	Harford District 2016 Cub Scout Day Camp June 27 – July 1 **Cubstruction**

Adventures in Science I
Electricity

Station Volunteer's Guide

Thank you for being a station volunteer! The stations are the heart of camp and truly provide our scouts with an opportunity to try out a new skill (or build on one they know) while having a great time. Our volunteers' knowledge and enthusiasm is what makes our camp great!

To make running the station easier, please take some time to read through the station guide. **While, <u>what</u> is being covered at the station needs to remain as outlined so that the scouts earn the correct achievements, <u>how</u> it is covered is only one of many methods**. If you find a better way to accomplish the requirements or if the method we have outlined doesn't seem to be working…please feel free to change it! This is only a guide…do what works best for you and the scouts coming to your station.

One other thing to keep in mind – some stations will be visited by all ranks. That means you may have 6 year olds through 11 year olds and may have to simplify or intensify the methods to meet the skills and knowledge of all the scouts.

Thanks again – we are glad to have you as part of Harford Day Camp!

<u>Station Procedures</u>

- The first station begins at 10:15 on Monday and 9:15 other days…so you have some time! We've tried to only schedule 2 dens at a time (max. 24 boys) but, there may be times when you have 3. Consult your station schedule so you will know who to expect and when.
- Greet dens as they arrive. Many will have a den cheer, ask to hear it!
- Once all the dens arrive or the start time has come, begin going through the procedures for the station. **It is very important that you start and end on time**! Each time slot lasts 45 minutes. If a den arrives 10 minutes late, they CANNOT stay 10 minutes past the end of the station…that would make you and them late for the next station. If a den doesn't get finished, suggest they come back during a break or take the remaining activity with them to work on at the den.
- **Execute the station with energy and enthusiasm**! Let the scouts do as much for themselves as possible. It doesn't need to be perfect, they just need to Do Their Best!
- Don't forget the beads. Each scout earns a bead at every station for participating. Beads can be given to the den leader for distribution.
- Once the den is finished, begin resetting for the next group.
- Close the station at the end of the day by packing/organizing the supplies and cleaning and disposing of all trash. Let the Program Director responsible for the station (either Tiger/Wolf/Bear or Webelos) know if supplies are running short!

Station Overview

Scouts will learn how electricity is generated and gets to their home and then build a simple electric circuit to light up a light bulb. If there is time, they will also experiment with conductors and insulators at the end.

Set-up:

Part I: : How Electricity Gets to the Home

- Poster of how the electricity moves

Part II: Simple Electric Circuit Project

Materials You Will Need – found in kit:

- Wooden base for mounting the circuit
- 2 light bulbs
- 2 lamp holders
- 1 battery holder (D size)
- 1 D size battery
- 1 Simple Switch (aka: knife switch)
- Screws used to mount the switch, lamp holder & battery holder
- Insulated solid copper wire (22 Gauge)

Part I: How Electricity Gets To Your Home

It's always there whenever you flip a switch or plug in a cord - but electricity has to travel a long way to get to your house. In fact, the power plant where your electricity is made might be hundreds of miles away!

All the poles and wires you see along the highway and in front of your house are called the electrical transmission and distribution system. Using hydroelectric power from Niagara Falls, scientist Nikola Tesla designed the first full-scale electric system in the early 1900s.

Today, power plants all across the country are connected to each other through the electrical system (sometimes called the "power grid"). If one power plant can't produce enough electricity to run all the air conditioners when it's hot, another power plant can send some where it's needed.

We'll play a game to learn how electricity gets to your home. We'll review the process and then work together to put the process in order. Here's how the electricity gets to your house:

Electricity is made at a **power plant** by huge generators. Most power plants use coal, but some use natural gas, water or even wind.

The current is sent through **transformers** to increase the voltage to push the power long distances.

The electrical charge goes through high-voltage **transmission lines** that stretch across the country.

It reaches a **substation**, where the voltage is lowered so it can be sent on smaller power lines.

It travels through **distribution lines** to your neighborhood, where smaller pole-top transformers reduce the voltage again to take the power safe to use in our homes.

It connects to your house through the **service drop** and passes through a **meter** that measures how much our family uses.

