EN: Elektronic building set
Set is powered by 4 AAA batteries (not included). Toy is meant for kids 8years old and older.
Study the manual thorougly before the first use.
Especially the category about what to be aware of and how to clean the contacts.

Warning: Toy is unsuitable for kids up to 3 years of age because it contains small parts.
Producer: 3Dsimo s.r.o., Praha 9, K Žižkovu 282/9, 19800, **www.boffinmagnetic.com**
Manual in the language of your preference on the link:
boffinmagnetic.com/manual

CZ: Elektronická stavebnice
Stavebnice na 4x AAA baterie (nejsou součástí balení). Hračka je určena pro děti od 8 let.
Před použitím si pečlivě prostudujte návod.
Zejména kategorii, na co si dát pozor a jak provádět čištění.

Upozornění: Hračka není určená pro děti do 3 let, protože obsahuje malé části.
Výrobce: 3Dsimo s.r.o., Praha 9, K Žižkovu 282/9, 19800, **www.boffinmagnetic.com**
Manuál v příslušné jazykové mutaci naleznete online na odkazu:
boffinmagnetic.com/manual

PL: Elektroniczny zestaw konstrukcyjny
Zestaw na 4 baterie AAA (brak w zestawie). Zabawka przeznaczona jest dla dzieci od 8 lat.
Przed użyciem przeczytaj uważnie instrukcję.
Zwłaszcza rozdział, na co zwrócić uwagę i jak przeprowadzić czyszczenie.

Ostrzeżenie: Zabawka nie jest przeznaczona dla dzieci poniżej 3 roku życia, ponieważ zawiera małe części.
Producent: 3Dsimo s.r.o., Praha 9, K Žižkovu 282/9, 19800, **www.boffinmagnetic.com**
Instrukcję w odpowiedniej wersji językowej można znaleźć online pod linkiem:
boffinmagnetic.com/manual

DE: Elektronisches Kit
Das Kit verwendet 4x AAA-Batterien (nicht enthalten). Baukasten ist konzipiert für Kinder ab 8 Jahre.
Lesen Sie die Anweisungen vor dem Gebrauch gründlich durch.
Besonders die Kategorie, worauf zu achten und wie die Reinigung durchzuführen.

Beachtung: Das Spielzeug ist nicht für Kinder bis 3 Jahre konzipiert.
Hersteller: 3Dsimo s.r.o., Praha 9, K Žižkovu 282/9, 19800, **www.boffinmagnetic.com**
Das Manual in der betreffenden Sprache finden Sie am Link:
boffinmagnetic.com/manual

HU: Elektronikus építőkészlet
Az építőkészlet működtetéséhez 4 AAA elem szükséges. A csomag elemet nem tartalmaz.
A játék 8 éves kortól ajánlott **Használat előtt olvassa el figyelmesen a használati útmutatót.**
Különösen a tisztítás és karbantartás kategóriát.

Figyelem! Nem alkalmas 3 éves kor alatti gyermekek számára. Fulladásveszélyes!
Gyártó: 3Dsimo s.r.o., Praha 9, K Žižkovu 282/9, 19800, **www.boffinmagnetic.com**
A kézikönyvet a megfelelő nyelvi változatban online található ezen a linken:
boffinmagnetic.com/manual

FR: Kit de construction électronique
Le kit utilise 4 piles AAA (non inclus). Le jeu est destiné pour les enfants à partir de 8 ans.
Lisez le mode d'emploi attentivement avant utillisation.
Notamment la categorie de ce qu 'il faut fair attention et comment nettoyer le produit.

Attention: le jouet n'est pas destiné pour les enfants jusqu'à 3 ans.
Fabricant: 3Dsimo s.r.o., Praha 9, K Žižkovu 282/9, 19800, **www.boffinmagnetic.com**
Le mode d'emploi dans la langue correspondante se trouve sur le lien:
boffinmagnetic.com/manual

IT: Kit elettronico
I kit utilizza 4 batterie AAA (non incluso). Il giocattolo è destinato a bambini dagli 8 anni.
Leggere attentamente le istruzioni prima dell'uso.
Soprattutto le avvertenze e i consigli su come effettuare la pulizia.

Avvertimento: il giocattolo non è destinato a bambini di età inferiore a 3 anni, poiché contiene piccole parti.
Produtore: 3Dsimo s.r.o., Praha 9, K Žižkovu 282/9, 19800, **www.boffinmagnetic.com**
Il manuale nella versione linguistica pertinente si trova al link:
boffinmagnetic.com/manual

ES: Kit electrónico
Kit para 4 pilas AAA (no incluido). El juguete es para niños a partir de 8 años.
Lea atentamente las instrucciones antes de usar.
Especialmente la categoría de qué evitar y cómo realizar la limpieza.

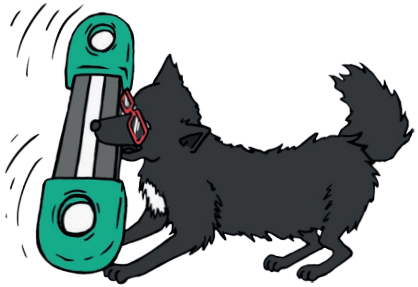
Advertencia: el juguete no está destinado a niños menores de 3 años, ya que contiene piezas pequeñas.
Fabricante: 3Dsimo s.r.o., Praha 9, K Žižkovu 282/9, 19800, **www.boffinmagnetic.com**
El manual se puede encontrar en línea en:
boffinmagnetic.com/manual

HI!

You have received a unique electronic kit, with which you can build fun and sometimes even almost crazy projects.

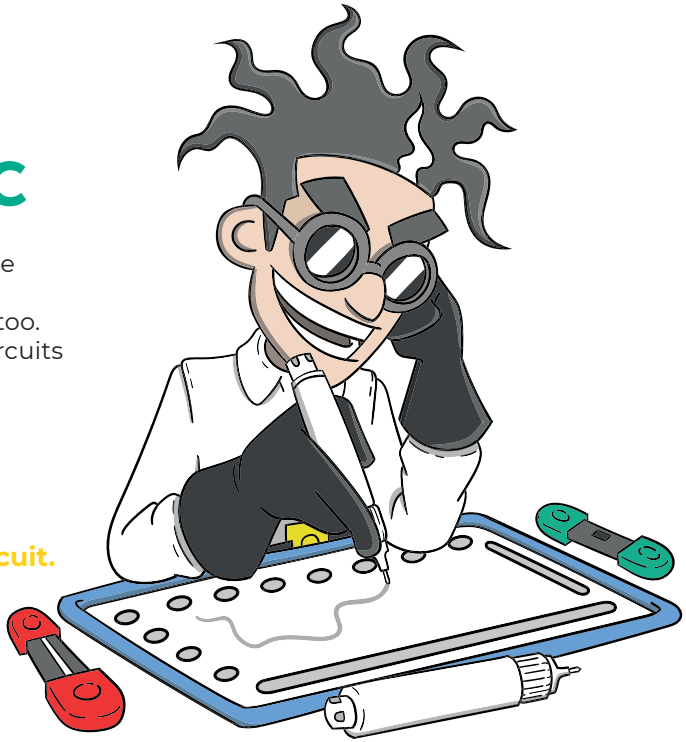
In this book you will find 100 sample builds.
Every month we are going to add another 10 new projects to our official website. There are already more than 50 of them now.

You can find online projects at:
www.boffinmagnetic.com/community/projects



My name is Boffin Magnetic

I will accompany you throughout the book. From the simplest builds to the most complex ones. We can accomplish everything together and you will learn, too. I am going to teach you to understand electronic circuits and also how things work around us.



I am sure you can't wait to build your first circuit.

But before you start, turn to the next page!

WARNING!

Before you start building, read what you should definitely NOT do to avoid damaging the kit:

Battery type
Use only AAA 1.5V batteries!
(These batteries are not included in the kit.)

Battery polarity
Always insert the batteries with the correct polarity,
i.e. plus to ⊕ and minus to ⊖.

Replacing batteries
Replace AAA batteries regularly.
Remove defective batteries.
Do not mix old and new batteries.

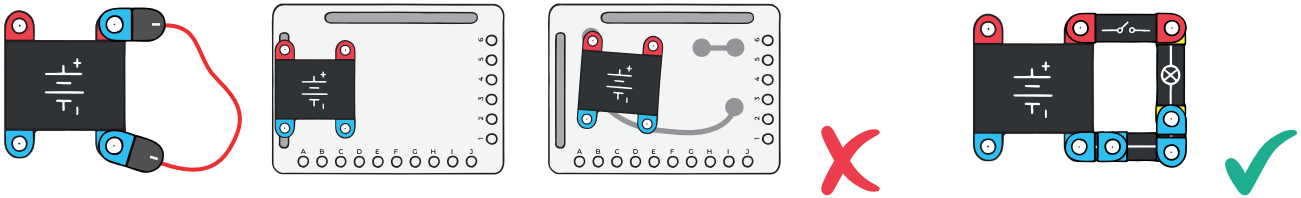
Always!
Always make sure that the build is connected correctly according to the instructions.
Never reverse the polarity of both batteries and other components where the contacts are marked with a ⊕ and ⊖.

The package contains small parts.
There is a risk of swallowing. Not intended for children under 3 years.

Never!
Never connect the circuit or any component to household electrical sockets (risk of electric shock).

Never connect the ⊕ and ⊖ contacts directly on the battery component, otherwise a short-circuit will occur and damage the batteries (the batteries will start to heat up quickly).

Do not forget that you can connect the ⊕ and ⊖ minus even with the conductive ink!



BASIC TROUBLESHOOTING:

1. Wrong build
Most problems are due to a wrong build.
Therefore, always carefully check that the circuit built corresponds to the sample drawing.

2. Polarity ⊕ and ⊖
Make sure that components with explicitly indicated positive / negative contacts are positioned in accordance with the sample drawing.

3. Bad contact
If the connection you have created does not havean adequate contact, you should gently move and push the components.

4. You may build your own projects at your discretion
3Dsimo s.r.o. cannot be held liable for any potential damage caused to components.

CLEANING:

Regularly clean magnetic contacts and the surfaces on which they rest.

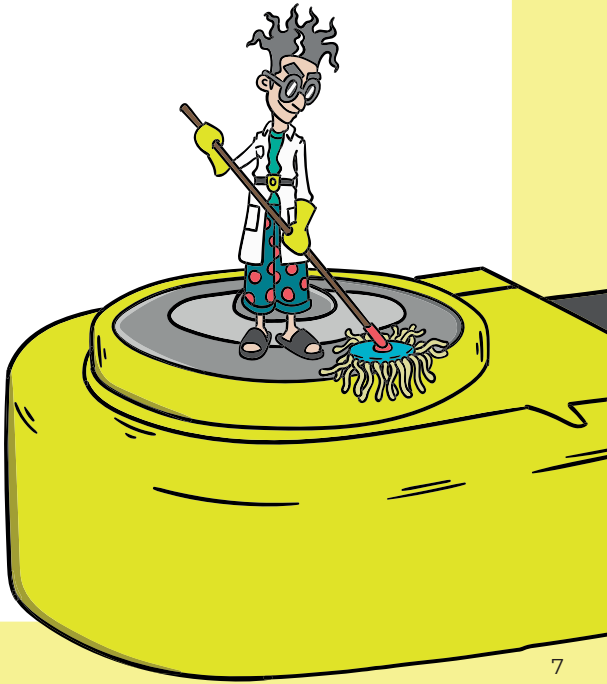
Use the included pen with cleaning liquid or alternatively wet wipes for electronics or a piece of cloth soaked in alcohol or diluted dish detergent to clean components.

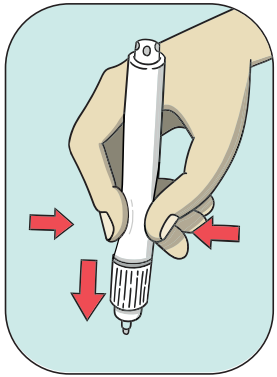
Over time, dirt or grease may adhere to the contacts, which may prevent the components from functioning properly (due to reduced conductivity).

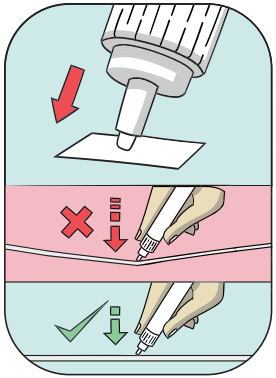
Magnetic pad cleaning:

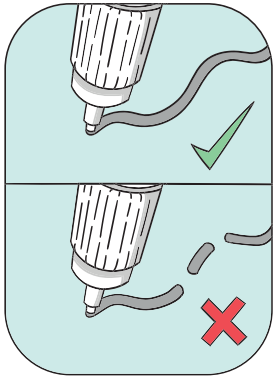
Clean the conductive ink off the pad with the cleaning brush you will find in the package and cloth or paper towel.

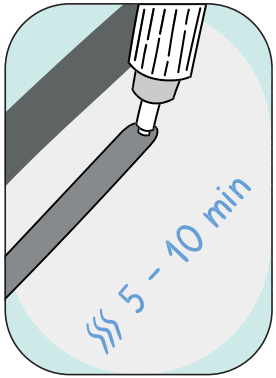
You can wash off the conductive ink with alcohol or an alcohol-based cleaner. Never use the rough side of the sponge to clean, as this may damage the magnetic pad.







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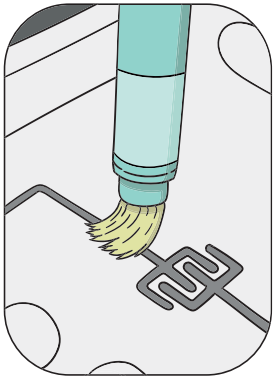
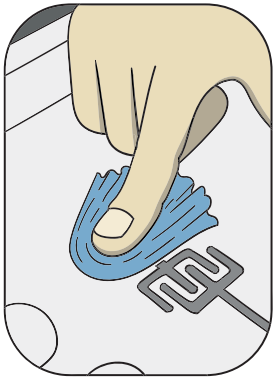
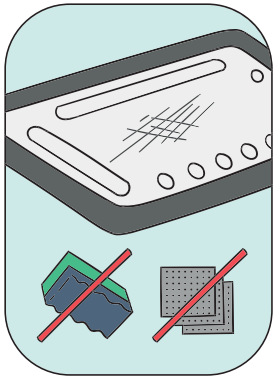
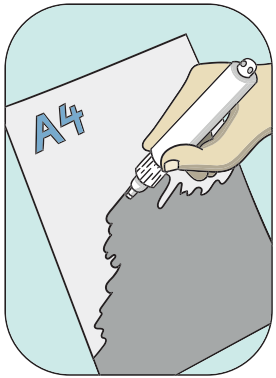






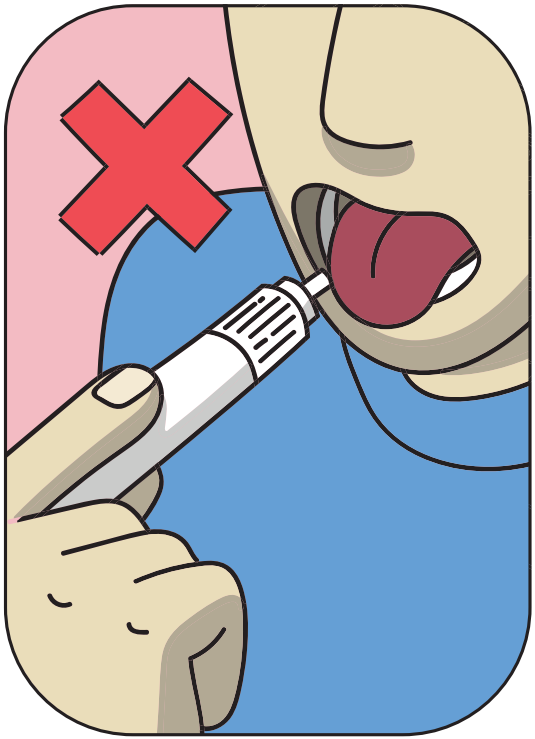

A4

CONDUCTIVE PEN:

In this kit you will find a magical pen, with which you can draw electrically conductive circuits.

First, the pen should be shaken well (repeat before each use). Then just place it on paper or pad, gently press on the tip and squeeze the plastic case. Each time you draw a circuit, you must wait at least 5 minutes, so that the connection dries and becomes conductive.

Use the included cleaning brush to clean.
The conductive pen refill should be sufficient to color up approximately one A4 paper.

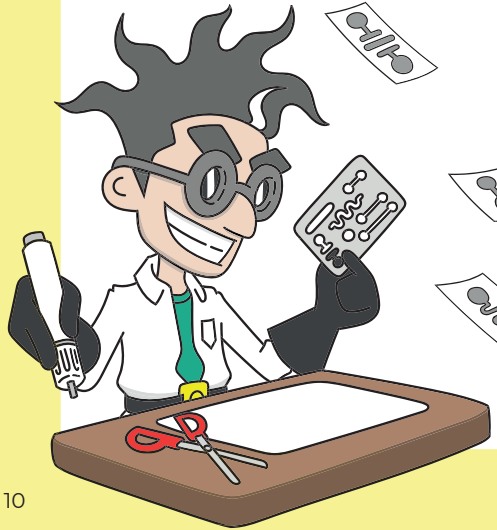


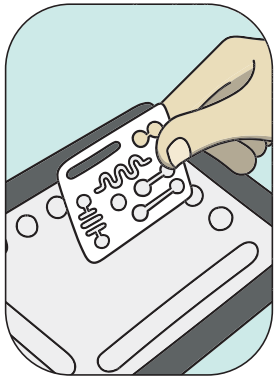
ATTENTION!

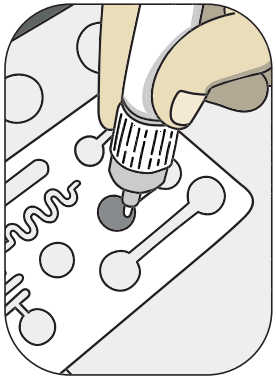
**The ink in the conductive pen must never come into contact with the mucous membranes.
If this happens, the area must be rinsed with watter immediately!**

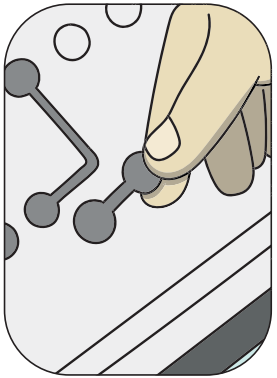
STENCIL:

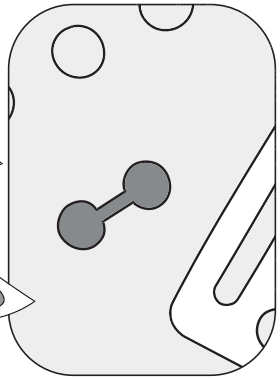
Use the included stencil to draw parts accurately.

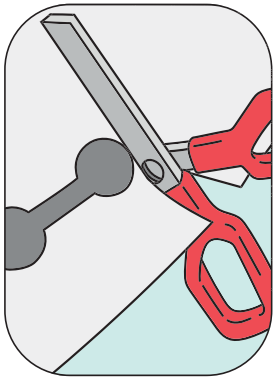


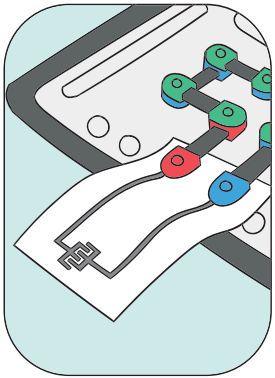


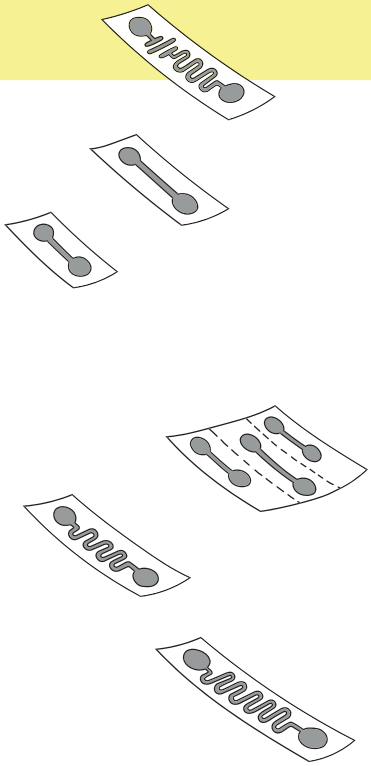


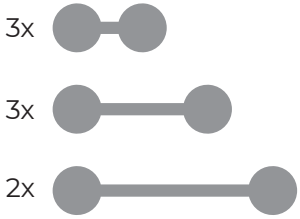


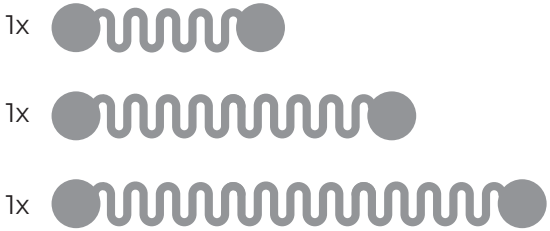


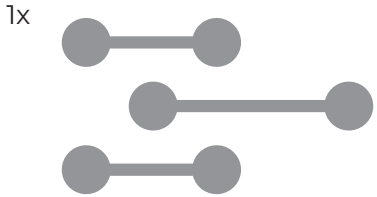






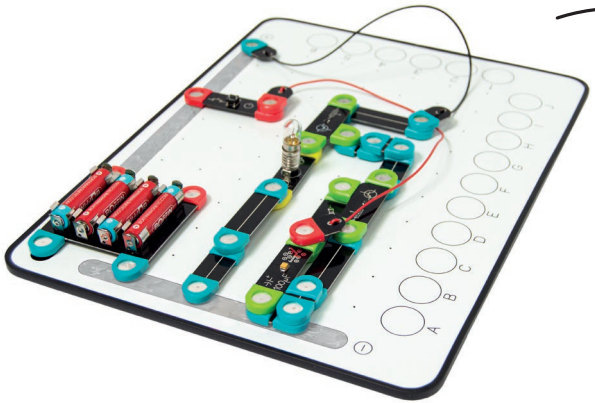




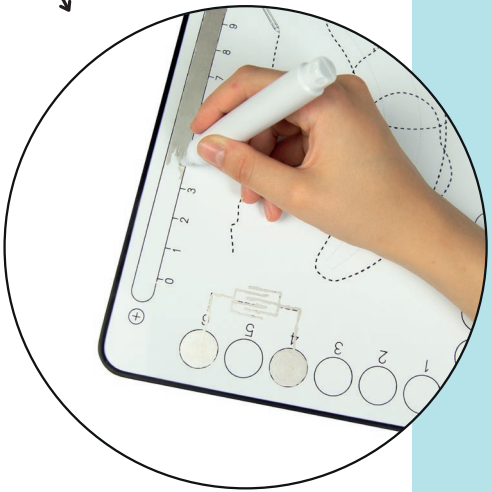


We recommend drawing the components on paper.
You can then reuse them in various builds.

COMPONENTS



MAGNETIC PAD



CONDUCTIVE PEN

CLEANING BRUSH

CONDUCTIVE TRACE

It is a simple component that is only used to interconnect the components with which you create a functional build. It consists only of a conductive track or path that should bring electricity from point A to point B.

(ON-OFF) SWITCH

It is a manually operated mechanical switch used to switch an electrical circuit on or off. In one position, a permanent conductive trace is made (ON), whereas in the other position the trace is open or broken (OFF).

BUTTON

It is a simple switch that is used to manually control electrical equipment. The circuit closes when the button is pressed.

POTENCIOMETER

It is a component that changes the resistance when its axis rotates; for this reason, it is used to directly control, for example, the volume or intensity of light. With the Boffin Magnetic kit, you will find that it can also be used as a steering wheel for controlling a racing game.

CAPACITOR

It is a component used in electrical circuits to temporarily store an electric charge, and thus to store electrical energy - charge.

REZISTOR

One of the basic components without which no circuit and build can do. Its basic property is electrical resistance. The main reason for including a resistor in an electrical circuit is to limit the flow of electrical current through the circuit or to obtain a certain voltage drop for measuring non-electrical quantities.

PHOTOREZISTOR

This is a light-sensitive component. This means that the more light shines on the component, the less resistance it will have. For example, a motor connected to a circuit will spin faster in high light. If you shade the photoresistor with your finger, a high resistance will cause the motor speed to decrease until it stops. With this component you can create a large number of interesting and experimental builds that will respond to illumination or its change, as the case may be.

DIODE

The purpose of the diode is to let electric current flow only in one direction, and this is why the diode symbol is similar to an arrow. The diode contains two transitions – P and N – referred to as the anode and the cathode, respectively.

LED (LIGHT-EMITTING DIODE)

The LED has the main task to light up as efficiently as possible.
It is a semiconductor device that can be connected in the forward or the reverse direction. If you connect the diode in the reverse direction, no current will flow through it and it will not light up. Current can flow through a diode connected in the forward direction, and it then lights up.

BULB

A light bulb is a simple device used to convert electrical energy to light. It works on the principle of heating a thin conductor (mostly a tungsten filament) by an electric current flowing through it. At high temperatures, the filament of a light bulb glows, but consumes most of the energy to radiate heat instead of light. For this reason, we nowadays mostly used light sources that are much more economical and efficient. In one of the builds, you can compare both types of radiators and test how much they heat up, shine and consume energy.

NPN/PNP TRANSISTOR

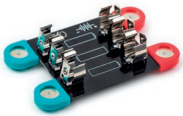
The main feature of a transistor is its ability to amplify an electric current. This simply means that small changes in input voltage or current can cause large changes in output voltage or current.

BUZZER

Due to the piezoelectric effect, this component emits a squeaky tone. This phenomenon occurs due to changing voltage at its contacts, which is applied to the crystal.

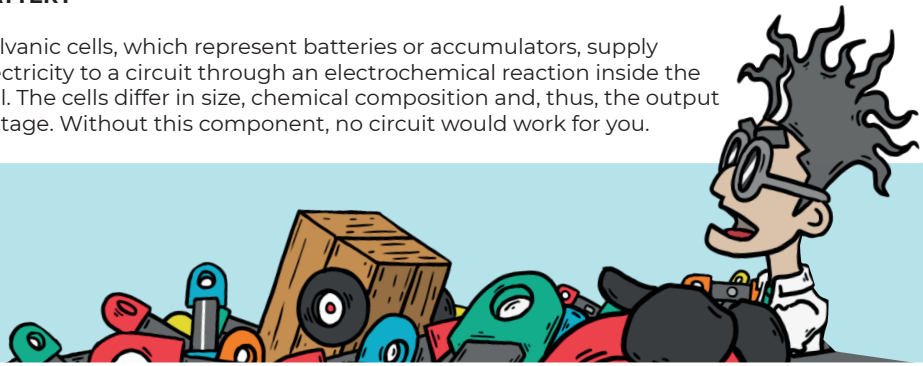
MICROPHONE

A component enabling the conversion of an acoustic signal, or sound, to an electrical signal. Thanks to this, you can hear the singer at the concert even in the back rows.



