

teknikio

ACTIVATING ORIGAMI SET GUIDEBOOK



WELCOME TO THE TEKNIKIO ACTIVATING ORIGAMI SET



This is one in a series of sets. In this set you will learn how to activate origami with paper circuits. Remember to color in the drawings as you go through your guidebooks!

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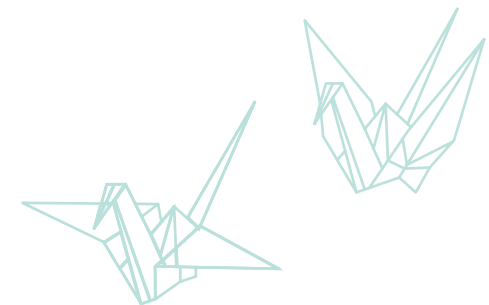
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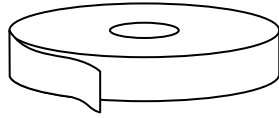
SKETCH YOUR IDEAS



YOUR MATERIALS CHECKLIST



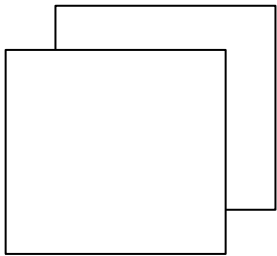
4 Blinky LEDs



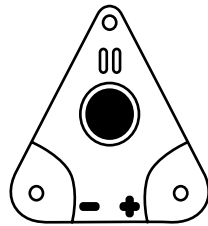
1 Roll of Conductive Tape



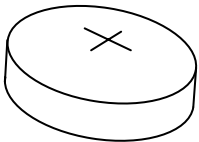
10 Paper Fasteners



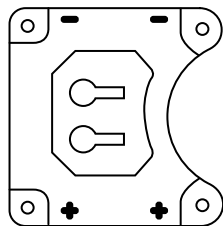
Assorted Origami Paper



1 Motionboard



2 Coin-cell Batteries



1 Battery Holder

Here is a list of tools and supplies that complement your set if you happen to come across them. We also encourage you to combine this set with other Teknikio sets and parts.

ADDITIONAL TOOLS

- Wire cutters/strippers
- Sewing needle/machine
- Scissors
- Glue/hot glue
- Multimeter

ADDITIONAL MATERIALS

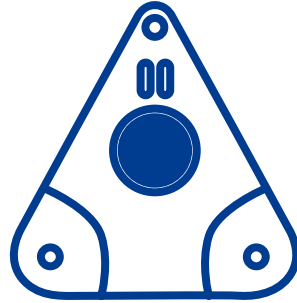
- Fabric and Thread
- Snaps
- Velcro
- Paper
- Cardboard
- Scrap metal and plastic
- Beads and sequins

PAGER MOTOR BOARD

These mini motors are usually found in pagers and cell phones that have a “vibrate” feature. They have an offset weight on their shaft that makes them vibrate as the motor spins.

HOW TO USE:

You can attach the motor board to a paper sculpture to make it vibrate or move around.

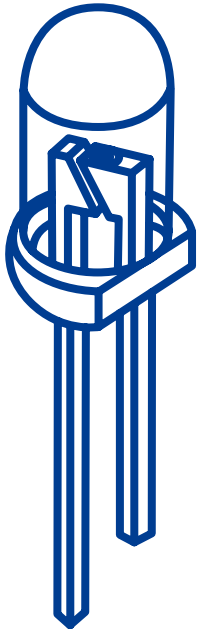


CONDUCTIVE TAPE

This tape is coated with conductive copper foil. The copper lets current pass through it and transmit power and/or signals through a circuit. Note: only the non-sticky side is conductive!

HOW TO USE:

You can use the alligator clips to attach parts without making a permanent connection. Just squeeze the ends to open the claws and clip them on.



LED (Light-Emitting Diode)

LEDs are the most popular way to test a circuit. When electricity is flowing through them they turn “on” and produce light. They have a positive end (longer leg) and negative end (shorter leg). The LEDs in your kit are “Blinky LEDs” that flash between different colors.

HOW TO USE:

If you hold the LED up with the legs sticking out, you’ll notice that one is a bit longer: this is the positive leg and is a bit longer. The shorter leg is the negative side. Sometimes the negative side is also flat on the plastic bulb of the LED.