The electricity goes to the **service panel** in your basement or garage, where breakers or fuses protect the wires inside your house from being overloaded.

The electricity travels through wires inside the walls to the **outlets and switches** all over your house.

Part II: Build a Simple Electric Circuit Project

Please read carefully and stress cautions to the scouts!

All experiments use safe, low-voltage battery power. Household electrical current contains high voltage that could cause serious injury. DO NOT use household electrical current for any experiments. ALL experiments with electricity should be conducted under adult supervision.

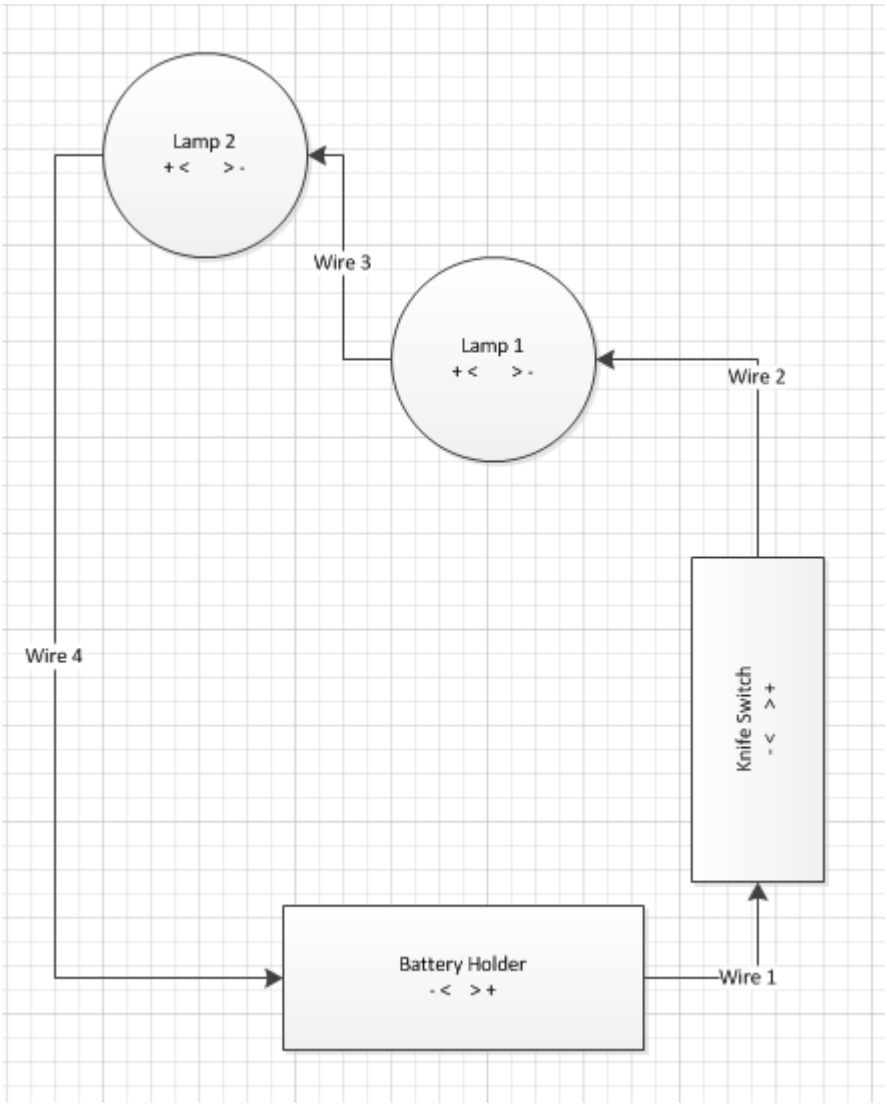
- Carefully follow wiring instructions for each experiment. Improper wiring can result in battery leakage and/or rupture.
- DO NOT take a battery apart. Contact with internal battery material can cause injury.
- DO NOT dispose in fire, recharge, put in backwards, or mix with used or other battery types. This may cause batteries to explode, leak and cause personal injury.