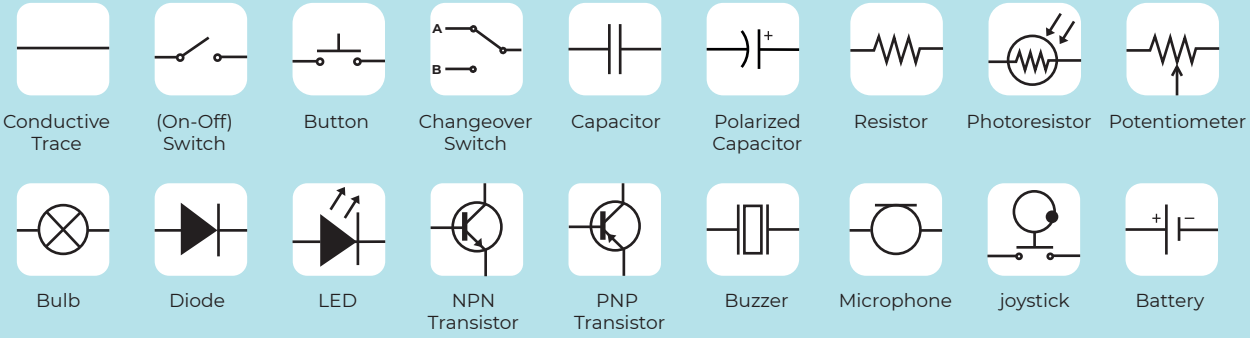
BATTERY

Galvanic cells, which represent batteries or accumulators, supply electricity to a circuit through an electrochemical reaction inside the cell. The cells differ in size, chemical composition and, thus, the output voltage. Without this component, no circuit would work for you.



SYMBOLS

On each module you also have the electrotechnical symbol of the component, which is commonly used.
For a better understanding, you will find below an explanation of which component, which brand it belongs to.



Conductive Trace | (On-Off) Switch | Button | Changeover Switch | Capacitor | Polarized Capacitor | Resistor | Photoresistor | Potentiometer

Bulb | Diode | LED | NPN Transistor | PNP Transistor | Buzzer | Microphone | joystick | Battery

PROJECTS

2 SOUND

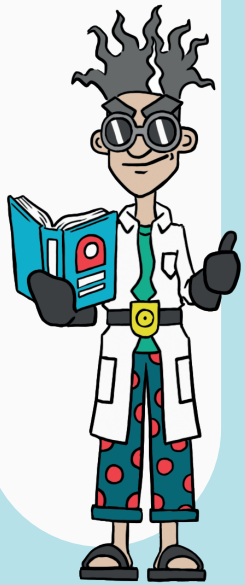
3 ENERGY

4 FUNCTIONS

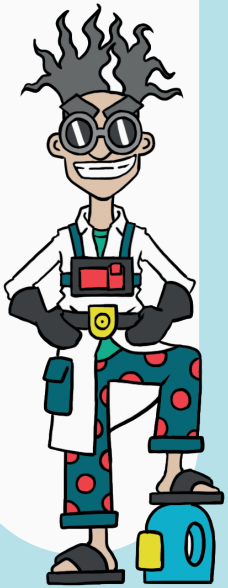
5 GAMES

PROJECTS

BEGINNER



ADVANCED

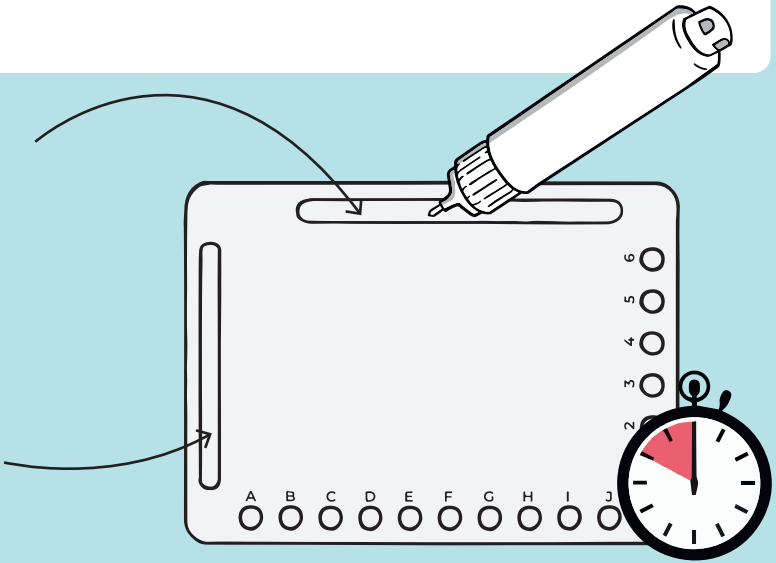


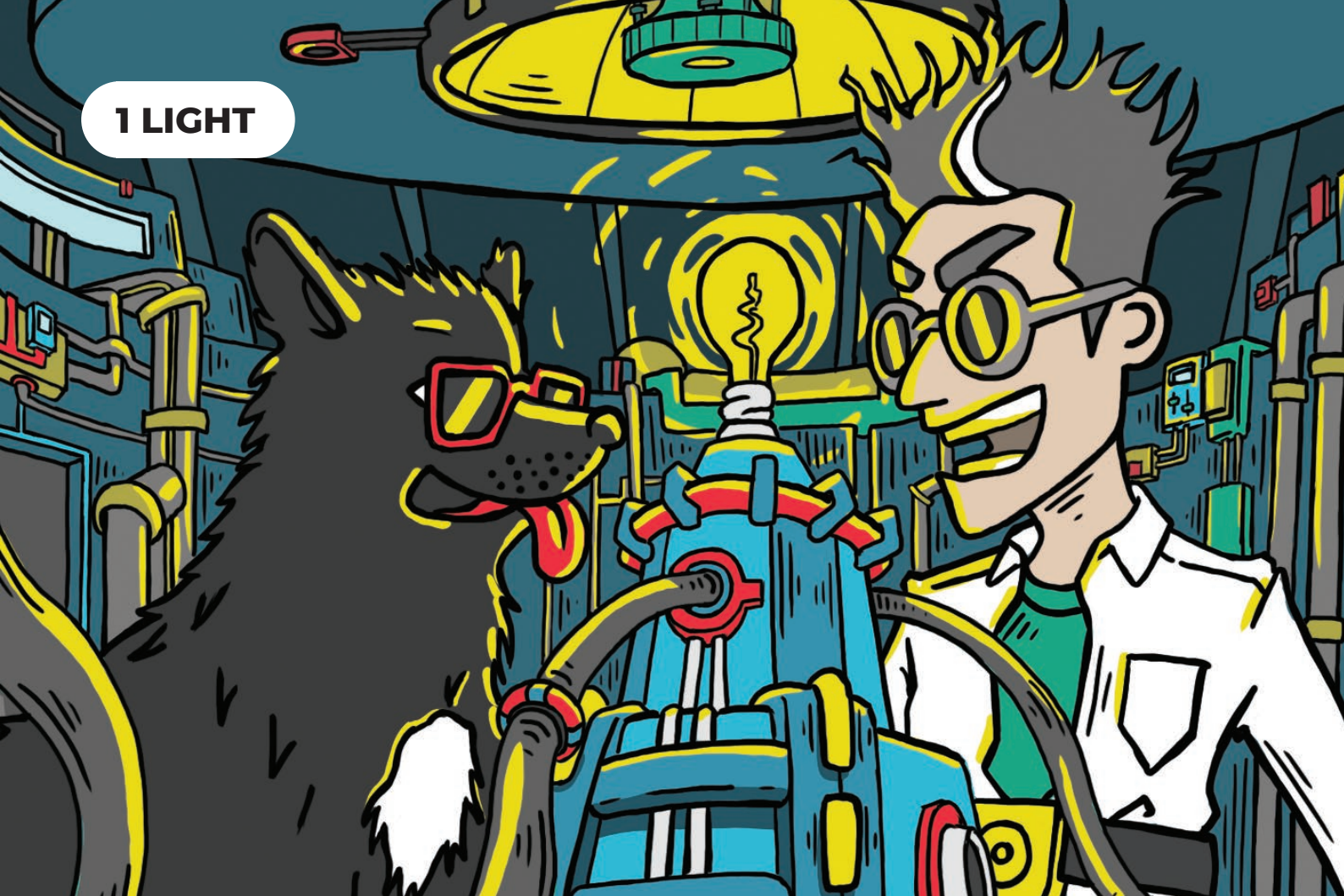
EXPERT

L00 CONDUCTIVE CONNECTION

1x conductive pen

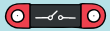
First, fill in the the areas on the magnetic pad (as shown in the picture) with the conductive pen. These parts will serve as connecting lines for ⊕ and ⊖. Be sure to wait at least 5 to 10 minutes for the ink to dry. When you‘re done you can start having fun with all the exciting builds.

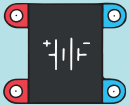



1 LIGHT

LL10 LIGHTBULB WITH SWITCH


1x bulb

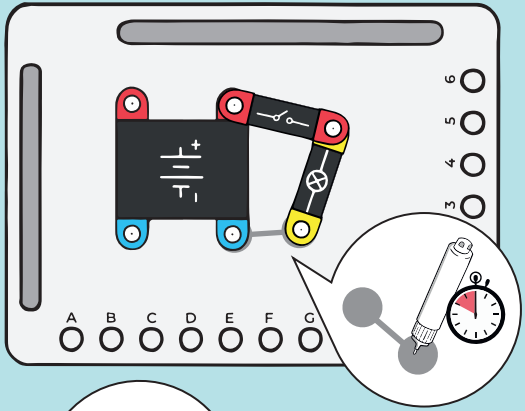

1x switch


1x battery

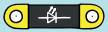

1x conductive pen

A basic build that demonstrates how the electronic circuit in principle works. The switch acts as a circuit breaker, the bulb generates light and the drawn conductive path closes the circuit, so that electric current can flow through it. The battery is an integral part of the circuit and serves as a source of energy for the light bulb.

ATTENTION: First draw the connecting path on the pad using the conductive pen. Let it dry for at least 5 minutes. Then you can continue building the circuit.

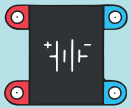


LL20 LED WITH SWITCH


1x LED


1x resistor 1kΩ

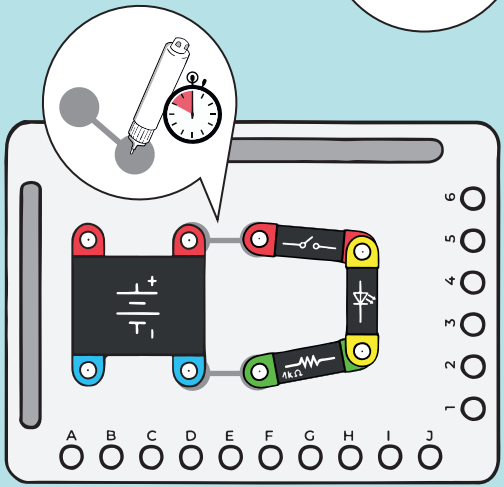

1x switch


1x battery


1x conductive pen

A basic build with an LED as a light source. LEDs are not adjusted to the soupply voltage of a battery, therefore it is necessary to add a serial resistor to the build. That will lower the curent flow in the circuit. Othewise the LED would be destroyed.

ATTENTION: First draw the connecting path on the pad using the conductive pen. Let it dry for at least 5 minutes. Then you can continue building the circuit.

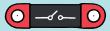


LL30 SWITCH VS. BUTTON

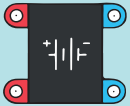

1x LED


1x bulb


1x button


1x switch

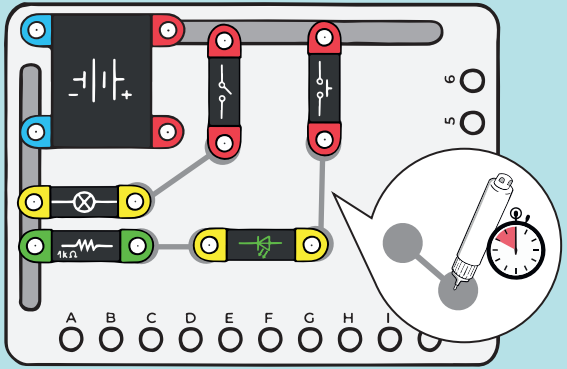

1x resistor 1kΩ


1x battery


1x conductive pen

The basic components in the circuit include switches and buttons that control the current flow. The switch has two stable positions (ON and OFF) and the current flows only in the ON position. The current flows through the button only when it is pressed.

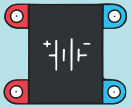
ATTENTION: First draw the connecting paths on the pad using the conductive pen. Let them dry for at least 5 minutes. Then you can continue building the circuit.



LL40 SERIAL CONNECTION OF LEDS


3x LED

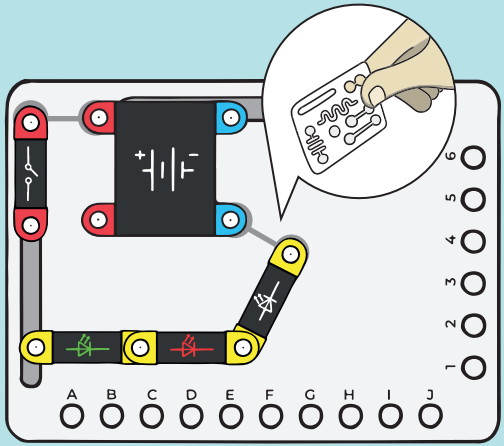

1x switch


1x battery

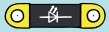

1x conductive pen

The objective is to test that by connecting 3 LEDs in series, none of them will light up. That is because the voltage drop across each of the diodes is in total greater than the supply voltage of the batteries, which is 6V. Here you do not need to worry about destroying the LEDs by not adding a resistor since almost no current will flow through them.

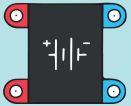
ATTENTION: First draw the connecting path on the pad using the conductive pen. Let it dry for at least 5 minutes. Use the stencil to draw precisely.



LL50 LED LIGHTS UP IN ONE DIRECTION


1x LED


1x resistor 1kΩ

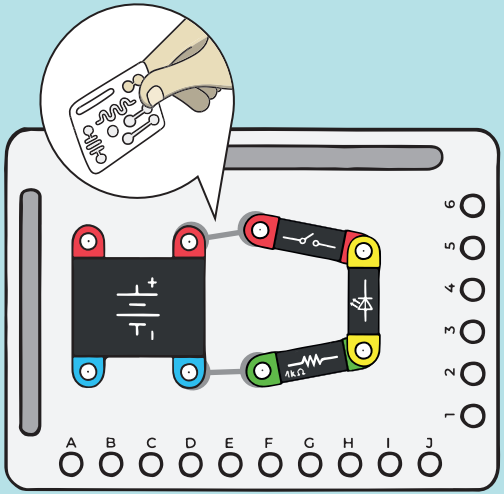

1x battery


1x conductive pen


1x switch

A LED is a semiconductor device (made up of two transitions called P and N) that conducts an electric current in only one forward direction - from the cathode (N) to the anode (P). For this reason, the LED can only light up if connected in the forward direction, which is not the case in this circuit as the LED is connected in the reverse direction.

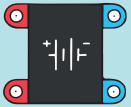
ATTENTION: First draw the connecting path on the pad using the conductive pen. Let it dry for at least 5 minutes. Use the stencil to draw precisely.



LL60 LOW LUMINOSITY WITH 10kΩ RESISTANCE


1x LED

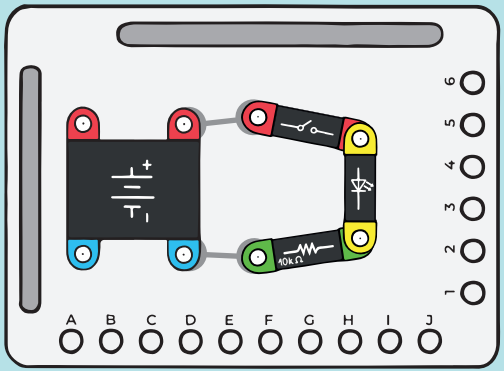

1x resistor 10kΩ


1x battery


1x conductive pen


1x switch

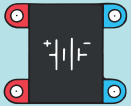
The LED light intensity is determined by the amount of current flowing through the circuit. A resistor included in the circuit blocks the current from flowing. This allows you to adjust the current flow. The smaller the resistance you insert into the circuit, the greater the current that will flow through the circuit and the brighter the LED light will be.



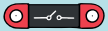
LL70 OVERLY HIGH RESISTANCE


1x LED

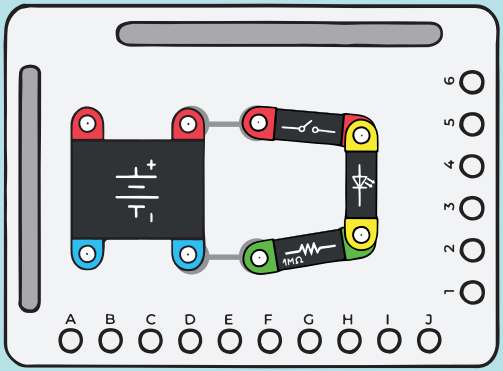

1x resistor 1MΩ


1x battery

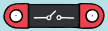

1x conductive pen


1x switch

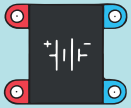
If the resistor we add in series with the LED has too high value, the current flowing through the circuit will be so small that the LED diode will not light up. The ballast resistor to the LED must always be selected so that the current flowing through the circuit is high enough to turn on the LED and at the same time doesn't exceed the maximum value specified by the manufacturer. Exceeding the maximum value of the electric current flowing through the LED leads to the destruction of the LED. The LED modules therefore have protection resistors integrated directly into them.



LL80 SWITCHING WITH BUTTON I.


1x switch


1x button


1x battery


1x

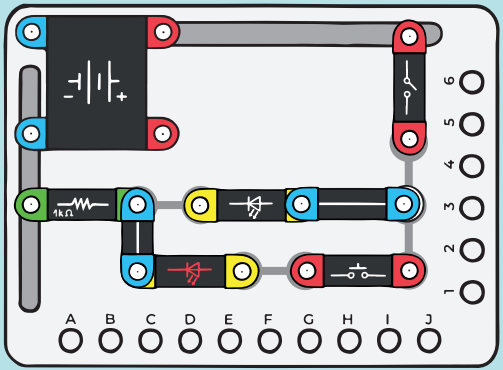

1x


1x

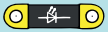

1x resistor 1kΩ


2x LED

In this circuit red and white LEDs are connected in parallel with a common resistor. When the switch is closed, the white LED lights up. If you press the button, you connect the red LED to the white LED in parallel. Since the white LED needs higher voltage than the red one to light up, connecting the red LED to the white LED will lower the voltage. The white LED goes out and the red LED lights up. In this case the button visually acts as a changeover switch even though it does not have a changeover contact.



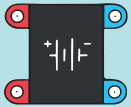
LL90 DRAWN BUTTON


1x LED

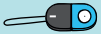

1x resistor 1kΩ

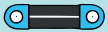

1x bulb


1x button


1x battery

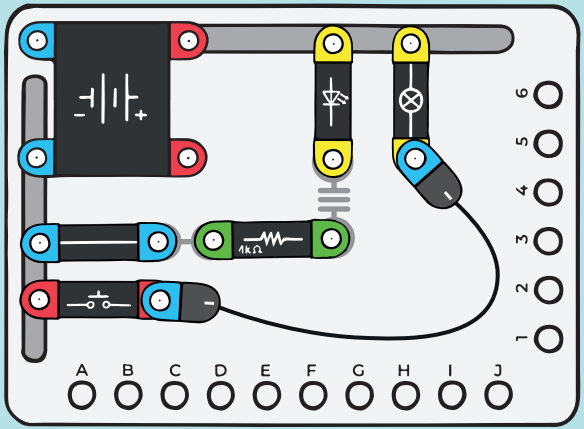

1x conductive pen


1x

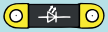

1x

You do not have to use the electrical component button. You can draw it with the conductive pen on either the magnetic pad or a paper. Draw the button using the stencil so that all the proportions are correct. Allow the drawn button to dry for at least 5 minutes and then assemble the entire circuit acording to the picture. The button you just drew works on a simple principle that uses your body's natural conductivity.

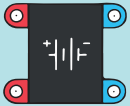
TIP: If you want the button to work the best, draw a conductive circle on your finger. After drying, try touching the button again.



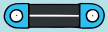
LL100 YOUR OWN BUTTON


1x LED


1x resistor 1kΩ

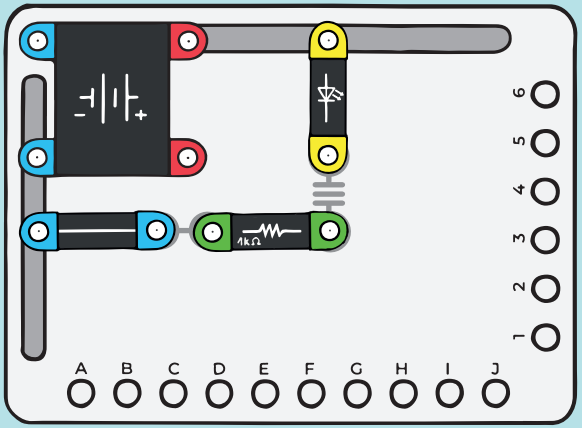

1x battery


1x conductive pen

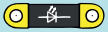

1x

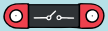
In the previous project, you drew the button using the stencil. Now it's time to give way to your creativity and start creating buttons of all sorts of shapes and sizes. Remember that functionality is affected not only by size and shape but also by the number of layers you draw on top of each other.

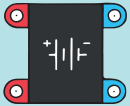
TIP: The more complex the button and the smaller the gap between the conductive parts, the better it will work.



LL110 DRAWN RESISTANCE


1x LED

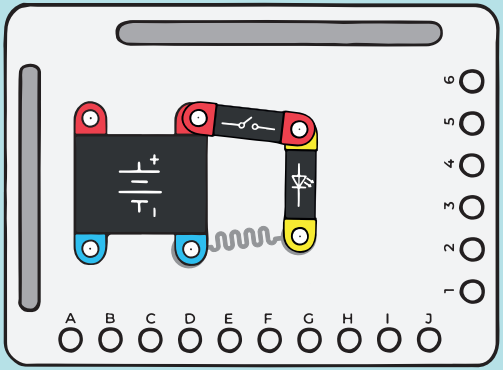

1x switch


1x battery

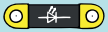

1x conductive pen

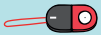
Before you start drawing a component called Resistor, let's talk about what electrical resistance is. Electrical resistance is a physical quantity characterizing the ability of a conductor to prevent the passage of electric current. The value of electrical resistance depends on the material, shape, length but also on the temperature.

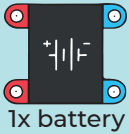
TIP: If you draw 4 waves according to the stencil, the value of the resistance is between 100 and 150 Ω.



LL120 DIFFERENT KINDS OF RESISTANCE


1x LED

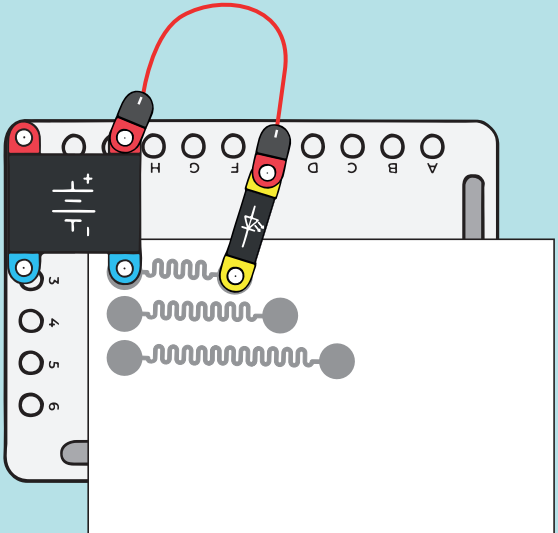

1x


1x battery

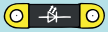

1x conductive pen

In the previous project you tried to draw a resistor. Now let's demonstrate the relation between the value the resistance and its length. The longer the path, the greater the resistance. If you want to calculate how the voltage applied to the diode drops, you can use Ohm's law, which is shown graphically on the right.

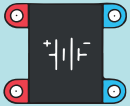
TIP: Try how long path can you draw for the LED to still light up.

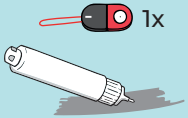


LL130 RESISTANCE COMPARISON


1x LED

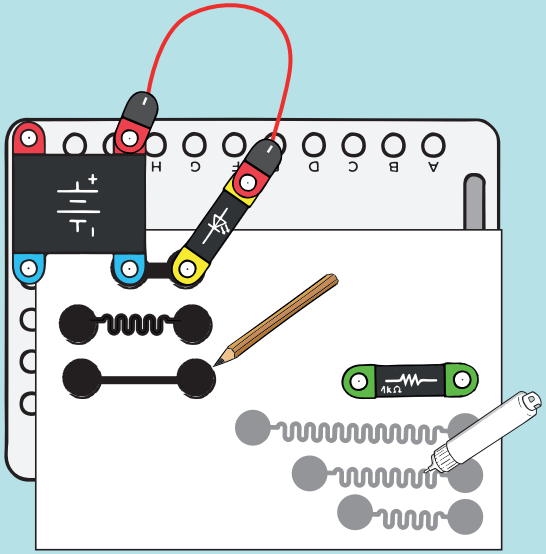

1x resistor 1kΩ


1x battery

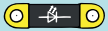

1x conductive pen


paper and pencil

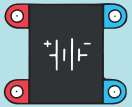
As we have said in previous projects, the value of the resistance also depends on the material. This project will show you how. Draw one type of resistors with an ordinary pencil (the inside of a pencil is made of graphite which is conductive) draw the other type of resistors with our conductive marker. Then connect the circuit with the LED diode and find out how much difference there is in the brightness LED between the two variants.



LL140 THREE BUTTONS


3x LED

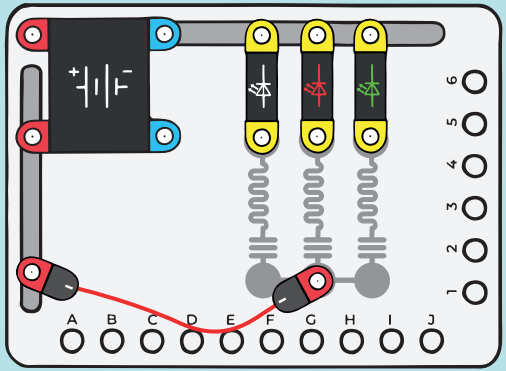

1x


1x battery


1x conductive pen

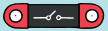
Draw 3 touch buttons, each button will light up a different color of LED. You can press the button with your finger or other conductive object. In this project 50% of the components are drawn.

TIP: If you want the button to work the best, draw a conductive circle on your finger. After drying, try touching the button again.