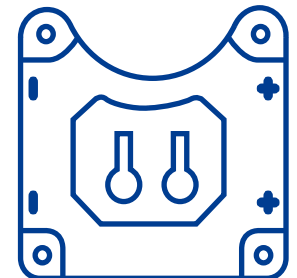
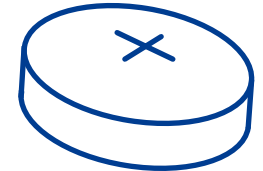
COIN-CELL BATTERY & HOLDER

This small battery can provide power and fit in tight places. You can connect this to your circuit for power- just make sure that the positive side connects to the positive end and the negative side (or ground) connects to the negative end.

You have a sewable battery holder in your kit, with conductive holes marked as positive and negative.

HOW TO USE:

When inserting your battery in the holder make sure the side with the “+” is facing up and the unmarked side (sometimes perforated) is facing down. Note that the edge of the battery is also positive.

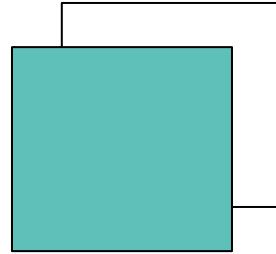


ORIGAMI PAPER

Paper has a special property of memory that allows you to fold it into many different shapes. We will show you how to add parts that can make your folded paper shapes come to life!

HOW TO USE:

More details instructions about how to fold origami paper are provided in the next section.

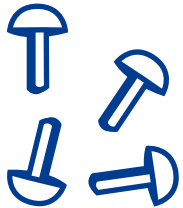


PAPER FASTENERS

These small fasteners bind your boards to the origami paper. They are commonly used in arts and craft for scrap-booking here we use them as connectors for our electronic circuit.

HOW TO USE:

Push the pins through

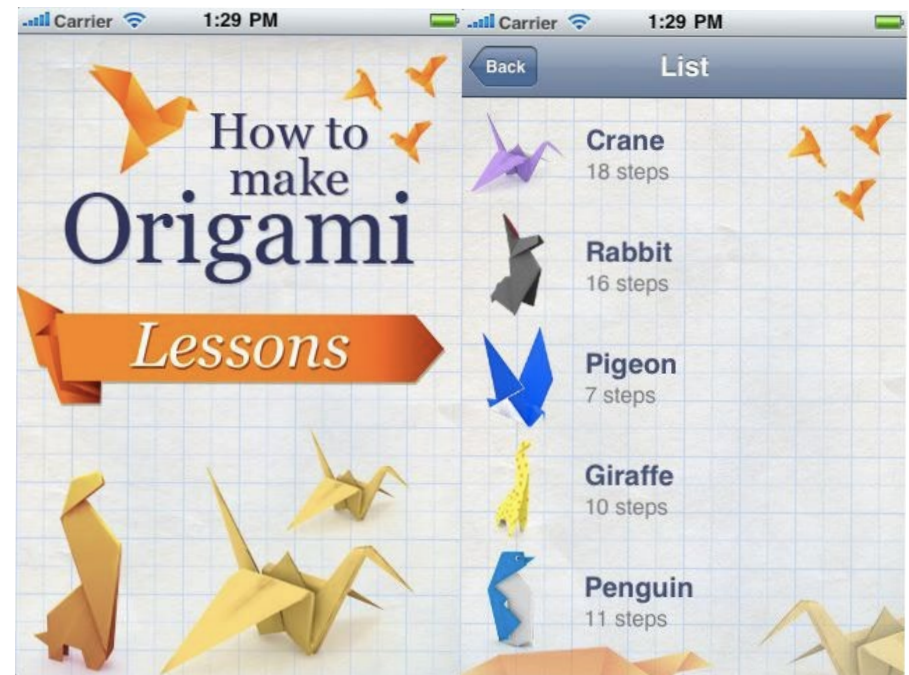


ORIGAMI BASICS

Origami is the Japanese art of paper folding. ORI means to fold and KAMI means paper in Japanese. It is an art form that has been handed down from parent to child through many generations.

