VANCOUVER HACK SPACE

LEARN TO SOLDER KIT INSTRUCTIONS

PREPARATION:

1. If you haven't done so already, read through the "Soldering is Easy" comic book (if you don't have a copy, you can download it for free from http://mightyohm.com/soldercomic).

2. Check that you have all of the parts listed in the parts list on the next page. Once you have everything, you are ready to start building the kit! Proceed to the next section.
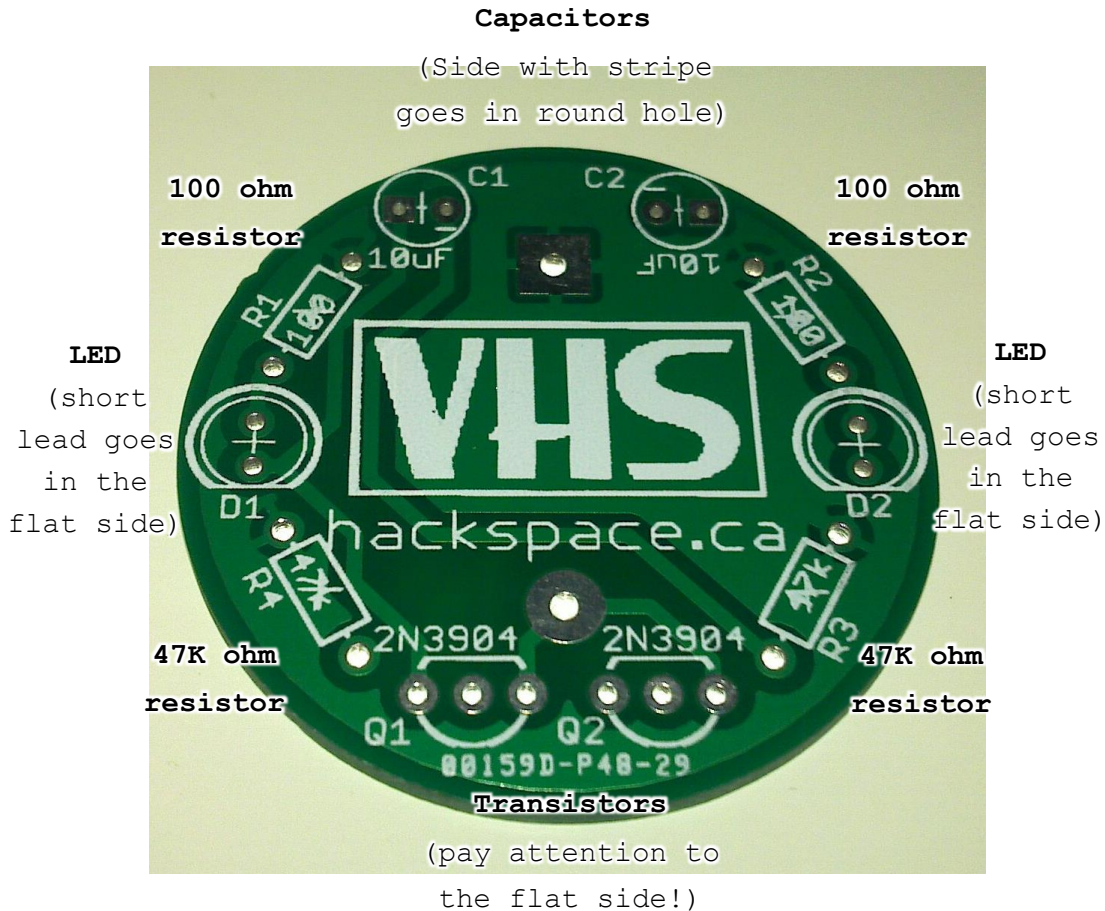

PLEASE LEAVE THESE INSTRUCTIONS AT THE WORKSTATION. THANK YOU!

PARTS LIST:

Quantity	Description	What it looks like
1	Printed Circuit Board (a.k.a. PCB or circuit board)	
2	100 ohm resistors	 (Colour bands: Brown Black Brown Gold)
2	47K ohm resistors (47K = 47000)	 (47K Colour Bands: Yellow Violet Orange Gold)
2	10μF capacitors	
2	2N3904 NPN Transistors	
2	5mm LEDs (Light Emitting Diodes)	
1	Battery Holder	
1	CR2032 Button Battery	

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BOARD LAYOUT AND PARTS PLACEMENT:

Capacitors

(Side with stripe
goes in round hole)

**100 ohm
resistor**

C1   C2

10uF   10uF

R1 100   R2 100

**100 ohm
resistor**

LED
(short
lead goes
in the
flat side)

D1

VHS

hackspace.ca

D2

LED
(short
lead goes
in the
flat side)

**47K ohm
resistor**

R4 47K

2N3904   2N3904

R3 47K

**47K ohm
resistor**

Q1   Q2

00159D-P48-29

Transistors

(pay attention to
the flat side!)

