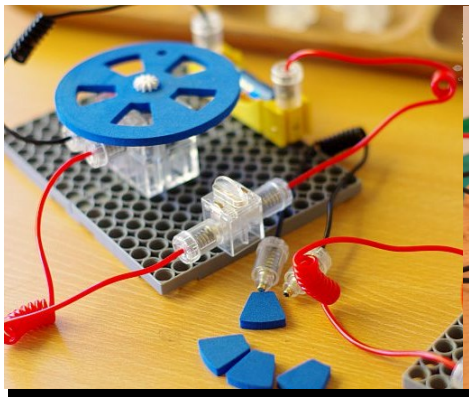
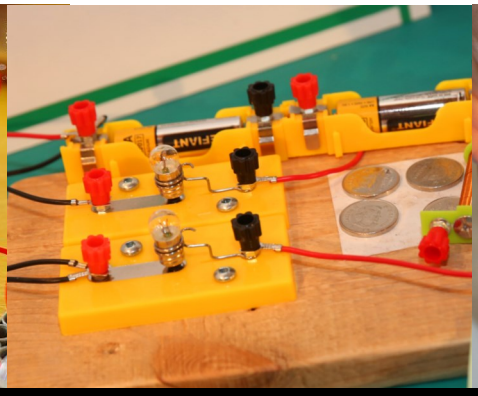




Electricity
Leaders Resource

You'll be shocked by how much you will learn! Learn where that zap of electricity comes from, how to make it and how to use it! Members will explore how to create simple, parallel and series circuits! The new module project format allows members and leaders to decide what topics and activities that they would like to explore in the electrical trade.

Project Completion Requirements

Project Items & Record Pages

- Complete at least five (5) project topics or activities
- Create at least two tangible items that will be on display at Achievement Day
- All activities/project meeting topics must be documented on the record page provided.
- Member Booklet *(with completed member reflection pages)*
- ***NOTE:*** *Although the group may do activities together, project members are expected to document & display their own project/activity items at Achievement Day.*

Exhibition Requirements

Members are strongly encouraged to participate in the 4-H Classes at PEI Fairs & Exhibitions

- Members may choose **ONE** tangible project item to send on the Exhibition Circuit.
- Group members **do not** have to send the same items.
- Chosen item must be approved by the 4-H Specialist at the Club Achievement Day

4-H Year Completion

In order to complete the 4-H year members are required to:

- Complete the **PCR's (Project Completion Requirements**) as outlined above
- Complete a **Communication** Project
- Complete a **Community Service** Activity
- Complete an **Agriculture Awareness** Activity

Revised 2019

The Project Leader's Job

To begin, thank you for volunteering your time to be a 4-H project leader! We appreciate your time and willingness to teach today's youth a new skill and share your knowledge.

Becoming a project leader can feel overwhelming at first, but we hope that this page will make your "job" clear and offer some tips to help you be successful.

Responsibilities

1. Become a screened leader
   You may have already completed this step, but it is a very important one. The best place to go is to the 4-H PEI website and visit this page: https://www.pei4h.ca/4-h-leaders , to see if you have completed all the necessary requirements. Project meetings cannot begin until you have received a "conditional letter" from the Provincial 4-H Office.
   NOTE: As of July 2019 a new policy has been implemented by 4-H Canada that each project group be accompanied by two screened leaders. ***Insert more information about what National has to say about this policy and why they think it is important for this policy to be in place.***
2. Set Project Meeting Dates
   The amount and length of project meetings is determined by you, the project leader. That being said, you are responsible for covering **five** activities or topics (see project activity ideas pages) with the group. You may decide that you'd like to have five meetings - covering one topic per meeting, or you may decide to spend two 5 hour sessions with your group and cover multiple topics or activities in one meeting. This will also depend on the project you are leading. For instance, if you are leading a quilting project, then the member will be focused on one large item with multiple steps and skills involved. However, a rabbit project may require multiple meetings (and even locations) to cover different activities and topics. Meetings can begin anytime after November 15th.
   Whatever the case, we highly recommend that Project Leaders **set dates in advance of members signing up for the project.** This method will ensure the members know what they are signing up for, or enable them to make a decision to not sign up if they cannot commit to the dates listed. We also hope that this will avoid a lot frustration for you, because working around multiple schedules is almost impossible!
3. Choose Topics and Activities
   You may choose to work on this step before setting dates for project meetings. Some topics and activities may be able to be covered in one project meeting, while others may need their own meeting. Regardless, we ask that you document your project meetings and topics covered on the next page so that the 4-H Specialist can refer to this information at Achievement Day if necessary.
4. Materials & Supplies
   While you are responsible for determining what materials and supplies are needed, you **are not** responsible for covering these costs. Options to consider:
   A. 4-H Canada has a FCC 4-H Club Fund that all leaders are welcome to apply to. These grants are valued at $500 each. Applications are accepted August through to the end of October.
   B. Asking for supplies. Depending on what project you are leading, just putting a call out for the supplies you need to friends, family, etc. may be successful
   C. Determine an estimate total for the materials and supplies needed and set a "project fee" that all members will pay to help cover the additional costs
5. 4-H Year Completion and Project Completion Requirements
   The project leader **is not** responsible for 4-H Year Completion (these components will be completed at the Club level) though each member **must** complete these components. Project leaders should focus on the Project Completion Requirements, found on the front cover of this guide. These are the items that the 4-H Specialist will expect to see on display at the Club's Achievement Day (typically scheduled for June-July).
6. Club Meetings & Events
   Project leaders are not expected to attend monthly club meetings, but are more than welcome to attend if they'd like to know what is going on at the Club, Provincial or National level of 4-H. Similarly, Club events and activities are open to project leaders, but it is not necessary to attend. Project leaders are encouraged to attend Achievement Day. This is an event that wraps up the Club's 4-H year and a celebration of member success.

The Project Leader's Plan

After reviewing the Project Completion Requirements list on the front of this guide, review the Project Activity Ideas page/s. You can also pull ideas from past experiences, books, social media, online or you can plan to join a took, attend an event or book a guest speaker. The sky is the limit! Regardless of what activities or topics you decide upon, you should choose five in total. It might be a good idea to ask the 4-H members in your project group what they envision before making a concrete plan. In some cases, the project group members may depict what activities or topics based on what project item they have in mind.

Topics and Activities

1. _____

Supplies needed:

_____ _____

_____ _____

_____ _____

2. _____

Supplies needed:

_____ _____

_____ _____

_____ _____

3. _____

Supplies needed:

_____ _____

_____ _____

_____ _____

4. _____

Supplies needed:

_____ _____

_____ _____

_____ _____

5. _____

Supplies needed:

_____ _____

_____ _____

_____ _____

Electricity

Electricity is the most versatile energy source that we have; it is also one of the newest: homes and businesses have been using it for not much more than a hundred years. Electricity has played a vital part of our past. But it could play a different role in our future, with many more buildings generating their own renewable electric power using solar cells and wind turbines. Let's take a closer look at electricity and find out how it works!

Retrieved from, explainthatstuff.com

Planning Your Project

- **Review** & **Select** the activities which you want to learn more about based on your division level - *possible topic choices are included on the next page!* Leaders and/or members are also invited to research and create their own

Divisions

Due to the nature of this project it is highly recommended that members begin with the first division - beginner, and then continue to progress into higher divisions upon the discretion of the Project Leader. Divisions do not reflect member age or time in 4-H rather, the skill level as determined by the Project Leader. Division may also reflect the skill level and comfort of the Project Leader Divisions are as follows:

Division I - Beginner
Division II - Intermediate
Division III - Advanced
Division IV - Artistic

https://thesciencepenguin.com/2014/10/energy-interactive-science-notebook-photos.html
http://www.miniscience.com/default.asp?count=1
https://www.exploratorium.edu/tinkering

Helpful Resources!

Supplies & Materials

Supplies and materials will be needed for this project. Project leaders are not expected to cover the cost of these items. The leader can decide if they would like to set a fee for the project or if they would like to divide up the total cost of materials and divide amongst the project members. 4-H Canada also offers annual FCC Club Grants. Applications typically go live in August and are due at the end of October. These

https://www.exploratorium.edu/snacks/circuit-workbench

https://mrsullerysclassroom.weebly.com/electrical-circuits.html

https://learn.sparkfun.com/tutorials/working-with-wire/all

Remember...

The multiple intelligence theory teaches us that people learn in at least 8 different ways. All individuals will be stronger in some ways of “intelligence” and weaker in others. It follows that the more ways we teach, the more members we will reach. Teaching projects using a broad blend of writing, reading, hands on work, artwork, self evaluation, discussion, and so on, will help increase the learning potential of all members.

Projects are designed to teach many skills. However, the 4-H member is always more important than the subject matter. Stress cooperation in the activities where possible to develop teamwork and cooperation skills. These are valuable skills that will assist them in a number of settings. Ensure the work is completed in a manner that members feel good about themselves and their efforts. This can be done by assigning appropriate tasks or roles based on member’s individual abilities. Modeling and expecting supportive behaviour (i.e. no “put-downs”) amongst members,

Project Activity Ideas

Division I

Circuit Symbols

Members will learn how to match circuit symbols to basic electrical components that will be used throughout project meetings.

Direct Current - Simple Electrical Circuit

The most basic electrical current - members will learn how to set up a direct current and practice assembling and disassembling by participating in different activities.

