

## Light Up LED Greeting Card - Program Proposal

### Description

Patrons get an introduction to circuits and working with LEDs by making a light-up greeting card. As a single session program or one in a series about circuitry, this program provides an opportunity for patrons to work hands-on and to participate in learning that is practical, creative, and collaborative. It's especially appropriate for holidays, Mothers and Fathers Days, or a seasonal theme.

### Audience

Teen/Adult

### Budget/Costs

Durable Goods Investment: \$15.00

Consumables: \$139.00

Cost/participant: \$5.80

### Number of participants

24 (in workshops of 8-12 participants)

### Program Time

1.5 hours plus .5 hours staff setup time

### Collection and Dewey Connections

Design - 745.4

Electric Circuits - 621.31

Electronics - 621.381

Handicrafts - 745.5

Magnets and Magnetism - 538

### STEAM Tie-ins

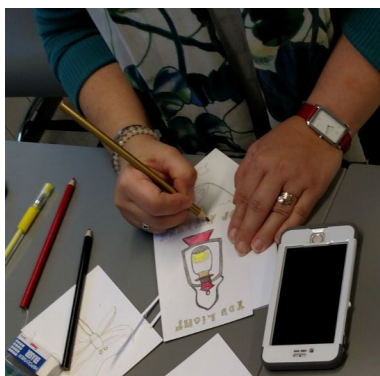
Science: electricity, magnetism, light

Technology: circuits, LED lights

Engineering: Electrical engineering

Art: colors, shape, composition

Math: Reading measuring devices



## Light Up LED Greeting Card

**For beginners, make a card with 1 LED in a series circuit.**

**For non-novices, make a card with up to 4 LEDs in a parallel circuit.**

### Method [TOTAL TIME: 2 hours (Prep - Cleanup)]

Prepare area: 15 minutes

1. Print patron handouts.
2. Cut cover stock sheets: halves for card “bodies,” quarters for card fronts
3. Cut “T’s” for switches (or participants can do this during the workshop)
4. Arrange equipment and supplies on tables
5. Optional: Test multimeter

### Introduction: 5 minutes

- Introduce yourself
- Provide overview - Today we’re making parallel circuits
  - Before the card, we’ll make a super simple circuit (throwie)
  - Draw the circuit on the front of the card
  - Create the circuit “switch” and use your drawing to create the circuit.
  - Make your final drawing/image on a pre-cut sheet.
  - Assemble the card.
- Timeline, and safety precautions for activity.
- (optional) Display, draw, and /or explain the difference between series and parallel circuits  
<https://www.allaboutcircuits.com/textbook/direct-current/chpt-5/what-are-series-and-parallel-circuits/>

### Make a throwie/tossie - a super simple circuit: 10 minutes

1. LED, battery, magnet, tape
2. Note LED leg length (+ is longer), battery +/- sides.  
(optional) Demonstrate multimeter use.
3. Slide the battery between the legs of the LED. Does it work?
  - a. If not, flip over the battery.
  - b. To create the circuit, + must be with + and - with -.
4. Attach the magnet on negative side
5. Tape
6. Throw

### Make the card

**For beginners, make a card with 1 LED/light in a series circuit.**

**For non-novices, make a card with up to 4 LEDs/lights in a parallel circuit.**

### Create the circuit: 25 minutes

Show examples. Demonstrate how to lay out the circuit and how it will work (see photos and video)

