

EXPLORING ELECTRICAL CIRCUITS

Students will explore the two basic types of electrical circuits. The type depends upon how the parts of the electrical circuit are arranged.

If all the electrical parts are connected one after another, the electrical circuit is a series circuit. In a series circuit there is only one path for the electrons to flow. The disadvantage of this type of electrical circuit is that if there is a break in any part of it, then the entire circuit is opened and therefore will not allow an electrical current to flow.

The second type of electrical circuit is a parallel circuit. In a parallel circuit the different electrical parts are located on separate branches therefore there are several paths for the electrons to take. If a break should occur in this type of circuit the electrons can still move through other branches. The electrical current continues to flow.

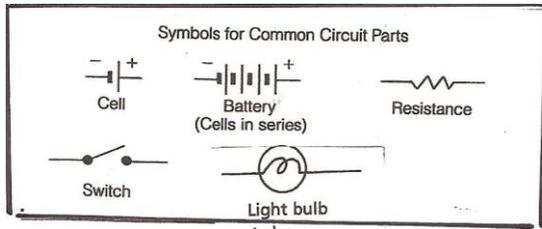
**Electric power is a measure of the rate at which electricity does work or provides energy. Power = voltage X current
Power is expressed as *watts*, voltage as *volt* and current as *amperes*.**

Question: What voltage is required to run a 75 watt light bulb if the current is 0.5 ampere?

Answer: 75 watts = volts X 0.5 amperes or 150 volts

Activity 1: Creating a series circuit

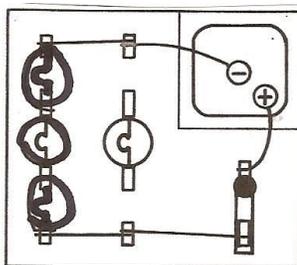
Symbols for Common Circuit Parts



Materials: 5 pieces of insulated bell wire--- cut 2 pieces 25 cm long and three pieces 15 cm long
3 flashlight bulbs in sockets
6V battery
switch

Procedure:

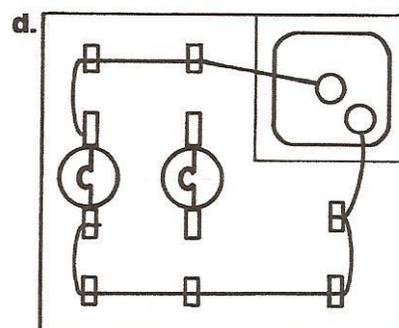
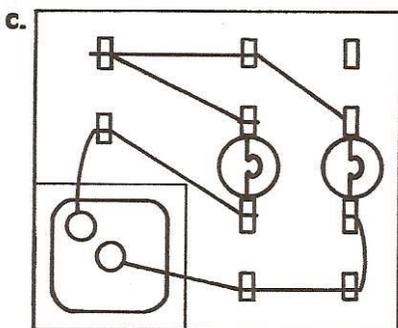
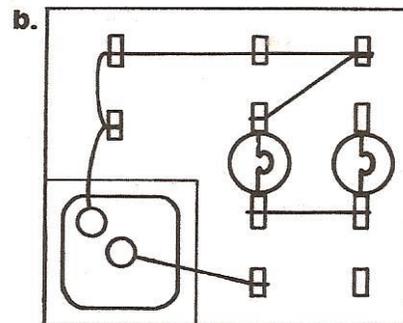
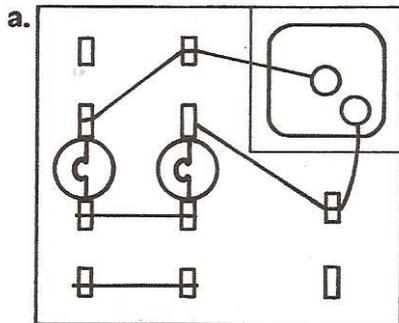
1. Strip 2 centimeters of insulation from the ends of each wire.
2. Connect the three bulbs in a series.
3. Attach one wire to the battery
4. Attach the other to a knife switch
5. Attach a wire from the switch to the other pole of the battery making certain that the switch is open.



Circuit No. 1

- Close the switch. What happens?
- Unscrew one of the bulbs. Close the switch. What happens?
- Draw arrowheads showing the direction the electrons are flowing when the switch is closed and all lamps are lit. Remember electrons flow from the negative terminal of the battery to the positive terminal.