Conductors & Insulators

What is the difference between a conductor and an insulator? Which materials fall under each category? Lots of experimental learning with this project activity!

DC Greeting Cards

A creative way to implement and practice making simple electrical currents.

DC LED Flashlight

Create your own flashlight with the most basic supplies!.... Maybe a game of flashlight tag is in order!?

Robot Car: DC Current & Switches

Learn how to add a switch to your direct current while making a robot car that will [hopefully] move when you flick the "on" switch.

Division II

Electrical Terms

A step up from the circuit symbols that you learned in division I, learn some electrical terms that are slightly more in depth.

Alternating Currents - Series Circuit

The second type of circuit 4-H members will learn about in the electricity project… take the skills learned in division I and build upon them while learning how to create a series circuit.

Lemon Powered Lights

When life gives you lemons… make electricity? A fun activity that will allow members to see how series circuits can be created.

DIY Christmas Lights

When decorating the Christmas tree - is there anything more frustrating then the lights!? The tangles… the mysteriously broken connection… Members will learn how to fix a strand of lights.

Circuit Tree

Recycle, reuse and reduce! Members will use old Christmas lights to create a new holiday decoration.

Squishy Circuits

A very textile exploration of electricity!

New Format. New activities. New ideas.

- In its first year of the new project format, the 4-H staff welcome any feedback, questions or concerns about the Blacksmith Project. Please do not hesitate to get in touch. Further instructions are provided in the Leader Guide.
- If you have an idea or topic in mind for a project activity that relates to blacksmithing, be sure to talk to your project leader! The new project format allows you to review, discuss and select activities that interest you and your fellow 4-H project members. If you don't see something that you are interested in, suggest a new idea! Have fun with it!

Project Activity Ideas

Division III

Alternating Circuits - Parallel Circuits

The third circuit that members will learn how to properly build!

Splicing Wires

Wires that are connected improperly or not insulated properly can be a major fire hazard. Learn how to properly splice wires and ensure they are safe to use.

Electromagnets

A fun way to learn how electricity and magnets go hand in hand.

Electrical Gadgets

Do some research or design work and create an electrical gadget… it can be something useful or something fun. A great way to practice the skills you've learned.

Quiz Boards

Members can decide if they'd like to create a quiz board in small groups or individually. Themes and topics for this activity are endless!

Using an Ammeter

Practice using this electrical instrument to measure electrical currents.

Division IV

Chemistry & Circuits

Electricity can be defined as *the flow of electrical charge*, but there is so much behind that simple statement.

Inside a Light Switch

A closer look - what is behind the switches that we use so effortlessly and without much thought multiple times a day!

Electrical Outlets

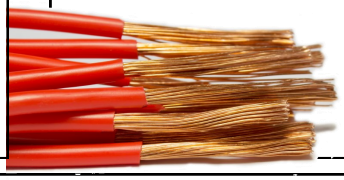
Electricity that is ready to use at all times… A look behind the wall… What happens when a plug is inserted into an electrical outlet?

Switch Boards & Electrical Panel

Wire colours, sizes & load capacity

Members will have the opportunity to learn about colour codes, wire sizes and what these characteristics mean.

Polygraphs



New Format. New activities. New ideas.

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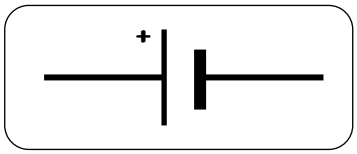
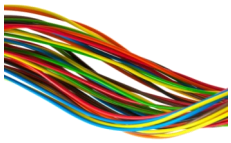
Circuit Symbols

Cell

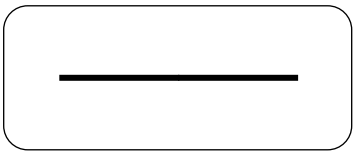
A cell is a source of electrical energy.





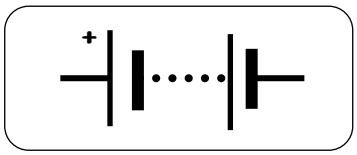
Connecting Wire

Plastic coated electrical wire which conducts electricity around a circuit



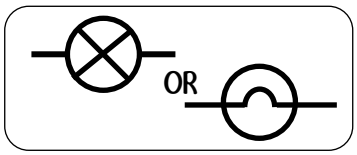
Battery

A battery contains numerous cells connected so that they produce more electrical energy.



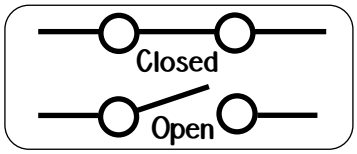
Bulb

A bulb will light up only when it is in a circuit that is complete.



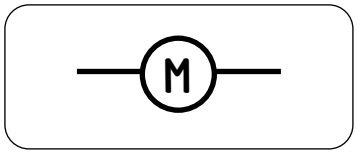
Switch

A switch can be turned on (closed) to let current flow or turned off (open) to stop current flows.



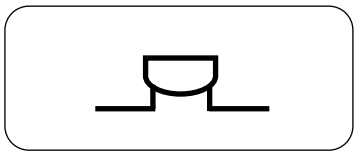
Motor

A motor turns current into motion, for example, in a hair dryer.



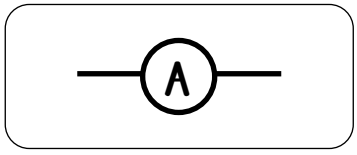
Buzzer

A buzzer turn current into sound.



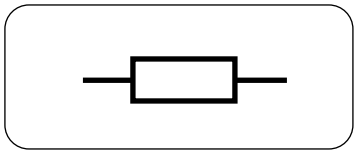
Ammeter

An ammeter is used to measure current.



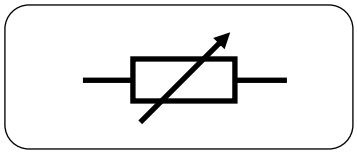
Fixed Resistor

A fixed resistor controls the amount of current in a circuit.



Variable Resistor

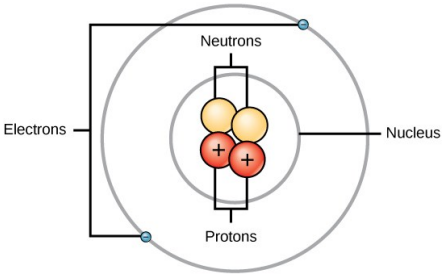
A variable resistor can be adjusted to control the amount of current in a circuit.



Basic Electrical Circuits

Electrical energy is from the flow of moving electrons. Electrons move through a path called a circuit. Electrical energy can produce other forms of energy such as thermal, sound and light.

Atom: Everything in the universe is made up of atoms… they are tiny and cannot be seen by the human eye. Solids are made up of densely packed atoms, while gasses are made up of atoms that are spread out.



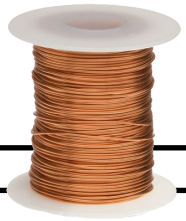
Electrons: The atom has three parts - electrons, protons and neutrons. Electrons are the smallest of these three particles.

Current: The flow of electrons

Parts of a Circuit

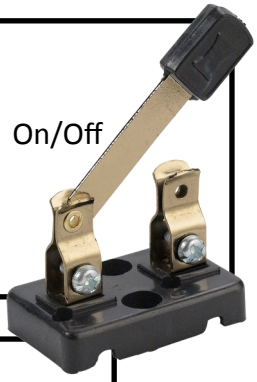
Power Source

Connectors



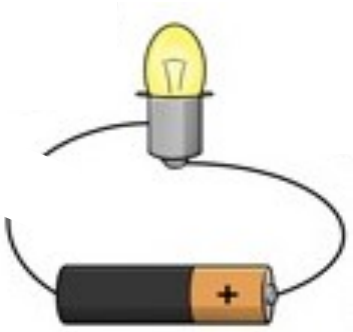
Load

On/Off



Open Circuit

An incomplete path of electricity…
if it's open its broken!

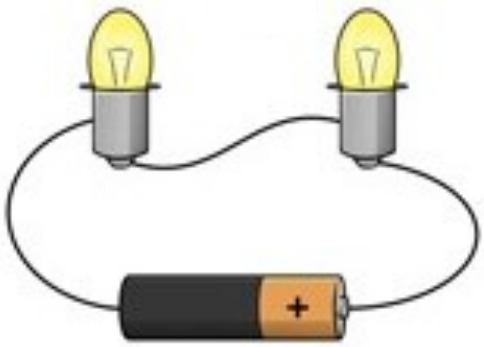


Closed Circuit

A complete path of electricity…
if it's closed its flows!

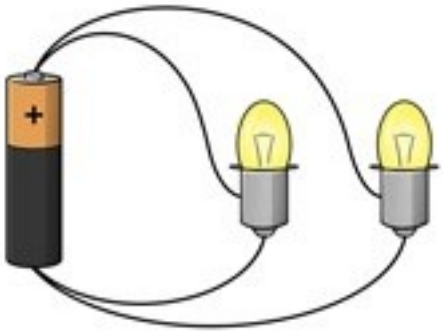
Series Circuit

Electrons flow in one path. A break in the circuit will shut down the current.



Parallel Circuit

Electrons flow through more than one path. A break in the circuit might only shut down part of the current.