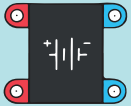


LL150 HIGH LUMINOSITY WITH RESISTOR CONNECTED IN PARALLEL


1x LED


1x switch

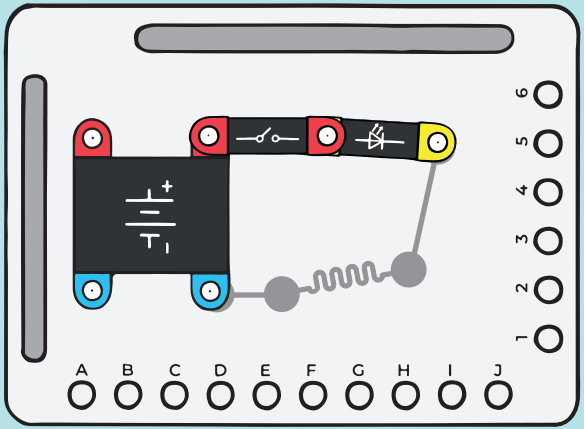

1x resistor 1kΩ


1x battery

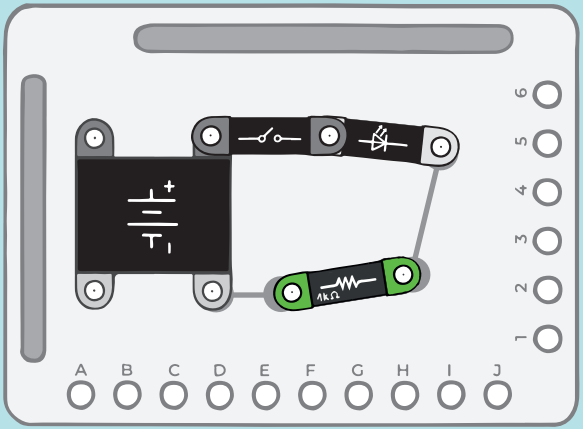

1x conductive pen

You can find the resistor as a component in the package in several values. It is possible to connect them in parallel (next to one another) or in series (in a row). When resistors are connected in parallel, the total resistance value decreases. This is used in cases where we do not have the required value or it is not produced. In the case of two identical resistors, the resistance is halved, thus increasing the LED light brightness. In our case, the botton resistor is drawn.

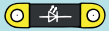
1.



2.

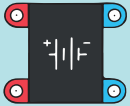


LL160 CONTROLLING BY PHOTORESISTOR


1x LED

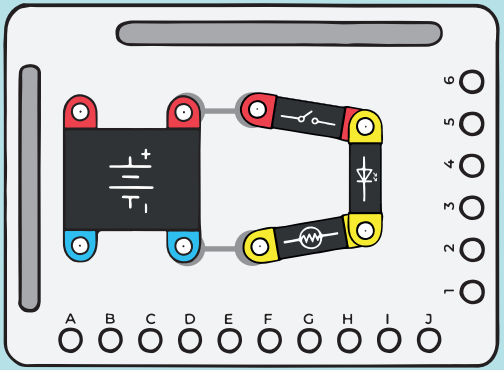

1x photoresistor


1x switch


1x battery

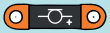

1x conductive pen

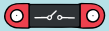
There are electronic components that respond to light. One of them is a photoresistor – its resistance changes with the intensity of incoming light. When you cover the photoresistor with your finger, its resistance increases. This reduces the current flowing through the circuit, which decreases the light intensity of the LED.

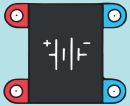


LL170 CONTROLLING BY MICROPHONE


1x LED

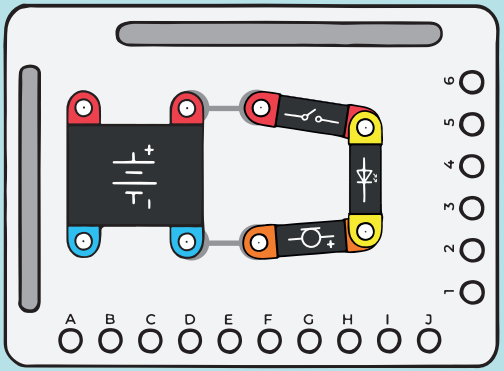

1x microphone


1x switch


1x battery

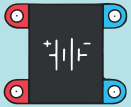

1x conductive pen

A microphone is a component that converts sound into an electrical signal. As a rule, the sound is converted into a diaphragm vibration, which is further evaluated as a change in resistance or capacitance. In the presented circuit, the microphone changes the current in the LED, whose light brightness reacts to the sound interacting with the microphone diaphragm.



LL180 CONNECTION ON PAPER

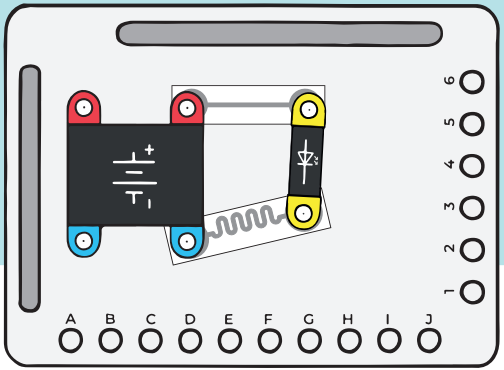

1x LED

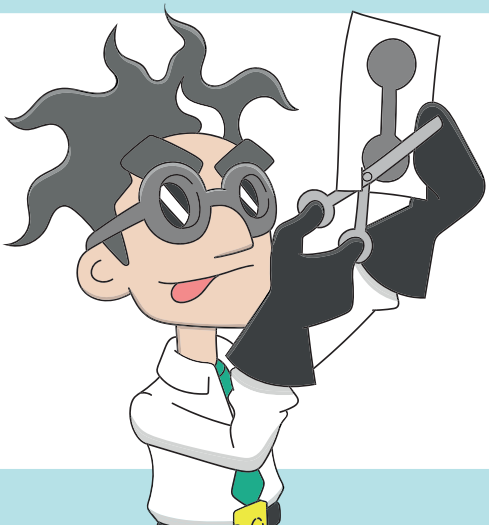

1x battery


1x conductive pen


paper

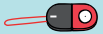
In previous projects, you drew a conductive connection directly on the magnetic pad. However, it is better to draw the connecting components on hard paper. Then you can use them repeatedly and in multiple projects. First, draw a classic conductive path of medium size and resistance (resistor). This makes it easy to connect a circuit with an LED that lights up.

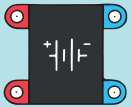




LL190 DRAWN SWITCH AND BUTTON

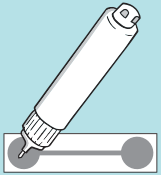

1x bulb


1x

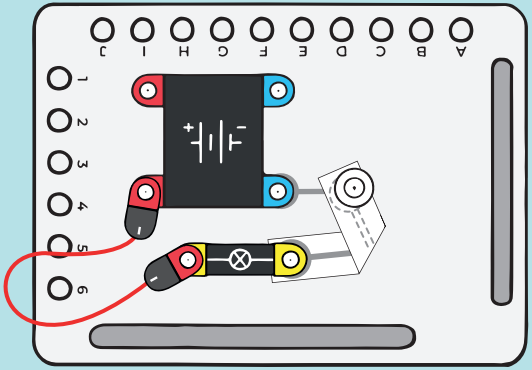

1x battery


1x

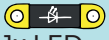
1x conductive pen



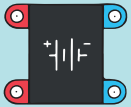
The electrical switch does not need to be just a manually operated component. A magnetic reed switch can sever as an alternative. It consists of two thin flexible steel contacts, usually in a glass flask. When the magnet approaches, the two contacts are magnetized and connect. This closes the electrical circuit and turns on the light bulb. After the magnet is moved away, the contacts open by their own elasticity. This interrupts the flow of electricity and the light goes out.



LL200 DRAWN SWITCH AND LED

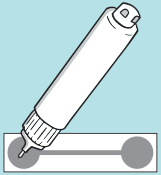

1x LED


1x resistor 1kΩ

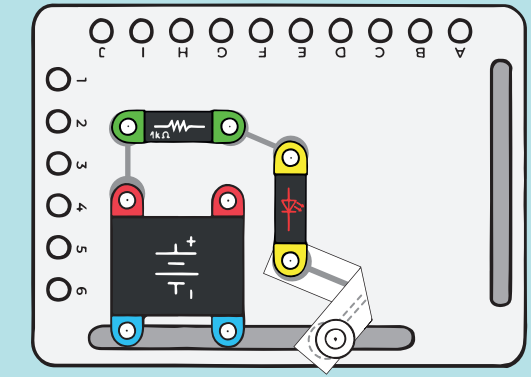

1x battery


1x

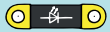
1x conductive pen

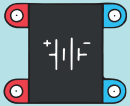


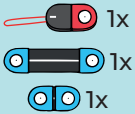
The magnetic reed switch can be used to directly switch a wide range of appliances. However, it is not suitable for large appliances with high current consumption as the contacts may slowly get burned or lose flexibility due to overheating. Although our small bulb represents a marginal load even for a small reed contact, it is always advantageous to minimize the current through the reed contact. Instead of a light bulb, we use a LED diode since it needs rather low current flow values to function.



LL210 SWITCHING LED


2x LED


1x battery

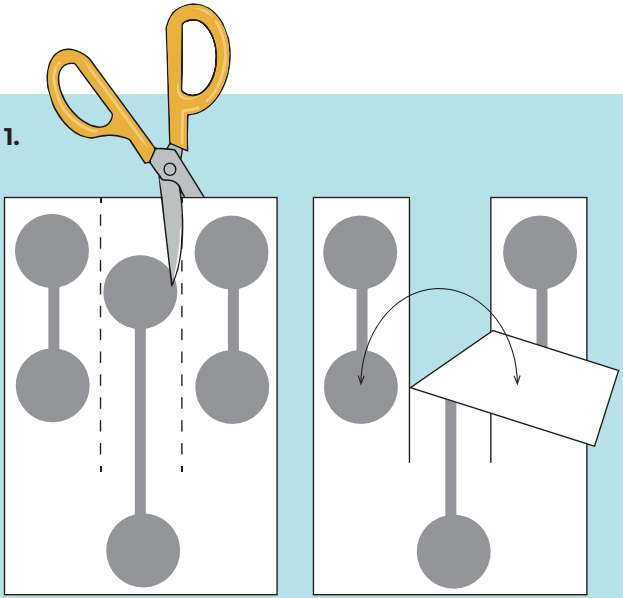

1x
1x
1x


paper

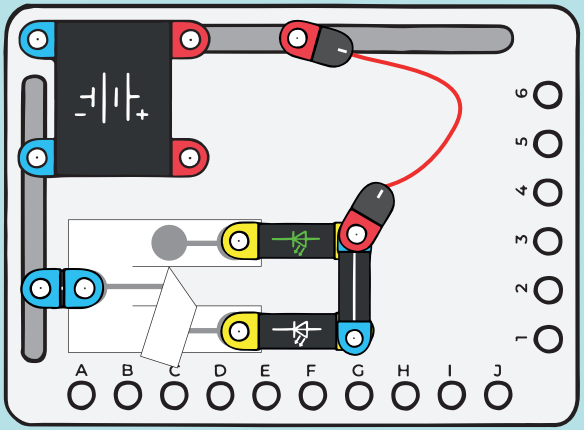

1x conductive pen

Follow the picture below to draw 3 connecting components on a piece of paper and cut in the middle. This makes it easy to draw the switch with conductive ink. The function of such switch is to simply switch between circuit A and circuit B, when one of the circuits is closed the other must be open. Both of these circuits have a common terminal under the designation COM.

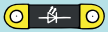
1.



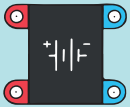
2.



LL220 DRAWN ON/OFF SWITCH


1x LED


1x resistor 1kΩ


1x battery

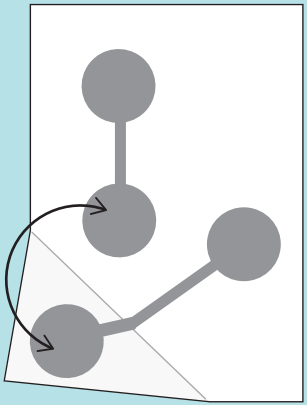

1x conductive pen

1x

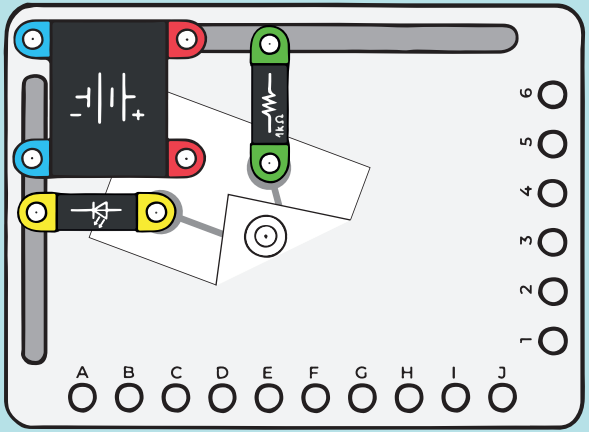

paper

As shown below, draw 2 interconnecting components on a piece of paper and fold the lower left corner to connect the contacts. You can use this drawn component as a button. For keeping the button pressed, use a single-pin white component at the point where the two contacts meet. Each switch always has two positions, OFF and ON.

1.

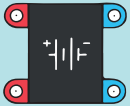


2.

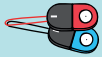


LL230 VARIABLE RESISTANCE


1x LED


1x battery


1x

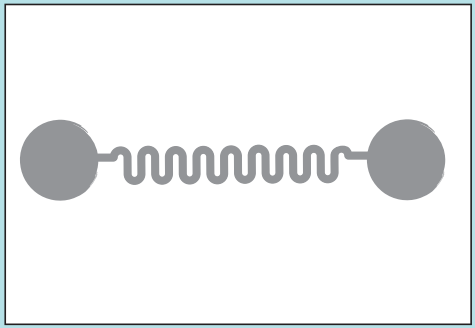

1x
1x


paper

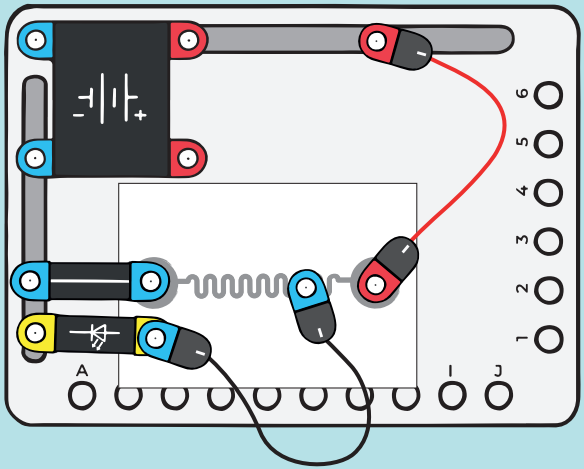

1x conductive pen

Use the stencil to draw a long path. You can use this drawn part as a resistor or as a variable resistor (a resistor that changes its value). By moving the blue wire connection over the drawn variable resistance, you change its resistance and thus the voltage that flows into the diode. You will notice a change in resistance when the LED intensity changes.

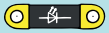
1.



2.

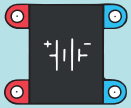


LL240 CHANGING THE CURRENT BY LED - A/B SWITCH


1x LED

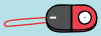

1x resistor 1kΩ


1x resistor 10kΩ


1x battery

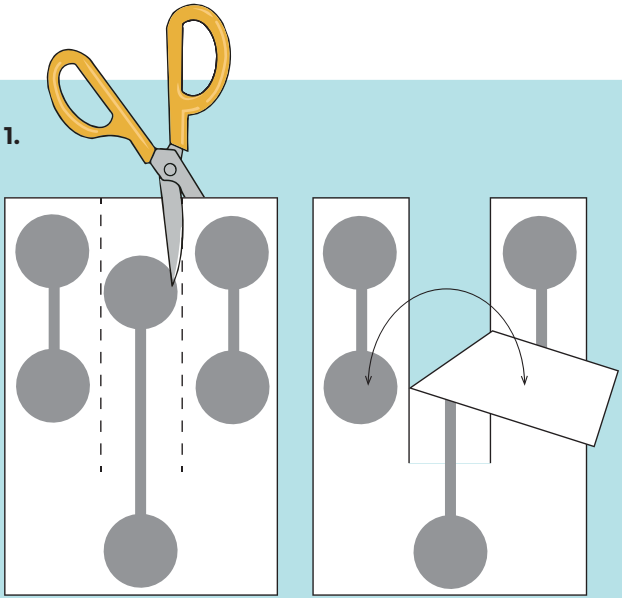

paper


1x conductive pen

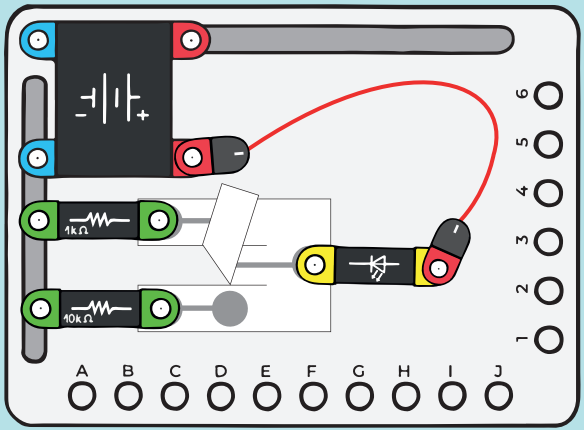

1x

We can use the switch to select two sizes of current flowing through the circuit, which will affect the change in brightness of the LED. In our case, the switch is a conductive layer on the paper as a movable contact, which we alternately apply to the fixed contacts connected to the resistors. We select a resistor that will be included with the LED in series and thus define the amount of current flowing through the circuit.

1.



2.



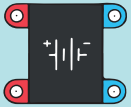
LL250 CONNECTING A LIGHT BULB AND LED IN SERIES


1x LED


1x bulb

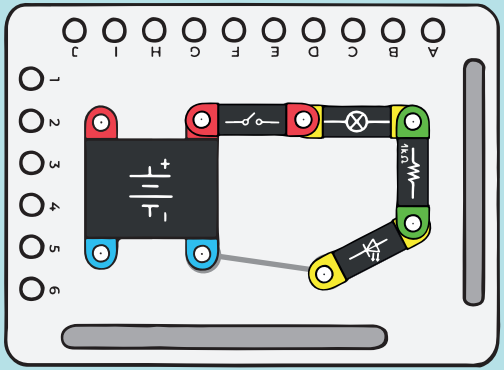

1x switch


1x resistor 1kΩ


1x battery


1x conductive pen

Connecting multiple appliances in a row. The same current flows through both appliances, but the battery voltage is divided between the two appliances. In our circuit, it is reflected in a low brightness of the bulb. In practice, a connection in series is used for the same appliances with the same consumption. One big disadvantage of connecting appliances in series is that the failure of any component will open the circuit, which you can simulate by unscrewing the bulb - the LED goes out.



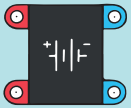
LL260 CONNECTING A LIGHT BULB AND LED IN PARALLEL


1x LED


1x bulb

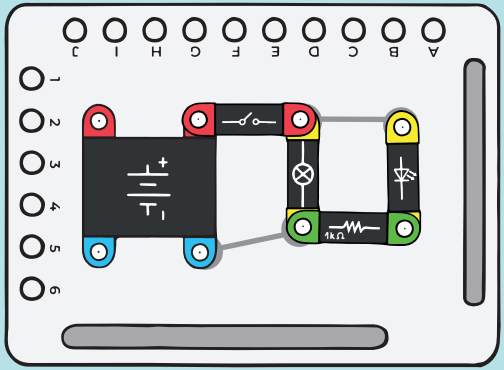

1x switch


1x resistor 1kΩ


1x battery


1x conductive pen

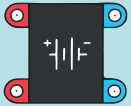
Connecting multiple appliances side by side. The total current drawn from the source is a sum of the partial currents taken. The voltage on both appliances is the same. If one appliance is disconnected from the circuit, it will not affect the rest, only the value of the current flowing through the circuit will decrease. Electricity is distributed to appliances individually in this way.



LL270 LED BYPASS


1x LED


1x button


1x battery

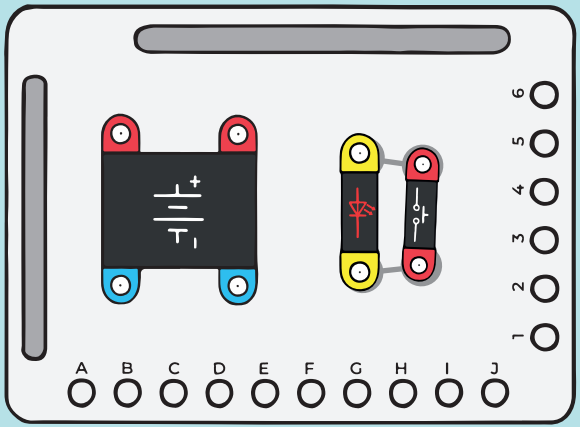

1x conductive pen


1x resistor 1kΩ

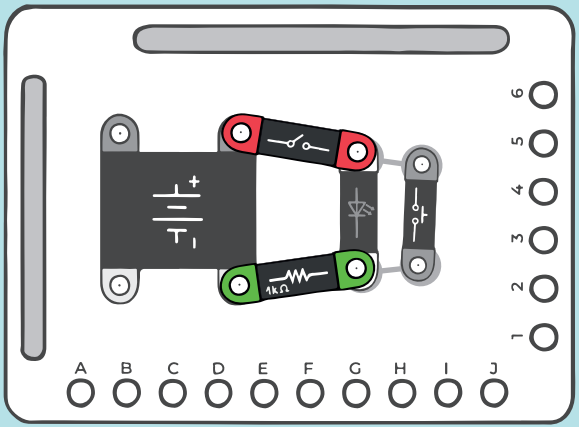

1x switch

A button connected in parallel to the LED. When the button is not pressed, i.e. it is open, the LED light is on. If you press the button, you short-circuit the LED diode and it goes out. It stays off as long as the button is pressed and lights up again when the button is released. The ballast resistor not only protects the LED from excessive current, but also ensures that the button does not short-circuit the battery directly. The resistor thus limits the short-circuit current and protects the battery as well as the button from excessive current.

1.



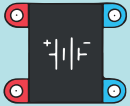
2.



LL280 SMOOTH BRIGHTNESS CHANGE I.


2x LED


1x potentiometer

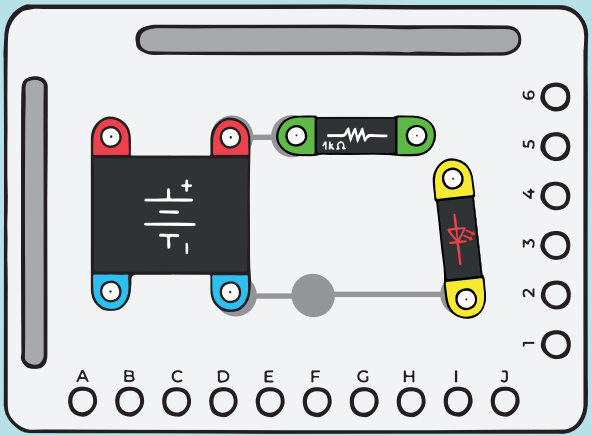

1x battery


1x conductive pen

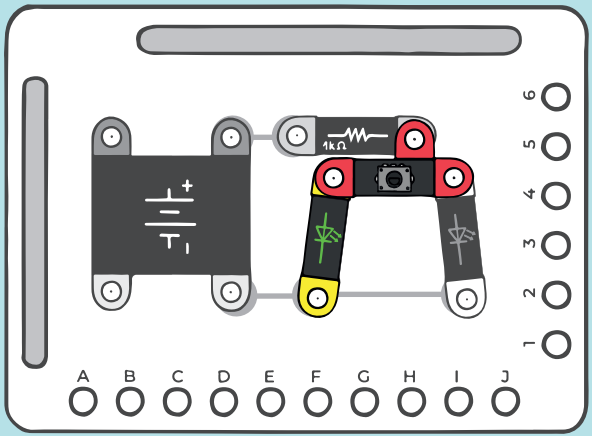

1x resistor 1kΩ

If you want to change the LED current continuously and without step changes, you can use a variable resistor, also called potentiometer, for which the resistance corresponds to the angle of rotation of the small shaft. Structurally, it is a fixed resistor that has an exposed resistance layer, along which the collector travels. By turning the slider you select how much of the resistance path will be included in the circuit. When being turned, it moves away from one end (the resistance of this end increases). Due to the shaft rotation, the brightness „spills" from one LED to the other as the resistance decreases on one side and increases on the other.

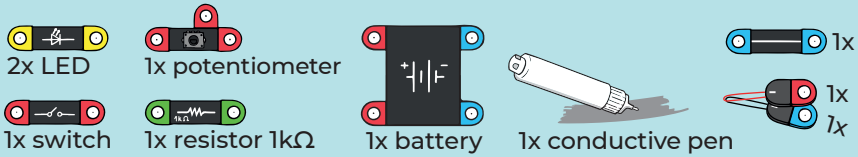
1.



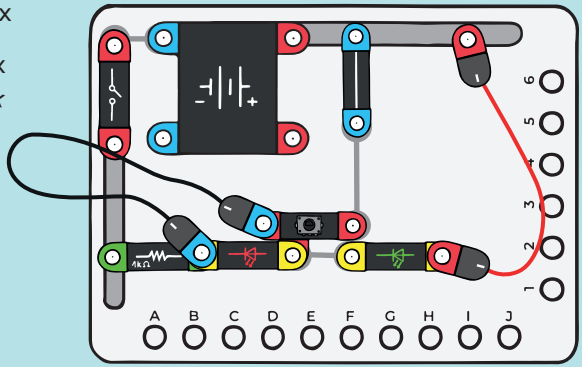
2.



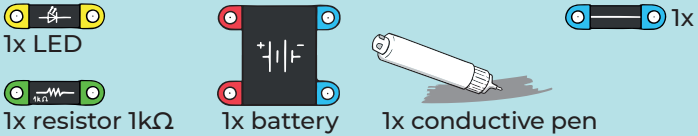
LL290 SMOOTH BRIGHTNESS CHANGE II.



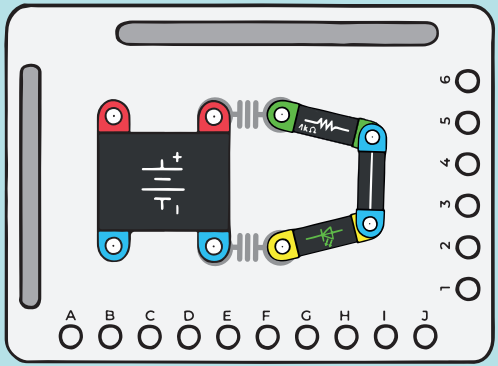
Two LEDs in series with a potentiometer connected in parallel. Use the slider to set the voltage between the LEDs. The build behaves visually as LL280, but now you do not control the current through the LEDs but, instead, control the current flow indirectly - by changing the voltage on the LEDs.



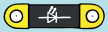
LL300 SAFETY BUTTON



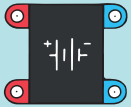
Two buttons connected in series close the circuit only if both buttons are pressed. The circuit closure is indicated by the LED. In practice, this connection is used as a safety element for dangerous machines (e.g. when material needs to be loaded manually under a press) where the operator must press two buttons with both hands to activate the machine. This ensures that both hands are out of the dangerous parts of the machine, which prevents injuries.



LL310 CONDUCTIVITY DETECTOR I.


1x LED

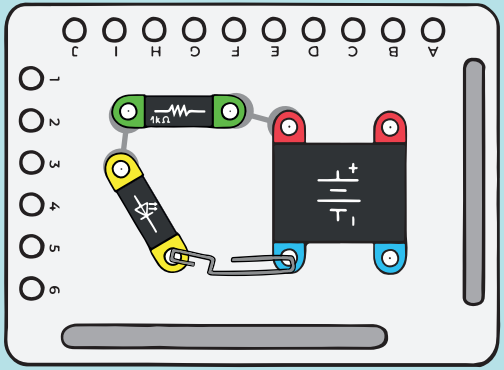

1x resistor 1kΩ


1x battery

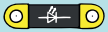

1x conductive pen


1x paper clip

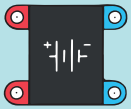
Connect the circuit as shown on the right so that you can test how different objects conduct or do not conduct electricity. For example, you can try to find a metal paper clip or teaspoon and place it on the contacts. If the object is conductive, the circuit will be closed and the LED will light up. In this case, the object has a similar function to a switch.



