A Battery, A Wire, and A Bulb – Oh My!

Activity Overview	This simple activity asks students to investigate electricity by using a wire, a small 2 volt bulb, and a battery to light a bulb. Students will be given the materials with the goal of manipulating the wire, battery, and bulb to cause the bulb to light. Students will utilize this exploration of electricity to explore a complete circuit and gain experience with problem solving and critical thinking
Next Generation Science Standards	**K-2ETS1-1.** Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool. **Science & Engineering Practices:** Ask questions based on observations to find more information about the natural world. **Disciplinary Core Ideas:** Asking questions, making observations, and gathering information are helpful in thinking about problems. **4-PS3-2.** Make observations to provide evidence that energy can be transferred from place to place by sound, light, and electric currents. **Science & Engineering Practices:** Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. **Disciplinary Core Ideas:** Energy can also be transferred from place to place by electrical currents, which can be used to produce motion, heat, sound, or light. **Crosscutting Concepts**: Energy can be transferred in various ways between objects.
Materials	One battery, one wire, and on 2 volt bulb
Protocol **To cause the bulb to light, a complete circuit must be formed.**	**Step 1**: Ask students to think about the story and select one of the pictures which they think will light the bulb. Ask the group to share their thoughts. **Step 2**: Show the students the materials they will have to work with and tell them that they cannot alter the wire bulb or battery (this means to somehow make changes to the objects other than holding the three objects in different positions. **Step 3:** Ask students to work in teams of two or with a parent. The students may try multiple iterations involving the battery, bulb and wire. **NOTE:** Keep in mind that the bulb will not light up unless a complete circuit is formed between the bulb, wire, and battery. Do not tell the students this, the goal is for the students to discover this relationship. **Step 4:** Ask students to draw the circuit they created on the notecards provided.

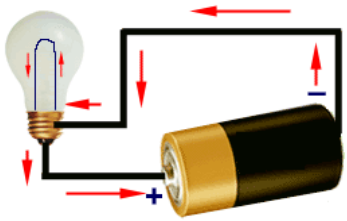
Background Information

A quick review of an electrical circuit.

The circuit must be complete so that the electrons flow from the battery through the bulb and wires and return to the battery.

The electricity that causes the light bulb to light in this activity is coming from the battery. The wire provides a conductive path for the electricity. But this information is not helpful in terms of understanding how the battery works.

- Think about this: there is a chemical reaction occurring inside the battery. This reaction results in release of negatively charged electrons which exit the battery at the negative terminal. The electrons will continue to move through the circuit and return to the battery at the positive terminal.
- When a wire makes contact with the battery, electrons will flow from the battery through the wire and through the bulb before returning to the battery. The path creates a complete circuit. But what if you want to light a small bulb. How do you use the wire, the bulb, and the battery to accomplish this?
    - Remember, a circuit is the complete path of electrical energy. When students attempt to light the bulb, they must create a complete circuit so that the electrons flow from the battery, through the wire, through the bulb, and finally return to the battery.
    - If the circuit is broken by disconnecting one wire from the battery, the bulb will no longer light even if it is in direct contact with the wire. The circuit is no longer complete.
    - We use copper wires for this investigation because copper is an excellent conductor of electricity.



Simple circuit with light

The diagram of the electrical circuit shown on the left shows the path of electrons from the battery through the bulb and back to the battery. This is the path for the electrons and also the reason that the bulb lights up. If the circuit is broken, then the electrons will no longer flow. So this means that if there is no return path for the electrons, the bulb will not light up. A switch works in this manner. When the switch is off, then the circuit is broken and the light or appliance is no longer powered with electricity. When the switch is in the 'on' position, the circuit is complete and the flow of electrons is complete allowing the light to light up or the appliances to function.

In the space below, draw the electrical circuit you created with the bulb, wire, and battery:

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