Direct Current (DC) - Simple Circuits

Written & Picture instructions: http://www.miniscience.com/kits/KITSEC/index.html

Basic supplies needed:

- ☐ A piece of wood or a base
- ☐ Battery
- ☐ Connectors
- ☐ Light

Outcomes:

- Members should be able to easily create a simple circuit
- Members should be able to successfully insert a switch into the circuit
- Members should know basic terminology that is used when speaking about simple circuits: power source, connectors, load, switch, current, closed/open circuit and path…

Suggested activities:

- Give a time limit; provided a dish of mini Christmas light bulbs… see which member can find the most "working" light bulbs in the given amount of time
  OR
  Similarly, give members a dish of batteries and use the same method
- Give members various items and see if they can creatively make a simple circuit without the "typical" supplies listed above
- Circuit greeting card (see page 9)
- Popsicle stick flashlight (see page 10)
- Practice adding switches (see page 11)

Direct Currents & Switches

Video instructions: https://www.youtube.com/watch?v=0j4gCvYYzdA&feature=youtu.be
GeekGuyMJ - "Build a Simple Circuit from a Pizza Box (No Soldering)"
Written & photo instructions: https://www.instructables.com/id/Build-a-Simple-Circuit-from-a-Pizza-Box-No-Solder/

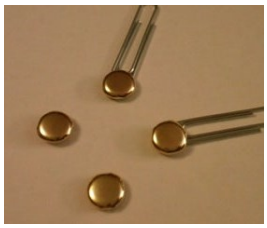
Basic supplies needed:

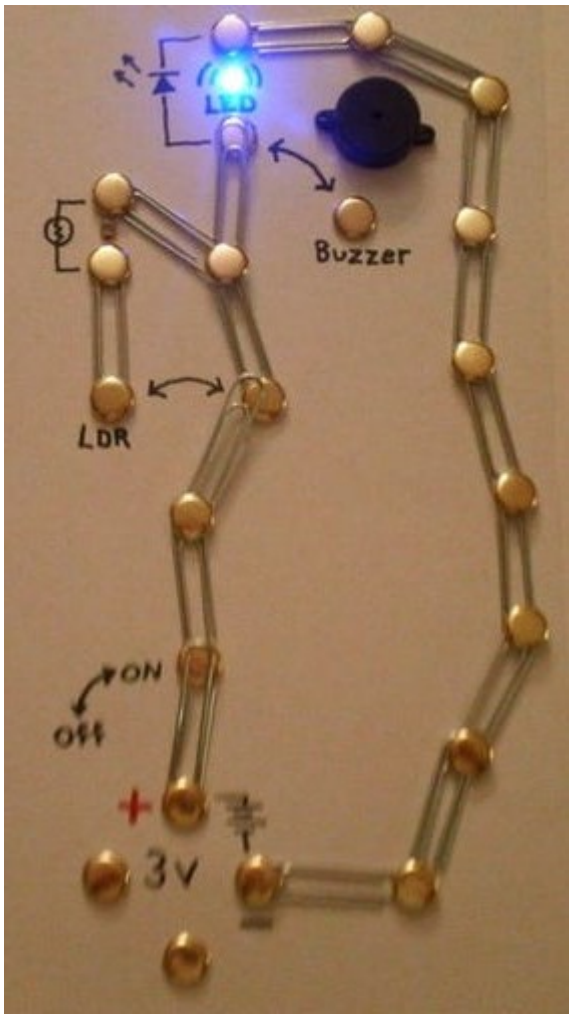
- ☐ Pizza box or cardboard
- ☐ LED diodes (white or blue)
- ☐ 3V lithium button battery
- ☐ Metal brads
- ☐ Paperclips
- ☐ Small nail or something to poke holes in cardboard
- ☐ Tape - electrical

Step by Step

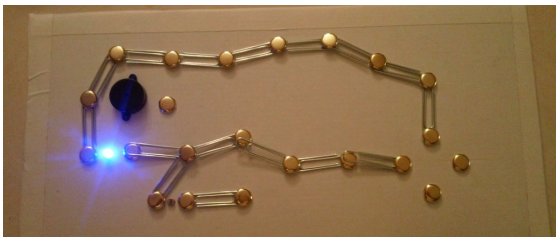
Leaders and members are highly encouraged to visit the links provided above for step by step instructions for this activity. The written and photo instructions are very well done and provide detail. Here is the basic steps...

1. Prepare your cardboard to the size you'd like
2. First choose where'd you like to place the battery and secure it as shown…
3. Test with an LED diode
4. Insert an on/off switch
5. Continue creating the "wire" with brads and clips.. You may insert as many or as few switches as you choose
6. These particular instructions include a buzzer, but this can be up to the discretion of the leader and how advanced the members are who are enrolled in the project group
7. When the pattern has been completed, members can test and connect each other's circuits
8. This is a great opportunity for members to practice using circuit symbols (page 6)





Front



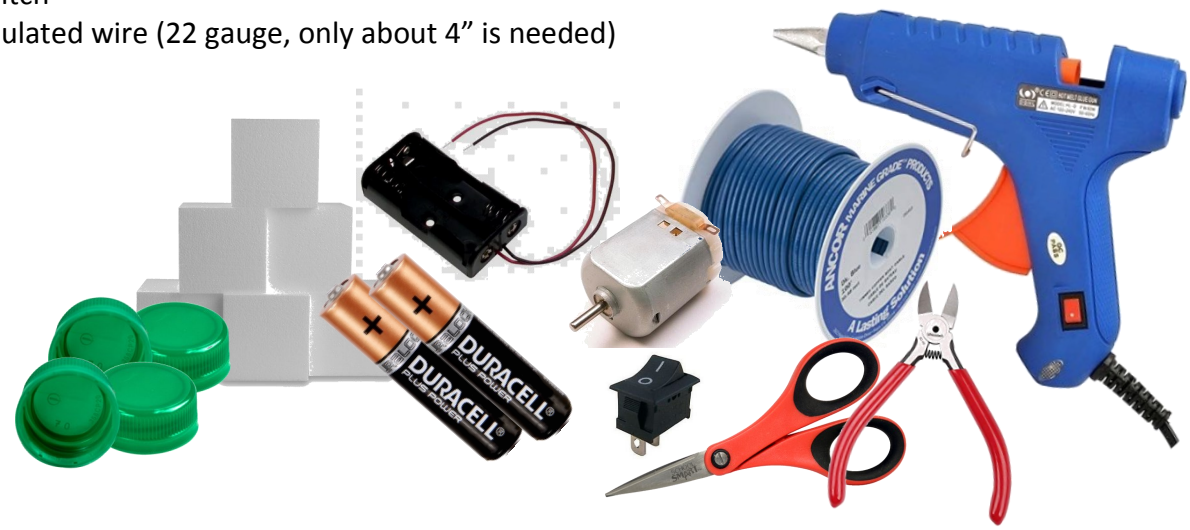
Back

Robot Car

Written & Photo Instructions can be found here: https://researchparent.com/simple-homemade-robot-car/?utm_medium=social&utm_source=pinterest&utm_campaign=tailwind_tribes&utm_content=tribes&utm_term=275797742_7149122_143004

Basic supplies needed:

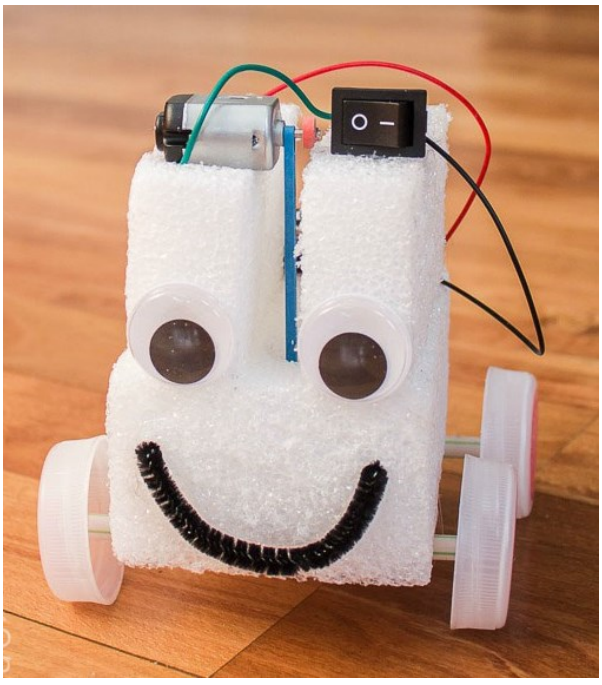
- ☐ Firm block of foam
- ☐ Four bottle lids (wheels) all the same size
- ☐ 2 straws
- ☐ 2 skewers
- ☐ Elastic band (longer than the smallest dimension of your foam when pinched flat)
- ☐ AAA battery holder (needs to hold two batteries)
- ☐ 2 AAA batteries
- ☐ 1.5-3V DC Motor
- ☐ Switch
- ☐ Insulated wire (22 gauge, only about 4" is needed)
- ☐ Scissors
- ☐ Wire strippers
- ☐ Needle nose pliers
- ☐ Hot glue gun
- ☐ Ruler
- ☐ Googly eyes - optional
- ☐ Pipe cleaner - optional
- ☐ Pencil
- ☐ Knife



Step by Step

Leaders and members are highly encouraged to visit the link provided above for step by step instructions for this activity. The written and photo instructions are very well done and provide detail. Here is the basic steps...