There is an example of how to fold an origami penguin in the next few pages that you can follow. We also have patterns online at teknikio.com/patterns. Our favorite app is called "How to make origami" and is available for iOS and Android, the interface is pictured below. The step-by-step animated instructions are very easy to follow.

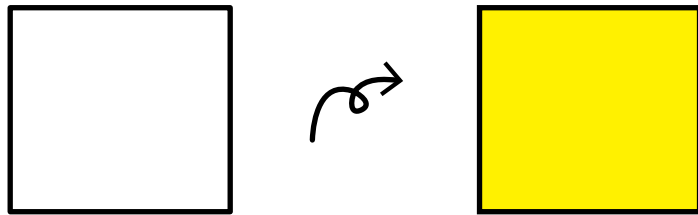
However, we recommend practice your origami skills before starting to add circuits to your origami.



ORIGAMI BASICS

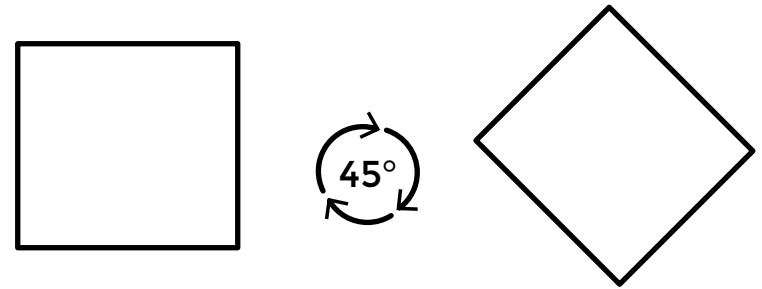
Flip Model

Turn the whole model over so that the underside now faces you. Origami paper is colored on one side, white on the other.



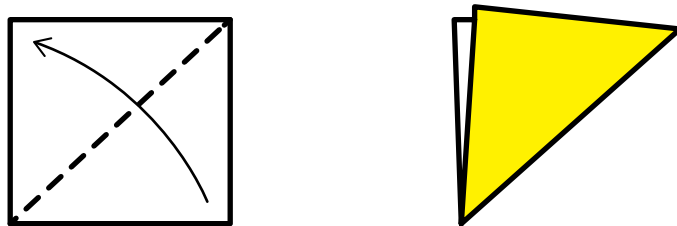
Rotate Model

Turn the model while keeping the same side facing you. The angle of rotation is shown inside the symbol.



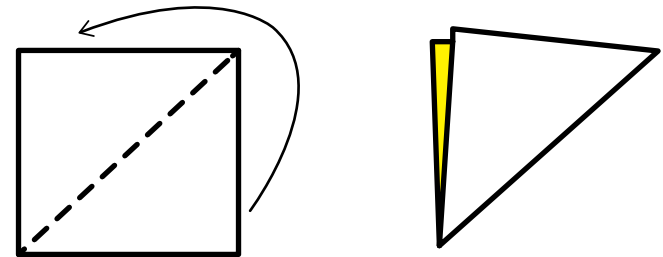
Valley Fold

Fold the paper towards yourself, along the dashed line.



Mountain Fold

Fold the paper away from yourself (underneath) along the dashed line.



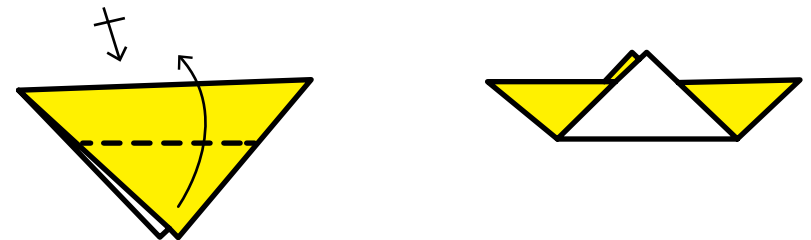
Fold and Unfold (crease)

Make a fold (valley or mountains as indicated by the line style) and then unfold to leave a crease line

