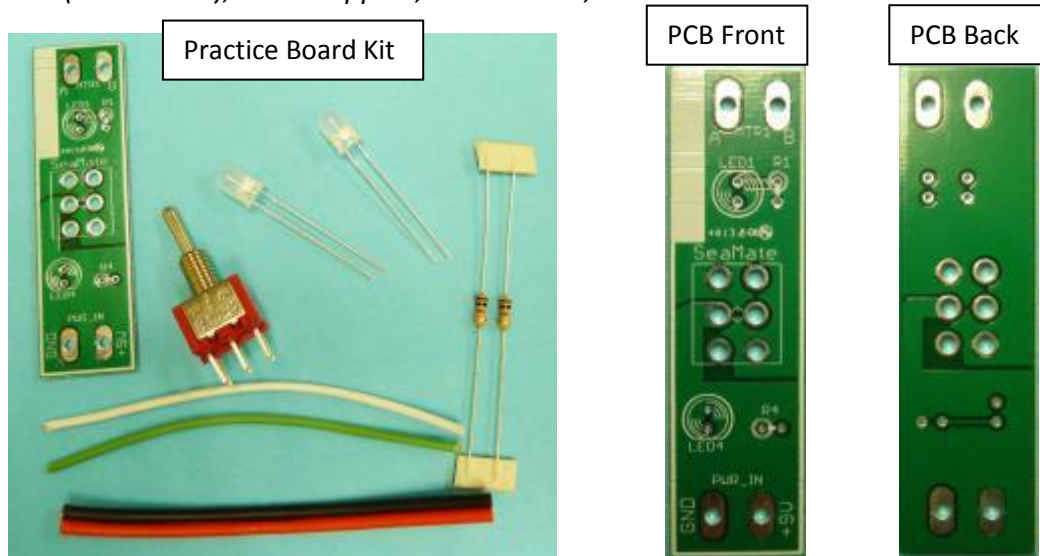


## Part 2: SeaMATE PufferFish Practice Board

**Components:** Practice Board Kit [Bag 2], (2 resistors, 2 LEDs, 1 DPDT switch, 1 PCB, 1 power cable, 2 motor wires – color varies)

**Tools & equipment:** Safety Glasses, battery pack, motor, soldering iron, electrical tape, motor mount (PCB holder), wire strippers, wire cutters, scissors.



A **printed circuit board** (or PCB) mechanically supports and electrically connects electronic components using conductive tracks (rather than wires) etched from copper sheets laminated onto a non-conductive surface. Take a good look at the printed circuit board. The front of the board or PCB has printed words; the back of the board does not. The components are inserted on the front of the board and soldered on the back. **However** the wires for power to/from the battery and to/from the motor are fed through the back of the board and soldered on the front of the board. Let's install the components.

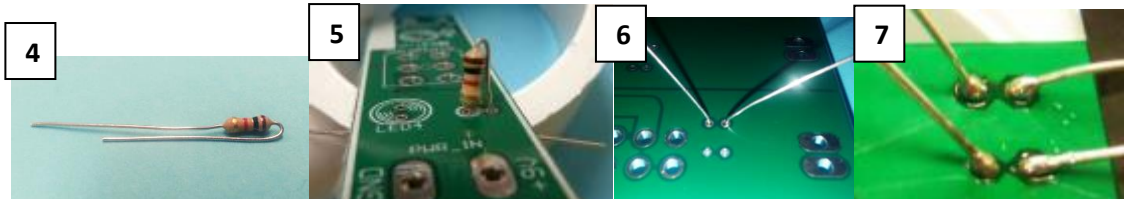
1. **Switch (1): Orientation DOES NOT matter.** Insert the DPDT switch pins into the six holes on the front of the board and tape the switch in securely with electrical tape as shown so it does not wiggle [Photo 1]. Turn the board upside down and tape it to the motor mount; the motor mount will serve as the board holder [Photo 2]. Solder the six pins on the back of the board so that every hole is filled with solder [Photo 3]. Remove all the electrical tape but save the tape, you will reuse it when you secure the board to solder other components.