1. Prepare your foam to the recommended sizes
2. Prepare straws and skewers for wheels.. Then punch holes through foam, secure, create "axels" and attach… Don't forget to insert elastic band during this step!
3. Next you will create the circuit that powers the motor. Once your circuit has been created be sure to insert batteries and try it out before securing all pieces to foam structure.
4. Once motor is secured you will be able to loop elastic on-to shaft.
5. Add a face to the car if you wish
6. All done - now turn it on and watch it go!



Electrical Conductors & Insulators

A material that allows electricity to pass through is called a conductor. Metals, especially silver, are good electrical conductors. Copper is cheaper than silver, so it is made into millions of miles of electrical wiring each year. Materials like glass and plastic are poor electrical conductors, and are called insulators. They are used to stop electricity from flowing where it is not needed or where it can be dangerous, such as through our bodies. Cables are wires covered in plastic so that we can handle them safely.

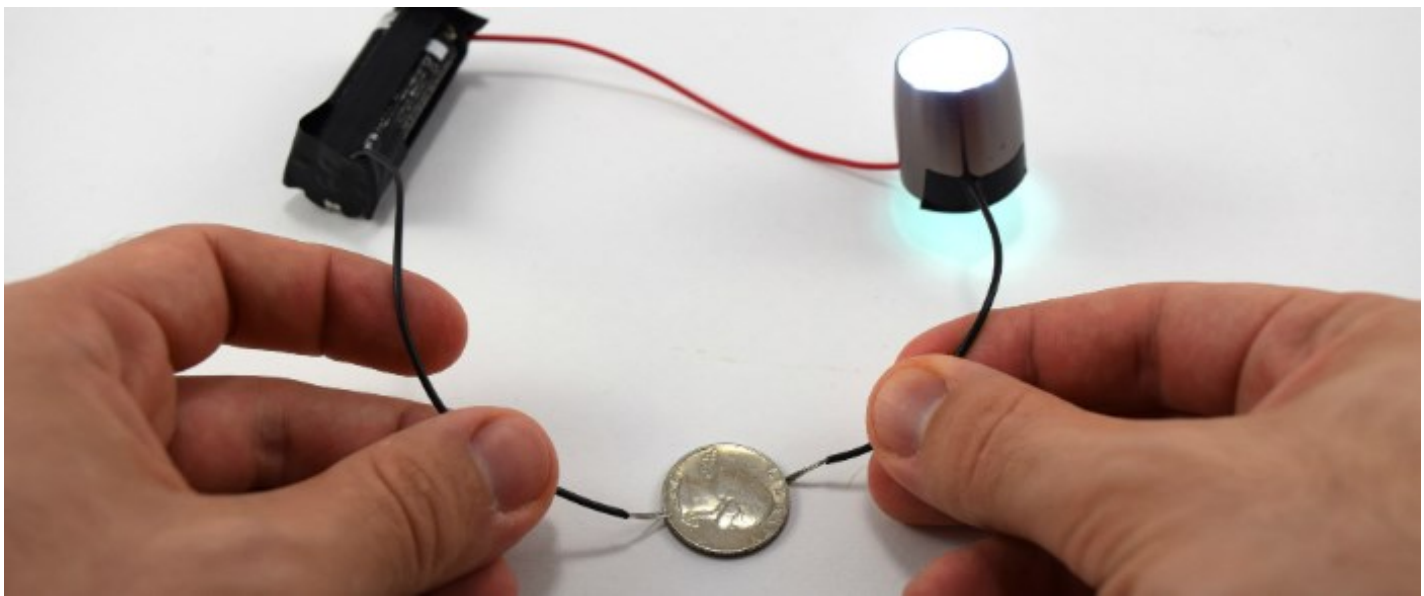
Electrical Conductors & Insulators Challenge

Challenge members (individually or in groups) to find electrical conductors and insulators around the space that the group meets…. Or provide a large assortment of items for members to test.

Basic supplies needed:

- ☐ Battery
- ☐ Connectors
- ☐ Light
- ☐ Assortment of items to test

Conductors	Insulators



DC Greeting Card

Note: This activity can also be used once when members learn how to create series circuits.

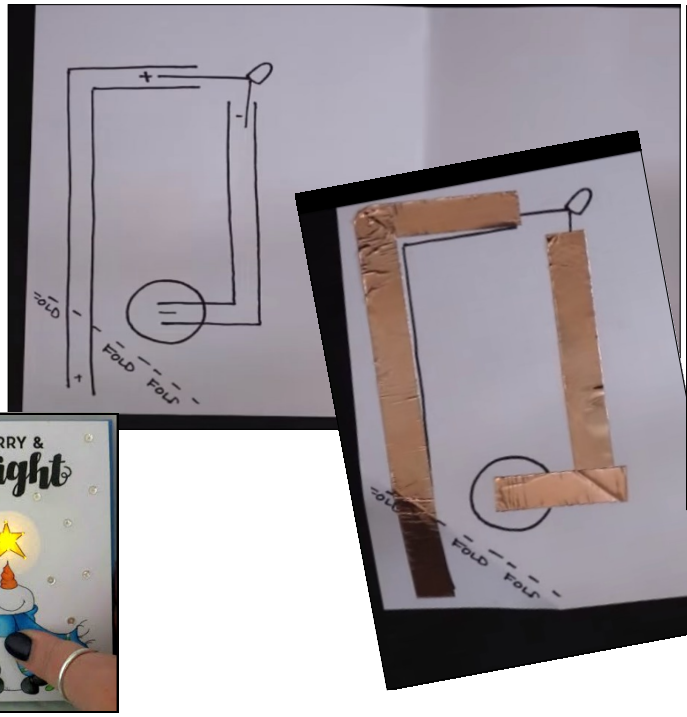
Video instructions can be found here: https://www.youtube.com/watch?v=7hb-9eUpfbQ
Melanie STEMdola - "Cupcake Paper Circuit Card with LED Light"
Written instructions: https://www.sciencekiddo.com/paper-circuit-cards/

Basic supplies needed:

- ☐ Cardstock paper or preprinted pattern
- ☐ Scissors
- ☐ Scotch tape
- ☐ 1/4" copper foil tape
- ☐ 3V lithium button battery
- ☐ LED diodes (3mm or 5mm)

Step by Step

1. Create design for front of card - colour page or complete design work
2. Draw simple circuit plan on inside page - be sure to line lightbulb up
3. Stick copper tape in place - the video link provided above explains how to do the corners very easily
4. Add lithium battery using scotch tape
5. Make hole on front of card where the light/diode will go - wire should be pushed through front side
6. On the back, tape the diode wires in place (long wire has positive charge, shorter wire has negative charge)
7. Fold over corner that will act as the switch
8. If you choose, cover the "circuit page" with a coloured piece of paper to cover up your work, but don't forget to leave the folded tab
9. Add a "Press here" button to the front of your card



DC Popsicle Stick LED Flashlight

Written instructions: https://www.funlovingfamilies.com/popsicle-stick-led-flashlight-summer-stem-activity/

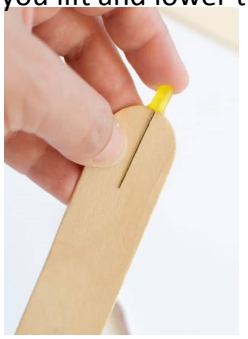
Basic supplies needed:

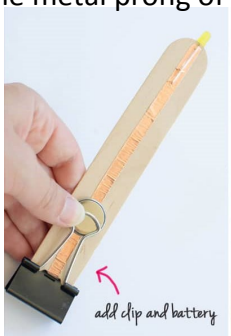
- ☐ Large wooden craft sticks
- ☐ Scissors
- ☐ Scotch tape
- ☐ 1/4" copper foil tape or aluminum foil*
- ☐ 3V lithium button battery
- ☐ LED diodes (3mm or 5mm)
- ☐ 25mm or 32mm binder clips

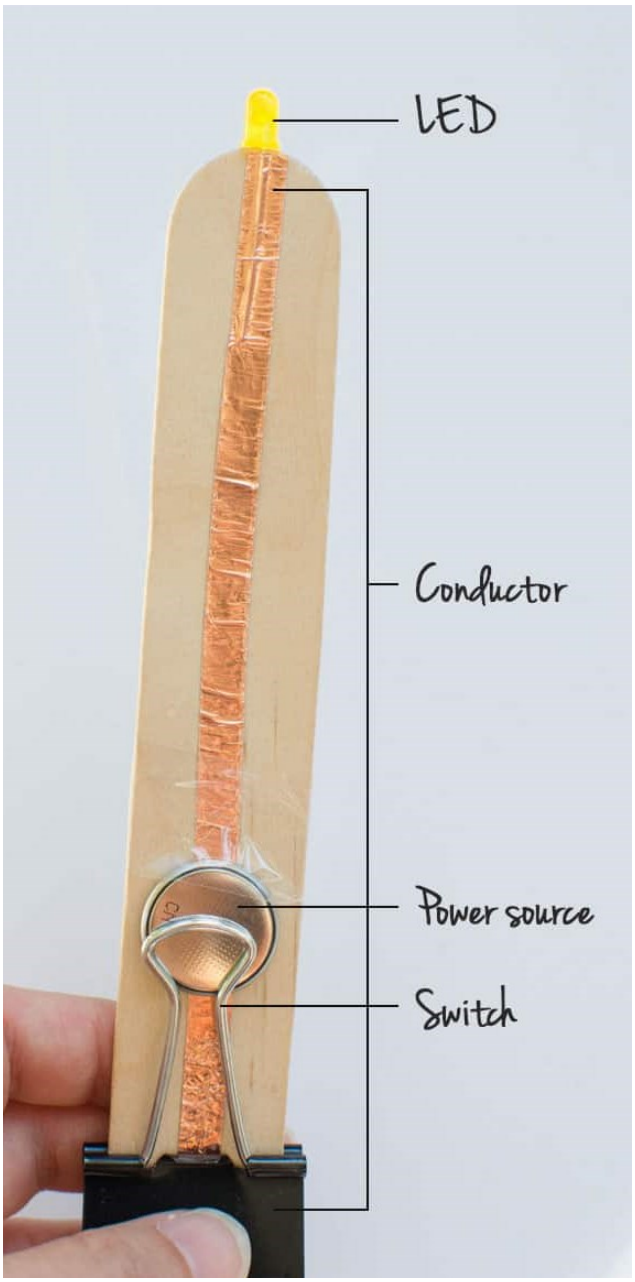
*Regular kitchen foil can be used instead of copper tape, however the copper tape is much more reliable.

