Sci-Book

STEPS to STEM – Student Science Notebook

Aaron D. Isabelle and Gilbert A. Zinn

Aligned with the Next Generation Science Standards (NGSS)

SensePublishers

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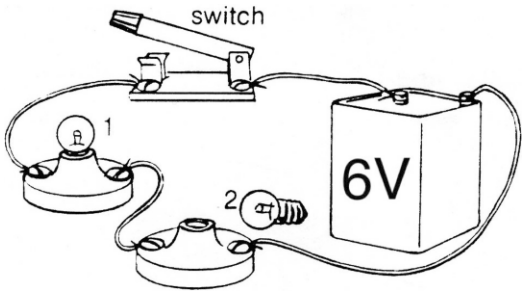
INTRODUCTION

This Science Notebook or Sci-Book serves as a companion to the *STEPS to STEM* program. Using this Sci-Book, you should maintain a record of your completed activities so that you can share evidence, observations, results, and discoveries with your classmates. Recording your ideas, plans, sketches, and questions are especially critical while working on a STEM Center Team Challenge so that you can look back on your work, review your progress, and share your thinking with your team and with your teacher. Adult scientists keep a record of all of their work so that nothing gets lost. Similarly, as a young scientist, you should feel a sense of purpose and pride in using and maintaining your Sci-Book. Also, don't worry about grammar and spelling. A Sci-Book is meant to be single –draft writing. In other words, you should primarily focus on recording your observations, ideas, and evidence *carefully and accurately* as adult scientists do. If your teacher wants you to type or rewrite a particular STEP activity or a STEM Center into a more formal science report, then that would certainly be appropriate. Lastly, we hope you enjoy working through the various STEP activities and STEM Centers: there are things to do, discoveries to be made, and problems to solve. In addition, be sure to keep in mind that you and your team are young scientists; you and your classmates form a community of scientists; and your teacher is part of that community to help guide you along the way. Enjoy learning and making new discoveries!

ELECTRICITY & MAGNETISM

Step 1: Series Circuits

A. Investigate



1. Set up the electric circuit as shown in diagram. This is a series circuit.

2. Close the switch by pulling the blade down. What happens?

_____

_____

3. Take out bulb #1. What happens?

_____

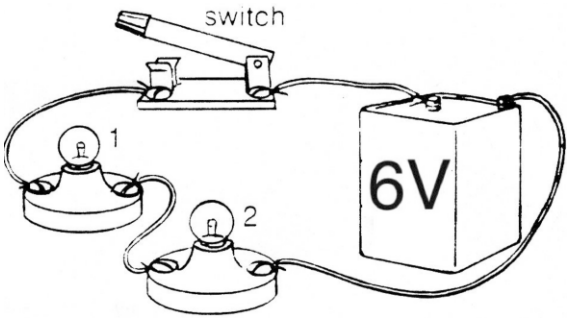
_____

4. Replace bulb #1. What happens?

_____

_____

B. Hypothesis



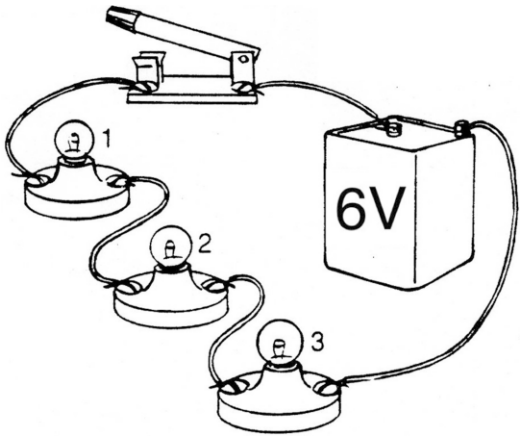
1. In a series circuit, there is:

   _____ a) only one path for the current.
   _____ b) more than one path for the current.

2. When any part of a series of a circuit is disconnected:

   _____ a) the current stops flowing.
   _____ b) the current flows through the other parts.

C. Test



1. Add bulb #3 to the series circuit.

2. Close the switch.
   What happens?

_____

_____

_____

3. Remove one of the bulbs. What happens?

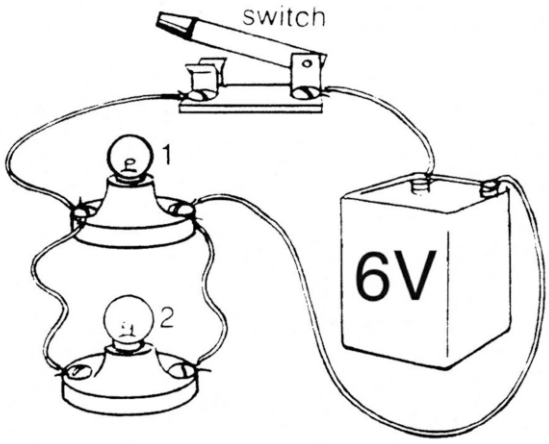
_____

4. Replace the bulb and remove another. What happens?

_____

Step 2: Parallel Circuits

A. Observe



1. Set up the circuit as shown in the diagram. The two bulbs are connected in parallel.

2. Close the switch. What happens?

_____

_____

3. Remove bulb #1. What happens to bulb #2?

_____

_____

4. Replace bulb #1. Remove bulb #2. What happens to bulb #1?

_____

_____

B. Record

1. Connect 1 bulb, a switch, and a battery in a series circuit.

2. Close the switch. Observe how bright the bulb is. Call this brightness NORMAL.

3. Observe the brightness of the bulbs in each of the following circuits:

   a) 2 bulbs in series with a battery
   b) 2 bulbs in parallel with a battery

4. In the chart, record whether the bulbs are NORMAL, DIMMER, or BRIGHTER.

Kind of Circuit	Brightness
1 bulb in series	NORMAL
2 bulbs in series	
2 bulbs in parallel	

C. Predict

1. With two bulbs in parallel, open the switch.

2. Add a third bulb in parallel with the other two.

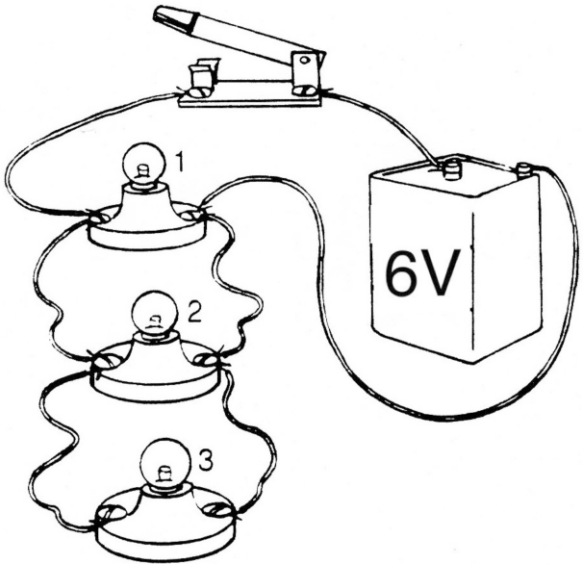
3. Predict whether the bulbs will be NORMAL, DIMMER, or BRIGHTER when you close the switch.