LL320 HUMAN BODY CONDUCTIVITY DETECTOR

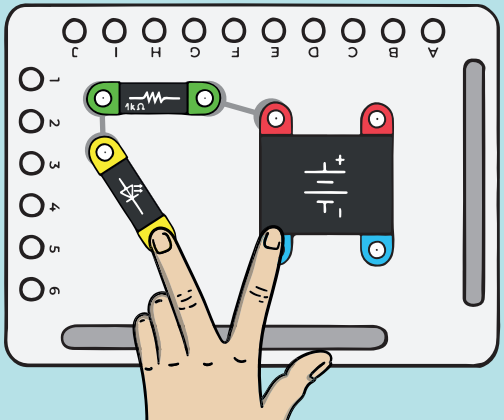

1x LED


1x resistor 1kΩ


1x battery


1x conductive pen

You can use a simple electrical circuit to test the conductivity of your body. The human body is made up mostly of water; however, the human skin is dry and poses high resistance to electrical current. The resistance of the skin decreases when the skin is moist. A moist skin has such a low resistance that enough current flows through the circuit for the LED to give a dim light (this can be best demonstrated with the white LED).

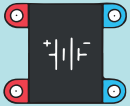


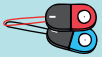
LL330 CONDUCTIVITY DETECTOR II.


1x LED


1x resistor 1kΩ


banana


1x battery


1x

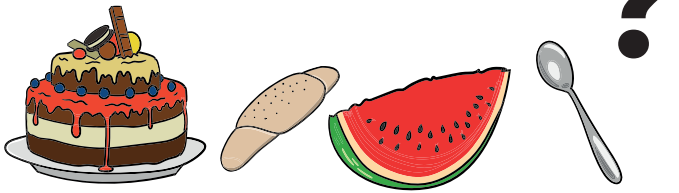
1x


1x conductive pen

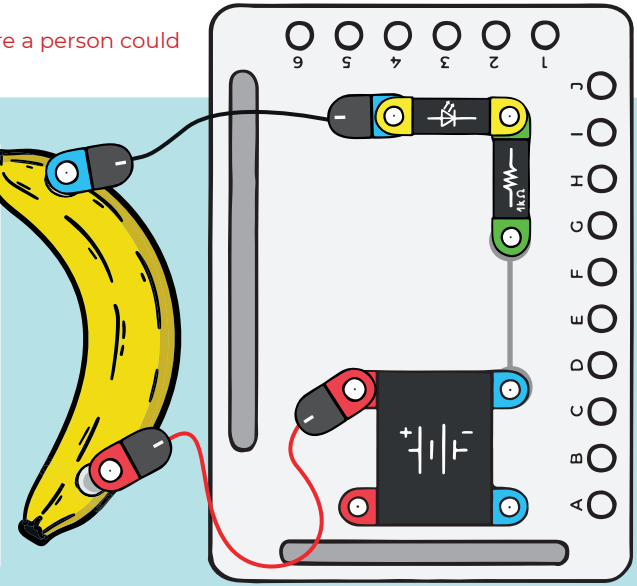
In addition to the human body, which has a high water content, you can test the conductivity of other water-containing things, such as various fruits and vegetables.

WARNING: Never test the conductivity of an electrical network where a person could be injured!

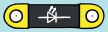
Guess what has the highest conductivity?



(Hint: You can eat almost anything with it - except maybe a bread roll.)

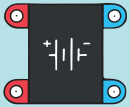


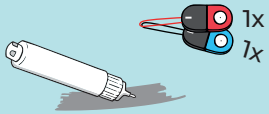
LL340 WATER DETEKTOR


1x LED


1x resistor 1kΩ


hrnek

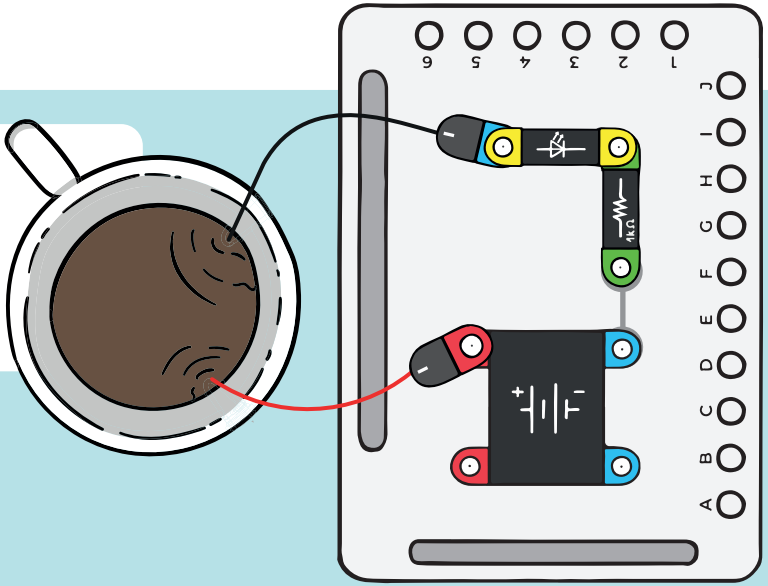

1x battery


1x conductive pen

Test that pure water, tea, or any other liquid is conductive enough to light up the LED in the circuit. Take conductive parts with magnets and connect them to kitchen utensils – you can test the conductivity of water.

TIP: Try testing other household items that conduct electricity, such as a banana, bread roll, etc.

WARNING: Never test the conductivity of the mains as you could get injured!

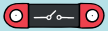


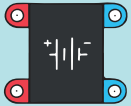
LL350 CARBON BUTTON


1x LED

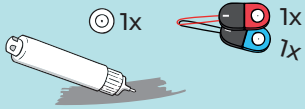

1x transistor NPN


1x resistor 1kΩ


1x switch


1x battery

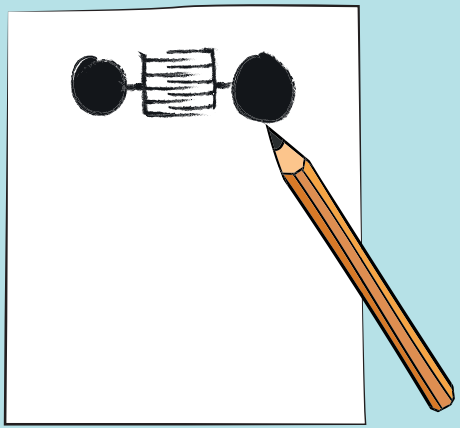

paper and pencil



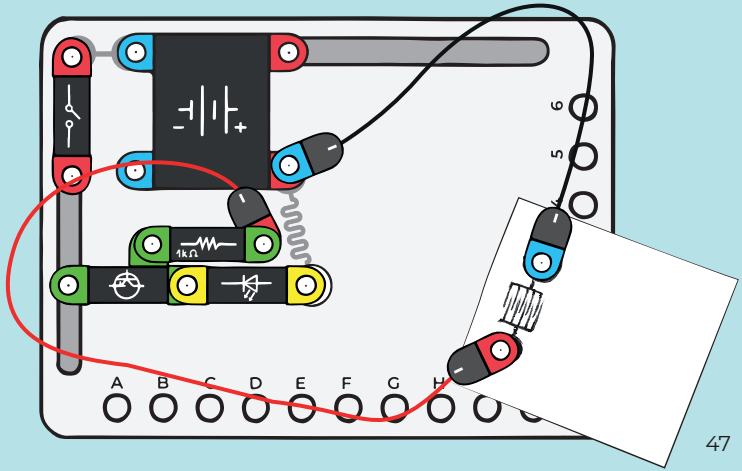
1x conductive pen

You can create a button using a graphite drawing - a set of two separate conductive parts that you connect with the touch of a finger. The current flow through the button is very small, so it is advisable to amplify it with a transistor. This graphic representation of the button is actually used in practice. For example, calculators or remote controls have the same pattern etched on a printed circuit board, and the conductive traces are connected by a graphite layer on the underside of a rubber button. It is a very simple and working solution that does not require separate buttons as additional components.

1.



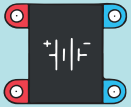
2.



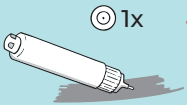
LL360 CARBON POTENTIOMETER

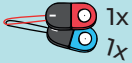

1x LED


1x transistor NPN


1x battery


paper and pencil


1x conductive pen

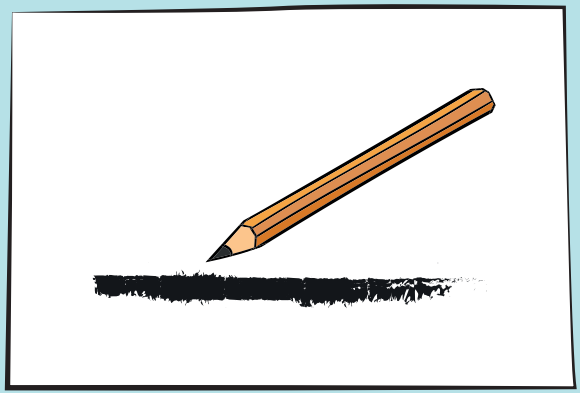

1x
1x


1x resistor 1kΩ

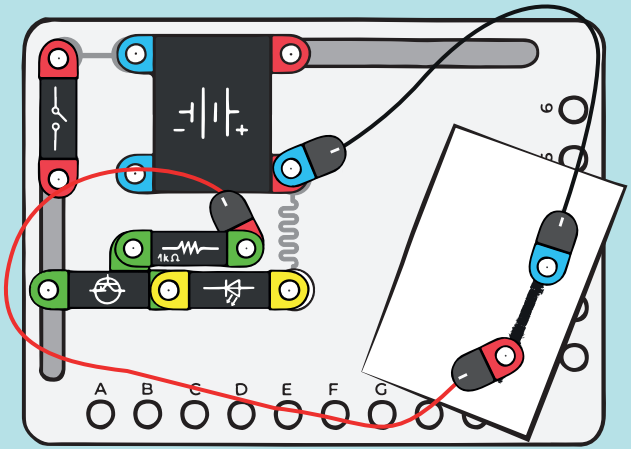

1x switch

The material from which the resistance layer of the potentiometer is made is graphite. It is the same material that forms the ordinary pencil lead. If you draw a thick line on paper with a pencil, a resistance path is created that you can then connect to the conductors in the circuit. The longer the line, the higher the resistance at its ends. The thicker the line, the less resistance there is. Since the resistance value may be too high to turn on the LED directly, we will use a transistor in connection with a common emitter, where we will use the voltage gain to light up the LED. If you fasten one conductive component firmly to one edge of the line and move the other, you will get a variable resistance, i.e. a potentiometer.

1.



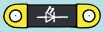
2.

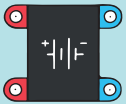


LL370 NPN AMPLIFIER WITH LED

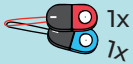

1x potentiometer


1x transistor NPN


1x LED

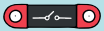

1x battery


1x conductive pen



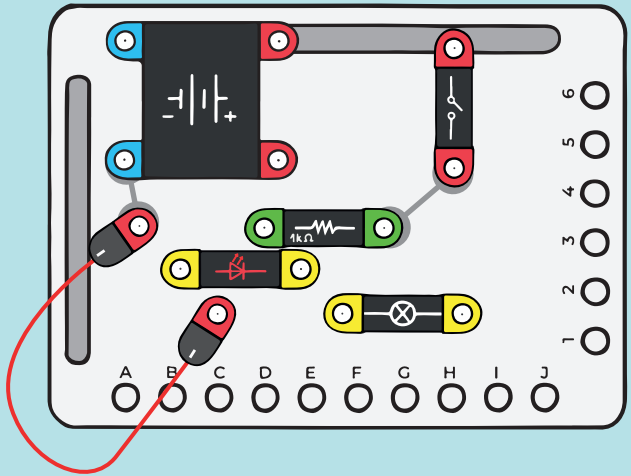

1x resistor 1kΩ


1x bulb

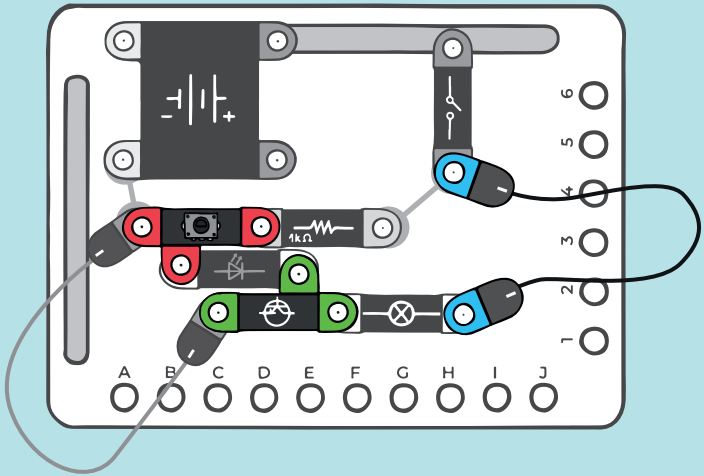

1x switch

The circuit demonstrates the ability of a transistor to amplify an electric current. Use a potentiometer to control the current flowing through a LED diode to the transistor base. A low current that is barely sufficient to turn on the LED will cause the transistor to open and cause a high current to flow through the bulb as the partial opening of the transistor will increase the voltage on the bulb. This build is called a common emitter circuit because the emitter of the transistor is connected to a common power supply.

1.



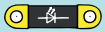
2.

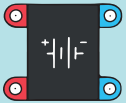


LL380 NPN AMPLIFIER WITH LED IN REVERSE DIRECTION

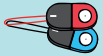

1x potentiometer


1x transistor NPN


1x LED

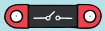

1x battery


1x conductive pen


1x
1x

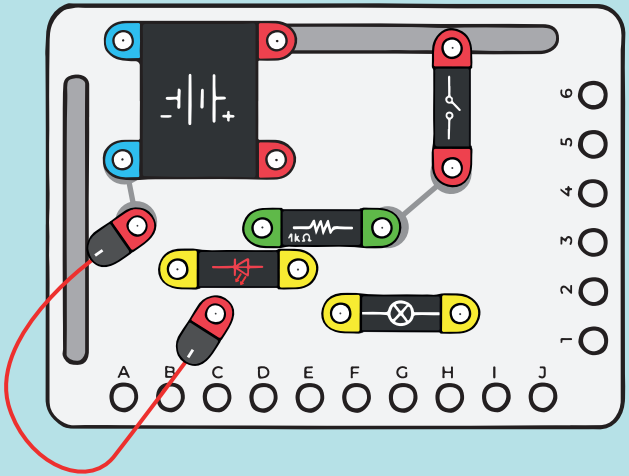

1x resistor 1kΩ


1x bulb

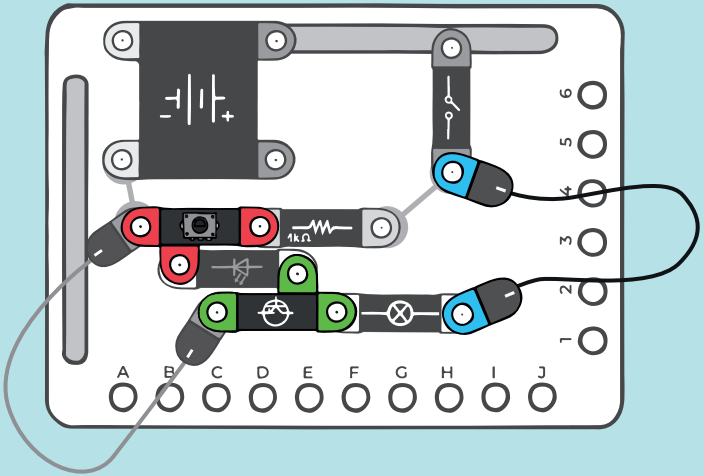

1x switch

This build uses the same circuit as the previous one, just with the LED connected in the reverse direction. Therefore, no current flows into the transistor base and the bulb does not give light.

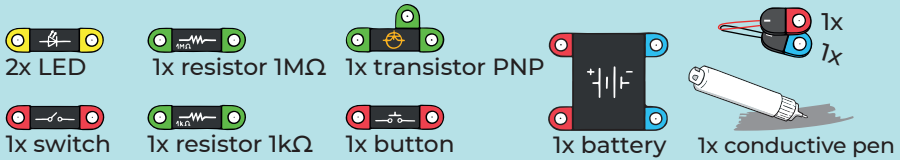
1.



2.

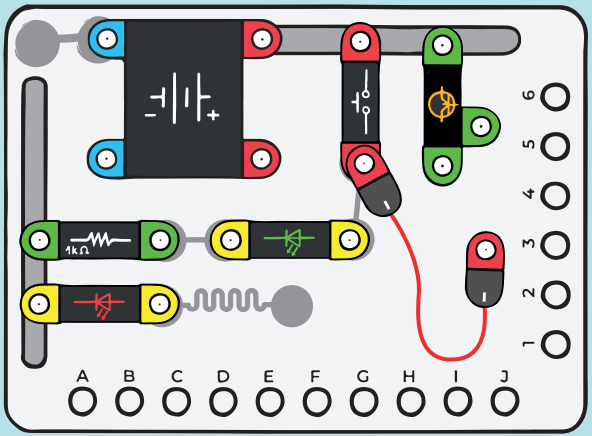


LL390 SWITCHING WITH BUTTON II.

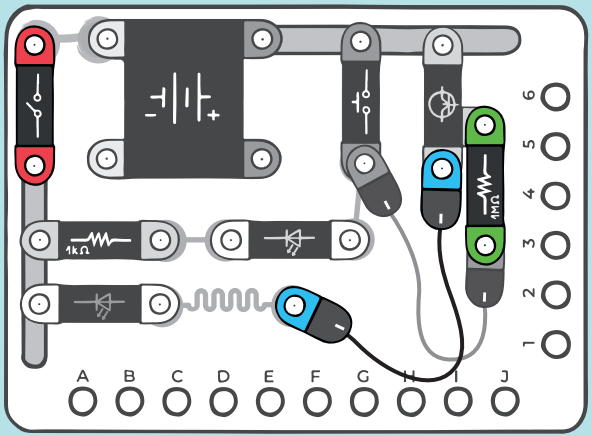


To switch between the red and the white LEDs, we used significantly different properties of both LEDs (different lighting voltages). However, if you want to switch similar or the same LEDs, you need to choose a different solution. You can use a PNP transistor. In this case, it acts as a switch that opens (and thus the corresponding LED goes out) if you press the button. At the same time, the button switches the second LED on, and it should light up when the button is pressed.

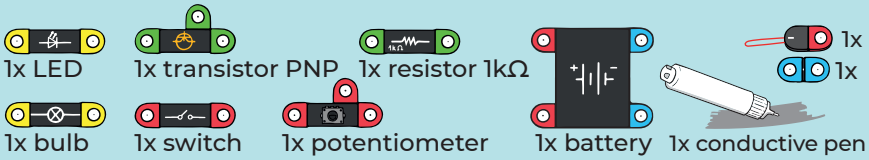
1.



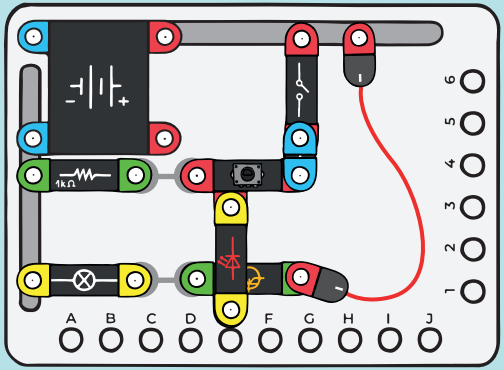
2.



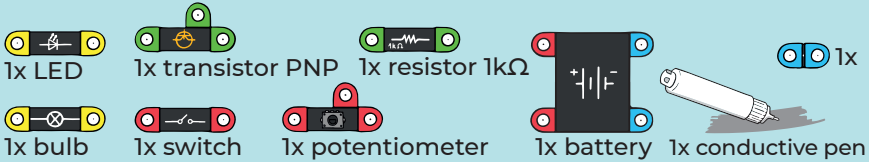
LL400 COMMON EMITTER PNP AMPLIFIER WITH LED AND BULB



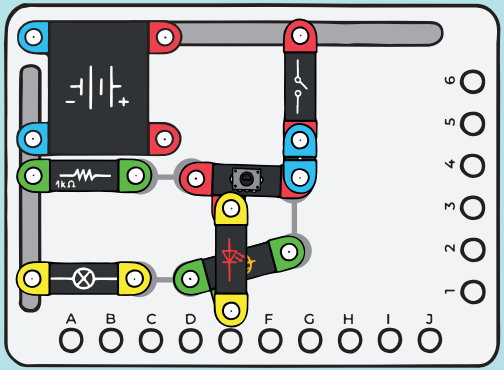
Functionally, it is the same circuit as the LL370, just with a transistor of opposite conductivity. The base current flows in the opposite direction. Therefore, it is necessary to modify the base circuit accordingly.



LL410 PNP AMPLIFIER WITH LED IN REVERSE DIRECTION



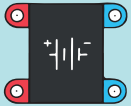
Use a potentiometer to control the current flowing through a LED diode to the transistor base. However, the LED is in the reverse direction, and so no current flows through the base and there is nothing to amplify. The bulb cannot light up because the transistor is closed.

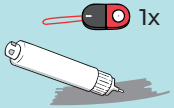


LL420 PNP AMPLIFIER WITH COMMON COLLECTOR I.

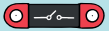

1x potentiometer


1x transistor NPN


1x battery

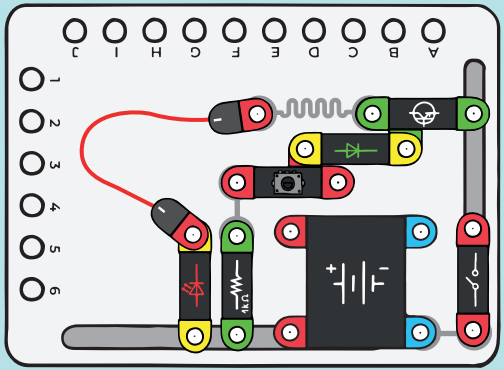

1x conductive pen


1x resistor 1kΩ

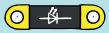

1x switch

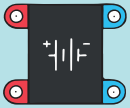

2x LED

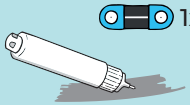
The circuit demonstrates the ability of a transistor to amplify the electric current. Use a potentiometer to control the current flowing through LED diode to the transistor base. A low current that is barely sufficient to turn on the LED will cause the transistor to open to the extent that the voltage on the LED is sufficient to light it up.



LL430 FUSE

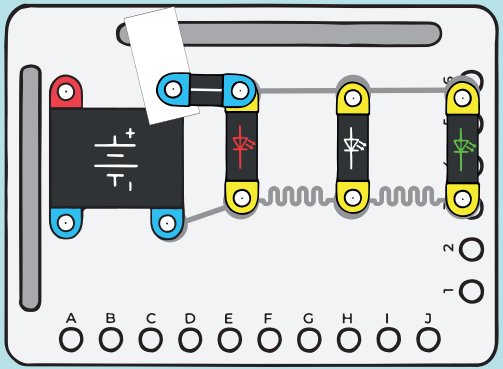

3x LED


1x battery

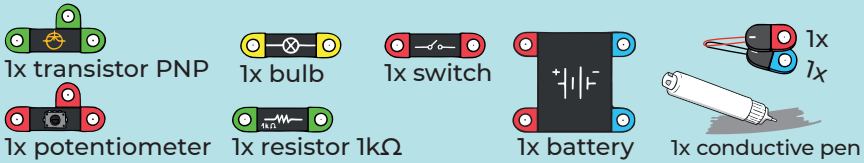

1x conductive pen


paper

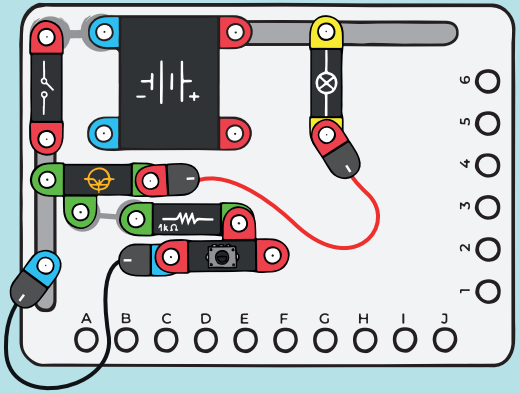
The kit's own magnetic contacts can serve as a switching element. If we insert a non-conductive material, such as paper, between the joints, we will temporarily interrupt the flow of electricity. By removing the paper, the contact between the magnetic contacts is restored, the electrical circuit is closed and the LEDs light up.



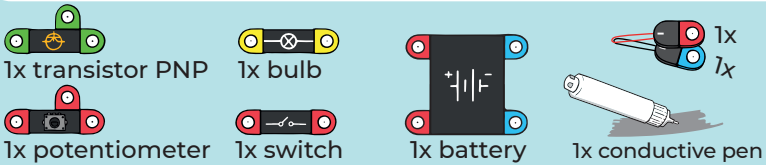
LL440 PNP AMPLIFIER WITH COMMON COLLECTOR I.



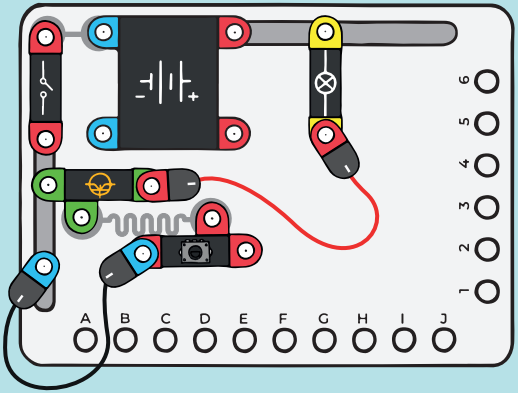
Functionally, it is the same circuit as the emitter follower with NPN, just with a transistor of opposite conductivity. The base current flows in the opposite direction. Therefore, it is necessary to modify the base circuit accordingly.



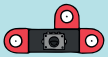
LL450 PNP AMPLIFIER WITH COMMON COLLECTOR II.



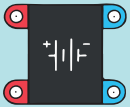
Changing the base resistor to a low value of 100 Ω will increase the current flowing to the transistor base, but the bulb brightness remains almost constant. This is because the voltage on the bulb still corresponds to that on the potentiometer slider although the circuit would be able to supply more current. However, since the load is still just one bulb, the amount of current consumed does not increase, so changing the resistor has virtually no effect.

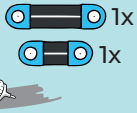


LL460 COMMON EMITTER AMPLIFIER WITH NPN AND BULB

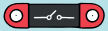

1x potentiometer


1x transistor NPN


1x battery


1x conductive pen

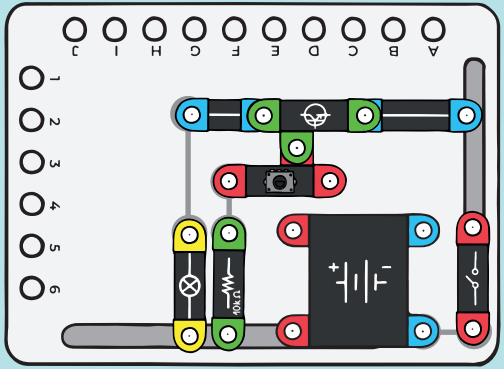
1x


1x switch

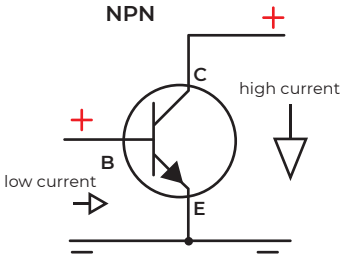

1x resistor 10kΩ

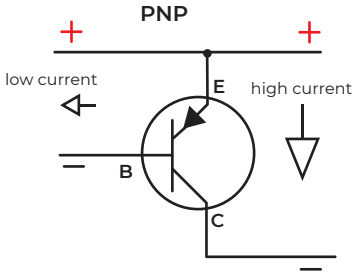

1x bulb

By changing the low current to the transistor base, you can control the high current flowing through the bulb since opening and closing the transistor causes the voltage on the bulb to change. We use an NPN transistor in this case.



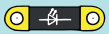
We control a high collector current with a low current to base B. NPN and PNP transistors differ in the direction of the base current.

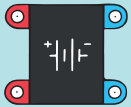




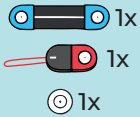
LL470 BUTTON - BRIGHTER LIGHT WITH NPN


1x transistor NPN

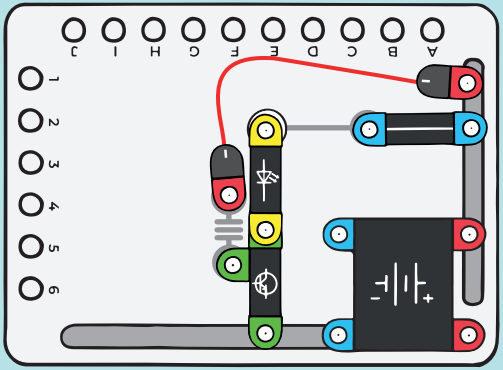

1x LED


1x battery


1x conductive pen


1x
1x
1x

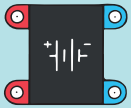
The NPN transistor is connected here as a transistor current amplifier. The very small current flowing through the contact pads to the base of the transistor is amplified by the transistor. The LED connected in the collector circuit of the transistor thus lights up much brighter than if it were switched directly by the contact pads.



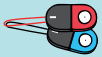
LL480 BUTTON - BRIGHTER LIGHT WITH PNP


1x transistor PNP

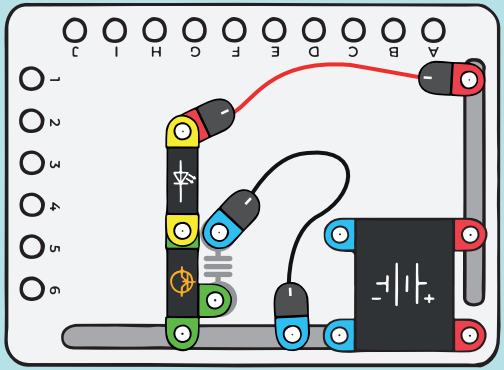

1x LED


1x battery


1x conductive pen

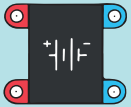

1x
1x

We can also use a PNP transistor as a transistor amplifier and, in addition to the collector, we can also connect the LED to the emitter circuit. Using a PNP transistor, the direction of the base current is reversed, when the touch button is switched to ground. The connection of an LED diode in the emitter circuit means that the current through the LED diode is not an amplified current flowing through the touch button, but is defined only by the amplification of the transistor.



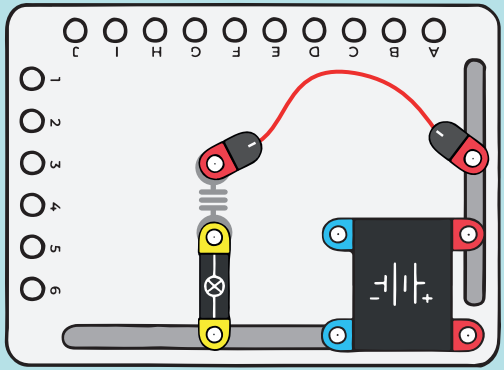
LL490 BUTTON - BULB DOESN'T LIGHT UP


1x bulb


1x battery

1x conductive pen

Current-intensive appliances, such as a light bulb, cannot be switched directly by a touch button. Its resistance is so great that not enough current can flow through the circuit to turn on the light bulb.



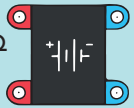
LL500 BUTTON - BULB LIGHTS UP

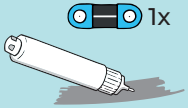

1x transistor PNP


1x transistor NPN

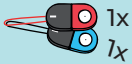
1x resistor 1kΩ


1x bulb


1x battery

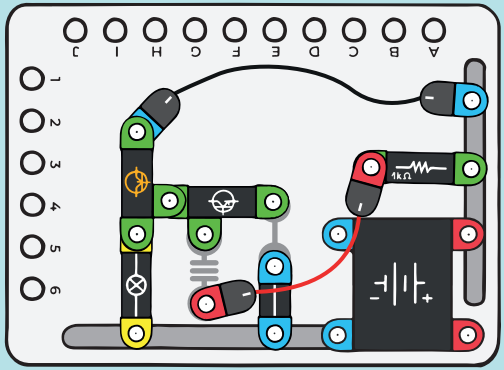


1x conductive pen



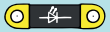
Using a pair of transistor amplifiers, we can turn on the light bulb also with a touch button. With the NPN transistor, we amplify the contact current through the button and we amplify it again with the PNP transistor. When the button is touched, the bulb lights up at full brightness, as if it were connected directly to the battery.

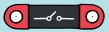
CAUTION: the PNP transistor may become hot during operation, so it is not advised to leave the bulb on for a long time.

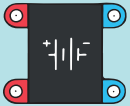


LL510 LIGHT ALARM


1x transistor NPN


1x LED


1x switch


1x battery

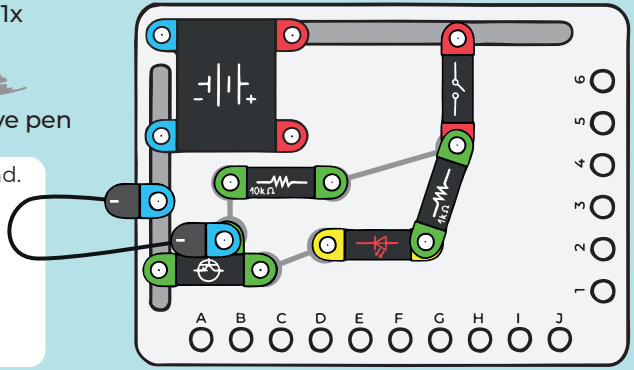

1x

1x conductive pen


1x resistor 1kΩ

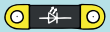

1x resistor 10kΩ

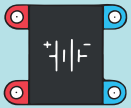
At rest, the base of the transistor is short-circuited by a conductor to ground. No current flows into the base and the transistor is closed. The LED is off. If the conductor is broken, the transistor opens because a current already flows into the base and the LED lights up.

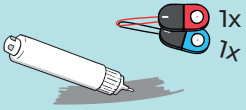


LL520 INTENSIVE LIGHT ALARM


1x transistor NPN


1x LED


1x battery


1x

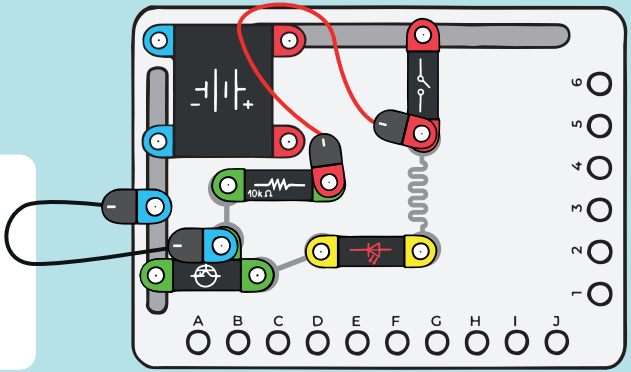
1x

1x conductive pen


1x resistor 10kΩ


1x switch

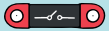
By replacing the red LED with a white LED that has a different resistance, you will obtain an intensive light alarm.



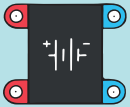
LL530 BRIGHTNESS CONTROL


1x LED


1x potentiometer

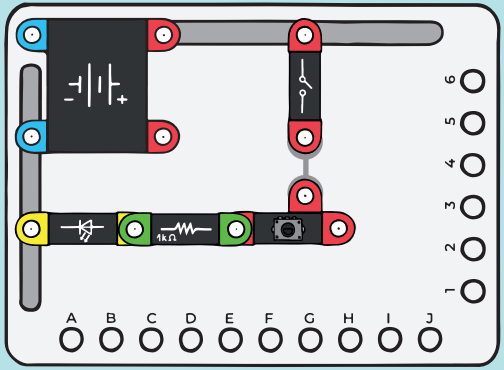

1x switch


1x resistor 1kΩ


1x battery


1x conductive pen

With the potentiometer you can directly control the current flowing through the LED diode and thus change its brightness. A small resistor in series serves as a current limiter when the potentiometer is set to the extreme position where it has zero resistance.



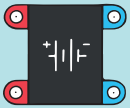
LL540 TWO-FINGER TOUCH LAMP


1x LED


1x transistor NPN

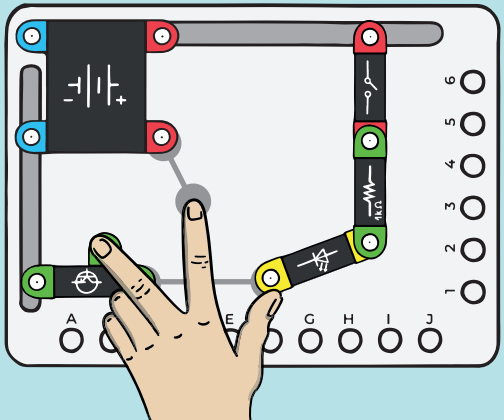

1x switch


1x resistor 1kΩ


1x battery


1x conductive pen

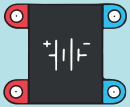
In addition to the graphite potentiometer, you can use your own fingers to turn on the transistor. Just touch the base terminal with one finger and the power supply contact with the other finger. For NPN it is the positive contact of the power supply, for PNP it is the negative contact. A very low current flows through the hand, which is then amplified by the transistor to a value that is enough to light up the LED diode.

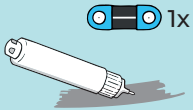


LL550 CONTROLLING NPN TRANSISTOR BY LIGHT I.


1x bulb


1x transistor NPN


1x battery

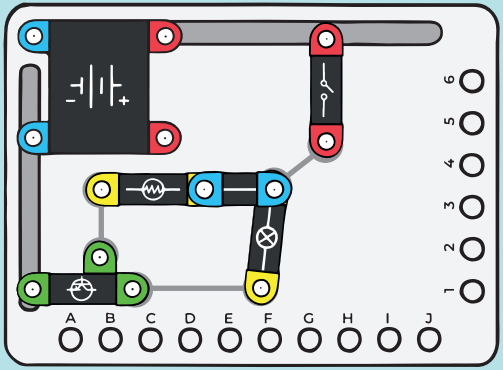

1x

1x conductive pen


1x photoresistor


1x switch

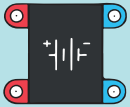
The more the photoresistor is illuminated, the more light the bulb emits since the transistor opens. The build is functionally the same as LL160, however the direct series combination of a photoresistor and bulb would have such a high resistance that the bulb would not light up on battery power. That is why we will use the transistor as a voltage amplifier for the bulb.

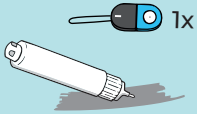


LL560 CONTROLLING PNP TRANSISTOR BY LIGHT I.


1x bulb


1x transistor PNP


1x battery

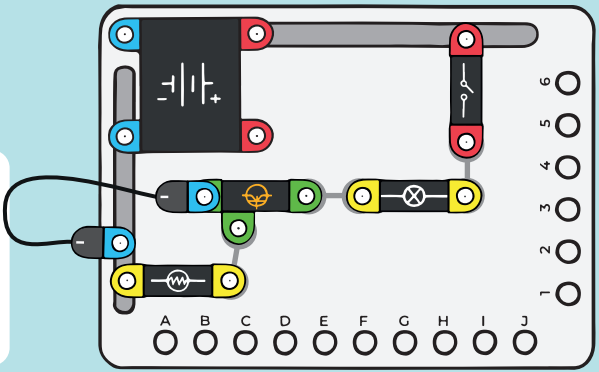

1x

1x conductive pen


1x photoresistor


1x switch

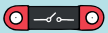
Functionally, this is the same build as LL550, but with a transistor of opposite conductivity. The direction of the base current is opposite, so it is necessary to modify the base circuit. The bulb is connected in the emitter circuit (see LL460), so the bulb reacts with lower brightness because the voltage on the bulb is low as it copies the voltage on the photoresistor.

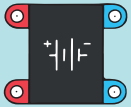


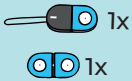
LL570 CONTROLLING NPN TRANSISTOR BY LIGHT II.


1x bulb


1x transistor NPN


1x switch


1x battery


1x

1x

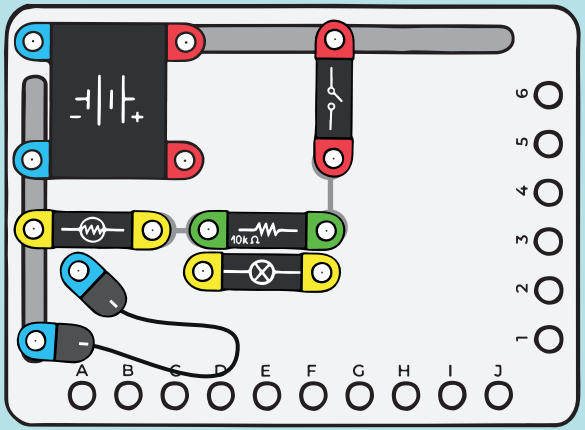

1x conductive pen


1x photoresistor

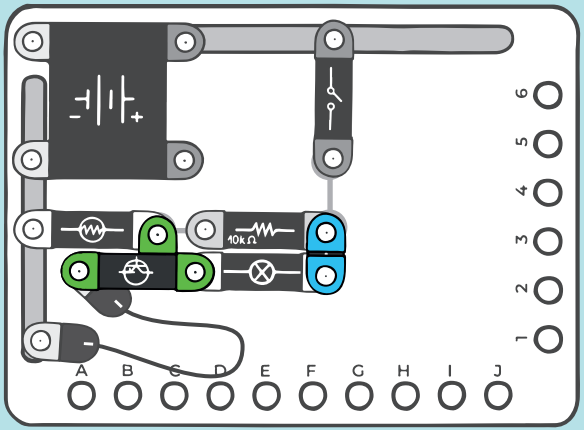

1x resistor 10kΩ

The photoresistor together with the resistor form a voltage divider, the output voltage of which depends inversely on the degree of illumination. The less the photoresistor is illuminated, the more the transistor opens, the voltage on the bulb and the current through the bulb increase until the bulb lights up. When illuminated, the current to the transistor base drops and the bulb goes out as the transistor closes.

1.



2.

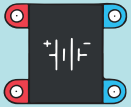


LL580 CONTROLLING PNP TRANSISTOR BY LIGHT II.


1x bulb


1x transistor PNP


1x resistor 1kΩ


1x battery


1x

1x

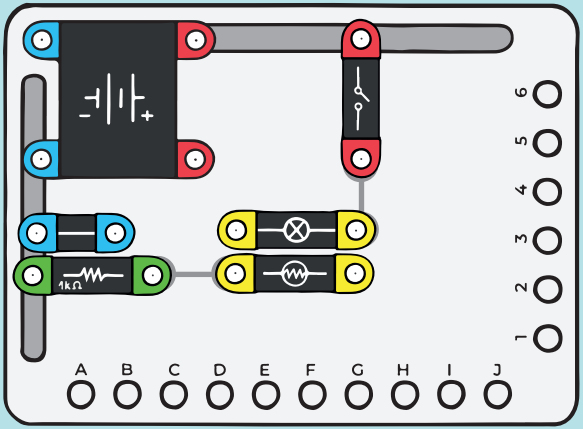

1x conductive pen


1x photoresistor

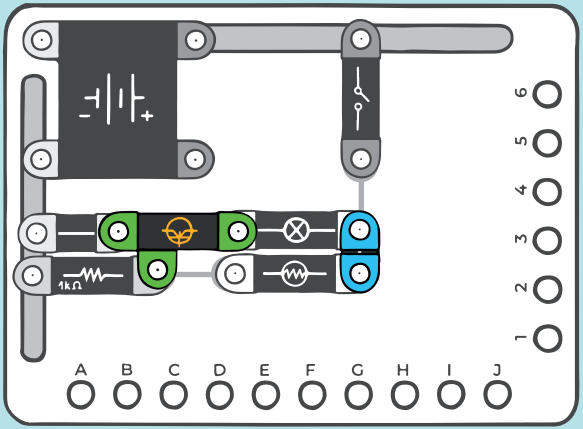

1x switch

Functionally, this is the same build as LL570 but with a transistor of opposite conductivity. The direction of the base current is opposite, so it is necessary to modify the base circuit. The bulb lights up again when the photoresistor is darkened, but because it is again connected in the emitter circuit, the voltage on the bulb is low and the bulb responds with lower brightness.

1.



2.



LL590 CONTROLLING BULB BY LIGHT I.


1x potentiometer


1x transistor PNP

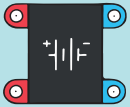

1x transistor NPN

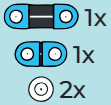

1x photoresistor


1x bulb


1x resistor 1kΩ


1x resistor 10kΩ

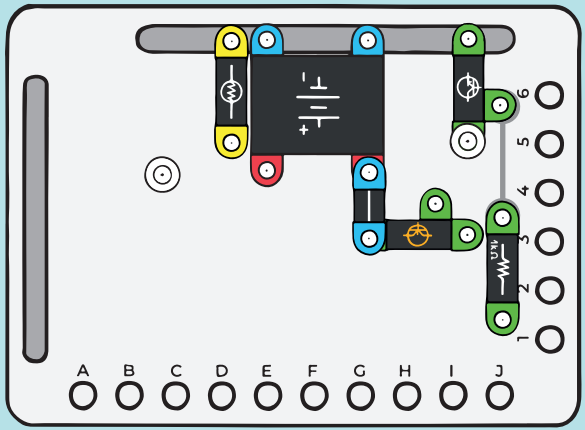

1x battery


1x
1x
2x

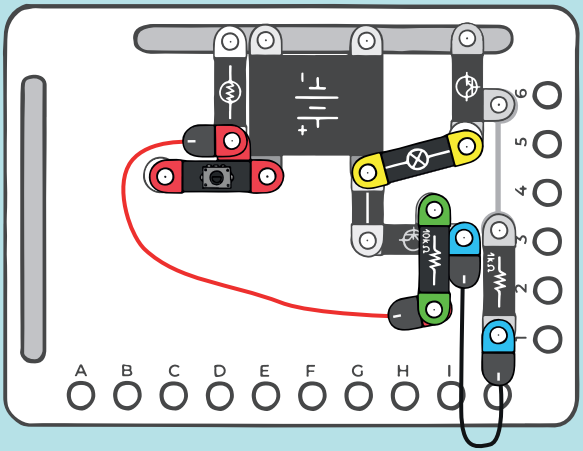

1x conductive pen

With the help of a double transistor amplifier we can increase the sensitivity of the whole circuit to light and the higher amplification also allows a much wider possibility of setting the sensitivity of the reaction to light with a potentiometer. This is achieved by not switching the appliance directly through the PNP transistor, but by another NPN transistor, which essentially acts as the appliance's power switch. With the unshaded photoresistor, turn the potentiometer all the way to the left and slowly turn it to the right to find the point where the light bulb lights up. When the photoresistor is obscured, the bulb goes out. The project thus serves as an indicator of sufficient lighting.

1.



2.



LL600 CONTROLLING BULB BY LIGHT II.


1x potentiometer


1x transistor PNP

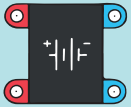

1x transistor NPN

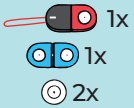

1x photoresistor


1x bulb


1x resistor 1kΩ

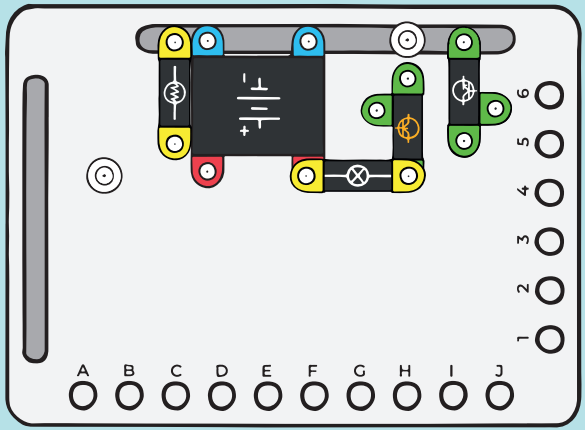

1x resistor 10kΩ


1x battery

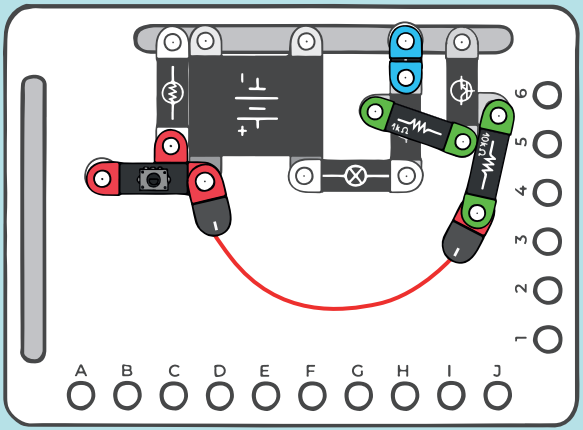

1x
1x
2x

By swapping transistors, we get a circuit that works in the opposite to the previous project. The bulb will not light up when the photoresistor is lit, but on the contrary when it is shaded. Turn the potentiometer to the left and slowly turn it to the right to find the moment when the bulb goes out (with the photoresistor uncovered). Subsequently, when the photoresistor is covered by hand, the lamp lights up.

1.



2.



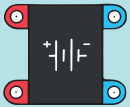
LL610 BLINKING LIGHT

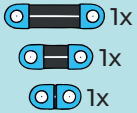

1x potentiometer

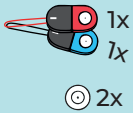

1x transistor PNP


1x transistor NPN


1x capacitor 100nF


1x battery

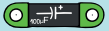

1x
1x
1x

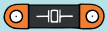

1x
1x
2x


1x resistor 1kΩ


1x resistor 10kΩ

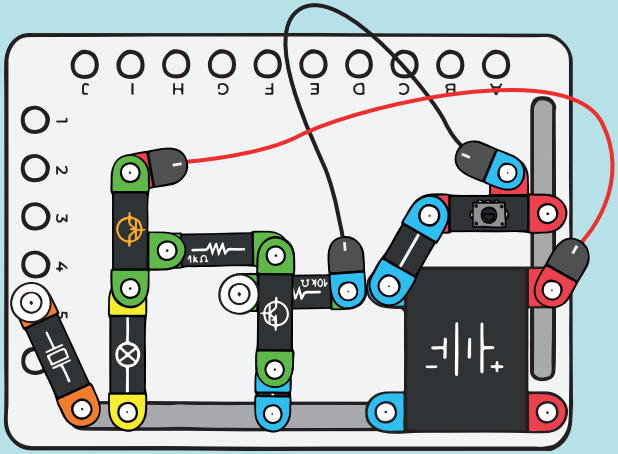

1x bulb


1x capacitor 100µF

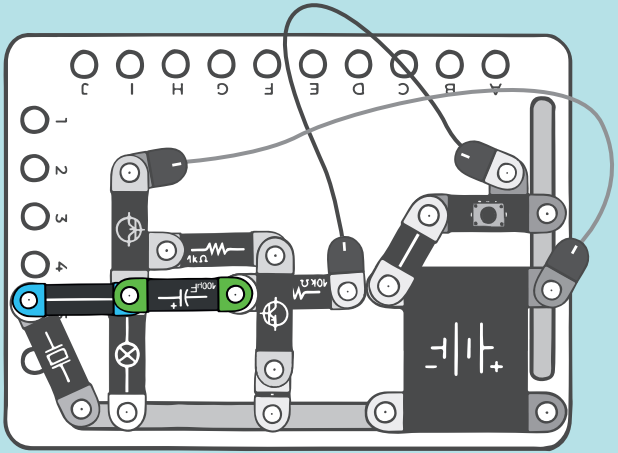

1x buzzer

A pair of transistors functioning as switches can be used to build a simple oscillator, ie a circuit that generates a periodic signal by constantly opening and closing the transistors. Turn the potentiometer to the left when the bulb is lit, then slowly turn it to the right to find the position when the bulb just goes out. Leave the potentiometer in this position and the switched off light bulb should light up after a while and the flashing mode should start. This puts the circuit in an oscillating state - regular opening and closing of the transistors. By replacing the 100 µF capacitor with 100 nF, the circuit starts to oscillate faster and we hear a continuous tone from the piezoelectric transducer.

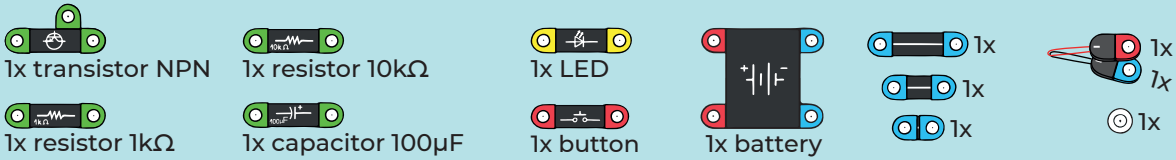
1.



2.

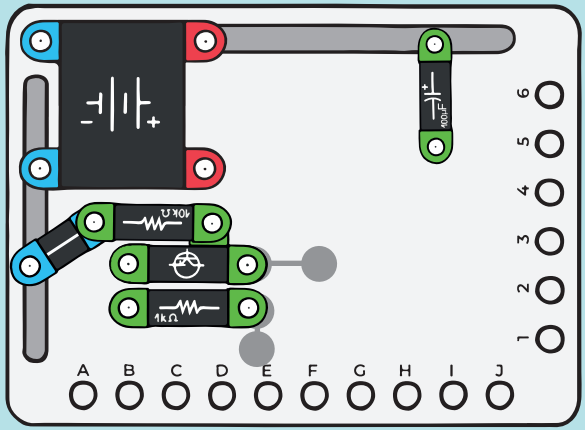


LL620 NIGHT LIGHT AUTOMATIC SWITCH-OFF I.

