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## Synopsis: Build a better bread-board

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In this activity we will build a bread-board to use to test DC circuits. We will test our bread-boards using a multimeter.

### Standards

#### **4<sup>th</sup> Grade**

**1a.** Students know how to design and build simple series and parallel circuits by using components such as wires, batteries, and bulbs.

#### **9-12<sup>th</sup> Grade**

**5a.** *Students know* how to predict the voltage or current in simple direct current (DC) electric circuits constructed from batteries, wires, resistors, and capacitors.

### Learning Objectives

1.) Students will learn about the essential components of a circuit board platform.

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## Build a better bread-board

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### Procedure

Work independently.

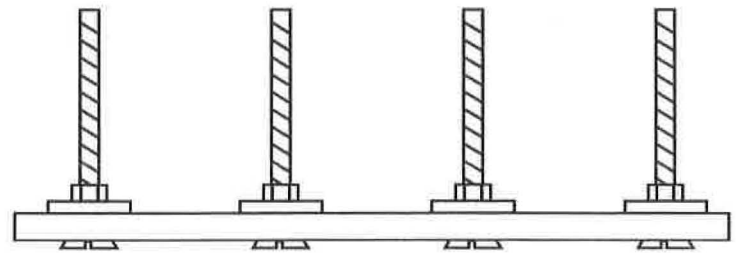
#### **Part A: Build your Bread-Board**

Make sure you have access to the following:

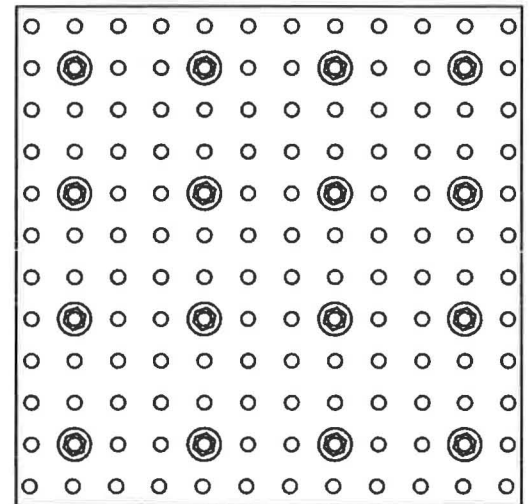
- Peg board square
- 16 flat head bolts
- 16 washers
- 16 nuts

You are going to make a 4 by 4 bolt grid. Attaching each bolt should be relatively straightforward.

- Insert the bolt through a hole in the peg-board.
- Put on a washer.
- Screw on a nut finger tight. You may need to hold the head of the bolt with a finger while you tighten the nut.
- Repeat until you have a 4 by 4 grid. It should look something like the cartoons above and on the right.



Side



Top

#### **Part B: Make a jumper**

Make sure you have access to the following:

- 2 alligator clips
- 1 piece of wire
- screwdriver

The vast majority of your circuit kit has already been put together. You are going to make a simple jumper wire with alligator clips so you can add to your kit when you want to fix a component if a wire comes loose. Use a screwdriver to attach an alligator clip to both ends of your wire.

(This is easier said than done. Most of the components in your kit have been soldered. If you decided to add many components to your kit you may want to consider soldering or crimping.)

#### **Part C: Testing, Testing**

You need to test your board and jumper –before launching into circuits– to make sure they will be able to do their jobs. This type of troubleshooting, or proving to yourself that you can trust your “tool”, is key to thinking like a scientist.

Make sure you have access to the following:

- the jumper you made
- the breadboard you made
- multimeter

*Does it work questions:*

1. What should the resistance between two bolts on your grid be without a jumper connecting them? Use your multimeter to test a few bolt pairs and make sure your board matches your expectation.
2. What should the resistance between the two ends of your jumper? Use your multimeter to test your jumper and make sure it matches your expectation.
3. What should the resistance between two bolts on your grid be with a jumper connecting them? Use your multimeter to test a few bolt pairs with jumpers and make sure your board matches your expectation.

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## Instructor Notes: Build a better bread-board

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You may not want to use class time to construct these boards. However, testing the boards before creating circuits is probably a worthwhile exercise.

The peg-board was purchased and cut at Home Depot. The hardware was purchased at Boltdepot.com. I bought brass hardware for esthetic reasons. "Normal" steel hardware is less expensive and would be just as functional.

### *Safety*

This activity has little to no risk associated with it.

### **Materials**

- Peg-board square ( $\sim 1 \text{ ft}^2$ ).
- 16 flat head bolts (brass slotted flat head machine screws, 10-24,  $1\frac{1}{2}$  inch)
- 16 washers (brass flat washer, 10)
- 16 nuts (brass hex machine screw nuts, 10-24)
- 2 alligator clips
- 1 piece of wire
- screwdriver
- multimeter

### **Notes**

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