

# BSA Electronics Merit Badge

By Thomas Weeks of Let's Code Blacksburg/Rackspace, v2013-11-02\_tweeks  
This PDF at: [http://theweeks.org/tmp/FILES/ARDUINO-STUFF/LCBB\\_BSA\\_Electronics-MBadge\\_part-1.pdf](http://theweeks.org/tmp/FILES/ARDUINO-STUFF/LCBB_BSA_Electronics-MBadge_part-1.pdf)

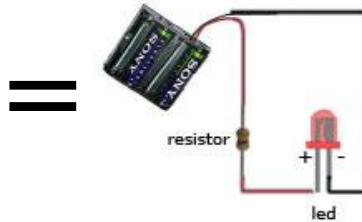
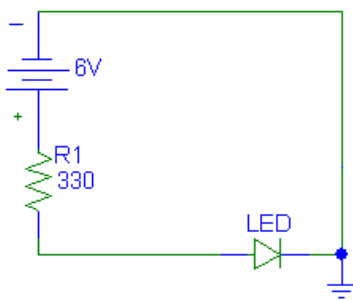
## 1) SAFETY of People and Electronics

- YOU: Always wear insulated/rubber shoes when working with **high voltage AC**.
- YOU: Always wear eye protection and be careful of sharp PC boards/wire
- YOU: Wash hands after handling PC boards containing lead.
- ELECTRONICS: Always wear cotton or non-synthetic clothes (min. ESD).
- ELECTRONICS: Work on a conductive, **grounded** bench top if possible.



## 2) Understanding electronic schematic diagrams

A schematic diagram is simply a nice neat way to diagram how electronics get hooked up:



Positive (red) wire connects to either side of the resistor. Other side of resistor connects to anode of LED.



Note: LED must be oriented correctly. Positive (red) wire must connect to the + (anode) the LED. The flat side of the LED is the - (cathode) and connects to the negative (black) wire which then leads back to battery terminal.

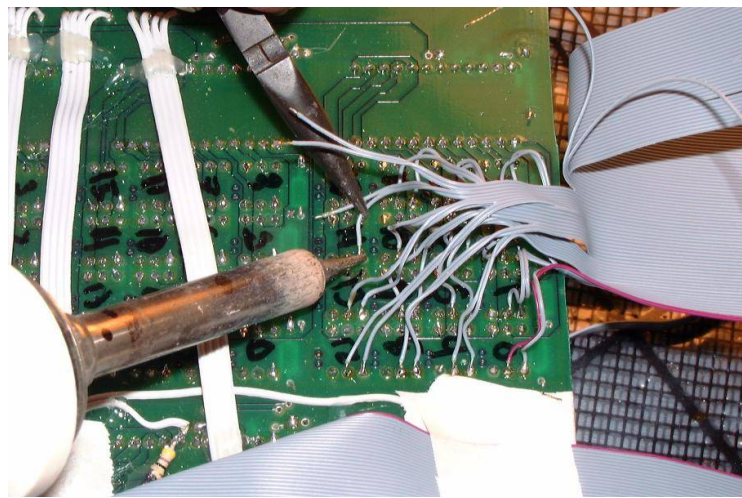
## 3) Soldering, desoldering and PC boards

- Soldering: a good solder connection should accomplish two things:
  - Seals an already existing solid mechanical connection (between wires or components)
  - Improves a solid electrical connection

### Soldering Uses These Tools:



### Soldering Looks Like This:



## Soldering Pros and Cons:

### Pros:

- +Quick/cheap way to secure connections
- +Tolerates high temperature (<200°F)
- +Good for surface mount PC boards (lasting)

