UTAH OFFICE OF
ENERGY DEVELOPMENT

Who Turned Out the Lights?

Grade/Subject: 4th Science

Strand/Standard 4.2.3 Plan and carry out an investigation to gather evidence from observations that energy can be transferred from place to place by sound, light, heat, and electrical currents. Examples could include sound causing objects to vibrate and electric currents being used to produce motion or light. (PS3.A, PS3.B)

Lesson Performance Expectations:

Witness a simple phenomenon where the classroom lights are out and all electronic devices/equipment are off as well. They will ask questions about how this would affect their lives and how it is affecting them right now.
Students will build a simple circuit with a battery and light.

Materials:

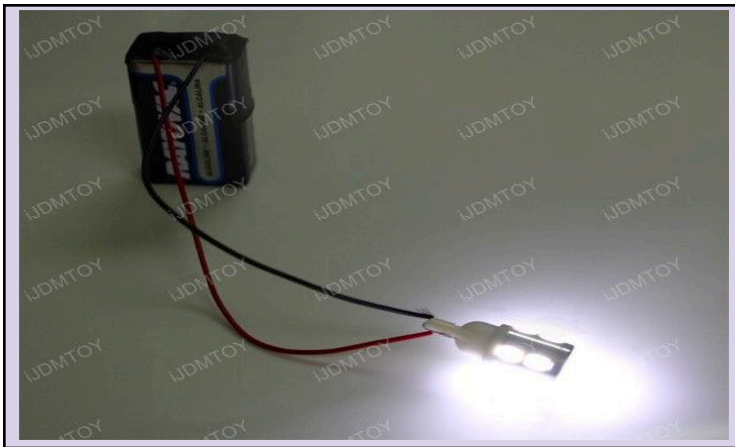
- Classroom with electric lights
- Electric light and accessory kit: battery holder and lights here.
- Miniature light bulbs here one per group.
- Double A batteries (2 per student group)

Time: 50 minutes

Teacher Background Information:

- Today's modern world requires electricity; our cars and other forms of transportation require fuel; and all of the machinery required to make material goods in plants and factories use energy. Without electricity, our day to day life would be very different.
- How do we get electricity? Energy is transferred from primary sources like fossil fuels or renewable energy to secondary sources, which often comes in the form of electricity. Utah is an energy-rich state in terms of both traditional and non-traditional energy resources. For further information, this site has excellent information: https://www.energy.gov/science-innovation/energy-sources
- Fossil fuels are our main sources of energy to generate secondary sources (such as electricity, gasoline, and other fuels). In 2018, 63% of electricity was generated from fossil fuels (U.S. Energy Information Administration). Utah has a significant amount of fossil fuel resources available to convert into electricity. This includes coal, petroleum and natural gas. Utah also has a diverse range of renewable energy resources like solar, wind and geothermal. Recent technological advances and cost reductions have increased renewable energy production in the United States, making renewable energy 17% of primary sources for electrical energy. (EIA)

To light a bulb that is not in a holder, the one wire must be placed on the bottom tip and the other on the side of the metal casing.



Student Background Knowledge:
Students should know that energy is needed for heating, lighting and transportation, all important parts of our society. Energy must be transformed and transferred into the most useful form for people to use.

Teacher Step by Step: A 3-d lesson should insist students do the thinking. Provide time and space for the students to experience the phenomenon and ask questions. The student sheet provided below provides guidance but is only an example of how students might respond.

1. **Introduce *Phenomenon:***
   Turn all of the lights off in the classroom along with all other electronic devices (except for computer carts). Students will come into a dark room where the lights are out. Tell them that we cannot have the lights on today because we are pretending there is no electricity in the room today.
2. Ask students for questions that they have about why the room is dark today and what it might mean. Students record them on their student sheet. (Hand them the student sheet upon entering the classroom, it will probably be light enough to see to write. If not, ask them to think of questions to write once the lights are back on)
3. Students will plan and build a simple light circuit and will investigate how energy is being transferred from a battery to a wire and can be used to create light.

Assessment of Student Learning.

1. What is the source of energy for most of the electricity we use? (*fossil and alternative fuels)*
2. A circuit and a circle have the same root word. How is a circuit like a circle? (*The circuit must be connected in a circle for it to work)*
3. Heat is often produced by a light bulb. What is heat a form of? (*energy)*
4. How different would our world be without electricity to use?

Standardized Test Preparation:

Who Turned Out the Lights?

1. What are the uses of electricity? Choose all that apply.
   a. To create light*
   b. To create sound*
   c. To create heat*
   d. To create matter

Battery Light Bulb

2. What evidence shows that the battery contains energy that turns on the light?
   a. The light bulb can turn on with a switch also.
   b. The battery is heavy and that is evidence that it is full of energy.
   c. The light only needs to get close to the battery to work.
   d. The light will not turn on without being connected to the battery.*

3. Where did the wires need to be attached to the light bulb? Choose all that apply.
   a. At the very tip of the metal part.*
   b. On the glass
   c. On the metal part around the base.*
   d. To each other.

4. What must happen to make this circuit work to turn on the light bulb? Choose all that apply.
   a. The wires must be attached to the top and bottom of the battery.*
   b. The wires must be longer than the battery and light bulb.
   c. The wires must be attached to the light bulb.*
   d. The wires must touch near the light bulb.

Extension of lesson and Career Connections:

Extension: Provide electric motors for students to experiment with.

Go to Energy.gov's site to compare Utah's energy usage with the US average and other states' usage.

Career Connections: Electricians, Power plant operators, Energy company workers.

Who Turned Out the Lights?

Name_____

Phenomenon: When you walked into the classroom today, you found a dark room with no electricity and no electronic devices working. Write down your observations or questions about this situation below. Write two observations and two questions:

Observations:
1.
2.
Questions:
1.
2.

The lights were off today to help us see how not having electricity would affect our learning environment. What would happen if the lights did not come on for the whole period? Give three ideas:
1.
2.
3.

Investigation:

Electricity comes to our classroom on wires from a power plant somewhere nearby. Various energy resources like coal, oil, natural gas, wind turbines, solar panels or a hydroelectric dam produce electricity. Today our energy will be provided by a battery (chemical energy) and you will investigate how it can be used to turn on a light bulb. Write a prediction about how the chemical energy in the battery could be changed into electric energy to light the bulb

Prediction:

_____
_____
_____

Challenge: Use the battery pack to get the light to glow.

Draw: Show how the circuit looked when the light was on. Be sure to notice where you placed the wires on the light bulb:

Claim: Write a short one sentence claim.

_____

_____

Evidence and Reasoning: Write down at least two evidence statements that show that electrical energy has been changed into light energy in your experiment.

1.
2.

Explanation: Now use your claim from above and add reasoning from your experiment to form an explanation for how the chemical energy from a battery might change into electric energy to light the bulb

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_____

_____

_____

Evidence and Reasoning: Write down at least two evidence statements that show that electrical energy has been changed into light energy in your experiment.