SUMMARY:
Learners will construct simple electrical circuits to turn on a light bulb.

GRADE LEVEL:
This activity has been used successfully with 1st to 3rd graders as well as college undergraduates.

TIME:
This activity takes approximately 45 minutes with 1st to 3rd graders. Depending on learners' prior experience this time may need to be extended or shortened.

SUBJECTS:
Physical Science (electricity), Art.

LEARNER BACKGROUND:
None needed.

LEARNING OBJECTIVES:
Completing this activity will allow learners to:
- ✓ understand electrical circuits
- ✓ describe by pictures of words how an electrical circuit works
- ✓ determine properties of metal

Discover Question:
How can you light up a light bulb?

Background:
This activity uses common items to construct simple electrical circuits. Instead of starting off by defining terms like metal and circuit learners are given the materials to explore and discover these concepts.

A circuit is a nothing more than a circle (notice the common linguistic root) that provides a path for the electricity. Constructing this circuit or path out of anything metal allows the most electricity to move around the path. Learners will learn that you must have this path for electricity to light a light bulb, run a motor or make anything that is hooked into the circuit operate. In addition, a learner will classify materials into metals and non-metals by noticing what turns on the light bulb and what does not turn on the light bulb. Further observation will turn up most of the properties of metals.

The educator needs to facilitate the sharing of observations and ideas. Try to avoid answering questions directly. Instead, ask questions like what have you tried? What do you notice? What else could you try? These types of questions encourage further exploration.

Materials:
- ❑ Each learner should receive a plastic ziplock sandwich bag with the following supplies:
  1. Flashlight bulb (1.5 Volt)
  2. Battery (C size works well)
  3. One nail (approximately 3 inches), penny, and washer
  4. Approximately 6 inches of string, ribbon (shiny is best), piece of cardboard, and piece of plastic.
  5. A few toothpicks and Q-tips
  6. Special foil (approximately 6 in. x 6 in.). To make special foil stick clear contact paper onto the shiny side of aluminum foil. This is easiest if both rolls are 16 inches wide.
- ❑ Each group of four learners should have the following community supplies:
  - Masking tape, Markers, Paper, Scissors, Extra Batteries (D and AA)

Resources and Handouts:
None needed.

Procedure:

1 You can introduce the activity any way that is appropriate for your class. I have told learners that they need to help NASA repair the Mars Rover which has some broken wires. Thus NASA has asked them to figure out how circuits work.

2 Hand out the ziploc bags with the materials and a battery to each learner. I usually do not tell learners names for the objects but refer to them as "shiny stuff", colored stuff,

3 Record learners' observations on the board. "The shiny stuff gets hot when I wrap it around the battery!" "There are 2 shiny ends to the batteries." "There are two shiny ends on the light bulbs."

4 Ask questions that are open-ended "What have you tried?" "What else could you try?" "What do you notice about your objects?"

5 Once some one has success encourage further exploration.

- ❑ Can you light the bulb any other way?
- ❑ What is the smallest amount of shiny stuff you can use to light the bulb?
- ❑ What other objects work and don't work to light the bulb?

6 Make a list of what can and can not light the bulb. Explore other objects as well like pencils, pens, scissors, chair or desk legs etc.

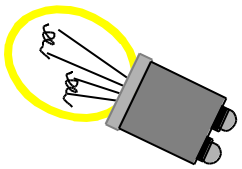
- ❑ Talk about list of objects that can light the bulb.
- ❑ What do they have in common -
  - shiny
  - hard
  - conduct electricity (they light a light bulb)
  - conduct heat (they feel hot or cold)
- ❑ Scientists refer to these objects as metals.

Modifications/ Adaptations:

Older learners can be given motors (with two leads) and asked to light the bulb using just the battery, bulb and motor. This will require putting the two objects in serial. Careful observers will note that the bulb lights initially then dims as the motor starts spinning.

Extensions:

- "Now that you have it light, make it bright?" Provide extra batteries of various sizes (AA, C, D). Does the size of the battery make a difference?
- Make a flashlight.
- Make a game like "operation" where a loop has to trace a curvy wire. If they touch a light turns on.
- Make a robot with eyes and a nose that lights.
- Make a buzzer or motor work.



7 Introduce the idea of a circuit.

- ❑ Have learners draw pictures of how they light the light bulb.
- ❑ Trace a path through the different objects (battery, Al foil, bulb, nail etc.)
- ❑ This path is referred to as a circuit.

8 Discuss any extensions learners may have explored.

Safety Considerations:

- ❑ Drop anything that gets hot. This will happen if a battery is "short circuited" by connecting the top and bottom with a conductor like the aluminum foil.
- ❑ If this is a multi-day activity collect batteries to avoid a short circuit in learner's storage containers.

Assessment Ideas:

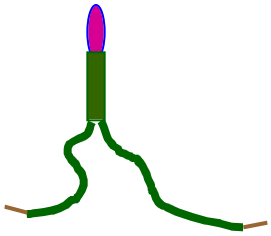
- ❑ Can the learner turn on the light bulb?
- ❑ How many different materials can a learner use to turn on the light bulb?

Internet Resource:

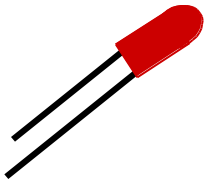
None required. This is part of a NatureShift unit on electricity and magnetism that can culminate in controlling the Mars Rover telerobot.

EXTENSIONS:

- ♦ Cut up a string of Christmas tree lights and hand out. Light one or a whole bunch with a friend.



- ♦ Light a L.E.D. (light emitting diode)



- ♦ Discuss serial and parallel connections

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