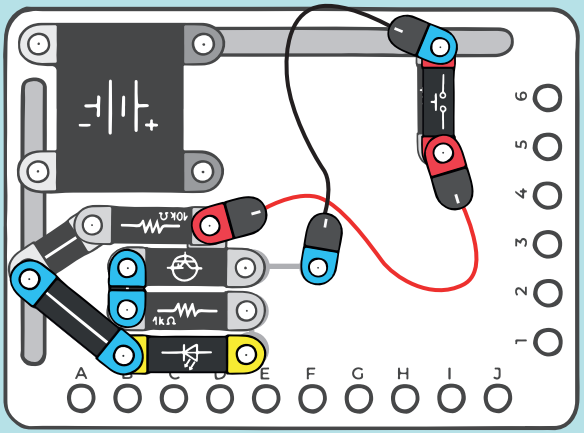


When the switch is turned to the ON position, the capacitor starts charging. As the capacitor charges, the current flowing through it decreases. This also closes the transistor and the LED slowly dims until it goes out. Press the button to discharge the capacitor and the LED will light up again and slowly dim until the capacitor is fully charged again.

1.



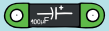
2.



LL630 LIGHT BULB GOES OUT SLOWLY


1x transistor PNP

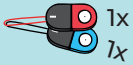

1x transistor NPN

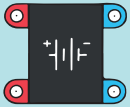

1x capacitor 100µF


1x bulb


1x resistor 1kΩ


1x resistor 10kΩ


1x
1x


1x battery

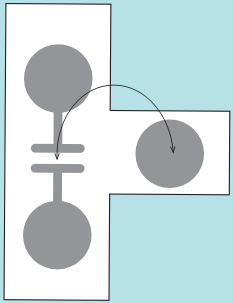

1x conductive pen


1x
1x

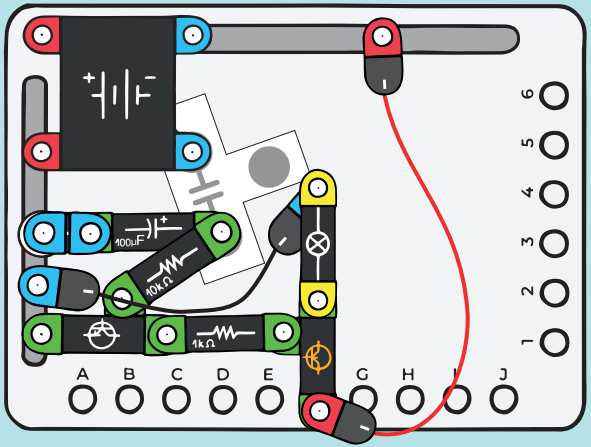

paper

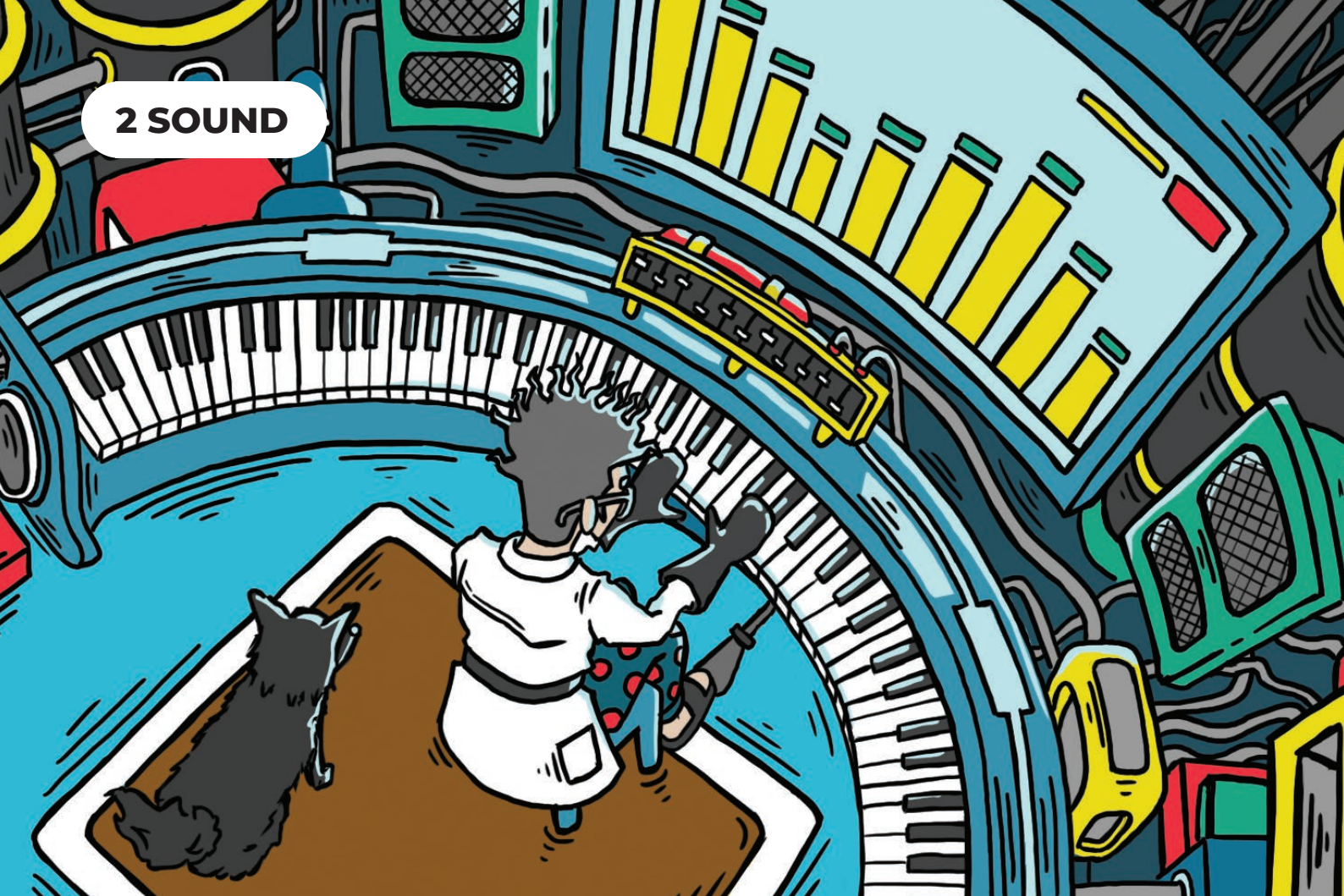
When the button is pressed, the capacitor is charged and the bulb lights up. When the button is released, the capacitor discharges and the bulb goes out slowly. The function is similar to the LL620, but slow dimming of the bulb is undesirable.

1.



2.

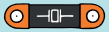



2 SOUND

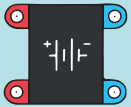
LS10 DJ

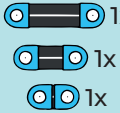

1x transistor PNP


1x transistor NPN


1x buzzer


1x resistor 100kΩ


1x battery


1x


1x

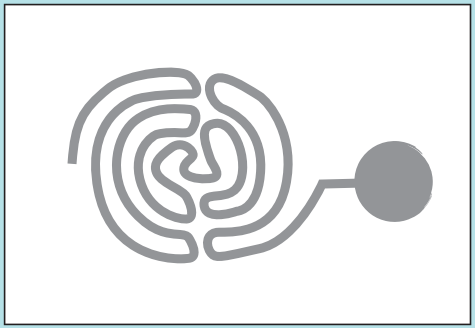
2x


1x conductive pen

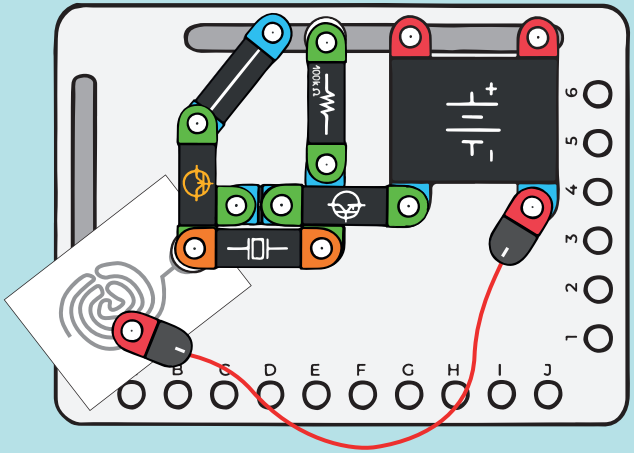

paper

Buzzer equipped with a variable resistor in the form of a drawn conductive path. By moving the wire along the path of the resisto, the tone of the buzzer changes. By periodically repeating the movement, you can create any melody.

1.



2.



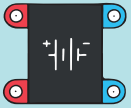
LS20 WIND DETECTOR

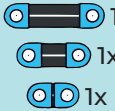

1x transistor PNP

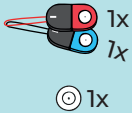

1x transistor NPN


1x microphone


1x resistor 1kΩ

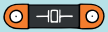

1x battery

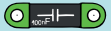

1x
1x
1x


1x
1x
1x


1x resistor 10kΩ

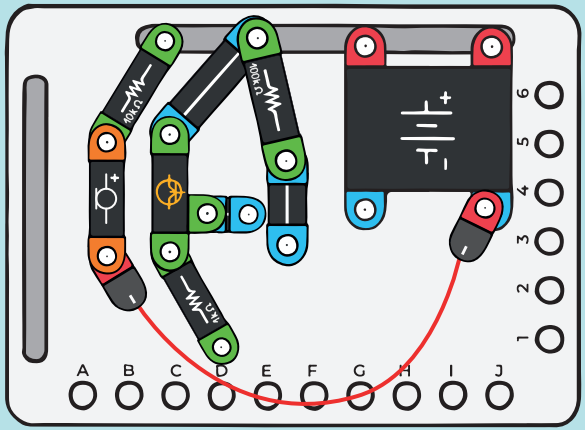

1x resistor 100kΩ


1x buzzer

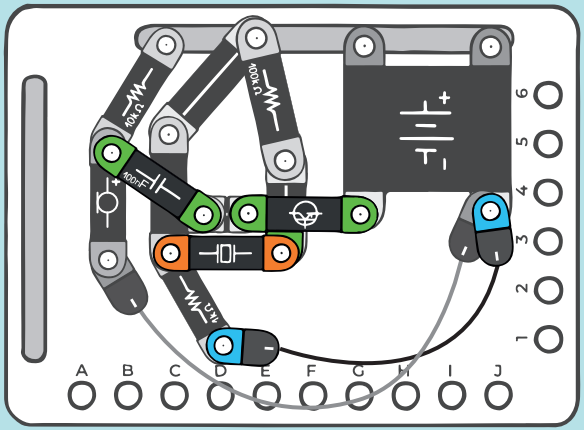

1x capacitor 100nF

The buzzer tone is affected by the microphone. At rest, the buzzer oscillator generates a stable tone. When the sound is captured by the microphone, the tone changes to lower values. When blowing into the microphone, the stable tone breaks down into very short tones, reminiscent of an amplified wind sound. The circuit can thus capture even a light breeze.

1.



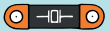
2.

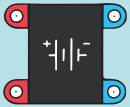


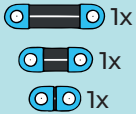
LS30 MORSE CODE


1x transistor NPN


1x transistor PNP


1x buzzer


1x battery


1x


1x


1x


1x resistor 1kΩ

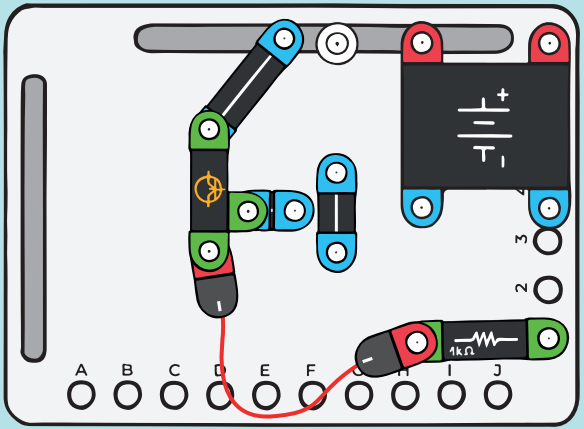

1x resistor 100kΩ


1x button

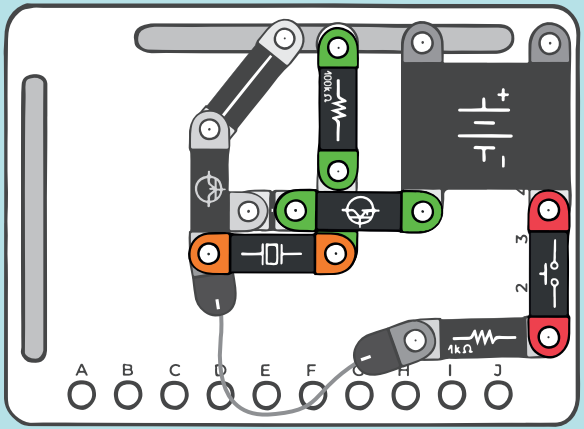
1x

Electronic buzzer with a characteristic tone for Morse code training. The pair of transistors forms an oscillator and the piezo transducer also functions as a capacitor. By pressing the button, we connect the power supply to the oscillator and the buzzer works only when the button is pressed.

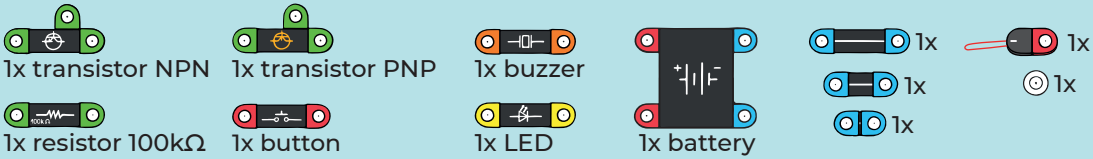
1.



2.

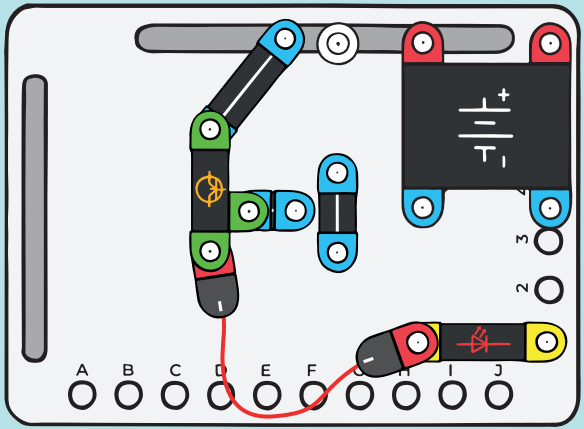


LS40 MORSE CODE WITH LIGHT SIGNAL

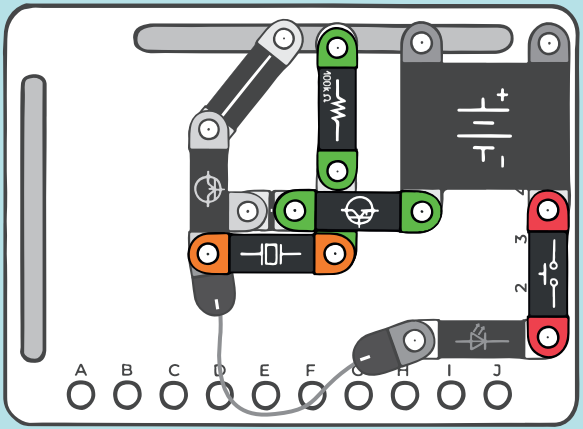


Electronic buzzer with a characteristic tone for Morse code training, equipped with an optical indication. The LED lights up when the buzzer is working. Its tone is accompanied by the light of an LED diode.

1.



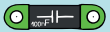
2.



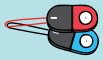
LS50 CICADA

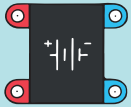

1x transistor NPN

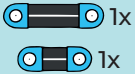

1x transistor PNP


1x capacitor 100nF


1x resistor 10kΩ


1x
1x

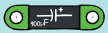

1x battery

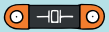

1x
1x


1x resistor 1kΩ


1x resistor 100kΩ


1x switch

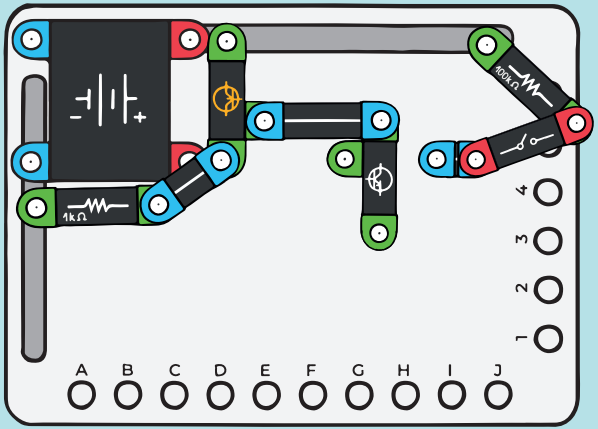

1x capacitor 100µF


1x buzzer

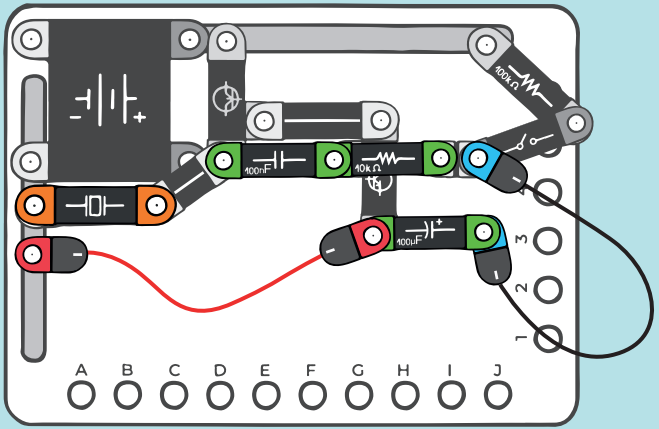

2x

Modified buzzer, which changes the pitch and duration of the tone itself. When the switch is turned on, a 100 uF capacitor is charged via a resistor and the buzzer sounds with a basic tone. However, this discharges the capacitor, the tone decreases until it stops completely. By stopping the buzzer, the capacitor starts charging again and the tone sounds again. Because the whole cycle is fast and to some extent irregular, the resulting effect resembles the chirping of a cicada.

1.



2.

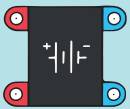


LS60 TONE GENERATOR

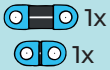

1x transistor NPN

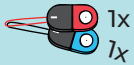

1x transistor PNP


1x potentiometer


1x battery


2x


1x
1x


1x
1x


1x resistor 100kΩ

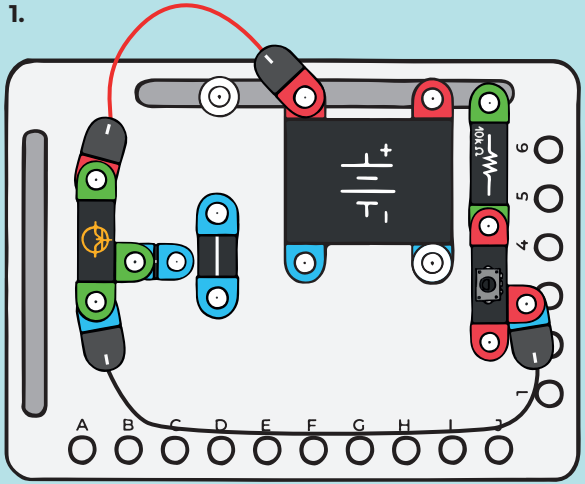

1x buzzer


1x resistor 1kΩ

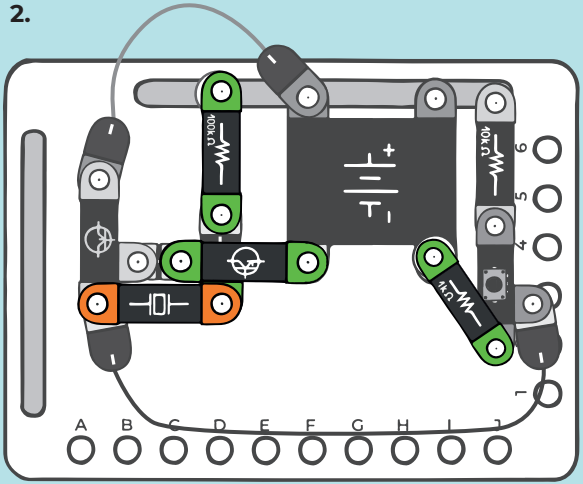

1x resistor 10kΩ

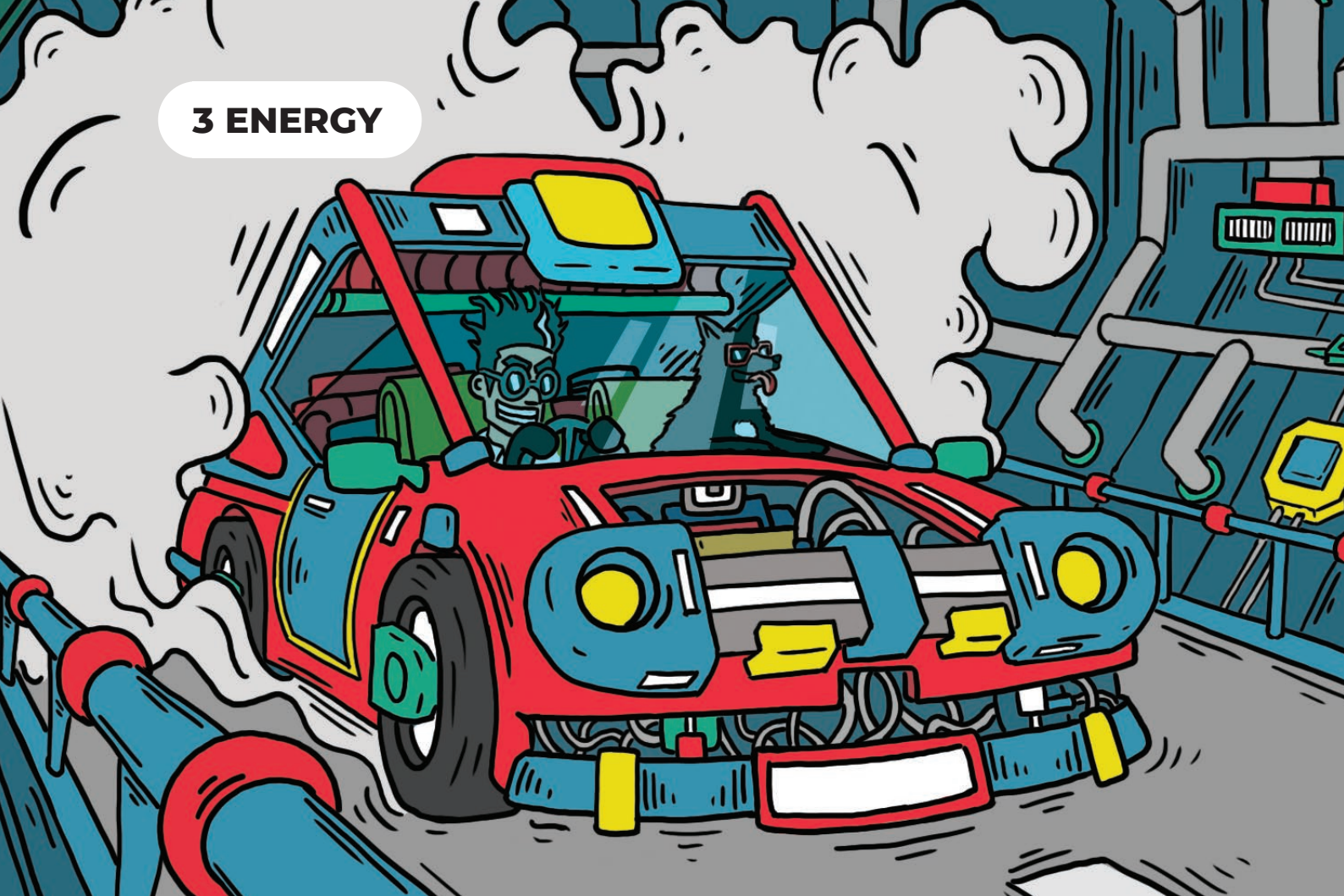
The adjustable buzzer can function as a musical instrument, the potentiometer influences the frequency of the oscillator and thus changes the pitch depending on its angle of rotation. By a quick change of rotation, which we repeat rhythmically, we can achieve a repetitive melody.

1.

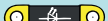


2.



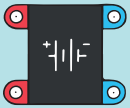

3 ENERGY

LE10 POLARITY INDICATOR


2x LED

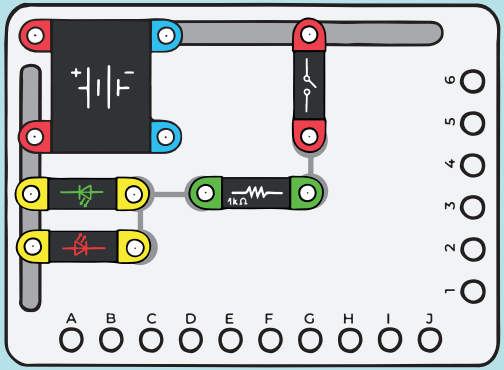

1x switch


1x resistor 1kΩ


1x battery


1x conductive pen

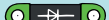
Two anti-parallel LEDs indicate the polarity of the power supply. The LEDs light up alternately depending on the battery orientation.Try connecting the battery the other way – you will see that the second LED lights up.

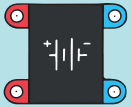


LE20 HOW A SEMICONDUCTOR DIODE WORKS IN THE FOREWARD DIRECTION


1x bulb

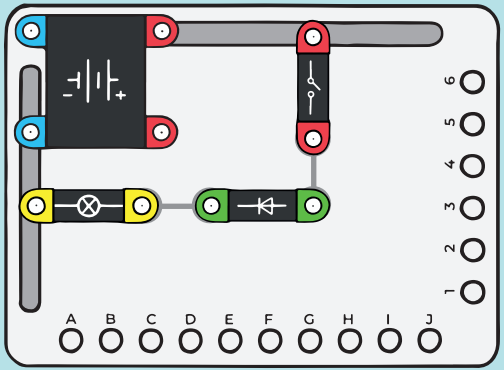

1x switch


1x diode


1x battery


1x conductive pen

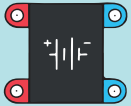
A semiconductor diode is a component through which an electric current can pass in only one direction. If we put a diode in series with a light bulb and a switch, then the light bulb will only light up if the switch is closed and if the source is of the correct polarity. The diode conducts electric current, only if its anode is connected to the positive pole of the source. In connection, this requirement is met. That means when the switch is pressed, the diode is open, current can flow and the light bulb can light up.



LE30 HOW A SEMICONDUCTOR DIODE WORKS IN THE REVERSE DIRECTION


1x bulb

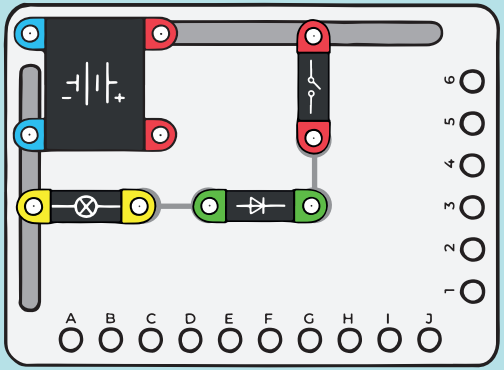

1x diode


1x battery


1x conductive pen


1x switch

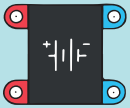
The semiconductor diode in the reverse direction is closed, current cannot flow through it and the light bulb cannot light up after pressing the switch. We can turn on the bulb again by turning the diode, as in the previous build, or by turning the polarity of the battery.