Step by Step

1. Cut one end of your craft stick, so that it has a straight edge
2. Make sure to test your LED before beginning to ensure it is working (*this can be done by sliding your battery between the prongs of the LED*)… once you know it is working place your LED on the top of your craft stick - this side should still be rounded - there should be a prong on both sides of the stick.
3. Cut a piece of copper tape, slightly shorter than your craft stick. Guide the stick over the LED prong and then down the remainder of the craft stick. Repeat on the other side.
4. Add the binder clip to the bottom of the craft stick (straight edge end) with the prongs flipped up. Using tape (must be non-conductive), secure the battery in place … be sure to only cover the top part of the battery, so that the metal prongs of the binder clip can still make direct contact with the battery. **You may need to make adjustments to the battery placement - you'll know it's in the right spot when the light turns on.
5. Try it out! The flashlight should turn on and off when you lift and lower the metal prong of the binder clip.







Electrical Terms

Ampere	Standard unit of measure of electric current. Sometimes written as amp.
Alternating Current (AC)	An electric current that reverses direction on a periodic base. Widely used to transport power on power lines.
Capacitor	A basic electrical component that stores electric charge. Capacitors are made from two electrical conductors separated by an insulator.
Conductor	A materials that allows the free flow of electric charge. Copper wiring is the most widely used electrical conductor.
Diode	An electronic component that only allows current flow in one direction.
Direct Current (DC)	A type of current that only flow in one direction (unlike AC)
Electric Charge	This is a basic characteristic of matter that is based on the balance of protons (positive charge) and electrons (negative charge). The standard unit for electric charge is the coulomb.
Electromagnetism	The interaction between magnetic fields and electric currents.
Inductor	A basic passive electrical component that resists changes in electric current. Inductors are generally made by winding or coiling a wire, sometimes around a magnetic core. The unit of measure for an inductor is the Henry.
Insulator	A material in which an electronic charge does not flow freely and does not conduct the flow of electric current.
Magnetic field	Magnetic influence produced by electric currents and magnetic materials.
Resistor	A basic electronic component that prevents the flow of electric current.
Semiconductor	A material that behaves between a conductor and an insulator depending on the conditions. Silicon is a widely used semiconductor in electronics.
Transformer	An electrical component that transfers electrical energy using inductive coupling between two winding circuits.
Transistor	A semiconductor device used in an electric circuit to regulate current flow to act as a gate, switch, or amplifier for electronic signals.
Volt	The standard unit of measure for electric potential (voltage).
Watt	The standard unit of measure used for electric power.

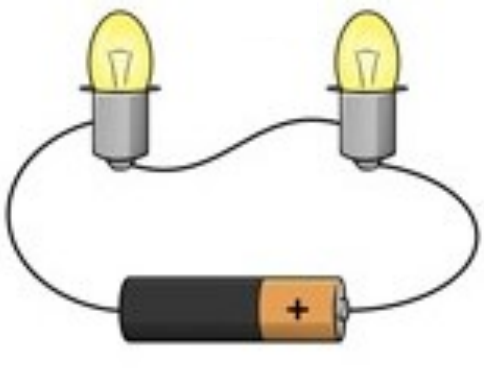
Alternating Current (AC) - Series Circuits

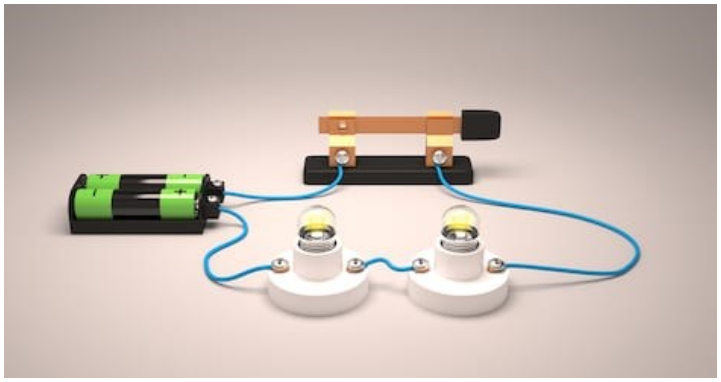
Basic supplies needed:

- ☐ A piece of wood or a base
- ☐ Battery
- ☐ Connectors
- ☐ Lights

Outcomes:

- Members should be able to easily create a series circuit
- Members should be able to successfully insert a switch into the circuit
- Members should know basic terminology that is used when speaking about series circuits: power source, connectors, load, switch, current, closed/open circuit and path…





Suggested activities:

- Experiment with batteries that have different voltages and how many lights the battery can power.. At what point do the lights become dimmer?
- Give members various items and see if they can creatively make a series circuit without the “typical” supplies listed above
- Christmas Lights (see page 16)
- LED Christmas Tree (see page 17)
- Conductive Play Dough (see page 18)

Lemon Powered Lights

Written & photo instructions: https://handsonaswegrow.com/lemon-battery-experiment/
https://www.rookieparenting.com/lemon-powered-light/

Basic supplies needed:

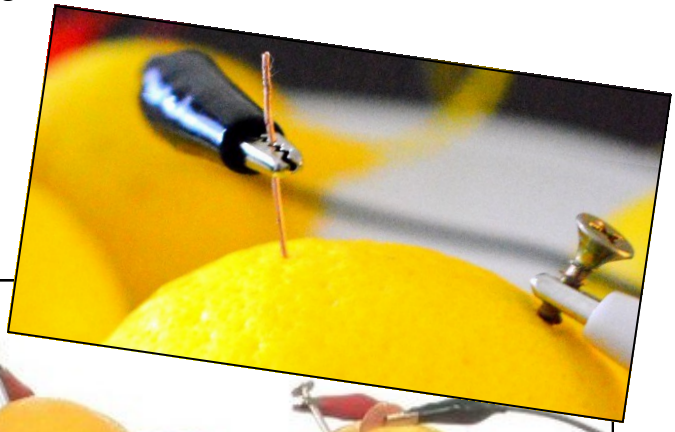
- ☐ LED Bulb
- ☐ Connectors (alligator clips or wire)
- ☐ Galvanized nails
- ☐ Copper wire or pennies
- ☐ Wire cutters
- ☐ 4 lemons

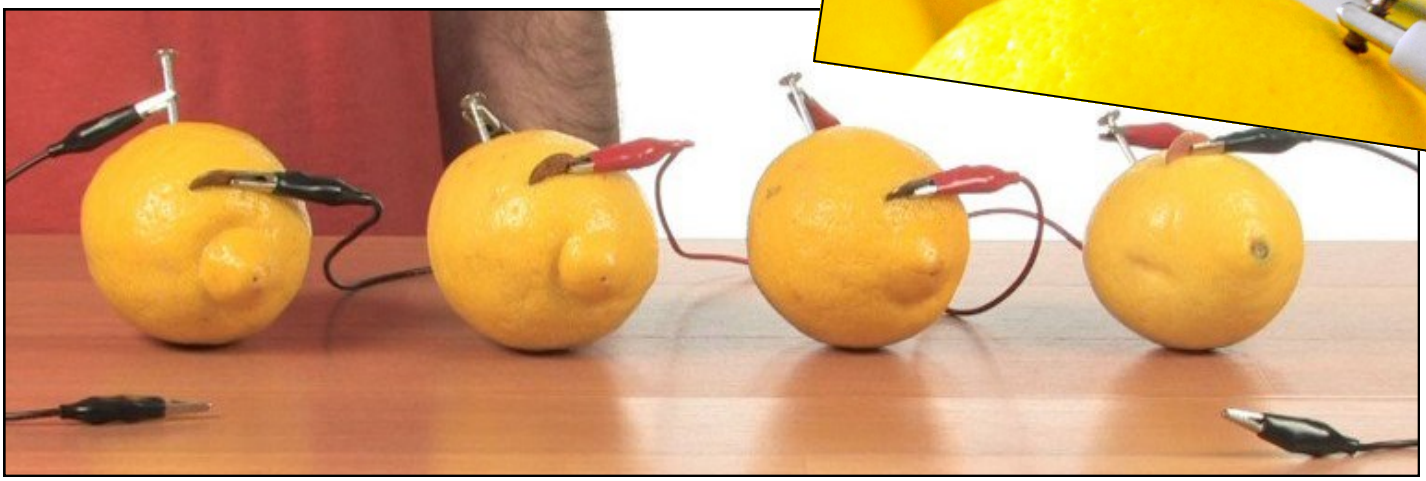
Step by Step

1. Start by rolling the lemons on a hard surface to break open the juices inside
2. Place one nail and one copper wire (or penny) on opposites side of each lemon
3. Use an alligator clip to connect the nail from one lemon to the copper wire of another.. Repeat until all the lemons are connected. Leave one copper wire and one nail disconnected
4. Connect an alligator clip to the last nail, then connect a separate wire to the last piece of copper
5. Separate the ends of the LED bulb… clamp one alligator clip onto each end.
6. Let there be light!