### Cons:

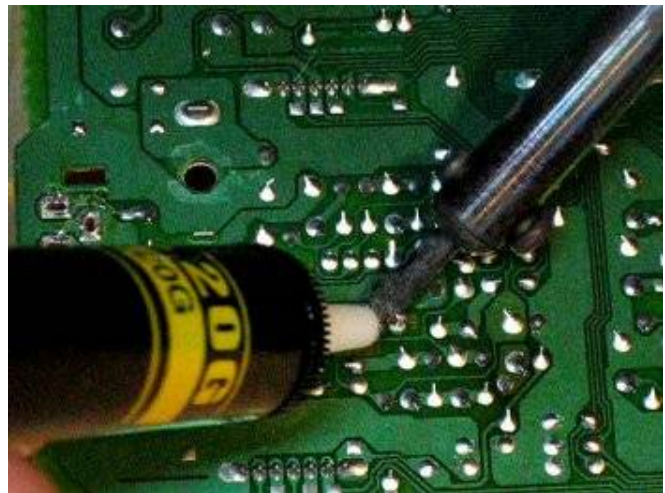
- Requires special tools w/high temperatures(>600°F)
- Often breaks down over time or with vibration
- Poor for through-hole PC boards (breaks down)
- Can contain dangerous chemicals
- Slower, more difficult for **prototyping** electronics
- Difficult to desolder & disassemble soldered parts
- Takes practice and experience to do well

- Desoldering is just removing the solder from two connected components or wires.

## Desoldering Uses These Tools:



## Desoldering Looks Like This:



## Desoldering Pros and Cons:

### Pros:

- +Gets *most* of the solder out of a connection

### Cons:

- Difficult to remove all solder and disconnect parts
- Can damage parts and PC boards (getting too hot)
- Desoldered components are often unusable
- Desoldering not good for prototyping (use breadboards or wirewrap for prototyping)

## SOLDERING & DESOLDERING DEMONSTRATION

Will use soldering and desoldering tools and methods to demonstrate a prototype build of this circuit, and then take it apart again.

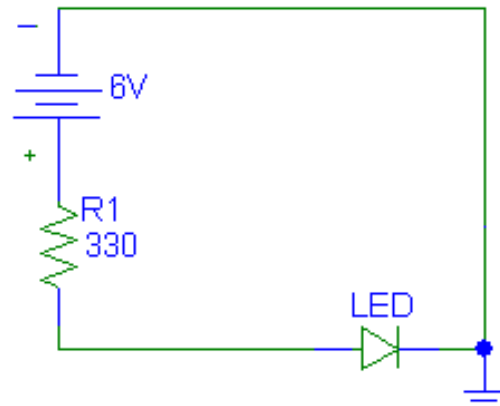
### Questions:

**Q: What was good about soldering?**

**A:** \_\_\_\_\_

**Q: What was not good about soldering?**

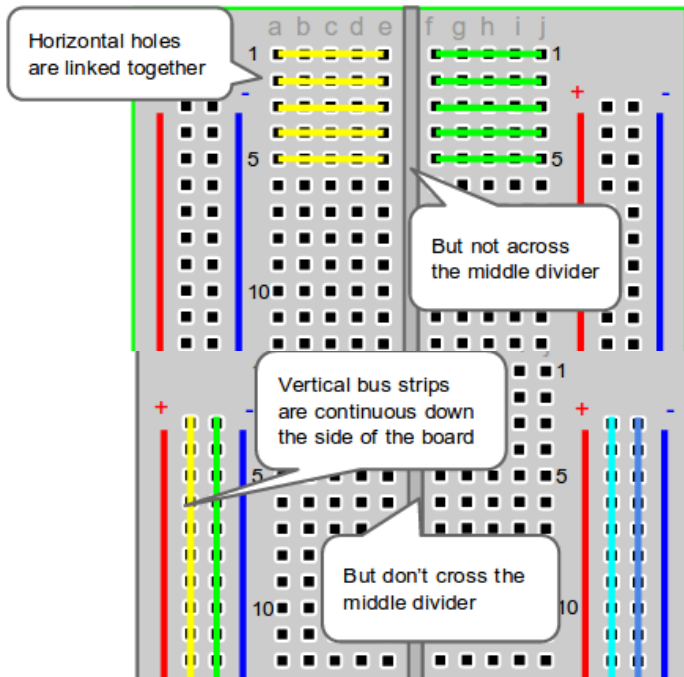
**A:** \_\_\_\_\_



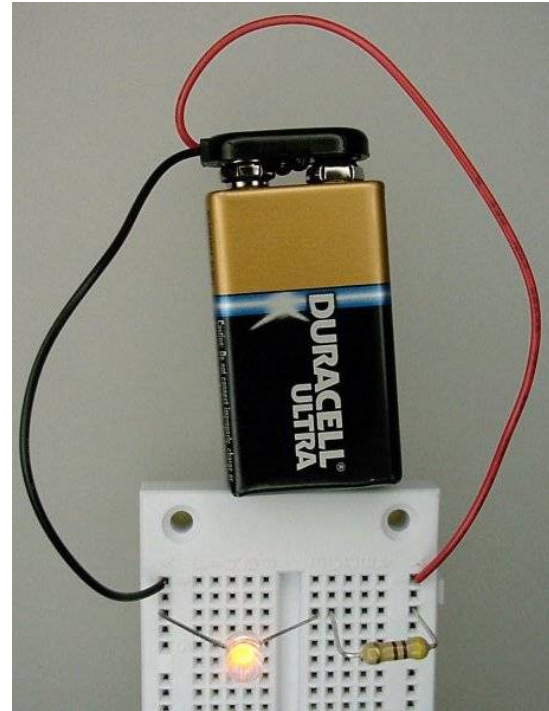
#### 4) Prototyping electronics using breadboards

Breadboards are like legos for electronics! They have the wires underneath their plastic bodies. You just push electronic parts or wires into it and the wires behind the plastic make simple electrical connections. Breadboards are great for prototyping because they are fast and easy to assemble, disassemble, and your electronic parts are ruined by getting all twisted, cut, bent and covered in solder.

#### How a Breadboard Works:



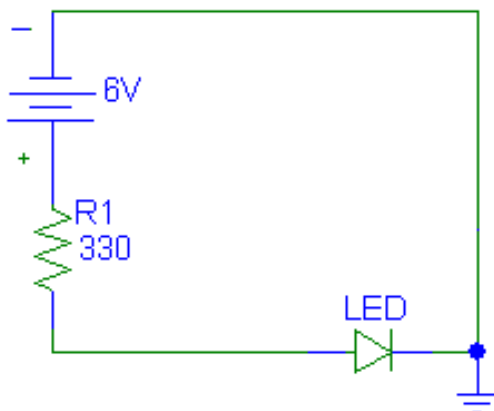
#### What Using a Breadboard Looks Like:



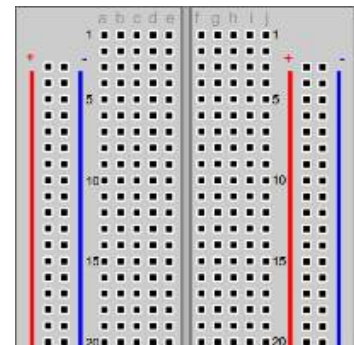
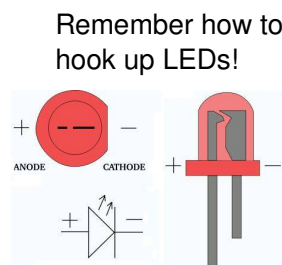
### LAB: BUILDING A SIMPLE BREADBOARD BATTERY / RESISTOR / LED CIRCUIT

Use your electronic kit to build the circuit below using 1 red LED, 1 330 ohm resistor (orange orange brown), and the battery (hooked to the vertical bus strips).

#### Build This Circuit...



#### On This!



**Call the instructor or helper if you have questions or problems!**