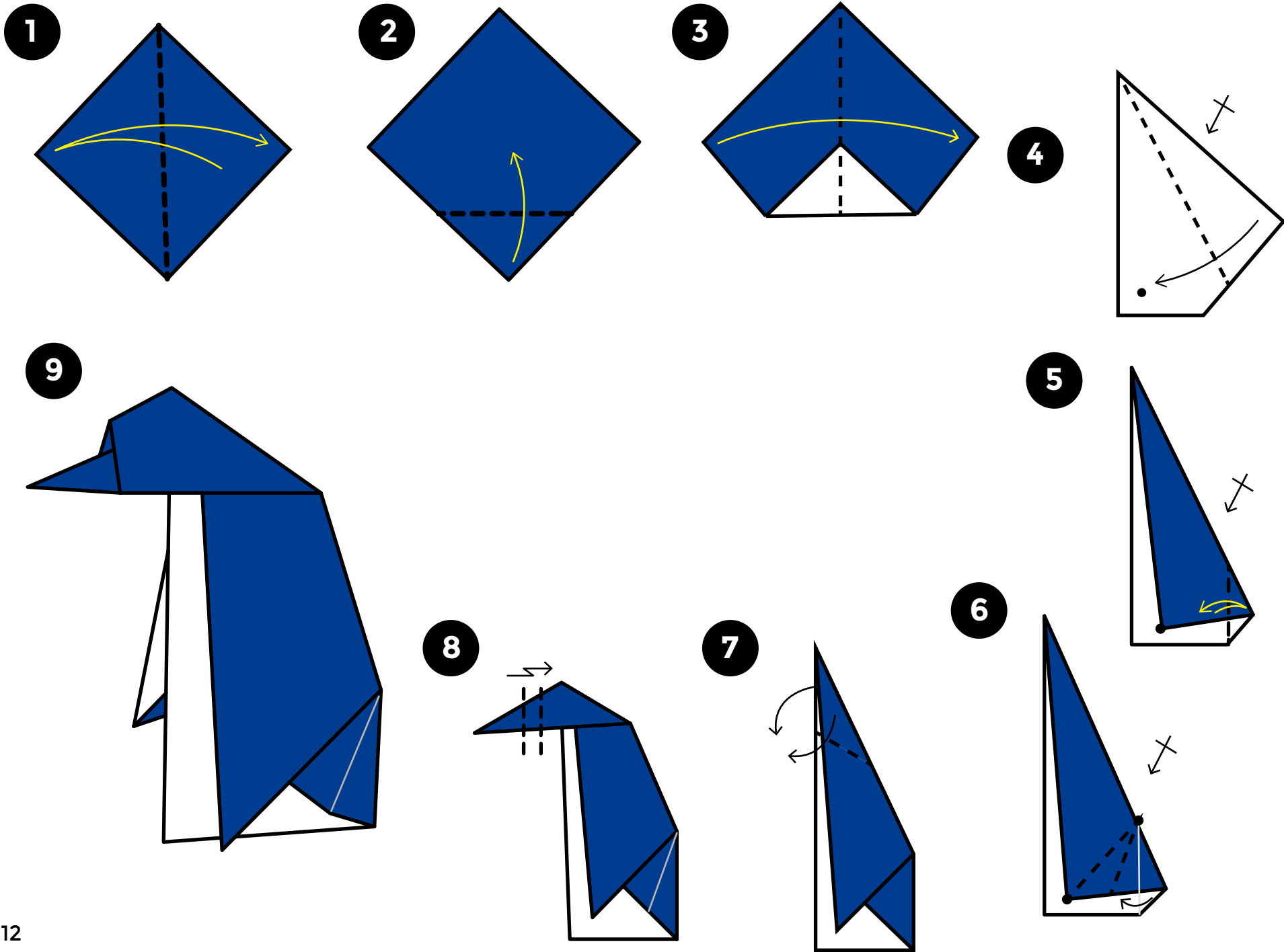


Repeat Behind

Perform the same step on the underside of the model. The number of bars across the arrow indicates the number of times to repeat the step; in this case, once.