HOW LOW CAN YOU GO? START WITH RESISTORS:

**If electricity flows through a material easily, it is called a
conductor. If electricity can't flow through it easily, it's an
insulator. If you have a component designed to let a very specific
amount of electricity flow through it, it may be a resistor! The
coloured stripes on a resistor tell you the value of its resistance.**

**When assembling a circuit board, start with the shortest parts first,
and finish with the tallest parts; the parts will stay flat against
the board this way.**

**The parts go on the front of the board, and the soldering happens on
the back.**

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1. Hold the body of the resistor in one hand, and with a finger on your other hand push the leads (the wires) of the resistors at right angles to form a "C" shape like in the illustration below:

How to bend the leads of the resistor.

2. Identify your resistors based on their colour bands and determine their **correct location on the board.**

100 ohm resistors	(100 ohm Colour bands: Brown Black Brown Gold)
47K ohm resistors (47K = 47000 ohms)	(47K Colour Bands: Yellow Violet Orange Gold)

3. Insert one resistor in its correct location through the board so that the leads are sticking out the back of the board. Resistors are **non-polarized,** which means they will work even if you reverse its orientation in the board.

4. While holding the resistor in place with your finger, flip the board over and bend the leads outward at about a 45 degree angle to keep the resistor from falling out. Now you're ready to solder!

5. Follow the soldering instructions in "Soldering is Easy" to solder the resistor to the board.

6. Repeat steps 3 to 5 for the rest of the resistors.

Little Buckets of Electrons: Capacitors

Even though they all can be charged up and emptied like a bucket of electrical charge, there are many different kinds of capacitor. However, they can all be sorted into polarized or non-polarized types. You will have one of the types shown below in your kit:

Electrolytic

Monolithic

Polarized

Non-polarized

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1. Find the correct location for your capacitors; Look for C1 and C2 on the board. If you have electrolytic capacitors, find the stripe, and align it with the – sign on the board.

2. Solder the capacitor into place and repeat for the second one.

Nifty Switches: Transistors:

Transistors are versatile devices. They can be used individually to switch devices on or off, like in your kit. They can also be combined with as many as billions of other transistors to make a computer chip. Transistors are why cool high-tech gadgets exist!
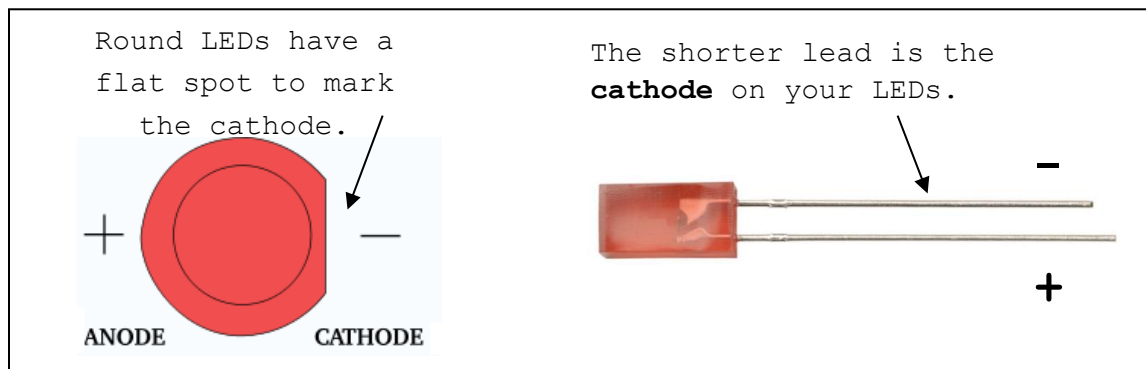
1. Insert a transistor so the flat spot is facing the way indicated on the board.

2. Solder the transistor. Transistors can be damaged by heat, so allow a maximum of 10 to 15 seconds of heat at a time. If you need to reheat the joint, wait for it to cool down first.

Twinkle Twinkle little diode: LEDs:

Diodes are like one-way valves for electricity; electricity can flow only in one direction through them. When a diode produces light in the process, it is called a Light Emitting Diode. You may have LED light bulbs in your home, or you may have a flashlight with LEDs. LEDs are everywhere!

1. LEDs are polarized. Identify which lead of the LED is positive, and which is negative.

   On most LEDs, there is a ridge around the base of the LED, and there is a flat spot on that ridge that identifies the negative side. The silhouette of the LED on the board also has a flat spot.

Round LEDs have a flat spot to mark the cathode.

ANODE   CATHODE

The shorter lead is the **cathode** on your LEDs.

−

+

PLEASE LEAVE THESE INSTRUCTIONS AT THE WORKSTATION. THANK YOU!

*Both the flat spot and the short lead
indicate the cathode on an LED.*

2. Insert the LEDs into the board, making sure the polarity is
   correct.

3. Solder the LED into place. Like transistors, LEDs can be damaged
   by too much heat, so let the LED cool down if you take longer
   than 15 seconds.

Battery Holder:

1. The battery holder goes on the back side of the board, so its
   pins stick out the front. Make sure that the battery holder goes
   in the same way as the outline on the printed circuit board.

2. Now solder the terminals of the battery holder.

3. Pop in a battery (+ side facing out!). If your kit blinks,
   congratulations! If not, ask an instructor for help. The
   battery will last approximately 24 hours, but you can take the
   battery out by pushing on the latch of the battery holder if you
   don't want to drain the battery.

4. If you need replacement batteries, most dollar stores will have
   them. The battery type is CR2032.

You're Done!

Congratulations!

Please leave these instructions at the workstation.

Thank you!

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