_____

4. Test your prediction. Was your prediction correct? Explain your thinking.

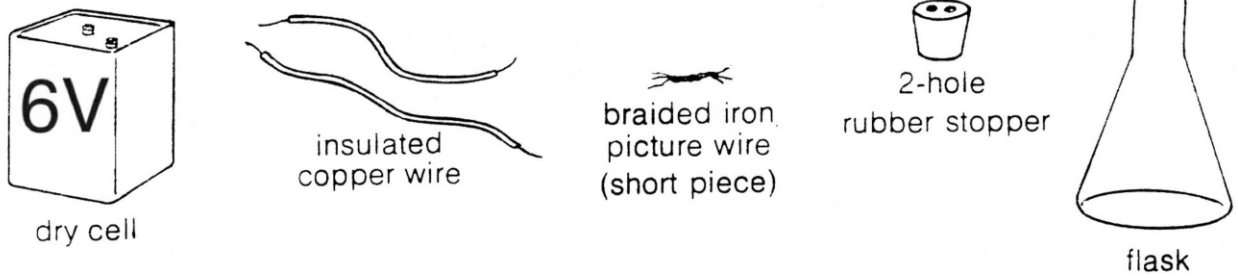
_____

_____



Step 3: Electricity and Heat

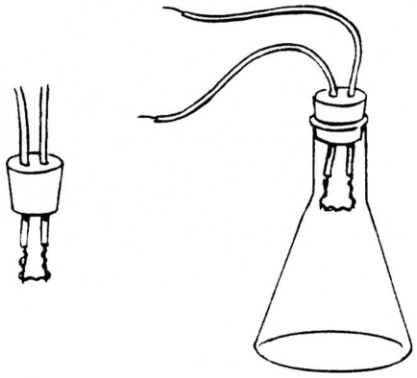
A. Gather



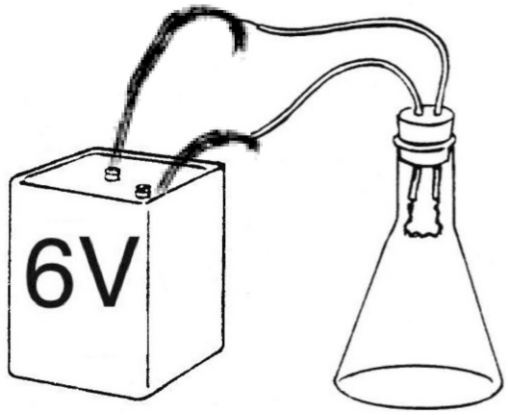
1. Strip ½ inch of the insulation from each end of the copper wires.
2. Unravel the iron picture wire (this will be the light bulb filament).

B. Make

1. Put a copper wire through each of the holes in the stopper.
2. Attach one strand of the iron picture wire to the two bare ends of the copper wire.
3. Put the stopper into the flask.



C. Try



1. Connect the outside ends of the copper wire to the dry cell.

2. What happens to the iron wire (filament)?

_____

3. How does the flask feel?

_____

4. Darken the classroom. What do you observe?

_____

5. Use 2 batteries in series instead of 1. What happens to the wire?

_____

_____

6. Where else can you find electricity being used in this way?

_____

_____

STEM Center 1.1

Team Challenge: *How can your team make a light bulb filament glow the longest and the brightest?*

A. Team Research

Using the computer as a research tool, find at least three (3) new facts on light bulbs and filaments that will help you solve the problem [e.g. what makes a light bulb filament glow? What kinds of materials were used for filaments in early light bulbs? What materials are used for filaments in modern day incandescent light bulbs?].

Fact 1:

_____

_____

_____

Fact 2:

_____

_____

_____

Fact 3:

_____

_____

_____

Find two scientists who were involved in the development of light bulbs through the years and identify at least one way that the use of light bulbs has impacted our everyday lives.

_____

_____

_____

_____

B. Team Plan

Where do we go from here to solve the problem? Discuss your ideas with your group members and devise a plan. Use the space below for notes and/or sketches of your design:

C. Team Results – Solve

What did you do to help find the solution to the problem? Describe what you did, what you observed, and explain your thinking. (Note: you can use both pictures and words in the space below.)

Write down any questions that you have and anything that you are curious about.