In each diagram below mark the (+) and (-) signs in the circles of the battery. For each diagram that shows a complete circuit, draw arrowheads on the wires to show the direction that the electricity is flowing.

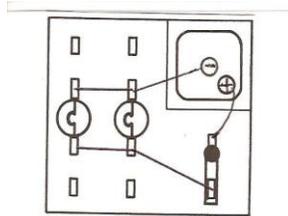


Activity 2: Creating a parallel circuit

**Materials: 7 pieces of insulated bell wire---cut each piece about 25 centimeters long
2 flashlight bulbs and sockets
6V battery
switch**

Procedure:

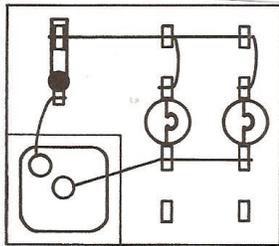
- 1. Strip 2 centimeters of insulation from the ends of each wire.**
- 2. Connect the two flashlight bulbs and sockets in parallel.**
- 3. Connect one wire from the battery to the first bulb.**
- 4. Connect one wire from the first bulb to the switch.**
- 5. Connect one wire from the switch to the battery. Keep switch in open position.**



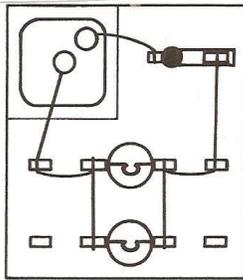
Procedure:

- 1. Close switch. What happens?**
- 2. Unscrew one of the bulbs. What happens?**
- 3. Draw arrowheads to show the direction of flow of the electrons when the switch is closed and all lamps are lit.**

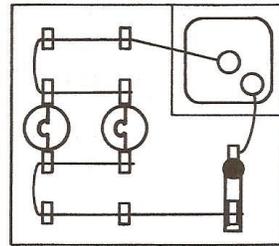
Identify each diagram below as being a series or parallel circuit. If the diagram shows an incomplete circuit than mark it with an X.



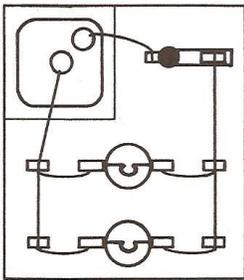
a. _____



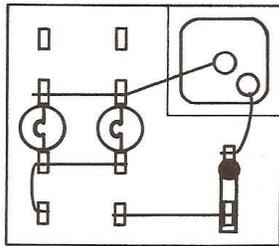
b. _____



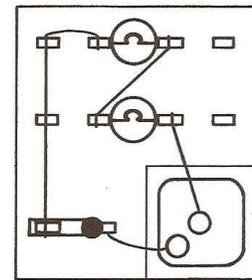
c. _____



d. _____



e. _____



f. _____

Question:

1. What voltage would be required to run a 20 watt light bulb if the current is 0.8 amperes?

Electrical Circuit Graphics, NASCO, Fort Atkinson, Wisconsin, 1986.

MAKING AN ELECTROMAGNET

An electric current traveling through a wire creates a magnetic field; thereby creating a temporary magnet. By building and experimenting with an electromagnet students will become acquainted with the basic concepts and properties of electromagnetism.

Materials: Coarse sandpaper, 30 yards of thin insulated wire, a small steel bolt and a large steel bolt, non-alkaline C or D cell batteries, rubber bands, large and small paper clips, masking tape, and a permanent magnet

Procedure:

- 1. Use a piece of coarse sandpaper to strip the insulation off each end of one yard of thin, insulated wire.**
- 2. Wrap the wire in neat, tight coils around the small steel bolt, leaving 4 inches of wire hanging free and uncoiled at each end.**
- 3. Wrap two rubber bands tightly around a non-alkaline C or D cell battery.**
- 4. Slip a small paper clip between the rubber band and the positive pole (+) of the battery. Fold the clip over the rubber band and wind the bare end of the wire around the clip.**
- 5. Slip another small paper clip between the negative pole (-) of the battery and the rubber band. Wrap the clip around the rubber band and hook the other bare end of the wire to the clip to complete the electromagnet.**
- 6. Test the strength of the electromagnet by trying to pick up paper clips.**
- 7. Repeat this procedure but this time use the larger bolt.**

Results for small bolt:

Trial	Number and size of paper clips picked up

Results for large bolt:

Trial	Number and size of paper clips picked up

Questions:

1. How many coils were wrapped around the small bolt?
2. How many coils were wrapped around the large bolt?
3. Did the number of coils make a difference in the number or size of the paper clips picked up:

