Evil Mad Scientist *Deluxe Electronic Breadboard Menorah Kit*

Assembly Instructions

Step 0: Tools required

You will need a pair of wire clippers to build this kit. If you happen to have one, a resistor lead forming tool will come in handy.

Step 1: Check kit contents

Compare the contents of your kit to this list. If anything doesn't look right, please contact us immediately at contact@evilmadscientist.com.
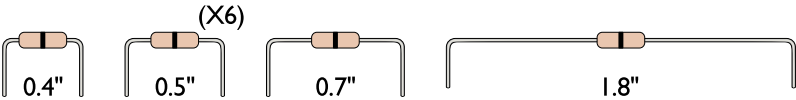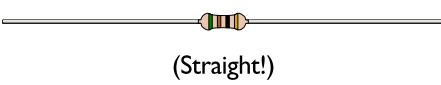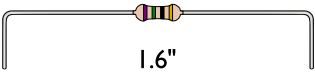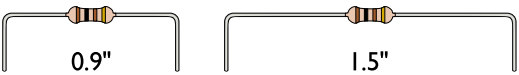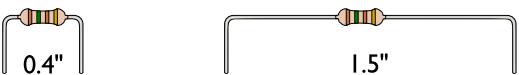
Quantity	Component	Quantity	Component	Quantity	Component
2	10 mm Red LED	2	Resistor: 150 ohm	1	Transparent Breadboard
1	10 mm Orange LED	1	Resistor: 75 ohm	1	ATtiny2313A Microcontroller
1	10 mm Yellow LED	1	Resistor: 51 ohm	1	2-pin Tactile Button Switch
1	10 mm Green LED	1	Resistor: 39 ohm	1	Battery box, 3xAA
2	10 mm Blue LED	2	Resistor: 16 ohm	1	0.1uF Ceramic Capacitor
2	10 mm Warm White LED	2	Resistor: 100 ohm	10	Zero-ohm Jumper

Step 2: Pre-form and clip your component leads

Refer to the following bending guide and pre-form your resistors and zero-ohm jumpers to the lengths shown. You can bend the leads by hand, by lead forming tool, or over the edge of a book or table.

The illustrations are actual size, so you can place your components atop this page to measure out the parts. After bending each part, clip the leads to match the drawings (about 0.3" past the bend). The components are shown with their leads clipped to the right length.

Note that two of the components are left straight (not bent) for the time being. Additionally, the 1.8" zero-ohm jumper is long enough that you won't need to clip the ends.

Value	Length(s)	Total Qty	Bent sizes (actual size)
0 Ohms (single black stripe)	0.4", 0.5" (X6), 0.7", 1.8", straight	10	(X6) — 0.4" 0.5" 0.7" 1.8"
16 Ohms (brown-blue-black-gold)	0.8", 1.4"	2	0.8" 1.4"
39 Ohms (orange-white-black-gold)	0.4"	1	0.4"
51 Ohms (green-brown-black-gold)	straight!	1	(Straight!)
75 Ohms (violet-green-black-gold)	1.6"	1	1.6"
100 Ohms (brown-black-brown-gold)	0.9", 1.5"	2	0.9" 1.5"
150 Ohms (brown-green-brown-gold)	0.4", 1.5"	2	0.4" 1.5"

Step 3: Insert most of the components

In this step we will insert the microcontroller, switch, capacitor, and form components into the breadboard. In the process, you may find it helpful to refer to this diagram, which shows where these parts will go:
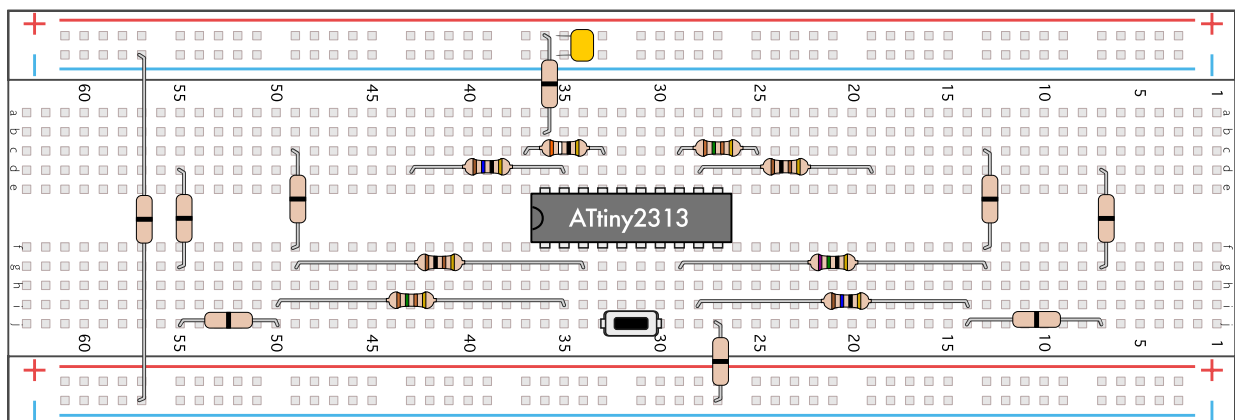
A. Orient the breadboard as shown, with the *red stripe at the top.* The rows of the breadboard are numbered from 1 to 63, and the columns are letted from 'a' to 'j'. We will also refer to the red and blue striped columns at the top and bottom of the breadboard in this orientation.

B. Insert the ATtiny2313 microcontroller. It spans rows 27-36 and columns e-f. Orientation matters: The side with the "half-moon" indentation is on the left side of the board (at row 36).

C. Place the button switch in column j with its pins in rows 30 and 33. The body of the button should get pressed flush to the breadboard. (Orientation does not matter.)

D. The capacitor is the little yellow bead with two leads. Clip those leads to the same length as the components in the bending chart. Insert the leads of the capacitor into the red and blue striped columns at the top of the breadboard at row 35. (Orientation does not matter.)

E. Take the components you have pre-bent and insert them into the breadboard at the following locations: (Orientation does not matter.)

16 ohms:
1.4": Column i, from rows 14 to 28
0.8": Column d, from rows 35 to 43

39 ohms:
0.4": Column c, from rows 33 to 37

75 ohms:
1.6": Column g, from rows 13 to 29

100 ohms:
1.5": Column g, from rows 34 to 49
0.9": Column d, from rows 19 to 28

150 ohms:
1.5": Column i, from rows 35 to 50
0.4": Column c, from rows 25 to 29

0 ohms:
1.8": Row 57 (upper blue stripe to lower blue stripe)
0.7": Column j, from rows 7 to 14
0.5" (#1): Row 7, from columns d to g
0.5" (#2): Row 13, from columns c to f
0.5" (#3): Row 36, from upper red stripe to column b
0.5" (#4): Row 49, from columns c to f
0.5" (#5): Row 55, from columns d to g
0.5" (#6): Column j, from rows 50 to 55
0.4": Row 27, from column j to lower blue stripe

### Step 4: Prepare the Yellow LED

(A)   (B)   (C)
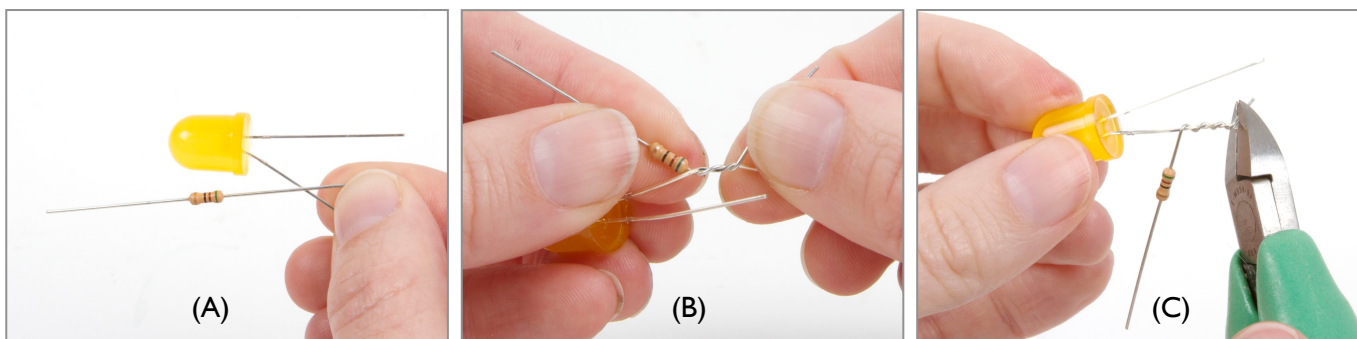
Identify the yellow LED and the 51 ohm resistor. Hold the 51 ohm resistor next to the short lead of the LED as shown (A), and then TWIST the resistor lead to the short lead of the LED. When doing so, make sure to hold the leads **firmly (B)** that you are twisting— on both sides — so as to not stress the lead where it comes out of the LED. Twist them together through five half turns to make a solid connection. Then clip off the excess leads past the twisted section (C).
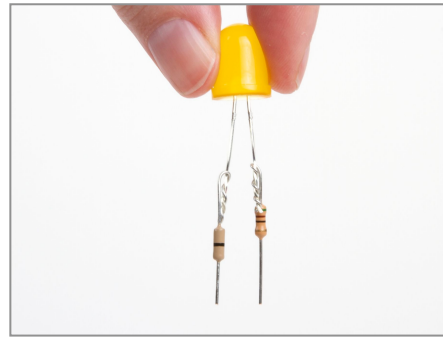
Repeat the procedure, twisting the remaining zero-ohm resistor to the long lead of the LED. Check that the height of your LED with its extended legs is taller than your lower LEDs. If needed, clip the lower wire ends to at least 0.3" below the resistor and jumper, so that you can insert it into the breadboard. Install it to the breadboard with the resistor at row 31, blue stripe, and the zero-ohm jumper to Row 32, column c.

