interaction between its own magnetic field and the field created by the flow of electricity through the copper wire.

3. The polarity of the magnetic field reverses when the direction of the current changes.

Teaching Tips

1. Do not operate the GENECON for more than a few seconds at a time, since the circuit in this case is essentially shorted out.

2. The compass wrapped with copper wire is functioning much like an electric meter or current detector. One such meter which can detect and measure weak electric currents is called a **galvanometer.**

3. Discuss the Earth's magnetic field in a relationship to the operation of a magnetic compass. Would such a compass be useful on the moon?

Materials

GENECON with output cord
Magnetic compass
- *#24 Enameled copper wire*

Procedure

1. Wrap a length of the copper wire around the magnetic compass. The rim of the case is grooved to facilitate wrapping the wire. About 6 or 7 wraps should be adequate. Scrape the clear insulation off the ends of the wires before connecting them to the leads of the GENECON.

2. Move the compass so that the needle aligns itself in the same direction as the wraps of wire.

3. Have a student turn the handle of the GENECON **slowly.** Even the slightest rotation will cause the needle to be deflected from its resting position, indicating the presence of the electric current.

4. Now reverse the direction of the GENECONs handle rotation. Result?