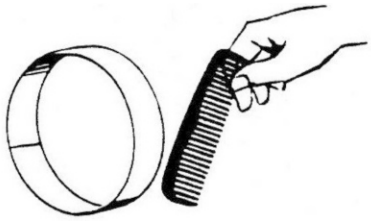
Science & Engineering Practices

During your work in the STEM Center, you used certain key "practices" similar to how scientists and engineers think and act. Identify which Science & Engineering Practices you feel that you were engaged in during the STEM Center problem-solving process. You are encouraged to talk with your team members about this and reflect upon your thinking process. Place a check in the right hand column next to each practice that you made use of:

1. Asking questions and defining problems	
2. Developing and using models	
3. Planning and carrying out investigations	
4. Analyzing and interpreting data	
5. Using mathematics and computational thinking	
6. Constructing explanations and designing solutions	
7. Engaging in argument from evidence	
8. Obtaining, evaluating, and communicating information	

Step 4: Static Electricity

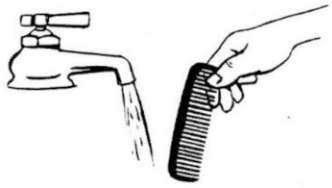
A. Investigate



1. Cut a strip of paper about 25 cm long and 2 cm wide.
2. Tape the ends together to form a hoop.
3. Rub or comb your hair briskly with the comb.
4. Place the comb just in front of the hoop. Move the comb slowly away.
5. What happens to the hoop?

_____

_____



6. Rub the comb through your hair again.
7. Hold it near a fine stream of water.
8. What happens?

_____

_____

B. Hypothesis

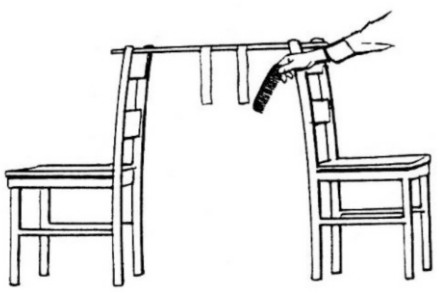
When certain materials are rubbed with other materials, they get an electric charge. Which one of these statements do you think is true?

_____ a. A charged object always attracts other things.

_____ b. A charged object sometimes pushes another charged object away from it.

C. Test

1. Cut two strips of paper about 15cm long and 2 cm wide.



2. Tape their ends to a meter stick and hang them up as shown in the drawing.

3. Charge the comb as before, and bring it near each strip of paper in turn. What happens to each strip of paper?

_____

4. Rub the strip of paper several times with your fingers or with a piece of fur.

5. Bring the charged comb near the paper you rubbed. What happens?

_____

6. Do charged objects always attract other things? Explain.

_____

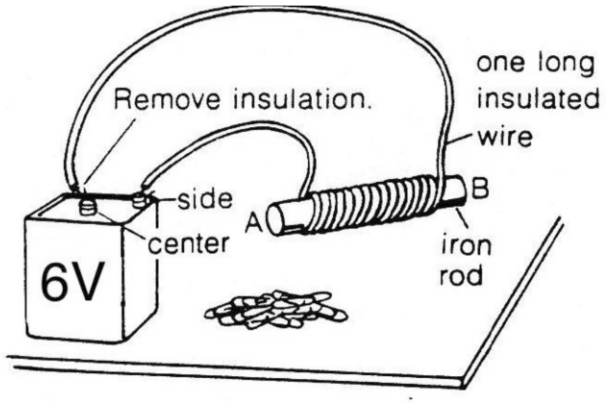
_____

Step 5: Electromagnetic Poles

A. Observe

1. Use the materials shown in the diagram to make an electromagnet.

2. Test the electromagnet to see if it is working. Use it to pick up and drop some paperclips.



B. Report

1. Bring the North Pole of a compass needle close to the A end of the electromagnet. See what happens.

2. Record your findings on the chart.

3. Bring the North Pole of a compass needle close to the b end of the electromagnet. See what happens.

4. Record your findings on the chart.

5. Study the chart; then answer this question

   Do electromagnets have poles? _____
   A is a _____ pole.
   B is a _____ pole.

6. Test both ends of the electromagnet with the South Pole of the compass needle. Record your findings on the chart. Were your original conclusions correct?

   "A" Wire Connected to Side Terminal
   "B" Wire Connected to Center Terminal

Pole of Compass	Ends of Electromagnet	
	A	B
North Pole		
South Pole		