1. Make the battery switch
  - a. Cut a piece of cover paper into a T shape. Each “leg” about 1” long.

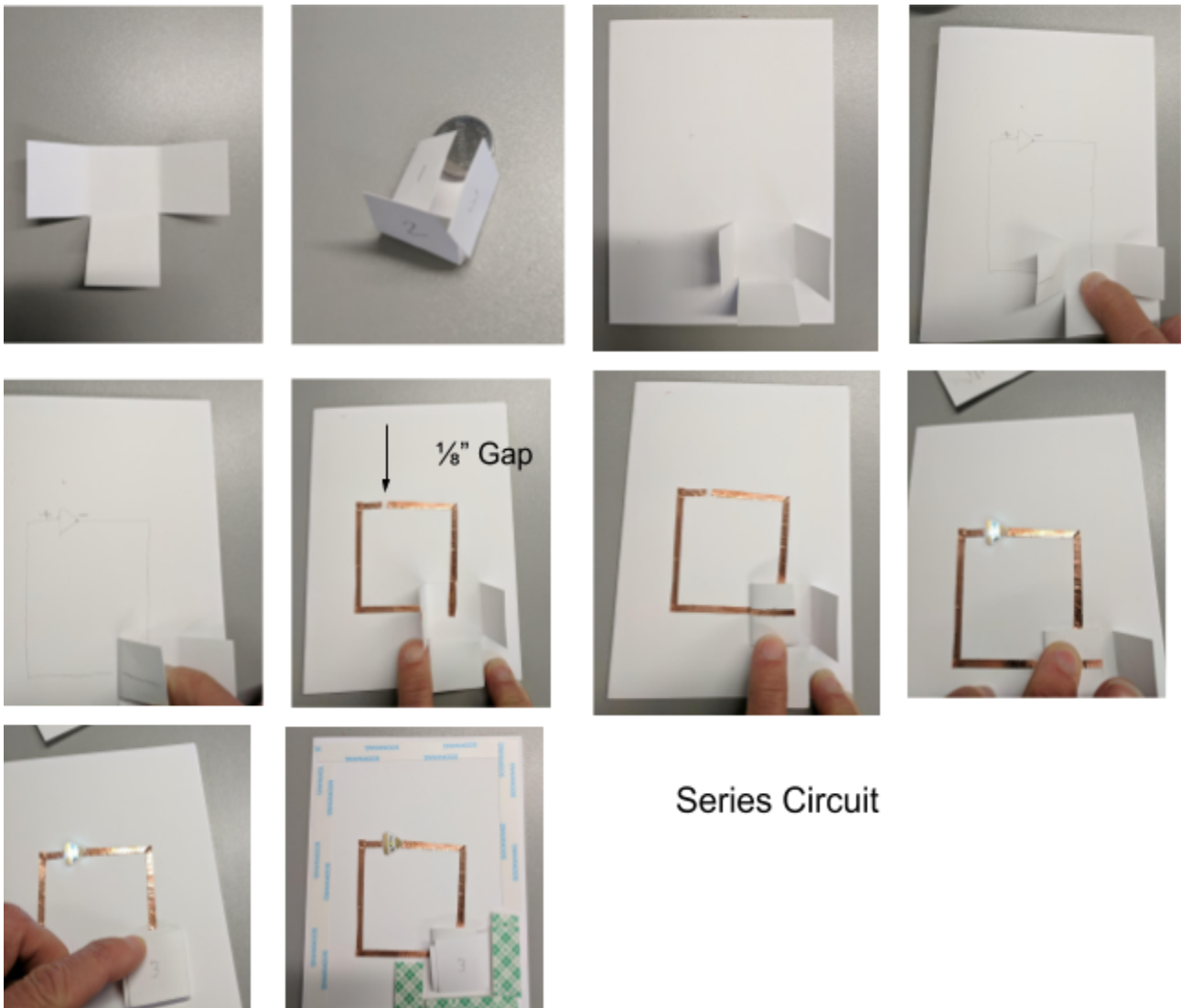
- b. Fold it around the battery and trim any extra paper.
  - c. Glue or use double face tape to attach the middle of the switch to the card where the battery will go, **at least  $\frac{1}{2}$ " from the edge of the card with the open side toward the top**. Draw the path of the circuit on the front of the card, leaving a gap for the LED and considering how the electrons will travel through the path.
2. Create the circuit with copper foil and LED.
  - \*\*Cut the copper tape in half lengthwise to make it easier to bend and fold.
  - \*\*Use a smooth, continuous strip of foil whenever possible, except for the gaps under the LEDs. Fold the foil gently around curves. Make sharp corners by folding 90 degrees away from the direction of the path and then back over the top.\*\***

[Video demonstration](#)

\*\*Handle the backs of the LEDs as little as possible to keep the contacts clean.