Step 4: Insert the lower eight LEDs
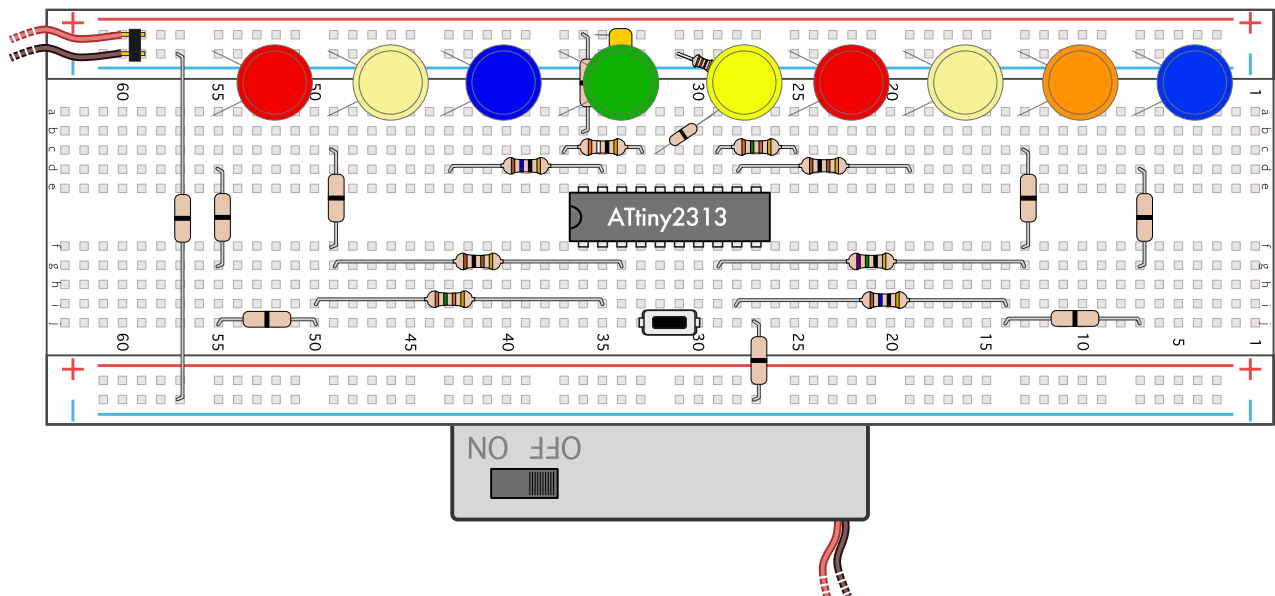
For each LED, the long lead goes into column a, and the short lead goes into the blue-stripe column:

Row 7: Blue.	Row 19: Warm white.	Row 37: Green.	Row 49: Warm white.
Row 13: Orange.	Row 25: Red.	Row 43: Blue.	Row 55: Red.

Step 5: Install the battery holder

Connect the two-pin connector to upper red stripe and blue stripe (Red wire to red stripe, black wire to blue stripe) at row 59.

Put in batteries, turn it on, and test it out!

You can also use the battery box as a stand. To do so, peel the pre-scored center third of the paper liner off of the back of the breadboard. Stick the battery box to the adhesive so that the on/off switch is accessible from the top as shown in the diagram above.

When you turn it on, it displays the correct configuration of LED "candles" for a given night of Hanukkah. Each time that you press the button (or switch it off and back on), it displays one more light than it did the previous time that you turned it on (unless it showed all nine last time, in which case it goes back to two). The LEDs are lit up in the traditional sequence, with a gentle fade. You can also switch (by a button press) between having your LEDs steadily on, or gently rippling with a "candle flicker" mode.

Documentation for this kit is at: http://wiki.evilmadscientist.com/bbmk