Experiment

Try out some other vegetables and fruits.. Do any others have the ability to act as a power source?
Potatoes, onions, and tomatoes conduct electricity quite well. Tomatoes (not vegetables, strictly-speaking) are good conductors in the vegetable category, as they have the highest acidity level. Scientists have show potatoes work very well as batteries. Acids make ions, charged particles when placed in a solution like, water, which many types of fruits and vegetables contain in abundance.





Further exploration… Using lemon juice as the battery: https://www.youtube.com/watch?v=GnsvoA7SbHU
Desertsun02 - “Lemon Battery - Powers an Electric Buzzer! (and more…)”

DIY Christmas Lights

Written & photo instructions: https://www.education.com/science-fair/article/series/
https://www.prekinders.com/christmas-lights-science-preschool-kids/

Basic supplies needed:

☐ Old Christmas String lights - ones that “don't work” are preferred!
☐ Wire cutters
☐ Electrical Tape
☐ 3V or 9V Battery

Step by Step

1. Leader can decide if they’d like to have the stings of lights pre-cut for members or if the members will cut the lights apart by themselves (a good skill to practice when learning about electricity!)
2. Members should determine which lights work and which don’t by stripping the insulator from the wires and testing the light with the battery… a member may decide to test 2-3 lights at a time, testing the bulbs as a series circuit, rather than a simple circuit.
3. Members may be able to spot a problematic bulb before testing it with the battery… sometimes a problematic bulb can be repaired by straightening or adjusting the prongs
4. After gathering a pile of working lights, members then should work to tape the lights back together to create a “working” strand of Christmas lights.
5. Ensure that all wires are covered with electrical tape before the member attempts to plug the strand of light into the wall.

Circuit Tree

Written & photo instructions: https://www.steampoweredfamily.com/activities/circuit-tree-a-steam-activity/

Basic supplies needed:

☐ LED diodes (3mm or 5mm)
☐ Wire, preferably insulated
☐ Electrical Tape
☐ 3V lithium button battery
☐ Clothespins
☐ Pipe cleaners
☐ Scissors
☐ Lego

Step by Step

1. As always, check your battery and lights prior to beginning to ensure that all parts are working
2. Prepare wires - they should be twice the length of the clothespin. You will need two wires for each light.
3. If using insulated wire, strip the ends - about an inch each
4. Start by wrapping a wire around the long prong (positive) of an LED. Repeat on another LED. The loose ends of those wires should be twisted together and a piece of electrical tape added. As you continue your build you'll know that the wires with electrical tape are positive.
5. Repeat step 4, but with the short prongs (negative) of the LEDS. Once you twist the wires together do not add tape.

Squishy Circuits - Conductive Play Dough

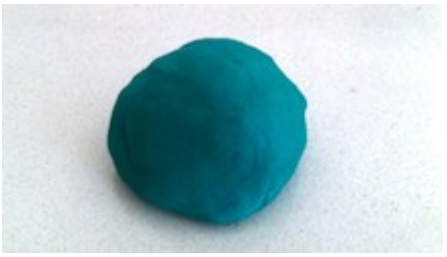
Written & photo instructions: http://www.abc.net.au/science/articles/2012/04/17/3479415.htm
http://www.abc.net.au/science/articles/2012/05/02/3493722.htm

Recipe, Materials Needed & Steps:

- ☐ 1/2 cup salt
- ☐ 1 cup warm water
- ☐ Food colouring
- ☐ 3 tbsp cream of tartar
- ☐ 1 tbsp vegetable oil
- ☐ 1 cup flour
- ☐ Saucepan
- ☐ Wooden spoon
- ☐ Heat source

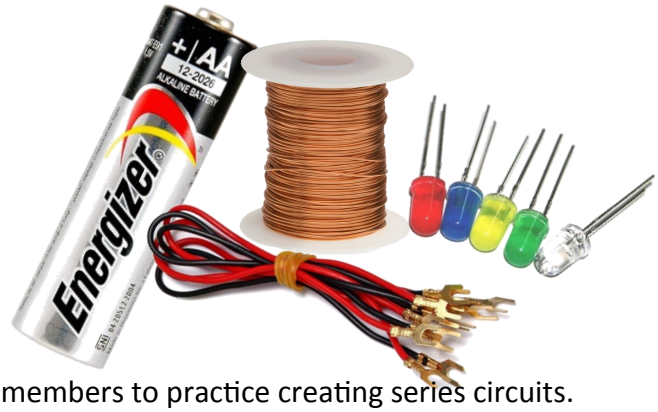
1. Ordinary play dough from the toy store conducts electricity and works fine, but you can also make your own with this standard play dough recipe. In a saucepan, completely dissolve half salt in warm water (dissolving the salt first ensures a good texture). Add food colour. Next, add cream of tartar, vegetable oil and flour. Stir thoroughly.
2. Cook the play dough mixture on low heat, stirring constantly with a wooden spoon until a ball forms (it takes just a few minutes). Place the ball and flatten it out on a lightly floured baking tray to cool (again, just a few minutes is enough).
3. Knead in more flour until the dough stops feeling sticky and you're done. Like play dough from toy stores, this batch will conduct electricity nicely.





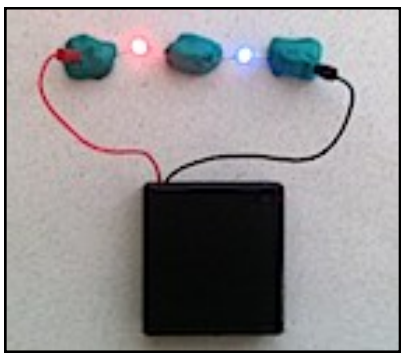
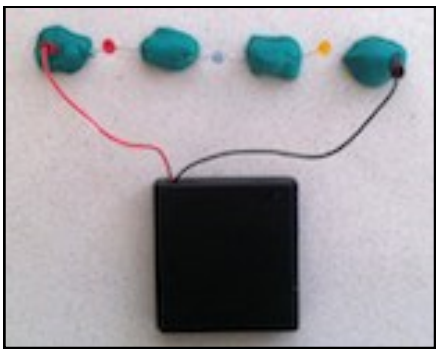
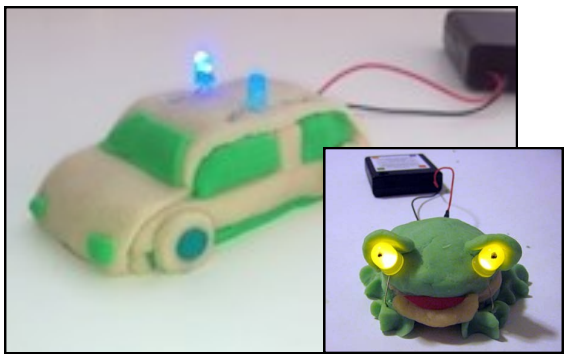
Basic supplies needed:

- ☐ Play dough
- ☐ LED diodes
- ☐ Connectors
- ☐ Battery



Using the play dough and basic materials listed above, allow members to practice creating series circuits.

Further Exploration… The link provided at the top of the page also gives a recipe and instructions for play dough that will act as an insulator (the difference is the salt & sugar!). The insulator play dough will allow members to further explore series circuits while putting their imaginations to work (see car & frog below).