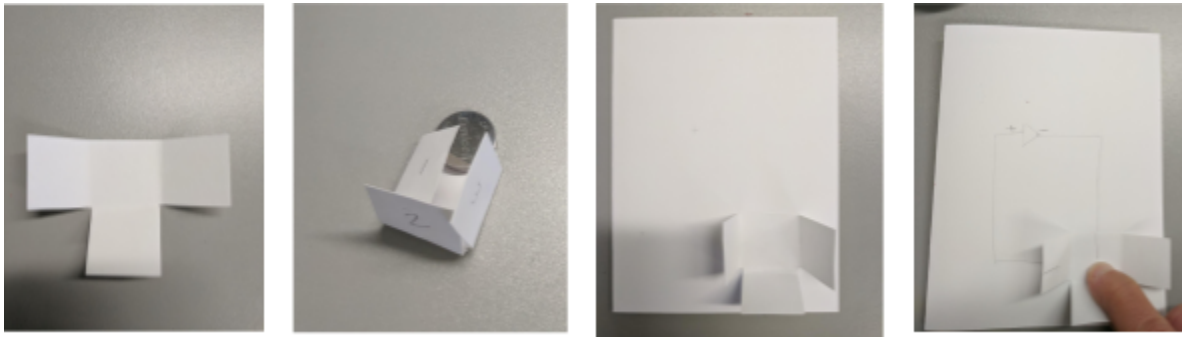
\*\*Lay down the copper foil first. Then add the LEDs.

- a. **For 1 LED/series circuit:**



Series Circuit

- b. **For more than 1 LED/parallel circuit.** Follow the instructions above, but make one path for positive and one for negative, note the position of the LEDs, across and connecting the paths. The paths should not touch or cross over.



### Parallel Circuit

No Gaps between copper tape and LED  
Cathodes (-) align with battery -  
Anodes (+) align with battery +

3. Test and troubleshoot!
4. Tape the switch together loosely, so that the LED is not lit when the switch isn't pressed.

**Make the version of the image: 25 minutes**

Draw/create the image on the cover paper ¼ sheet.

**Assemble the card: 10 minutes**

1. Cut and add 2 layers of foam tape around the battery switch.
2. Cut and add 1 layer of double-face tape around the edge of the front of the card.
3. Peel the backing off the tape and attach the the image on top of the card.