Steps to Building a Simple Electric Circuit:

- Use the picture to see how you must mount the components on the board. Use small mounting screws to mount the battery holder, the switch and the lamp holder to the appropriate places on the board. A screw driver and assistance of an expert adult may be required.
- Loosen the contact screws (not mounting screws) on the lamp holder and on the switch to make them ready for connecting the wires. Note: Do not unscrew too much as the back nut will fall off.
- Cut 3 pieces of wire (any color) to 7", 5" and 4".
- Remove the insulation from 1/2 inch of each end of the wires. To do that first make a cut on the plastic insulation all around the wire. Then pull the insulation out.
- Use the 7" long wire to connect the battery holder to the one of the contact screws on the lamp holder.
- Use the 5" long wire to connect the remaining contact screw of the lamp holder to one of the screws on the switch
- Use the 4" long wire to connect the remaining screw on the switch to the remaining clip of the battery holder.

Experiment I - Series Circuit

Connect 4 wires as specified in the following drawing. Remember, when connecting the wire do not unscrew the screw too much as it will fall apart.



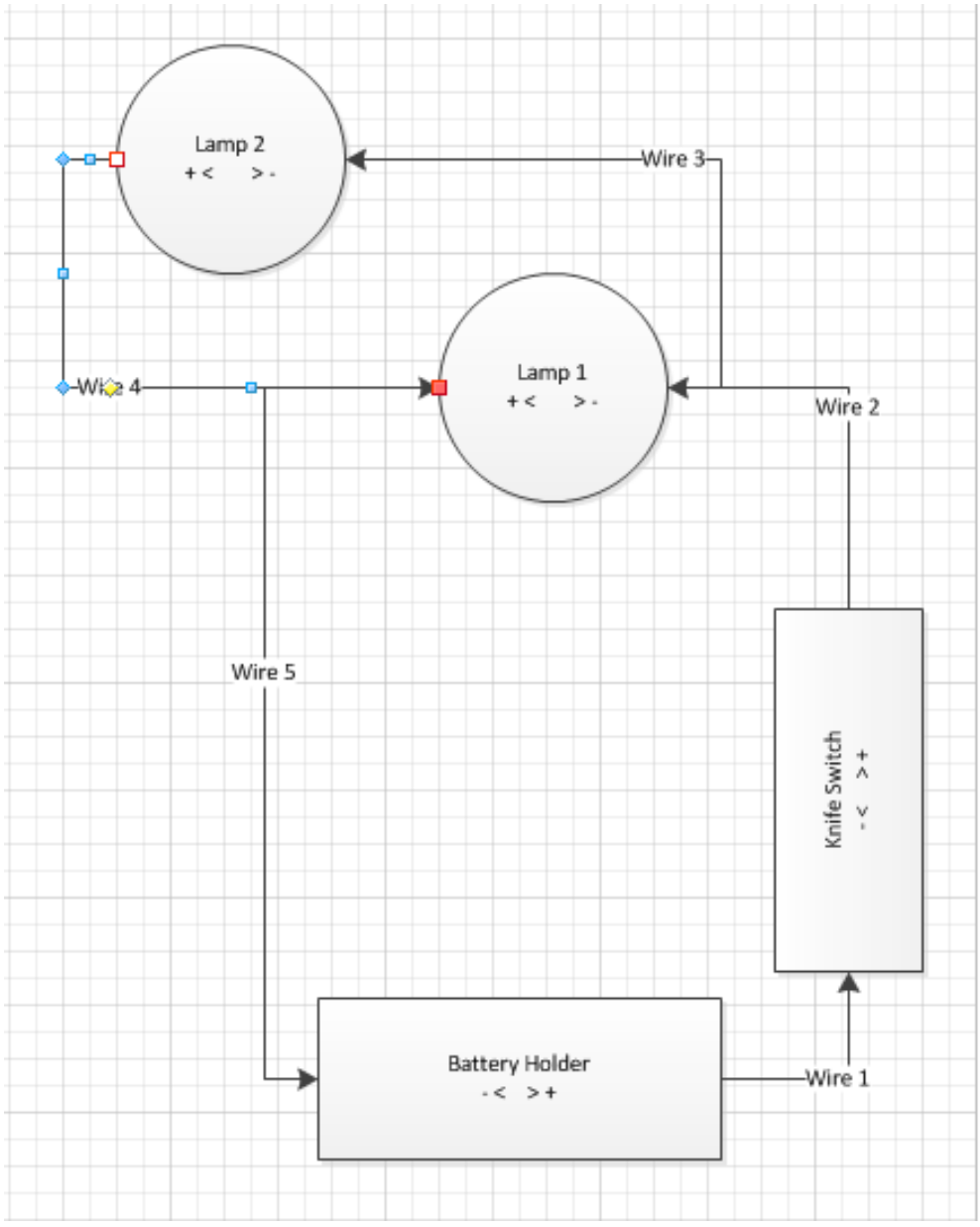
Test your circuit:

Insert the battery, screw in both light bulbs into the lamp holders and close the switch. The light bulbs must light up; if it does not, check all the contacts and try again. You may also need to check the battery and the light bulb.

1. Explain why the light bulbs light up?
2. If the knife switch is up (open), what happens to the light bulbs? Why?
3. If you disconnect one of the light bulbs, what happens to the other one? Why?

Experiment II - Parallel Circuit

Connect 5 wires as specified in the following drawing. Remember, when connecting the wire do not unscrew the screw too much as it will fall apart.



1. Notice that Wire 2 and Wire 3 are connected to the same connector on Lamp1.
2. Also notice that wire 4 and wire 5 are connected to the opposite connector on Lamp1.
3. Again, be careful not to over unscrew the connectors on the bulb holders.

Test your circuit:

Insert the battery, screw in both light bulbs into the lamp holders and close the switch. The light bulbs must light up; if it does not, check all the contacts and try again. You may also need to check the battery and the light bulb.

1. Explain why the light bulbs light up?
2. If the knife switch is up (open), what happens to the light bulbs? Why?
3. If you disconnect one of the light bulbs, what happens to the other one? Why?

Extra Experiment: Identify conductors and insulators around you. Identify conductors and insulators around you. It is important to know what materials are conductive and what materials are not. The test is simple. Open the switch and place the object between the poles of the switch. If the light comes on, then the object is conductive. You may try this with metals (coins, paper clips, nails, etc.) and non-metals (glass, plastic, stone, wood, etc.)

What Materials are Conductors of Electricity?

Introduction: By learning about conductors and insulators we can keep ourselves and our electrical equipment safe. Every year thousands of children and adults around the world are electrocuted because they did not use proper insulation while contacting with electrical wires or equipment. So much loss of life is a clear signal that every one must learn about electricity and safeguarding it by using insulators. This experiment is a fundamental step toward such education.

Procedure: Make sure the switch in your simple electric circuit is open and the light is off. Then place different objects between the poles of the switch one at a time. If placing the object between the poles of the switch can close the circuit and the light bulbs turns on, then the object is conductive. If the light does not come on, then the object is an insulator. Some of the objects you may try are: Coins, nails, gold and silver pieces, paper clips, safety pins, Pencil and the pencil's lead, rubber, wood, plastics, glass and aluminum foil.

Your results table may look like this:

Material	**Conductivity**
Iron nail	Conductive
Rubber eraser	Insulator

Warning: The voltage (electrical power) of a battery (also known as dry cell) is usually about 1.5 Volts. When a material is insulator for 1.5 volt, it may be conductive for higher voltages. Even air is conductive for high voltages. You must be more careful as you start experimenting with higher voltages in future.

Why don't the birds get killed when they sit on high voltage electrical cables?

This is a common question for those who know "most high voltage electrical cables have no insulation.". The answer is simple. High voltage electricity can kill if it passes trough your body. When birds sit on the power cable, the electrical current cannot pass trough their body because no part of their body is touching the ground or any other wire. With the same token, someone wearing thick rubber shoes may touch a 110 volt electrical cable with one hand and stay safe; however, the same person may get electrocuted if he is touching a moist concrete wall or a water pipe with his other hand. For very high voltages such as 6000 volts, no insulation can protect us and we must stay at least 5 feet away from such high voltage cables. (That is why such cables don't have any insulation on them).