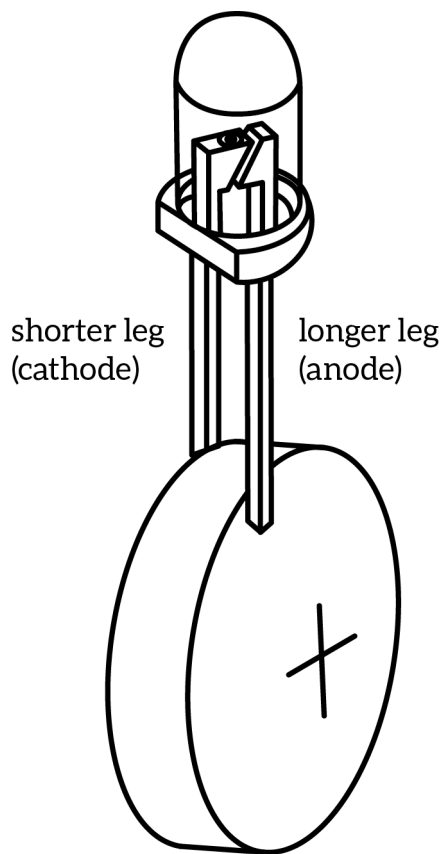
ORIGAMI PENGUIN PATTERN



CIRCUIT BASICS

As mentioned before, your LED has a positive leg and a negative leg. To understand what that means, take your LED and battery and sandwich the coin-cell between the leg of the LED. Now turn your battery around. Notice anything?

The LED should turn on only when the longer leg is touching the positive side of the battery and the negative is touching the negative side. This is because the LED has polarity, or direction. The motor does not have polarity, so it would turn on in both orientations.



The next section will provide a review of basic electronics and how a circuit works.

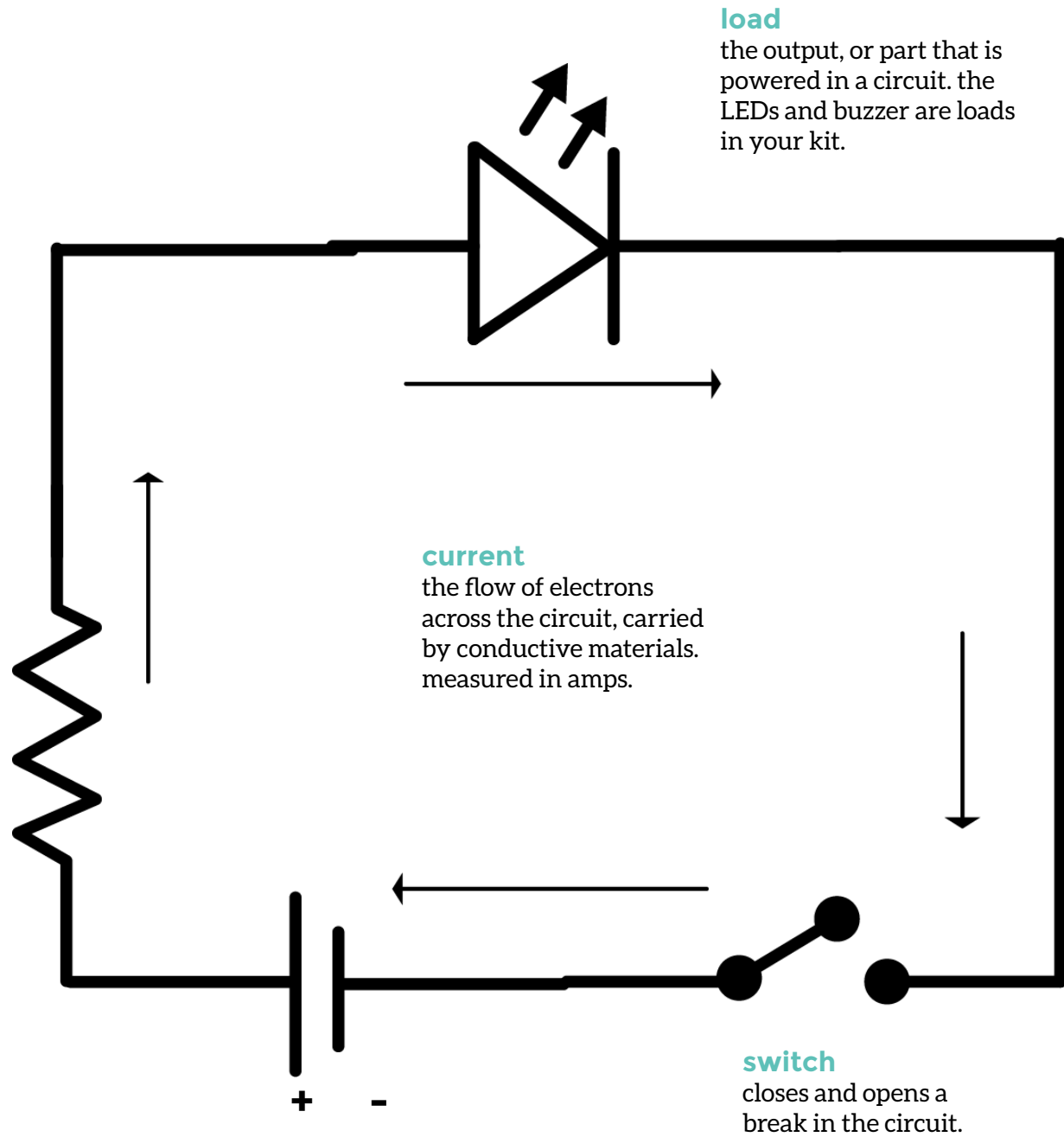
Things to remember:

- A circuit is always a loop.
- Electricity flows from positive to negative around the loop.
- Everything in the circuit must be oriented in the same direction for the circuit to work.
- Anytime a component is put into the circuit backwards, it causes a break in the circuit, meaning it breaks the loop.

Electricity will always take the path of least resistance. For example, if you are trying to build a light circuit and you connect the parts like below:

The light will not turn on! The current will flow through the shorter path and skip the path that connects to the LED.

This will also result in a **short circuit**- a short circuit is basically equivalent to connecting from the positive end of the power source to the negative, without putting anything in between. This will drain or "burn out" your battery very quickly. You should always make sure there are no short circuits in your design.



resistance
 resistance restricts the rate at which electrons flow through the circuit. conductive materials have different resistances

current
 the flow of electrons across the circuit, carried by conductive materials. measured in amps.

load
 the output, or part that is powered in a circuit. the LEDs and buzzer are loads in your kit.

power source
 provides power to the circuit. yours is the coin-cell battery

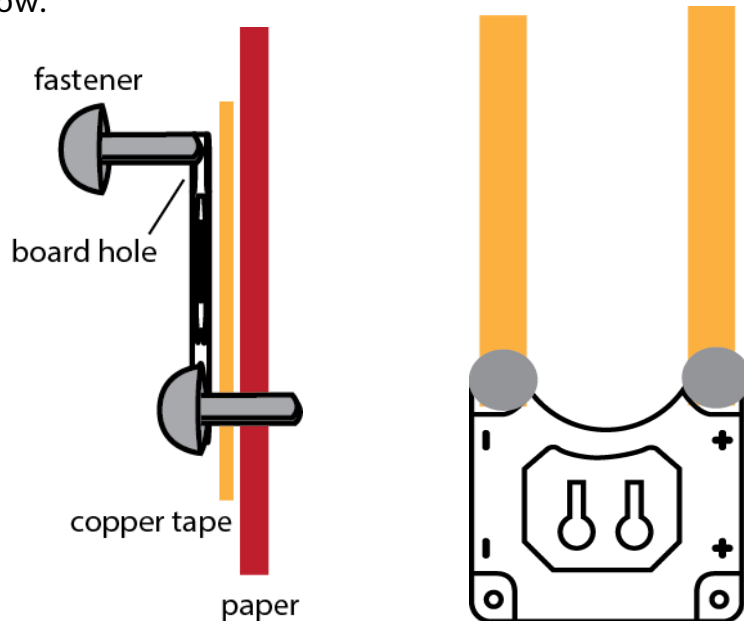
switch
 closes and opens a break in the circuit.

ACTIVATE YOUR ORIGAMI!

Fold your origami sculpture from a sheet of origami paper. To make it light up you will attach an LED, and to make it move you will attach a motor.

First mark where you want to put your battery on your sculpture and where you want your LED/motor. Cut 2 pieces of copper tape (about 1-2 inches long) and stick one on the paper across the 2 points (battery to LED/motor). Careful as you peel the tape as it likes to curl up!

The holes on one side of the battery holder are marked “+” and the holes on the other side are marked “-”. Stick the other piece of tape parallel to the first piece starting on the other side of your battery holder, and ending at the LED or motor like in the diagram below.



