Electricity
4th Grade

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Benchmark:

SLC 7: Students will select appropriate resources and tools to make accurate observations to gain desired results given the stated conditions (i.e., if a desired result is to build an outdoor greenhouse to start seeds, the design would have to promote the correct amount of sunlight.)

Objectives:

Students will:

- figure out how to light a light bulb with simple materials
- make predictions on whether a light bulb set-up will work
- understand the difference between an open and closed circuit
- figure out what resistors and conductors are and examples of each

Materials:

Day 1 & 2 (must have enough of each item for every student):

- D-cell batteries
- Penlight bulbs
- Strips of tin foil (at least 4inches long)
- Things that work, things that didn't work (Day 1), and Prediction Sheet 1 (Day2)

Day 3:

- D-cell batteries (2 for each student or group)
- Penlight bulbs
- Strips of tin foil (or wire)
- Light bulb socket
- Prediction Sheet 2

Day 4:

- All physical materials from Day 1
- Various objects to test conductivity like: steel nails, aluminum nails, paper clips, straws, sponges, cardboard, rubber bands, plastic spoons, pencils, etc.
- Making Connections and Conductors and Insulators worksheet

Initial Demonstration:

There is no initial teacher demonstration, but students are allowed free rein on trying to light the light bulb using the battery, bulb, and foil. This gives them the initial demonstration of what works and mostly, what doesn't. This set-up is consistent through all 4 days with the students experiencing failed and successful attempts.

Procedure:

Day 1:

Give each student a battery, bulb, foil, and what does and doesn't worksheet. Ask them to light the light bulb. If they try a way that doesn't work, draw it in the "things that didn't work" section and if it did, draw it in the "things that did work" section. Once they get a way that works, have them try for other ways (there are more than 1!). Have them fill out their sheets, especially the bottom question of "Did you get your light bulb to light after 3 tries?" This serves as your pre-test question, along with the entire worksheet.

Day 2:

Pass out Prediction Sheet 1 to the students. Have them guess yes or no to whether the bulb will light. Some students may never have gotten their bulb to light in Day 1, so a class discussion of predictions might not be suitable. Pass out the same equipment to the students from Day 1 and let them see if their predictions are correct. Have students circle the pictures that light up, to distinguish from their prediction and their test.

After all are done, discuss which system light and which didn't. Introduce the following vocabulary:

- Circuit- the complete path of an electric current including the source of electric energy
- Closed circuit- when the above pathway allows electricity to flow
- Open circuit- when the above pathway does not allow electricity to flow
- Volt- the unit of electrical energy used in our power source

If students are advanced, you can also introduce

- Potential energy- energy an item has stored because of its position or arrangements of parts
- Kinetic energy- energy associated with motion

Day 3:

Day 3 has the same procedure as Day 2, except with Prediction Sheet 2 and a few additional items of equipment. Students will predict, then experiment and record findings. Class discussion should involve not only the differences in added equipment, but noting the changes in the sheet from actual drawings (light bulb) to a symbol. Most students might not even notice the switch, but you should discuss how nothing has changed in the real experiment.

Introduce the following vocabulary:

- Insulator- an item that does not allow electric current to flow (often used for protection or current control)
- Conductor- an item that allows electric current to flow easily

Discuss if there were conductors and resistors in what they did today. Ask them to start thinking about other items that could be used as conductors.

Day 4:

Review the vocabulary words from all days. Pass out the "Making Connections" worksheet. Have students predict what things will conduct and insulate from a list of things written on the board (all these items you will later pass out to test). Discuss why students thought what they did.

Then pass out a battery, bulb, and foil to each and have students light their bulbs. They will take each item and place it between the foil touching the bottom of the battery. Make sure they do not have the foil touching the battery, but the foil touching the object, which touches the

battery. Fill out the second half of the worksheet with what actually happened. Discuss what the items were made of that were conductors. Have students think and write about conductors and insulators in the classroom.

Students should fill out their conductor and insulator sheet. This a good gauge as to what they learned. Discussion can come from this sheet as to why we care if things are conductors of insulators.

Discussion/Summary:

After Day 1 the discussion should be primarily on variables. Many students will struggle with lighting their bulb because they are changing more than one variable at a time. They won't see this right away because variables are the one thing that changes. None of their equipment changed during the trial, but the way in which it was used did. A large example might show this best.

Each day has discussion points within their procedures. Be sure to use new vocabulary as much as possible. In the end the students should know the objectives and why we care about these sorts of things.

Target Observations (What the students might say):

- This is impossible!
- My equipment is broken!
- How did (fill in smart student's name here) do that!
- This is so cool!
- I did it!
- Guessing from Day 1 (and 2), I think…will light the bulb.
- I think all these metal type things will light it, but not these other things.

Target Model (What we want the students to say):

To make the light bulb light, you need to have the foil touching the bottom of the battery and the metal part of the bulb. The bottom of the bulb needs to be on the top metal knob of the battery. This isn't the only way to light it, here are some others…

Based on my failures and successes, I can predict what set-ups of systems the bulb will light. I know this because a closed circuit, proper series wiring, and conductors, not insulators, are needed. Examples of conductors and insulator are…

Pre-Test:

This lesson is meant for high amounts of student exploration. Giving a formal written pre-test would lead the students too much. Instead the first worksheet can supply an informal pre-test. Knowing if they could light the bulb in the first 2 to 3 trials serves as a decent understanding

Post-Test:

Depending on time and depth, the post-test can be asking students to light a light bulb using the battery, bulb, foil, and a conductor of their choosing. They will need to draw, label and define each section. A more in depth one is attached, with drawing that will be pasted in from the FOSS kit electricity assessment.

Name: Date:

Things That Didn't Work

Draw the different set-ups you used to try to light your light bulb that DIDN'T work.

Things That Did Work

Draw the different set-ups you used to try to light your light bulb that DID work!

Did you get your light bulb to light after 3 tries? _____

Name: Date:

Making Connections

Predict which items will be conductors and insulators.

Conductors	**Insulators**

List the items where they actually go, as a conductor or an insulator.

Conductors	**Insulators**

List classroom items you think might be conductors and insulators.

Conductors	**Insulators**

Name: Date:

Conductors and Insulators

What is a conductor?

What is an insulator?

Explain why the wire in your home is covered with plastic?

Can you get an electrical shock if you are touching a wire covered in plastic in rubber? Why or why not?

Fill in the chart.

Conductors we would find at home	Insulators we would find at home

Name: Date:

Electricity Post-Test

Draw and **label** a light bulb being lit by a battery, foil and a conductor (you pick which one).

Look at the pictures below. Draw a circle around the bulbs that will light.

Look at the picture and tell two things that are causing the light bulb not to light.

_____

_____

_____

_____

_____

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