



Teacher Demonstration and Guiding Questions

Objectives:

- Show how an incandescent light bulb works.
- Explore the difference in resistance between wire and graphite.
- Demonstrate conversion of electrical energy to light and heat.

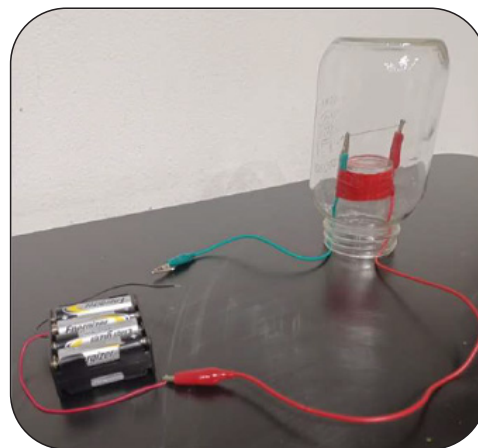
Materials

- 8 x AA batteries (1.5 V each)
- Battery holder
- 2 wire leads with alligator clips
- 1 large wide-mouth jar/beaker
- 1 small glass (50 mL beaker)
- 0.5 mm graphite pencil refills
- Electrical tape
- Porcelain or glass plate (if not working on a heat resistant surface)
- Timer (optional)
- Switch (optional)
- Thermometer (optional)
- Light sensor (optional)



Instructions

1. Place the 8 batteries into the battery holder in series to make 12 V.
2. Turn the small glass upside down and place it on the plate.
3. Tape two alligator clips to the small glass on each side using the electrical tape. Clips should be facing up and aligned.
4. Carefully clip in one graphite pencil refill between the two alligator clips. Graphite is fragile and may break if alligator clips are moved.
5. Place the large wide-mouth jar over the small glass and alligator clip wires. (This is to contain any smoke that may be released and to keep fingers at a safe distance during the reaction.)
6. Connect the remaining clips to the terminals of the battery holder. Optional: Include a switch in the circuit.
7. Do not remove the jar during the experiment. This will trap any smoke produced and provide a barrier to prevent burning fingers. Allow equipment to cool down after the experiment before removing the jar.



Safety Considerations

- Warning: The wires can get hot.
- Do not increase the voltage beyond 12 V.
- Only connect the final two wires (or turn on the switch) when the graphite rod is completely covered by the jar to avoid fumes building up in the air.
- Leave the jar on after the experiment to allow for a complete cool down.
- If you're not working on a heat-resistant surface, a porcelain or glass plate is advised to protect the surface from hot graphite.
- Avoid metal surfaces coming in contact with the wires in order to prevent short circuits.



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Guiding Questions

1. Why does the graphite glow while the metal of the wires does not?

Wires are made of good conductors and have a lower resistance (opposition to the flow of electrons).

2. What type of energy conversions are occurring in this circuit?

Chemical potential energy (stored in battery) to electrical energy to light and heat.

3. How does this demonstration illustrate how an incandescent light bulb works?

The filament in the light bulb resists the flow of electrons causing it to heat up and glow. Incandescent lights are a very inefficient light source as a lot of energy is lost as heat.

4. Pencil “lead” is not the elemental metal lead; it is graphite. Graphite is carbon. How do the physical properties of lead and carbon differ? Which makes a better light bulb filament?

Lead is a conductive metal; carbon is a non-metal and less conductive making it a better filament.

5. How could we improve upon our light bulb?

Answers may vary. For example: longer lasting filament (change the length, thickness, type of material), permanent housing (like a real light bulb), etc.