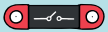
LE40 AMPLIFIER


1x potentiometer


1x transistor PNP


1x battery

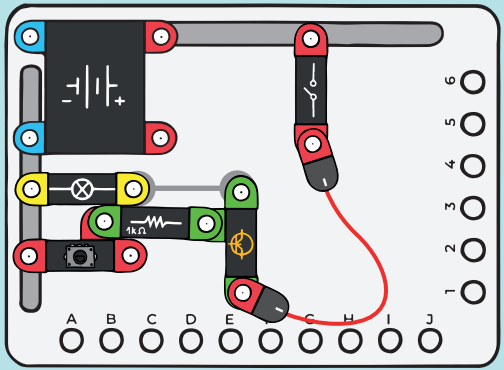

1x


1x switch


1x resistor 1kΩ

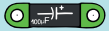

1x bulb

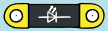
By changing the low current to the transistor base, you can control the high current flowing through the bulb since opening and closing the transistor causes the voltage on the bulb to change. We use a PNP transistor in this case.

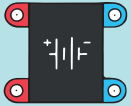


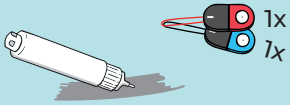
LE50 YOUR OWN BATTERY


1x switch


1x capacitor 100µF

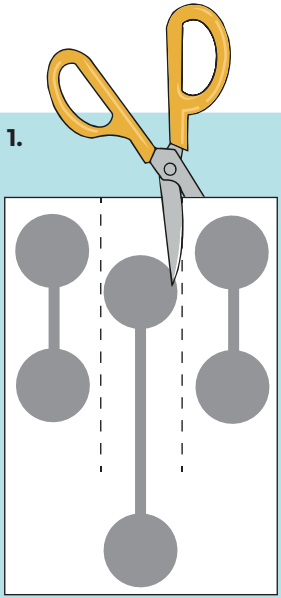

1x LED

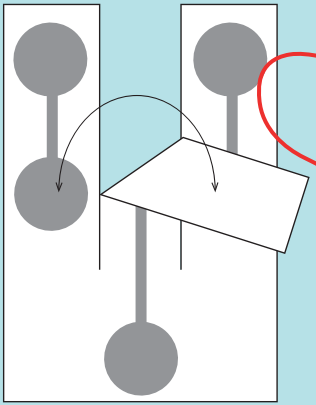

1x battery


1x conductive pen

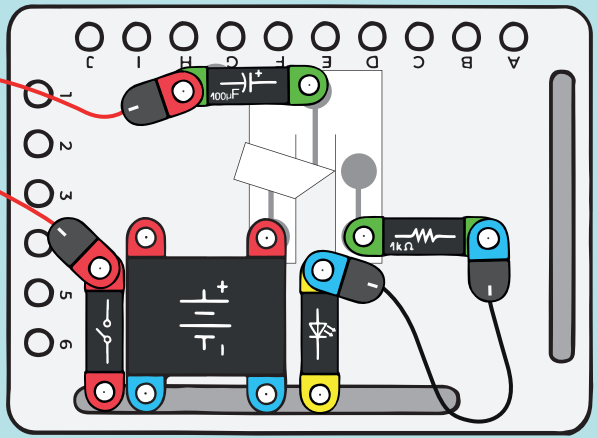
The connection demonstrates the ability of the capacitor to accumulate the electric charge. By switching the capacitor to the battery, we store electrical energy in the capacitor in the form of an electric charge. When we switch to the LED, the energy in the capacitor is released in the form of electric current flowing into the LED. The LED lights up briefly.

1.





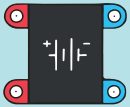
2.



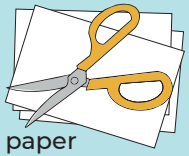
LE60 ADJUSTABLE POWER SWITCH

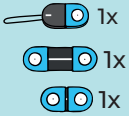

1x potentiometer


1x switch


1x battery


1x conductive pen


paper

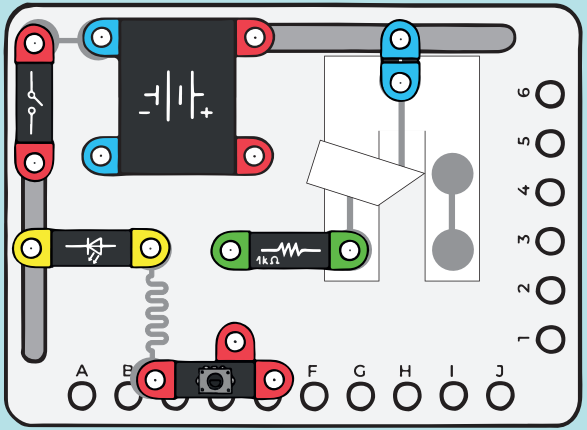

1x
1x
1x


1x resistor 1kΩ

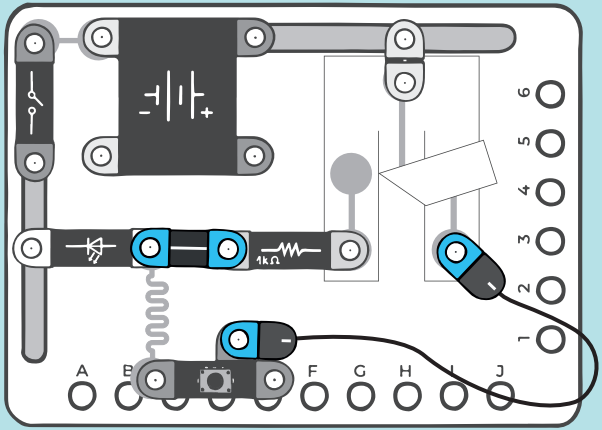

1x LED

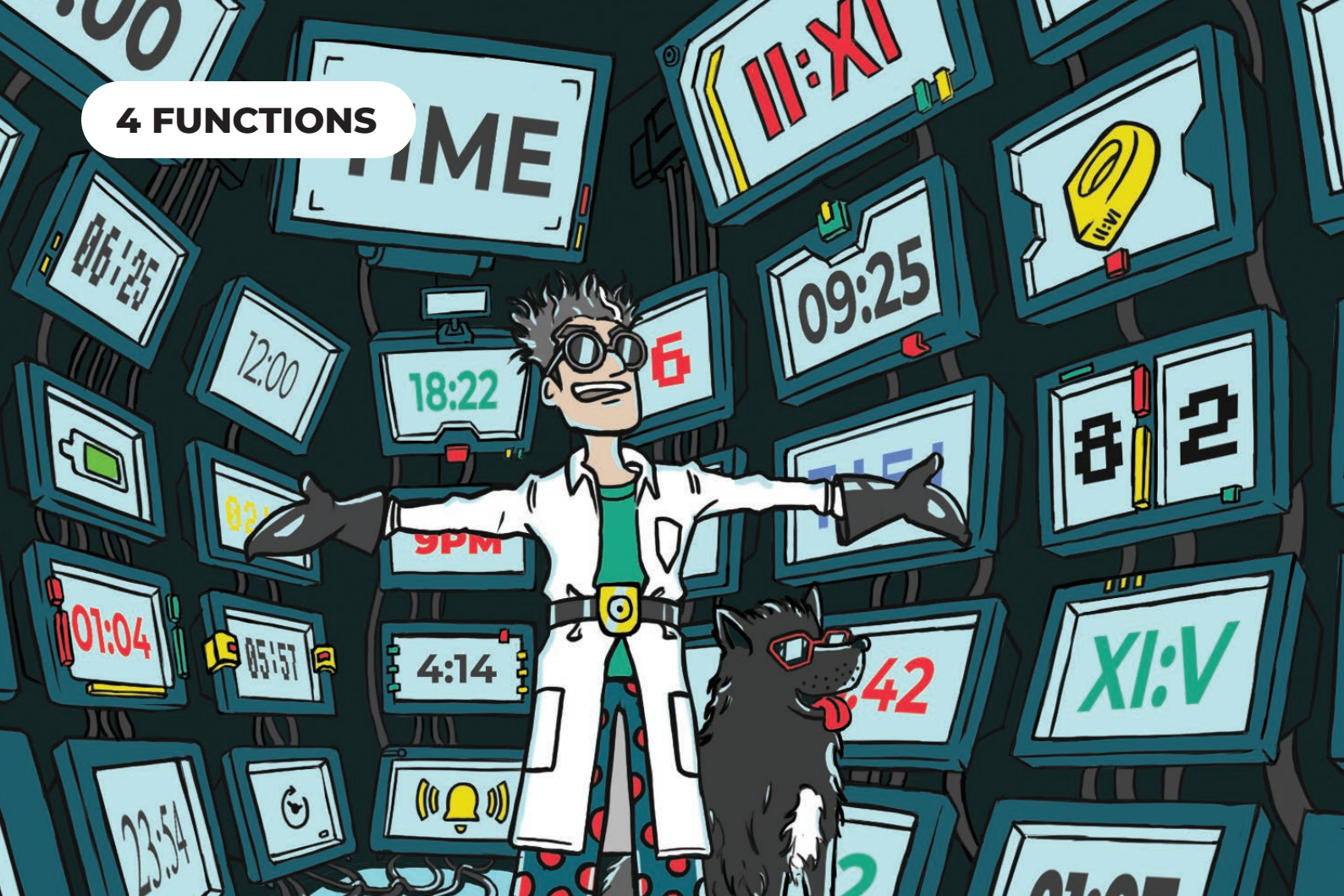
By combining a switch and a potentiometer, you can build a circuit where the switch can be used to select a constant brightness, or continuous LED brightness control with a potentiometer.

1.

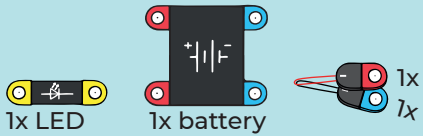


2.




4 FUNCTIONS
TIME
06:25
12:00
18:22
09:25
8:2
9PM
01:04
05:57
4:14
23:54

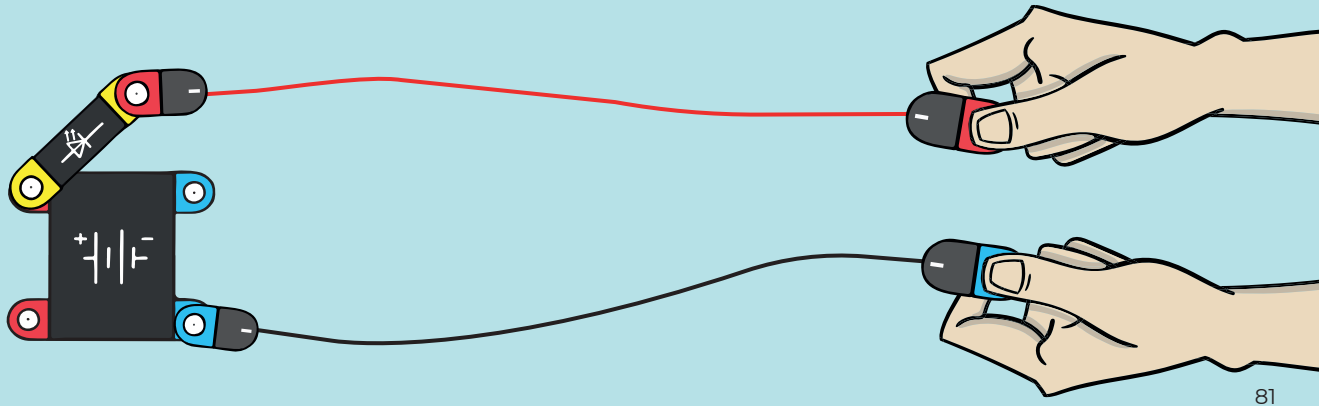
LF10 PORTABLE CONDUCTIVITY DETECTOR



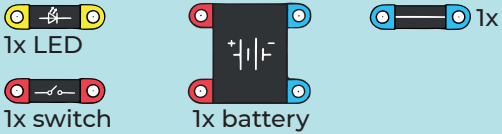
The basic electrical circuit can be used directly as a conductivity detector. If the object is conductive, i.e. it is able to conduct electric current, the conductive object is indicated by the LED light. Since a relatively small current is enough to light up the LED, we can even detect the less conductive objects. The best result is achieved by using a white LED diode, which has a high brightness and even its low light is so noticeable.

1.

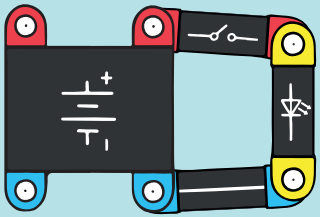
2.



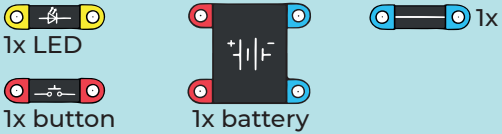
LF20 PORTABLE TORCH



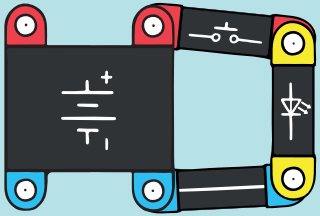
A simple flashlight consisting of a battery, a switch and a LED. When the switch is turned on, the LED lights up and stays on until we turn it off.



LF30 PORTABLE TORCH WITH BUTTON



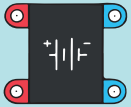
A simple flashlight consisting of a battery, a button and a LED. By pressing the button, the LED lights up and remains lit as long as we hold the button. At the touch of a button, we can emit various light signals. The button ensures that the flashlight stays off when we don't need it. This saves the battery life.

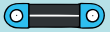


LF40 ADJUSTABLE PORTABLE TORCH


1x potentiometer


1x LED


1x battery


1x

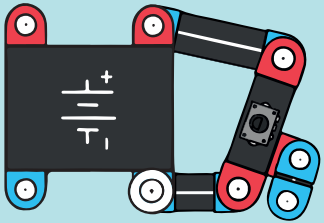

1x


1x

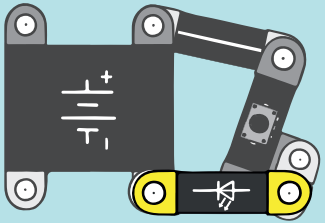

1x

A variable resistor connected as a voltage divider can be used to control the brightness of the LED. Because we change the voltage on the LED from zero to the supply voltage, we have the full range of brightness of the LED. This method of controlling the brightness of the LED is not very efficient and stable, usually the brightness of the LED changes by changing the current flowing. E.g. using a rheostat (variable resistor in series with the LED, as a current divider).

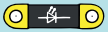
1.



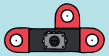
2.

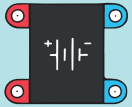


LF50 ADJUSTABLE PORTABLE TORCH WITH BUTTON


1x LED


1x button


1x potentiometer


1x battery

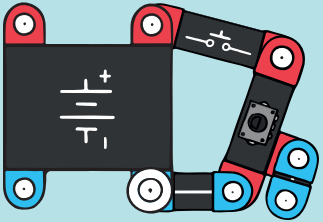

1x


1x

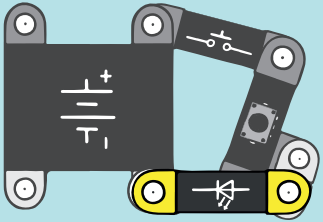

1x

Simple flashlight with button and adjustable brightness. The lamp only lights up when the button is held and the potentiometer here functions as a rheostat, i.e. as a current regulator passing through the LED.

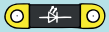
1.



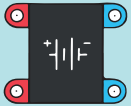
2.



LF60 ADJUSTABLE PORTABLE TORCH WITH SWITCH


1x LED


1x potentiometer

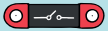

1x battery


1x


1x

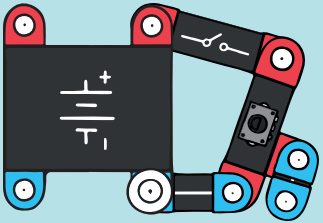

1x


1x button

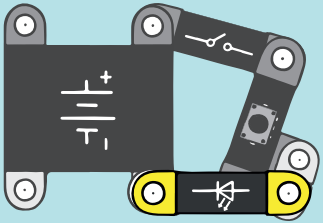

1x switch

A flashlight that has a button replaced by a switch, so we don‘t have to hold a button to turn it on, which is much more convenient. We just must not forget to turn off the flashlight.

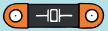
1.



2.

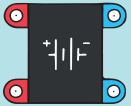


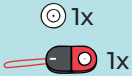
LF70 DOOR ALARM


1x buzzer

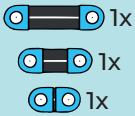

1x transistor PNP


1x transistor NPN


1x battery


1x

1x


1x

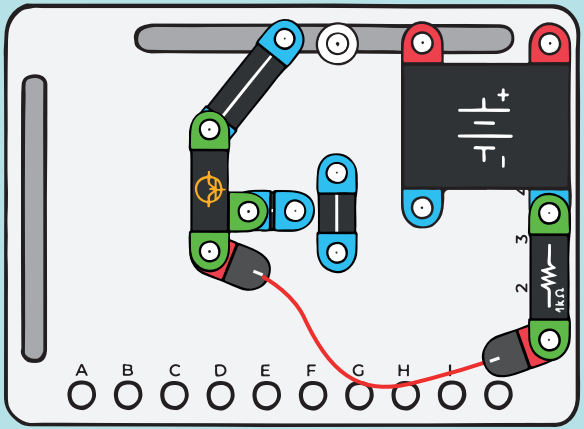
1x

1x

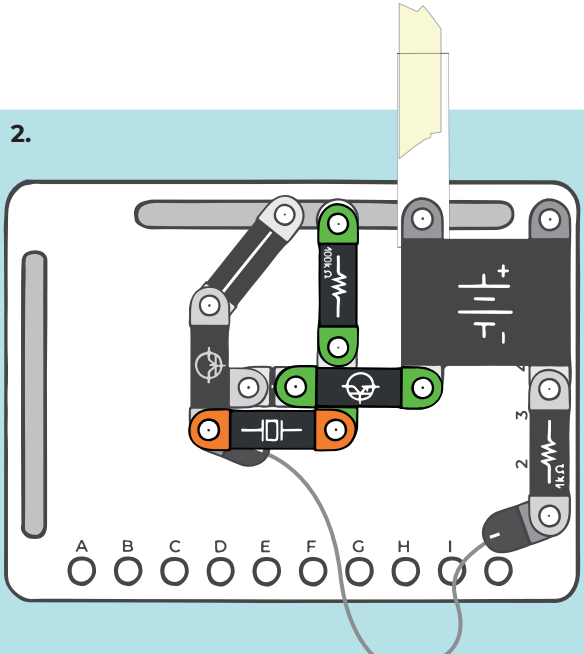

paper

The disconnecting contact in the buzzer power supply can serve as an indicator of the door opening. Pulling out the paper strip separating the connection between the battery and the buzzer oscillator connects the battery to the oscillator, and when the strip is pulled out, a tone is heard from the buzzer. Stick the paper strip on the door so that the strip is pulled out by opening the door.

1.



2.



LF80 LIGHT ALARM


1x transistor NPN


1x transistor PNP

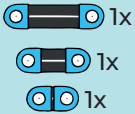

1x photoresistor

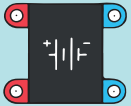

1x resistor 100kΩ

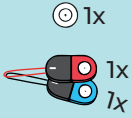

1x buzzer


1x resistor 1kΩ


1x resistor 10kΩ

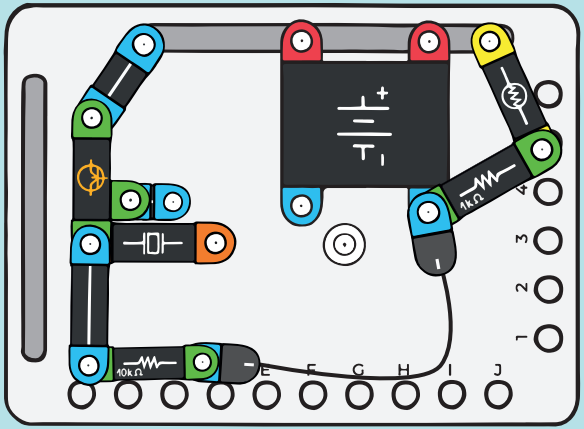



1x battery

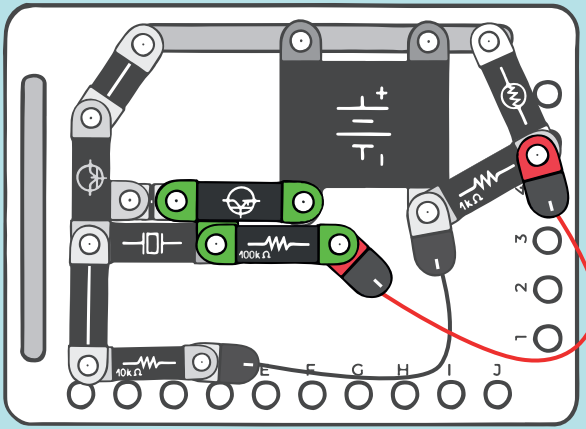


Electronic buzzer, the pitch of which depends on the level of illumination of the photoresistor. A photoresistor with a 1 kΩ resistor forms a voltage divider whose output voltage is directly proportional to the degree of illumination. The voltage then affects the frequency of the oscillator and thus the pitch.

1.

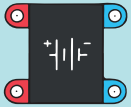


2.

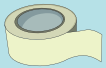


LF90 CLOSED DOOR INDICATOR

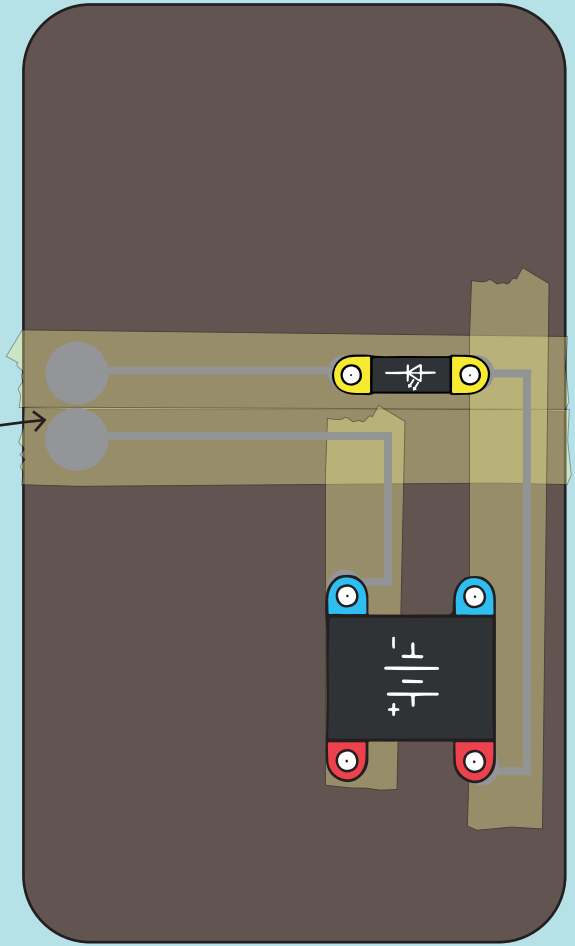

1x LED


1x battery


1x conductive pen

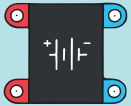

1x tape

A simple circuit can be used to signal a closed door. Place a pair of contacts drawn on a tape in the door frame so that the handle latch connects both contacts. The LED lights up when the door is closed and the handle latch is securely inserted in the door frame, because only then is the electrical circuit closed.



LF100 LOCKED DOOR INDICATOR

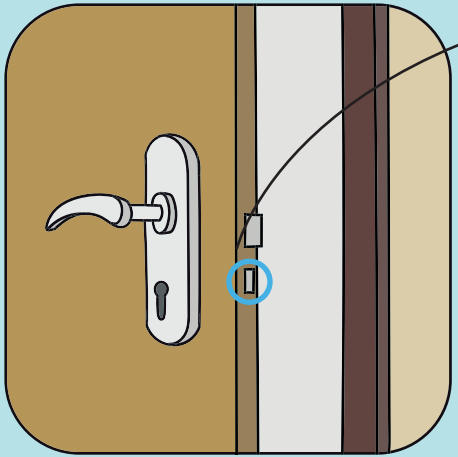

1x LED

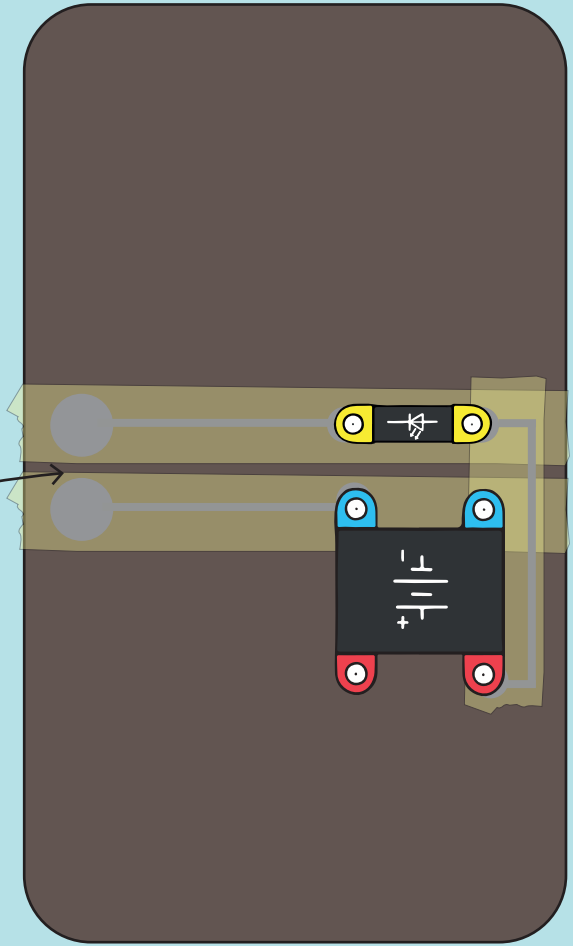

1x battery


1x conductive pen

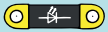

1x tape

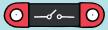
The same method of detection by a simple electrical circuit can be used to indicate that the door is locked. We place the contact in the door frame, so that the contacts are connected by the locking mechanism. If the door is locked and the barrier connects the pair of contacts, the LED is lit and we know that the door is locked.