**Discuss, take photos, clean up, complete program survey: 10 minutes**



**Total BooX Circuits  
and Electronics  
Shelf**

## LED Greeting Card Supplies List

	Price	Quantity	Total	Link
<b>Equipment</b>				
Digital Multimeter - Basic	\$14.95	1	\$14.95	<a href="https://www.sparkfun.com/products/12966">https://www.sparkfun.com/products/12966</a>
<b>Subtotal</b>			\$14.95	
<b>Consumable Supplies</b>				
Sure Electronics Super Bright 3mm T-1 LED 105 Piece Assortment 7 Different Colors (9.60+6.85 shipping)	\$16.45	1	\$16.45	<a href="http://www.parts-express.com/sure-electronics-super-bright-3mm-t-1-led-105-piece-assortment-7-different-colors-with-volt--073-007">http://www.parts-express.com/sure-electronics-super-bright-3mm-t-1-led-105-piece-assortment-7-different-colors-with-volt--073-007</a>
SPACECARE Round Magnet - 1/2"x1/8", 150 Per Box	\$9.99	1	\$9.99	<a href="https://www.amazon.com/SPACECARE-Round-Ceramic-Ferrite-Multiplier/dp/B06XVPHMJL/ref=pd_sim_201_2?_encoding=UTF8&amp;pd_rd_i=B06XVPHMJL&amp;pd_rd_r=HCVWHGG1W70DSN73M38P&amp;pd_rd_w=U6soZ&amp;pd_rd_wg=bSvsp&amp;psc=1&amp;refRID=HCVWHGG1W70DSN73M38P">https://www.amazon.com/SPACECARE-Round-Ceramic-Ferrite-Multiplier/dp/B06XVPHMJL/ref=pd_sim_201_2?_encoding=UTF8&amp;pd_rd_i=B06XVPHMJL&amp;pd_rd_r=HCVWHGG1W70DSN73M38P&amp;pd_rd_w=U6soZ&amp;pd_rd_wg=bSvsp&amp;psc=1&amp;refRID=HCVWHGG1W70DSN73M38P</a>
Chibitronics Circuit Stickers - Red, Yellow, Blue Megapack	\$30.00	1	\$30.00	<a href="http://store.chibitronics.com/collections/all/products/red-yellow-and-blue-megapack-circuit-stickers">http://store.chibitronics.com/collections/all/products/red-yellow-and-blue-megapack-circuit-stickers</a>
Chibitronics White LED Circuit Stickers - Megapack, 30 white LED circuit stickers	\$30.00	1	\$30.00	<a href="http://store.chibitronics.com/collections/all/products/white-leds-megapack-30-stickers">http://store.chibitronics.com/collections/all/products/white-leds-megapack-30-stickers</a>
Bullet Face Copper Foil Tape with Double-sided Conductive (1/4inch X 21.8yards)	\$5.99	2	\$11.98	<a href="https://www.amazon.com/Bullet-Face-Double-sided-Conductive-Electrical/dp/B01MR5DSCM/ref=sr_1_5?ie=UTF8&amp;qid=1496418737&amp;sr=8-5&amp;keywords=1%2F4%22+copper+foil">https://www.amazon.com/Bullet-Face-Double-sided-Conductive-Electrical/dp/B01MR5DSCM/ref=sr_1_5?ie=UTF8&amp;qid=1496418737&amp;sr=8-5&amp;keywords=1%2F4%22+copper+foil</a>
GI CR2032 3V Lithium Coin Battery, Bulk in Trays (package of 200 @\$24.00)	\$0.12	48	\$5.76	<a href="http://www.cheap-batteries.com/p/GI-CR2032.html">http://www.cheap-batteries.com/p/GI-CR2032.html</a>
Scor-Pal SP214 Scor-Tape, 0.375 by 27-Yard	\$4.89	1	\$4.89	<a href="https://www.amazon.com/Scor-Pal-SP214-Scor-Tape-0-375-27-Yard/dp/B00DLS8HLW/ref=pd_sim_201_3?_encoding=UTF8&amp;pd_rd_i=B00DLS8HLW&amp;pd_rd_r=XYDMVYB5YQAM23ZEWVJQ&amp;pd_rd_w=r876x&amp;pd_rd_wg=ps2Lv&amp;psc=1&amp;refRID=XYDMVYB5YQAM23ZEWVJQ">https://www.amazon.com/Scor-Pal-SP214-Scor-Tape-0-375-27-Yard/dp/B00DLS8HLW/ref=pd_sim_201_3?_encoding=UTF8&amp;pd_rd_i=B00DLS8HLW&amp;pd_rd_r=XYDMVYB5YQAM23ZEWVJQ&amp;pd_rd_w=r876x&amp;pd_rd_wg=ps2Lv&amp;psc=1&amp;refRID=XYDMVYB5YQAM23ZEWVJQ</a>
Scotch 4013 1/2-Inch by 150-Inch Mounting Tape	\$5.19	1	\$5.19	<a href="https://www.amazon.com/Scotch-4013-2-Inch-150-Inch-Mounting/dp/B003W0R4PE/ref=pd_sim_229_1?_encoding=UTF8&amp;psc=1&amp;refRID=EAQ92HR0Q8E6X3VH673F">https://www.amazon.com/Scotch-4013-2-Inch-150-Inch-Mounting/dp/B003W0R4PE/ref=pd_sim_229_1?_encoding=UTF8&amp;psc=1&amp;refRID=EAQ92HR0Q8E6X3VH673F</a>