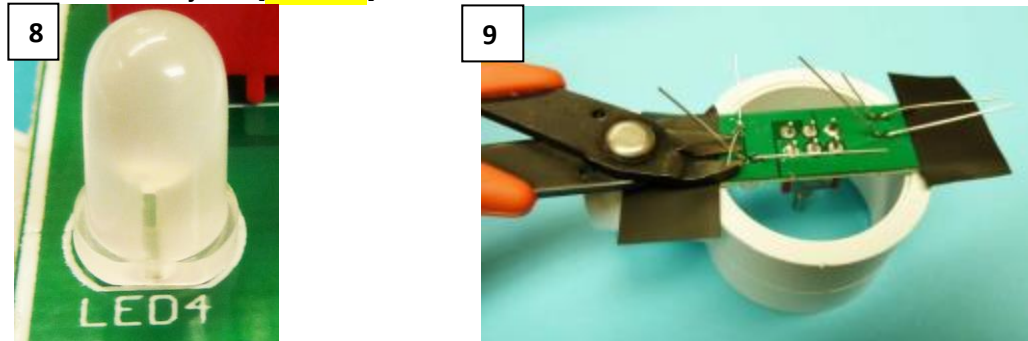
2. **Resistors (2): Orientation DOES NOT matter.** Bend resistor wire and insert the two resistors into the R1 and the R4 holes [Photo 4 & 5]. Splay the wires as they come through the back of the board to hold the resistor in place [Photo 6]. Solder the leads (wires) on the back of the board; the solder joints should look like mini, shiny, silver Hersey Kisses [Photo 7]. Solder both resistors into place. Learning to read the resistor code is helpful.

*Why do we need to use resistors for the LEDs?*

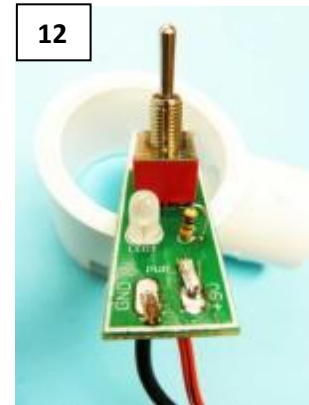
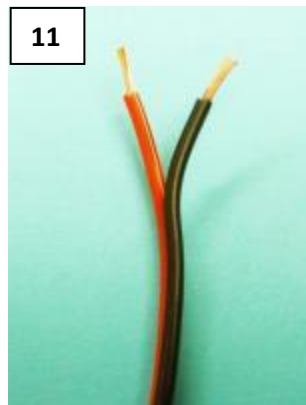
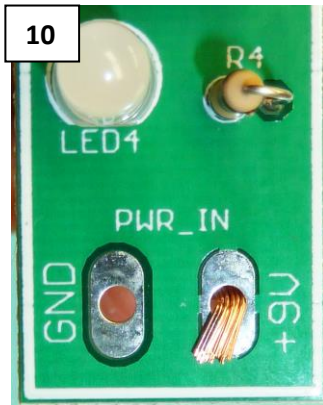
*How many Ohm's of resistance do these resistors provide?* \_\_\_\_\_



3. **LEDs (2): Orientation DOES matter.** Look carefully at the LED; it is circular, but if you look closely, one side is flat. Look at the LED symbol on the PCB; one side is flat. Insert the LED so the flat sides match [Photo 8] and solder the leads. These are special bi-polar LEDs. The color will change with polarity change. Clip off the leads above the solder joint [Photo 9].



4. **Power Cable:** Look for the PWR\_IN on the PCB. **REMEMBER, Wires are inserted in the back and soldered on the front of the board.** The red (positive) wire is soldered to the +9V hole and the black (negative) wire is soldered to the GND (or Ground) [Photo 10]. Separate the two power wires 2 cm or more from the end and strip 4 mm off of the end of each wire [Photo 11]. Do this for both ends of the wire. Take one wire and bend the wire 3 mm from the end at a right angle and feed the wire through the proper hole and solder [Photo 10]. Do the same for the other wire. It is important that your wires and solder DO NOT exceed the footprint of the silver metal pads, otherwise you will short out the system if they touch. The board should look like this [Photo 12].



5. **Motor Cable:** In the practice kit there are two motor wires, these were removed from the gray motor cable that comes with the PufferFish Kit. The gray cable encloses 6 wires in colored sheaths inside it. The two wires in the kit will be 18 gauge wires of different colors (your colors may be different than shown below.) Strip 4 mm off both ends of the wires [Photo 13]. Solder the motor wires to the MTR pads A and B in the same manner as you did for the power wires. For this exercise either wire can be attached to pad A or B.



6. **Test the board:** Using alligator clips, attach the red power wire on the board to the positive wire on the battery pack. Attach the black wire to the negative wire on the battery pack. Does the power LED turn on? Does the switch work? As you move the switch towards the top of the board the LED should turn red (forward); as you move the switch towards the bottom of the board the LED should turn green (reverse). [Note, the LEDs are reversed on the PufferFish PCB.]

7. **Add a motor:** Using alligator clips, attach one motor wire to the metal loop on the motor. Attach the other motor wire to other loop on the motor [Photo 14]. Can you turn the motor on and reverse it using the DPDT switch on the PCB [Photo 15]?