Use the fasteners to attach your battery holder to the paper. Stick the fastener through the hole on the holder then through the tape, and finally through the paper. Bend the legs apart to hold it in place. Do this on both sides of the holder.

To attach the motor...

First, stick a fastener through the silver hole on the bottom edge of the motor board, then through the copper tape coming from the positive side of the battery, and then through the paper. Stick the other fastener through the other silver hole on the board, then through the copper tape coming from the negative side of the battery, and through the paper. Fold the legs of the brass fasteners flat against the paper to secure them.



To attach an LED...

Note that the positive side is the longer leg of the LED and the negative side is the shorter leg of the LED. Attach the positive side of the LED to the copper tape coming from the positive side of the battery holder. To attach, just place the leg **on top** of the copper tape and then tape it down with a small square of regular scotch tape or copper tape. Take the negative leg of your LED and similarly attach it to the other piece of copper tape coming from the negative side of the holder. Be careful if you bend the legs of the LED as they may break.



To attach 2 LEDs:

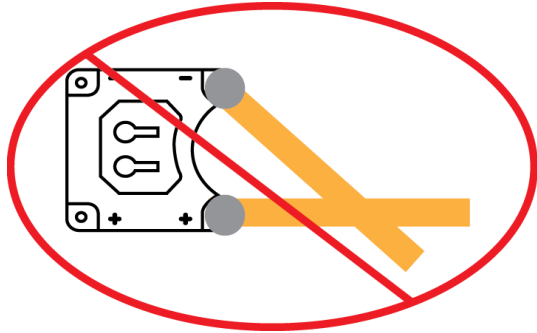
To attach a second LED, first pair the two LEDs together so that they are oriented in the same direction, with positive legs on one side and negative on the other. You may want to stick the LEDs through the paper if you plan to have the bulbs on one side of the paper and the legs on the other.

Then twist the two positives and negative together. At this point it is a good idea to check that both turn on by inserting the battery between the legs as shown on page 16. If they both turn on, continue by making two conductive lines from the batteries and attaching the positive legs to the positive line and negative legs to the negative line.

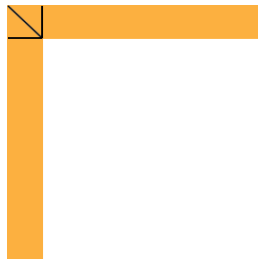


TROUBLESHOOTING

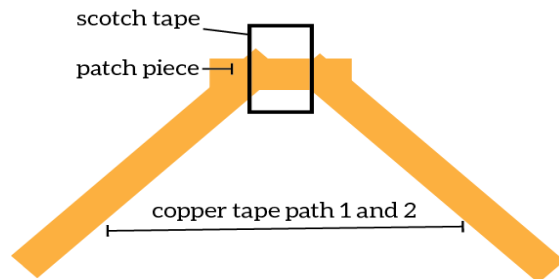
* REMEMBER ONLY THE NON STICKY SIDE OF THE TAPE IS CONDUCTIVE *



make sure the positive and negative lines of tape do not touch or cross (this will short the circuit)



to make a corner pinch the tape at a 45 degree angle and turn the other side of the tape perpendicular like in the diagram above. do not tear or cut the tape!



to “patch” 2 paths of tape you can take another piece of copper tape and place the non-sticky side across the gap you want to patch and then stick another piece over the top of it.

SKETCHING YOUR IDEAS

Now that we’ve covered our bases, get to inventing!

The last section contains blank paper for you to sketch your ideas.

Please share your projects online:

twitter: @teknikio / instagram: seeteknikio

When you are designing a project, it is important to keep asking questions:

- 1) What steps do you need to make that?
- 2) What materials and tools do you need to put it together?
- 3) What will it look like when you are done?
- 4) How do you want someone to interact with it?

SKETCH YOUR IDEAS

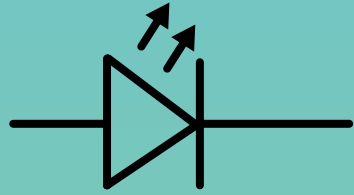
SKETCH YOUR IDEAS

CIRCUIT SYMBOLS

Below are the symbols engineers use for the parts in your kit when making circuit diagrams!



motor



LED



switch



power

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