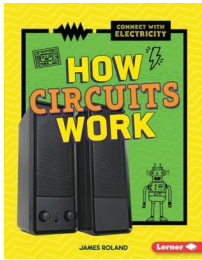


4 1/4" x 5 1/2" White Greeting Card Sets - 40 Cards and Envelopes	\$12.99	1	\$12.99	<a href="https://www.amazon.com/Heavyweight-Blank-White-Greeting-Card/dp/B00IIPRQCO/ref=redir_mobile_desktop/147-3005308-3341253?encoding=UTF8&amp;dpID=31DwsBampg&amp;dpID=1&amp;keywords=blank%20greeting%20cards%20with%20envelopes&amp;pi=AC_SX236_SY340_QL65&amp;qid=1502301762&amp;ref=plSrch&amp;ref_=mp_sa_1_5&amp;sr=8-5">https://www.amazon.com/Heavyweight-Blank-White-Greeting-Card/dp/B00IIPRQCO/ref=redir_mobile_desktop/147-3005308-3341253?encoding=UTF8&amp;dpID=31DwsBampg&amp;dpID=1&amp;keywords=blank%20greeting%20cards%20with%20envelopes&amp;pi=AC_SX236_SY340_QL65&amp;qid=1502301762&amp;ref=plSrch&amp;ref_=mp_sa_1_5&amp;sr=8-5</a>
Stamps, preferably in your program theme	\$0.50	24	\$12.00	<a href="https://store.usps.com/store/product/buy-stamps/national-parks-S_560604">https://store.usps.com/store/product/buy-stamps/national-parks-S_560604</a>
Subtotal			\$139.25	
<b>Total</b>			<b>\$154.20</b>	
<b>Cost per participant</b> 24 participants (3 classes of 8)			\$5.80	
<b>Standard Lab/Library supplies</b>				
Standard copy paper for sketching (can be scrap), Cover stock (60 lb) or card stock, Scissors, Art supplies, Scotch tape, Glue sticks				
<b>Optional</b>				
Micro Binder clips (pkg 100)	\$5.29	1	\$5.29	<a href="http://www.staples.com/Staples-reg-Micro-Metal-Binder-Clips-Black-1-2-Size-with-1-8-Capacity/product_614400">http://www.staples.com/Staples-reg-Micro-Metal-Binder-Clips-Black-1-2-Size-with-1-8-Capacity/product_614400</a>
Washi Tape Set (Set of 20 )	\$13.97	1	\$13.97	<a href="https://www.amazon.com/Washi-Tape-Set-Exclusive-set/dp/B01MXL4ILJ/ref=sr_1_19_m?s=arts-crafts&amp;ie=UTF8&amp;qid=1484073702&amp;sr=1-19&amp;keywords=washi+tape">https://www.amazon.com/Washi-Tape-Set-Exclusive-set/dp/B01MXL4ILJ/ref=sr_1_19_m?s=arts-crafts&amp;ie=UTF8&amp;qid=1484073702&amp;sr=1-19&amp;keywords=washi+tape</a>
Chibitronics Chibi Lights LED Circuit Stickers STEM Starter kit	\$30.00	1	\$30.00	<a href="http://store.chibitronics.com/collections/all/products/chibitronics-chibi-lights-led-circuit-stickers-stem-starter-kit">http://store.chibitronics.com/collections/all/products/chibitronics-chibi-lights-led-circuit-stickers-stem-starter-kit</a>

## Related links

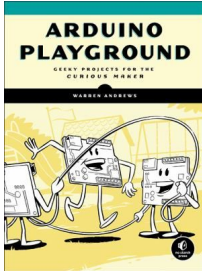
- <http://www.explainthatstuff.com/>
- <https://learn.sparkfun.com/tutorials/how-to-use-a-multimeter>
- <http://electronics.stackexchange.com>
- <https://www.allaboutcircuits.com/textbook/direct-current/chpt-5/what-are-series-and-parallel-circuits/>
- <https://www.youtube.com/watch?v=S85JZQ7JAmS>

## Related Titles



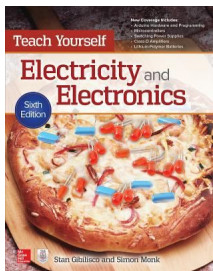
### [How circuits work](#)

by Roland, James.  
ISBN 9781512407785



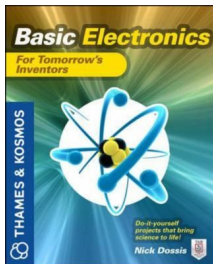
### [Arduino playground : geeky projects for the curious maker](#)

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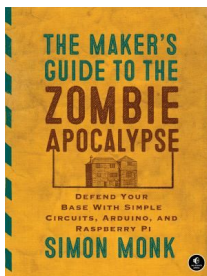
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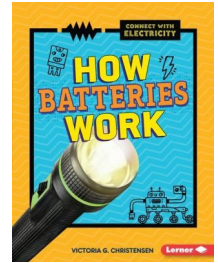
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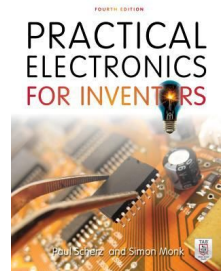
### [How batteries work](#)

by Christensen, Victoria G.  
ISBN 9781512407815



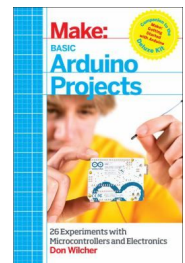
### [Wearable electronics](#)

by Hartman, Kate, author.  
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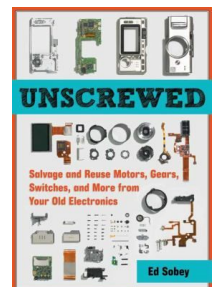
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### [Unscrewed : salvage and reuse motors, gears, switches, and more from your old electronics](#)