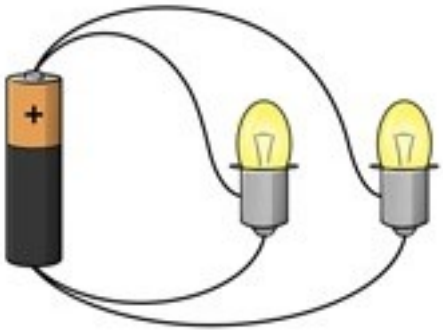
Alternating Current (AC) - Parallel Circuits

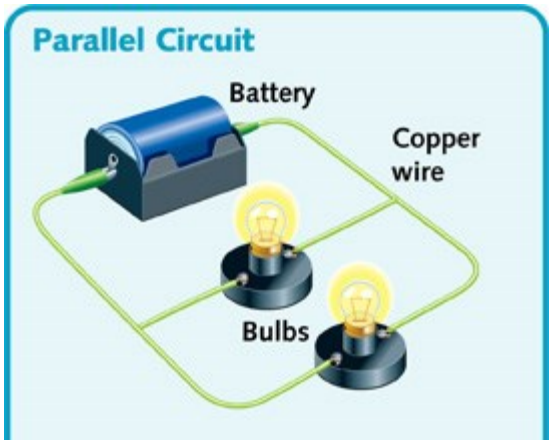
Basic supplies needed:

- ☐ A piece of wood or a base
- ☐ Battery
- ☐ Connectors
- ☐ Lights

Outcomes:

- Members should be able to easily create a parallel circuit
- Members should be able to successfully insert a switch into the circuit
- Members should know basic terminology that is used when speaking about parallel circuits: power source, connectors, load, switch, current, closed/open circuit and path…





Suggested activities:

- Experiment with batteries that have different voltages and how many lights the battery can power.. At what point do the lights become dimmer?
- Give members various items and see if they can creatively make a series circuit without the “typical” supplies listed above
- Christmas Lights (see page 16)
- LED Christmas Tree (see page 17)
- Conductive Play Dough (see page 18)

Splicing Wires

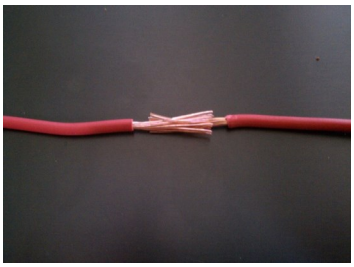
Written and photo instructions can be found here: https://www.instructables.com/id/Soldering-Tutorial-Inline-Splicing/
Video instructions can be found here:

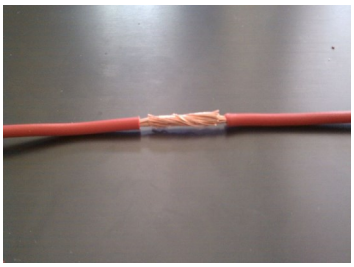
Basic supplies needed:

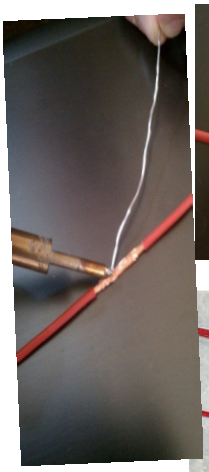
- ☐ Scraps of stranded copper wire
- ☐ Wire stripper/cutters
- ☐ Soldering iron
- ☐ Electrical Tape
- ☐ Heat shrink (and lighter)

Step by Step

1. Strip both wires approximately 1” from ends. Do not twist strands after stripping. Note: If you choose to use a heat shrinking tube to insulate the splice, remember to slip it on now.
2. Align and evenly interweave the strands of both wires
3. Carefully twist the intertwined portion of the two wires
4. Place the spliced section on a flat surface and anchor both wires, as it is preferred to have both hands free for the next step.
5. Press the soldering iron on the center of the splice area… feed solder directly into the stranded wire adjacent to the contact point of the soldering iron.
6. Apply heat generously to evenly distribute the solder along the length of the splicing area. Flip the slice over and repeat on the underside.
7. Allow it to cool for at least 30 seconds before handling. At this point you may insulate with a shrink tube or electrical tape.







Electromagnet

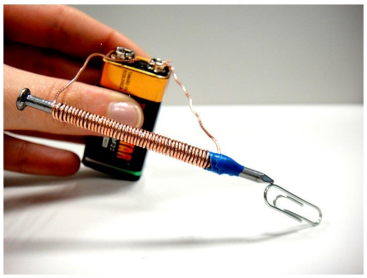
Written and photo instructions can be found here: https://deceptivelyeducational.blogspot.com/2014/09/how-to-make-electromagnet.html?m=1
Simple explanation can be found here: https://www.slideshare.net/mith17/how-electromagnets-work
Video instructions can be found here: https://www.youtube.com/watch?v=wX9QBwJBI_Y
HooplakidzLab - "How to Make an Electromagnet Experiment"

Basic supplies needed:

- ☐ Bolt or nail (consider size of battery)
- ☐ Wire, preferably insulated
- ☐ Battery
- ☐ Wire cutters
- ☐ Paperclips or other metal objects
- ☐ Tape or rubber band

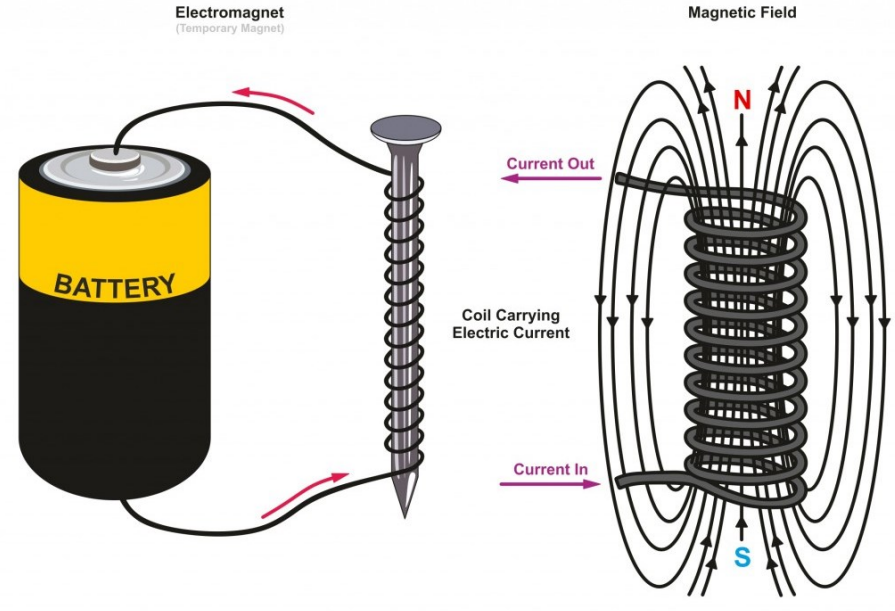
Step by Step

1. Wrap bolt or nail with a continuous, tightly-wound coil of wire, tying off each end of the coil to the nail or bolt with a simple knot and leaving a length of wire at each end.
2. With wire cutters (or wire strippers) carefully remove about 1 inch of insulation from each end of the wire, exposing the copper wire inside.
3. Attach 1 end of the wire to 1 of the electrodes on the battery.
4. Then, holding the end of bolt or nail over a pile of paper clips (or other magnet-attracted metal objects), touch the other end of the copper wire to the other electrode on the battery. The flow of current should turn the nail



Outcomes:

- ☐ Members should understand that an electromagnet is a temporary magnet that only works when an electrical current is present
- ☐ Members should experiment with batteries of different voltages and many coils vs. few coils on the bolt o rail… how do these changes impact the



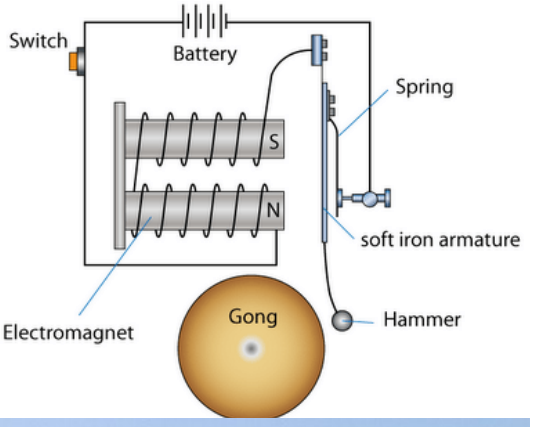
Electromagnet Uses

Electric Door Bell

When the circuit is closed, the electromagnet pulls the armature towards it, causing the hammer to strike the bell.

The movement of the armature breaks the circuit, and the hammer returns to its original position.

This sequence repeats, causing the bell to sound continuously.

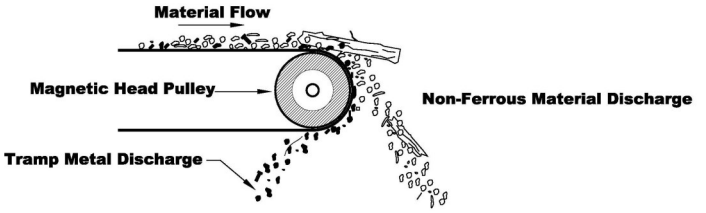


Scrap Yard & Recycling

Electromagnets are used to lift objects made of magnetic materials, eg. Iron and steel

The crane has a large electromagnet, which is turned on to lift scrap iron and steel, and turned off to drop it somewhere else.

In a recycling plant, a conveyer belt may have an electromagnet that allows the belt to sort, pick up and move metal.



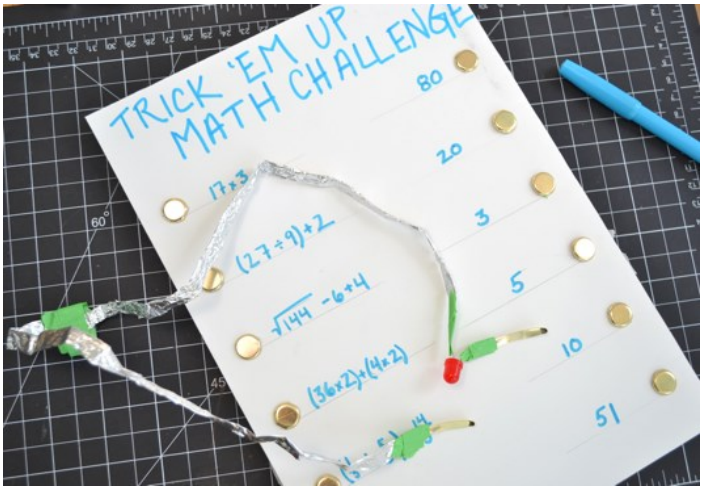
What other's can your project group think of?