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ISBN 9781569766040

# Help Sheet: Terminology & Support

## LED (Light Emitting Diode)

- red, orange and yellow LEDs contain aluminum gallium indium phosphide (AlGaInP) alloys
- green, blue and white LEDs contain indium gallium nitride (InGaN) alloys

## Circuit

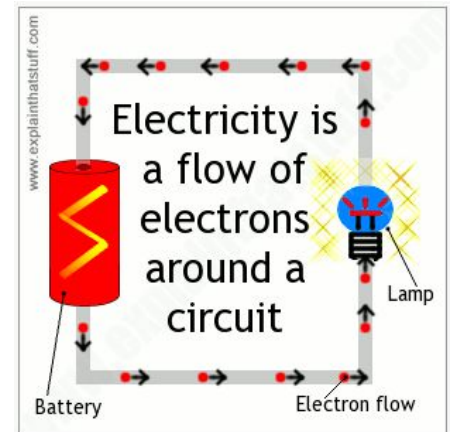
- a closed path or loop through which electricity flows
- The electric power in a circuit is equal to the voltage  $\times$  the current (volts  $\times$  amps = watts).

## Current

- Steady flow of electrons
- Measured in amperes (amps)

## Voltage

- An electromagnetic force (EMF) that pushes electrons along a current
- The bigger the voltage, the more current will tend to flow

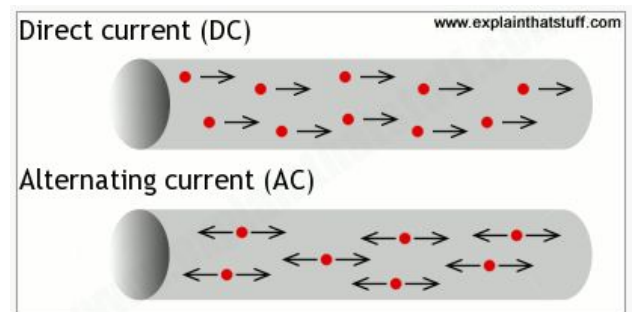


## DC Current

- Electrons flow in one direction
- Found in toys and small gadgets

## AC Current

- Electrons switch directions every 50-60 times per second
- Found in large appliances



## Conductor

- A material that allows electricity to flow freely (many "free" electrons, not tightly bound together)
- High conductance; low resistance

## Insulator

- A material that doesn't allow electricity to flow freely (few "free" electrons, tightly bound together)
- Low conductance; high resistance



## Digital Learning Survey

Your response to this brief survey helps to improve programming in the short and long term. Thanks in advance for your input!

You learned something new that is helpful

Agree

Disagree

You feel more confident when using digital resources

Agree

Disagree

You intend to apply what you just learned

Agree

Disagree

You are more aware of applicable resources and services provided by the library

Agree

Disagree

What did you like most about the program?

What could the library do to improve your learning?

What other projects would you like to learn?

Where did you hear about the program?

## Program Survey

Your response to this brief survey helps to improve programming in the short and long term. Thanks in advance for your input!

On a scale of 1 to 5, rate your knowledge of and confidence about the activity BEFORE the program.

- 1 - I've never heard of it.
- 2 - I've heard of it but don't have much knowledge of it. I haven't participated in it.
- 3 - I have participated in this activity once. I am a novice.
- 4 - I have some knowledge about the activity and have participated in it as a hobby or past time.
- 5 - I am an expert or professional in this field or activity.

On a scale of 1 to 5, rate your knowledge of and confidence about the activity AFTER the program.

- 1 - I've never heard of it.
- 2 - I've heard of it but don't have much knowledge of it. I haven't participated in it.
- 3 - I have participated in this activity once or twice. I am a novice.
- 4 - I have some knowledge about the activity and have participated in it as a hobby or past time.
- 5 - I am an expert or professional in this field or activity.

What did you like most about the activity?

How likely is it that you will recommend this program to someone?

Very likely

Not likely

If you answered "Not likely" above, why not?

It needs to be better organized.

It wasn't fun.

I didn't like the materials.

I wasn't happy with my finished product.

Other:

Where did you hear about the program?

What suggestions do you have for making the activity better?

What suggestions do you have for other programs at the library?