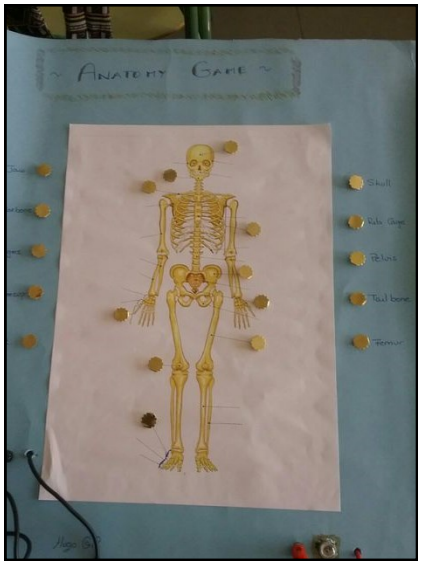
Quiz Board

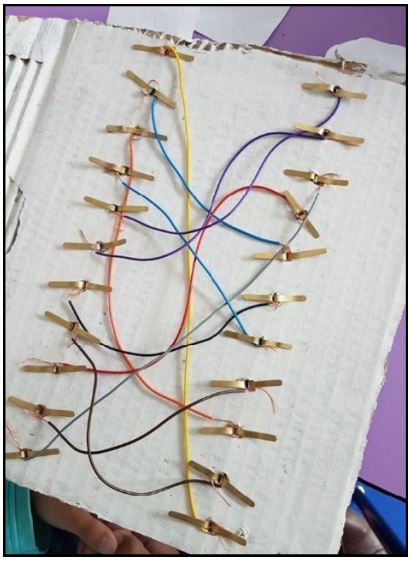
There are lots of quiz board ideas online… They come in various sizes, shapes, materials, etc. Have a look!
Here is a well done explanation of a basic quiz board:
Written Instructions can be found here: http://momfilter.com/kid-diy/homemade-electrical-quiz-board
Video instructions can be found here: https://www.youtube.com/watch?v=j78m0KmHpdQ
Electro Demolish - How to Make an (Erasable Electronic Quiz Project) Professional Way for School/College

Basic supplies needed:

- ☐ Base material
- ☐ Metal brads
- ☐ LED diodes (3mm or 5mm)
- ☐ Wire, preferably insulated
- ☐ Electrical Tape
- ☐ 3V lithium button battery
- ☐ Wire cutters
- ☐ Markers, printed pattern, etc.

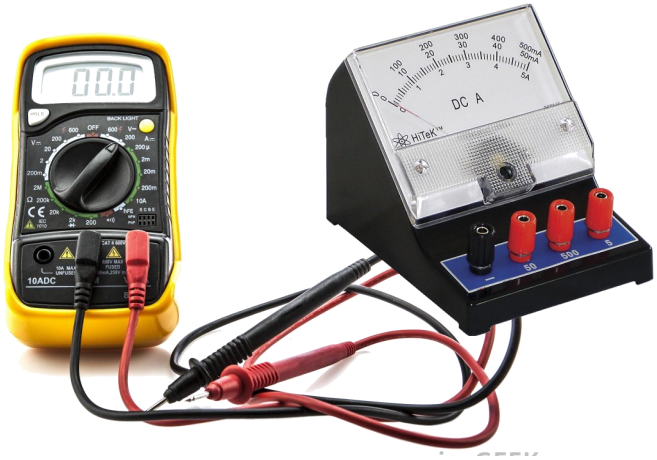






How to use an Ammeter

An **ammeter** is a device that is used to measure the amount of electric current that runs through a circuit. The standard unit used to measure electric current is called an ampere (amp), hence the name ammeter or ampere meter. An ampere measures how fast electric charges pass through a circuit point. As current passes through an electrical circuit, an electromagnetic field is generated. This created field allows the needle on the ammeter to measure the electrical current on the circuit. In case of a digital model, the electrical field allows the screen to display the correct reading.



First, you'll have to determine if you need to use a digital or analog ammeter.

You'll need to break the circuit in a location where you want to measure the amperage. Disconnect a part of the circuit to make way for the ammeter. The device should always be connected to the circuit in a series.

There are two leads with different colours: red and black. Connect the leads to the device. The red lead should be connected to the positive terminal and the black lead should be connected to the negative terminal on the device. Using the alligator clip, connect the red lead to the wire nearest the positive terminal of the battery or power source. Do the same with the black lead, but connect it to the wire closest the negative terminal of the power source. Connecting the wrong lead to the wrong terminal will cause the device to malfunction.

Reading the current measured by the device will vary depending on the type of device used. For analog ammeters, read the smallest division on the scale and round off the next digit. The needle will point to the approximate amount of amperage. For digital ammeters, there is no need to round off or read the smallest division on the scale because the reading is automatically displayed on the LCD screen on the device.

Information retrieved from: https://kids.kiddle.co/Ammeter
https://www.doityourself.com/stry/how-to-use-an-ammeter

4-H Judging

Judging is an important skill that you will use in 4-H and beyond. As a 4-H member, judging will help you develop important assessment skills, and with practice, you will learn to carefully **observe, evaluate, make decisions, communicate with confidence.**

Is Judging a requirement for THIS project?

Judging is not a requirement for **ALL** 4-H PEI projects, but you are encouraged participate in the practice whenever possible.

- When Judging is a requirement, it will be listed in the PCR's (Project Completion Requirements) on the front page of this member booklet. Members will need to fill out the score card below showing that the activity has been completed. The judging activity will be arranged by your project leader!
- When Judging is not a requirement, members and leaders may use the information and scorecard below for practice and learning. The skills learned from 4-H judging are used in everyday life situations, so it is always a useful skill to build!

Score Card for Judging

I place this class of: _____ in the order of _____ _____ _____ _____
(Description - specify type of animals or items) *(1st)* *(2nd)* *(3rd)* *(4th)*

I place _____ over _____ because:
Reasons: _____
_____

I place _____ over _____ because:
Reasons: _____
_____

I place _____ over _____ because:
Reasons: _____
_____

I place _____ at the bottom of this class because:
Reasons: _____
_____

For these reasons, I place this class of: _____ in the order of _____ _____ _____ _____
(1st) *(2nd)* *(3rd)* *(4th)*

4-H MEMBER OPPORTUNITY - Provincial 4-H Judging Competition (Annual Event)

This event is open to all members, ages 9-21, and offers a great opportunity to learn more about judging in a competitive atmosphere (Three age categories & cash prizes awarded to top members for their judging abilities). Senior members (17-21) also compete for the chance to join the **Maritime 4-H Judging Team** to compete at **Agribition** (Regina, SK) in November.

- **4-H Canada Learns** is a resource tool providing information on 4-H projects from different provinces. Check out www.4-h-learns.org/resources - keyword "judging" for resource documents that will help with developing and building your judging skills!
- **4-H PEI** is able to provide information to members and leaders on both livestock and non-livestock judging practices. Check with your 4-H Specialist for more information **AND** be sure to check out the 4-H PEI Judging Resource page at www.pei4h.ca/4-h-judging-resources

Member Reflection

As a 4-H member, you are encouraged to "Learn to Do by Doing" through hands-on activities. Keeping a record of your 4-H activities with this **Member Reflection** will provide helpful insight for you, your leader and the 4-H Specialist as to skills you have learned and projects you have completed throughout the 4-H year!

Skill Based Project: You are encouraged to work on skill development and completion of project requirements (with guidance from the project leader) throughout the 4-H year. Not every activity will have a tangible item (for display), but you are asked to share the activities and learnings in which you participate below...

Project Activity: _____

What I did: _____

What I learned: _____

What I liked: _____

Project Activity: _____

What I did: _____

What I learned: _____

What I liked: _____

Project Activity: _____

What I did: _____

What I learned: _____

What I liked: _____

Project Activity: _____

What I did: _____

What I learned: _____

What I liked: _____

Project Activity: _____

What I did: _____

What I learned: _____

What I liked: _____

(feel free to use more space if necessary!)

LEADER COMMENTS (optional): Leader observations can be helpful to you in future years with this and other 4-H projects. Be sure to ask your project leader if they would like to reflect on your 4-H year.
I am most impressed by…
I believe that you have learned…
In the future I encourage you to...

4-H Year Completion Checklist

In addition to completing a Skill Based 4-H project, members are also required to participate in Communications, at least **ONE** Ag. Awareness Activity and **ONE** Community Service Activity in order to complete the 4-H year.

Use the space provided to reflect on what you have learned through participation in these activities.

If this information has already been completed in another booklet, please indicate where it can be found:

My Communications Activity

☐ Speech ☐ Demonstration (Single) ☐ Demonstration (Team) ☐ Alternate Communications: _____

What I learned:

What I can work on:

Agriculture Awareness Activity

What did you do to complete this activity this year? (Either on your own or with your 4-H Club)

What area of Agriculture would you like to explore in the future?

Community Service Activity

What did you do to complete this activity this year? (Either on your own or with your 4-H Club)

What will you do in the future to give back to your community?

4-H PEI - Staff Comments (Optional)

Completion Requirements		**Completion Notes**
Skill Based Project		
Communications		
Ag. Awareness Activity		
Community Service Activity		