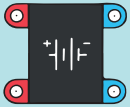




LF110 CLOSED AND LOCKED DOOR INDICATOR


1x LED

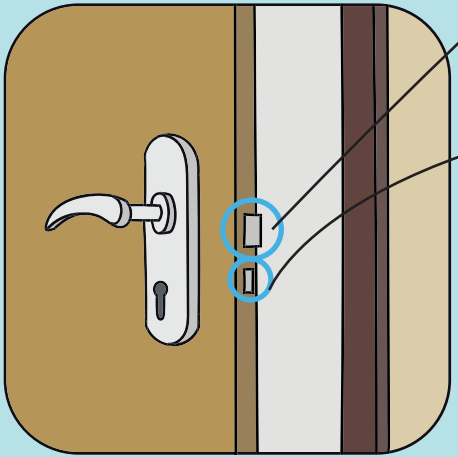

1x switch

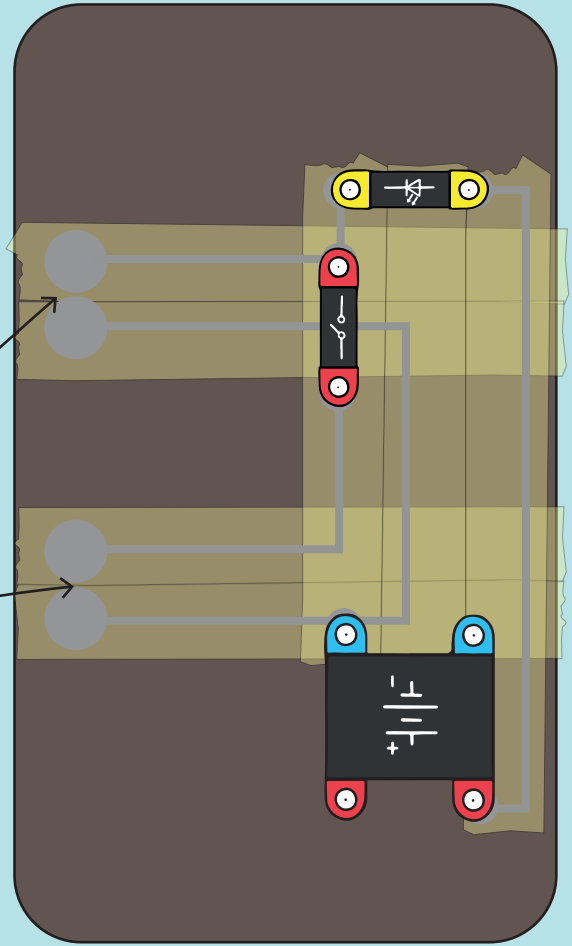

1x battery


1x conductive pen


1x tape

We can connect the contacts for detecting closed and locked door in series and thus we create a circuit which indicates the state of the door by a LED light. The circuit can also detect that someone is trying to open the door when the door is locked, by the led flashing.

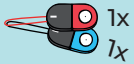


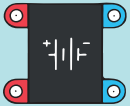


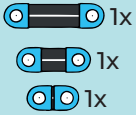
LF120 THIEF

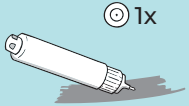

1x transistor PNP


1x transistor NPN


1x


1x battery


1x


1x conductive pen


paper

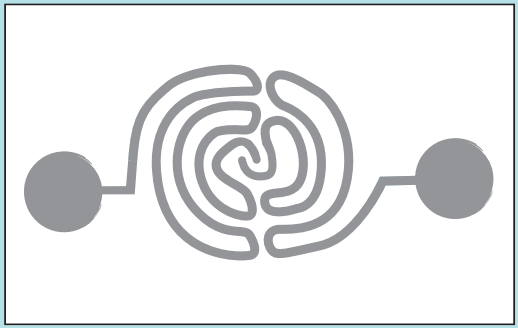

1x buzzer


1x resistor 100kΩ

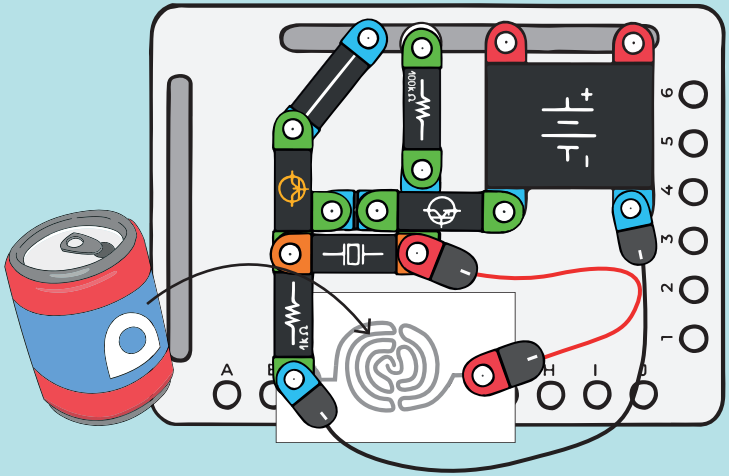

1x resistor 1kΩ

When a conductive object is placed on the drawn part, connection is made that blocks the buzzer, when someone lifts the object, the buzzer starts making sound. This warning sound alerts us that the guarded object has been stolen, or prevents someone from stealing it. The connection can only be made with electrically conductive object. If you would like to use non-conductive object, wrap its bottom in aluminium foil.

1.



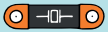
2.

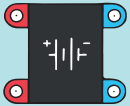


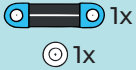
LF130 BELL


1x transistor NPN

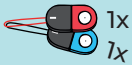

1x transistor PNP


1x buzzer


1x battery


1x

1x


1x

1x


paper and tape

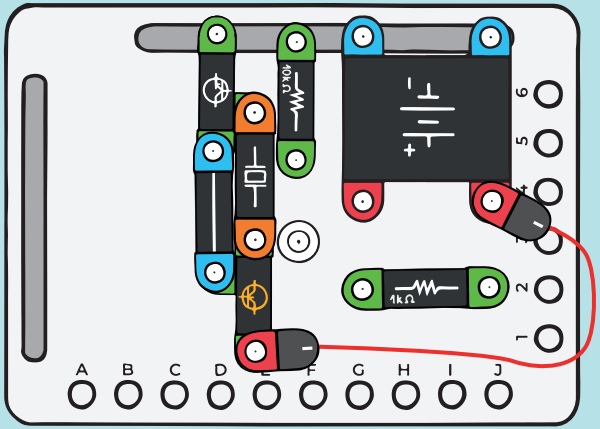

1x resistor 1kΩ


1x resistor 100kΩ

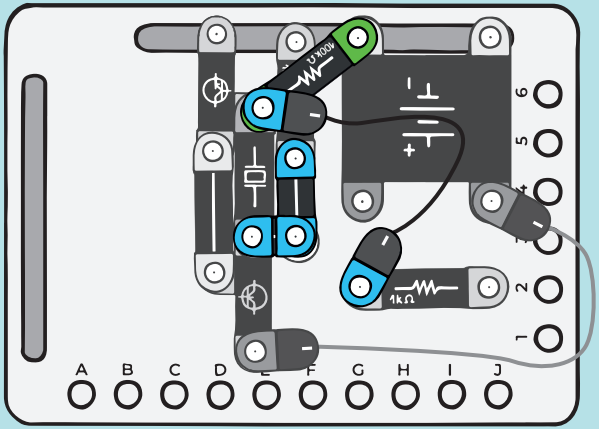

1x resistor 10kΩ

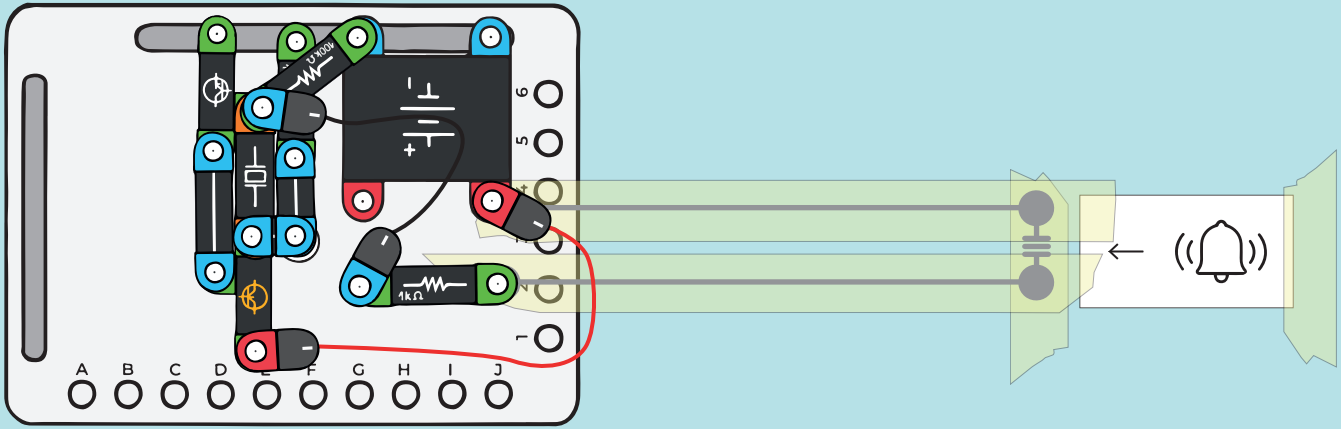
Electronic buzzer with a contactless button, which can serve as a replacement for the bell. The button consists of two contacts. By connecting them with your finger, the buzzer is activated. The NPN transistor is used here as a part of the current-generating oscillator and as a contact current amplifier, so that the connection responds well to dry fingers.

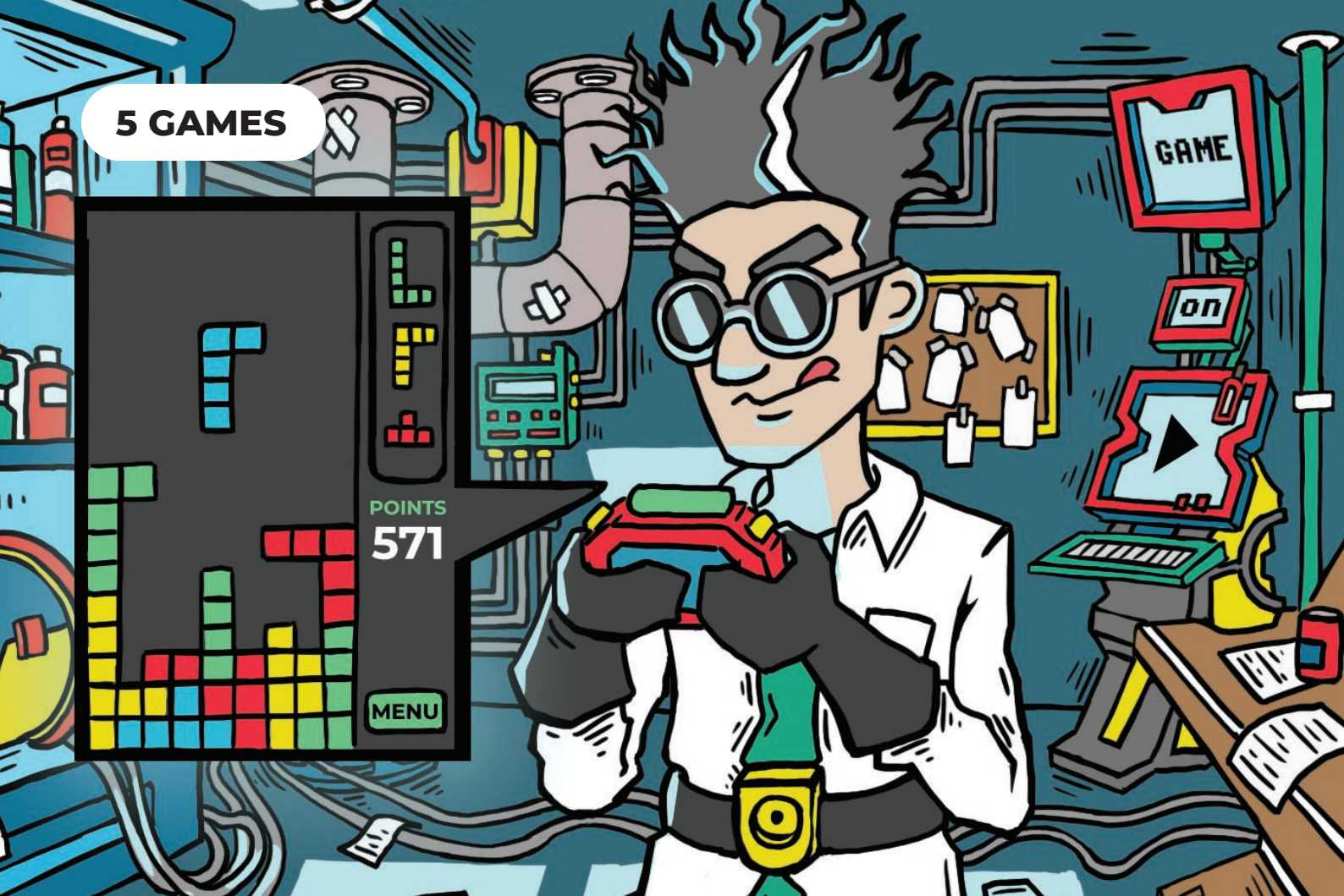
1.



2.



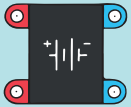

A
B
C
D
E
F
G
H
I
J
1
5
6
1kΩ


5 GAMES
POINTS
571
MENU
GAME
on

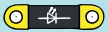
LG10 TWO BUTTONS - WHO WILL LAST LONGER

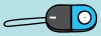

1x transistor NPN

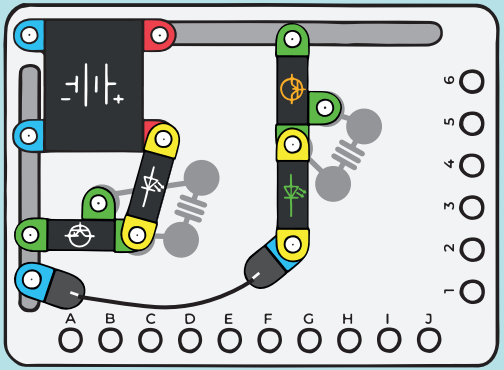

1x transistor PNP


1x battery

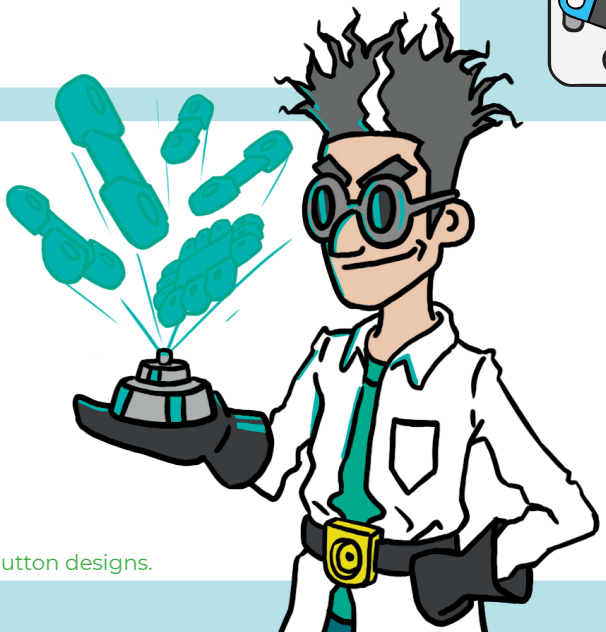

1x conductive pen


2x LED


1x

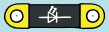


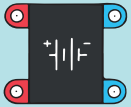
A pair of contactless buttons with a transistor amplifier can serve as a simple endurance competition. Each of the competitors places their finger on the touch button, which is signaled by the LED lighting up. Loses the one whose LED goes out first due to the loss of contact between the conductive surfaces of the drawn button.

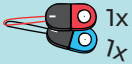


TIP: Try to compete with your own button designs.

LG20 STRATEGY GAME

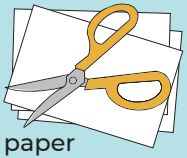

2x LED


1x battery


1x

1x

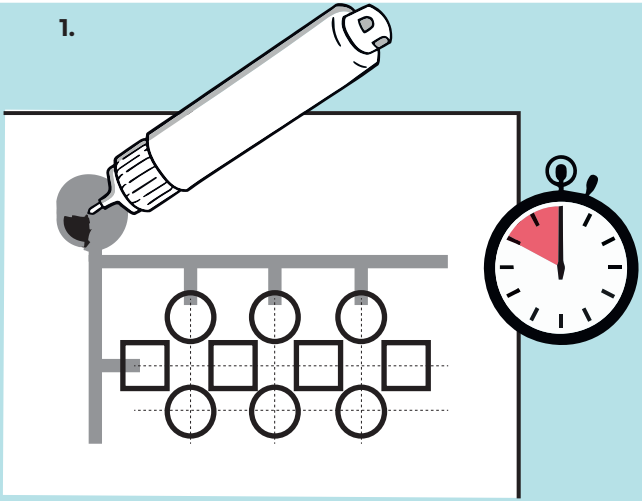

1x conductive pen


paper

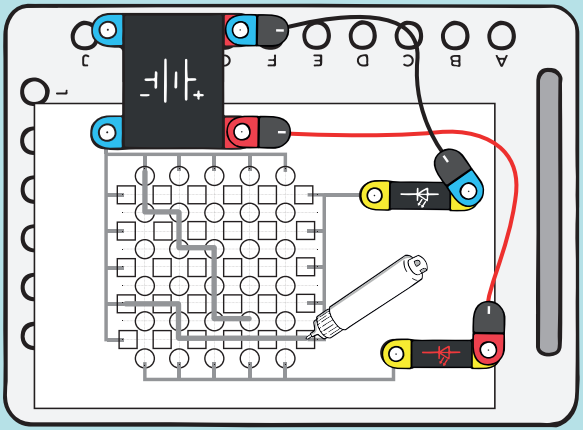
At the beginning of the game, players choose the shape they will play for. The winner is the one who lights up his LED first when he connects the opposite sides of the square. In each turn, the player can draw only one line connecting the two shapes. Players' routes cannot intersect. The winning player closes the electrical circuit on his way using the drawn route and his LED can light up with the last turn.

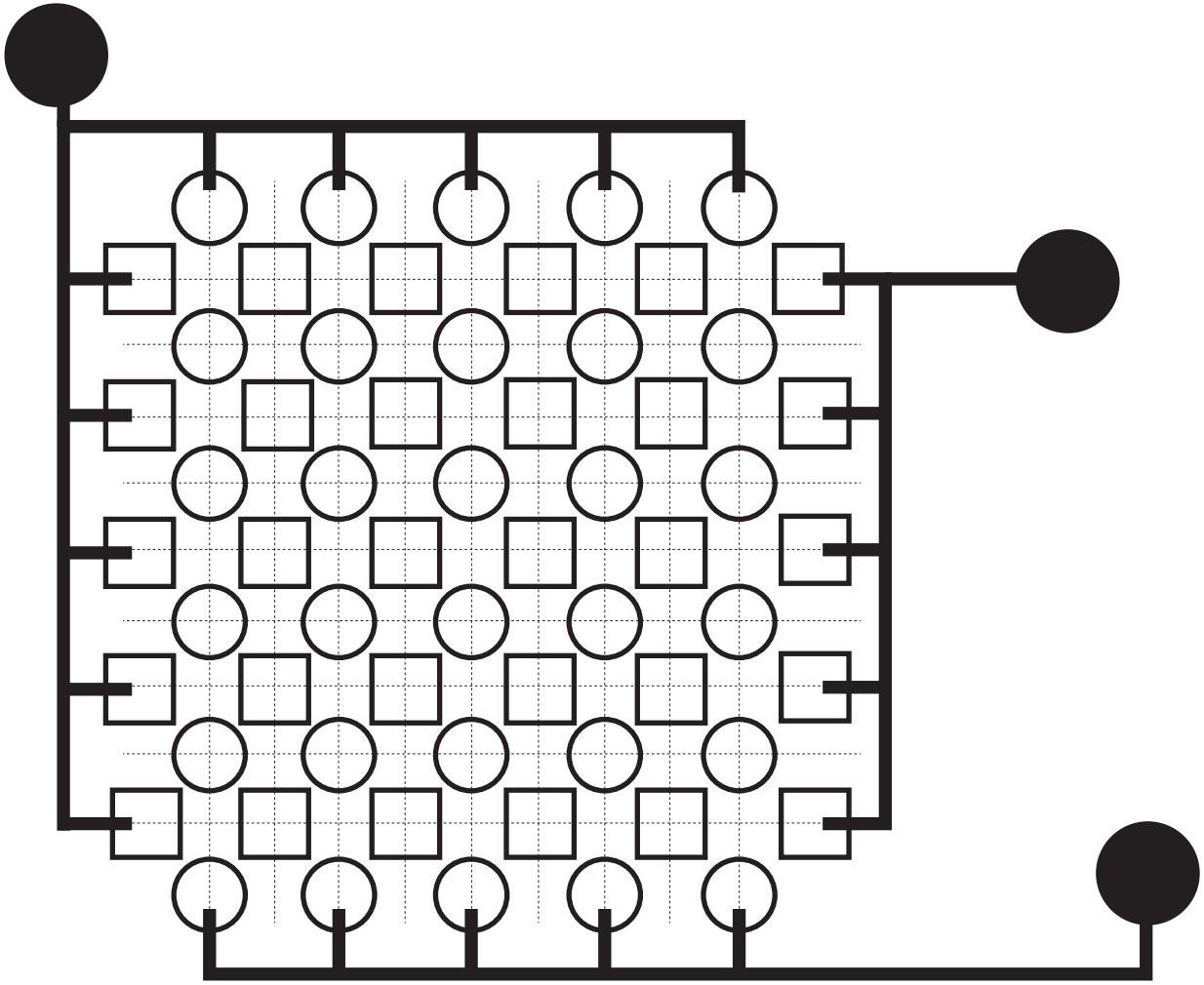
TIP: Copy the game on a clean piece of paper from the picture on the following page.

1.

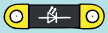


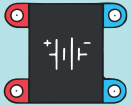
2.

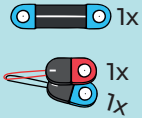




LG30 TIC-TAC-TOE


2x LED


1x battery


1x
1x
1x

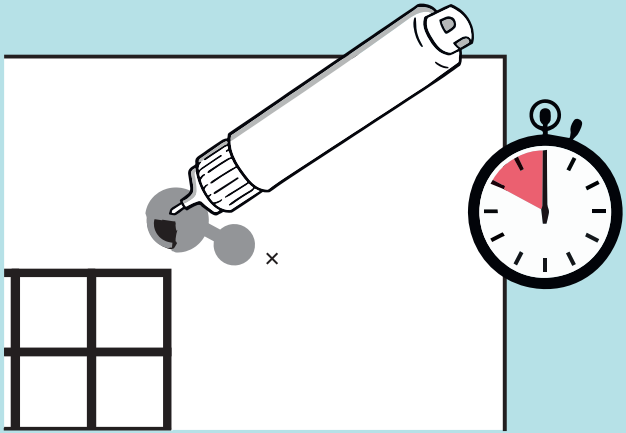

1x conductive pen


paper

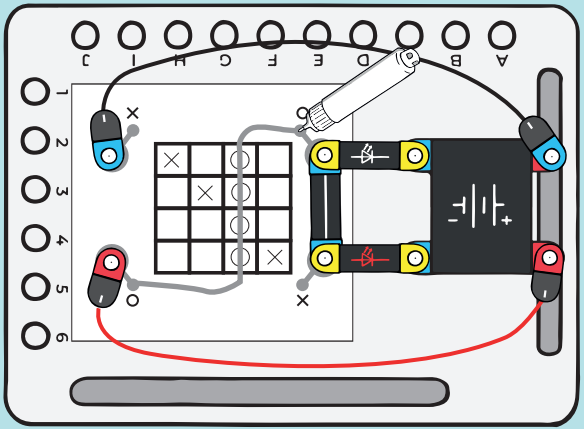
Classic Tic-Tac-Toe, where the winning player closes the electrical circuit by crossing out the winning four and confirms his victory by lighting the LED diode.

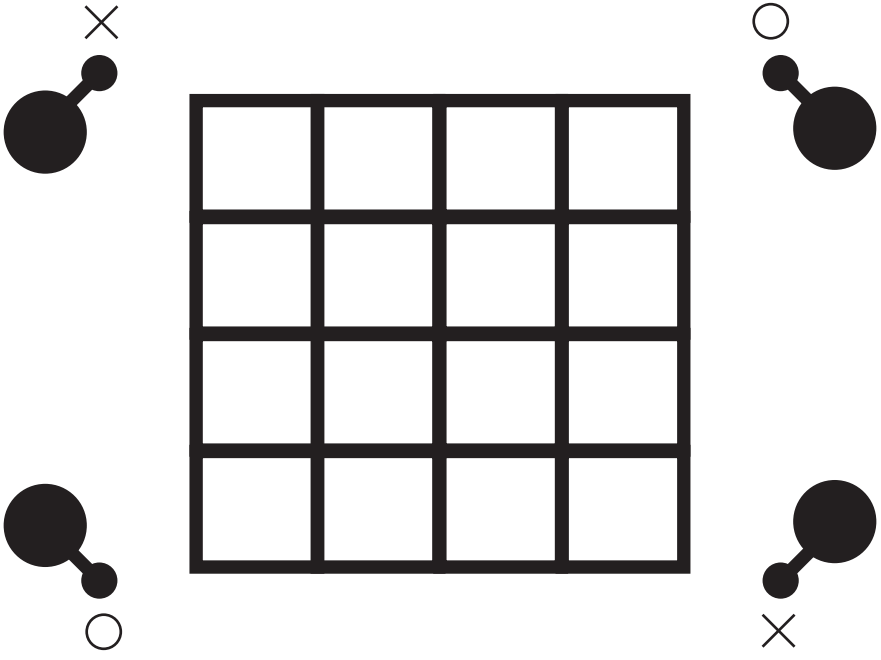
TIP: Copy the game on a clean piece of paper from the picture on the following page.

1.



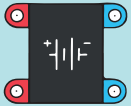
2.

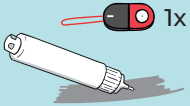




LG40 LABYRINTH


1x LED


1x battery

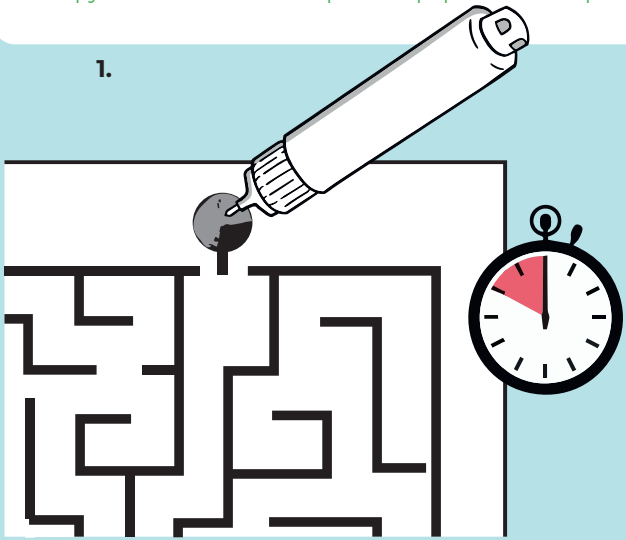

1x conductive pen


paper and tape

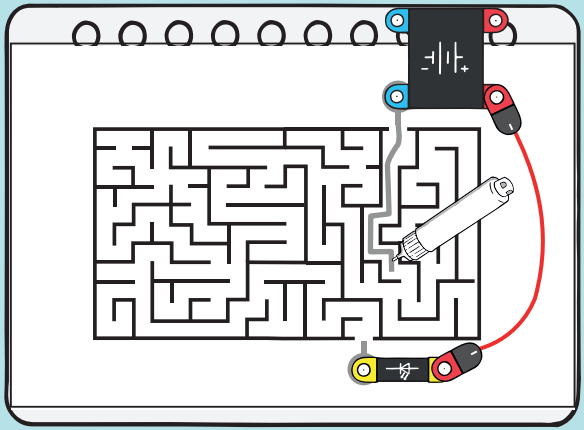
A simple electrical circuit can be used as an indication of successful passage through the maze. The starting point is the pole of the battery, the route with a conductive marker through the maze forms a switch, the destination point is connected to the appliance. If we connect the start and end points of the maze with a conductive route, the successful passage through the maze is indicated as we close the electrical circuit. The LED lights up to signal a successful passage.

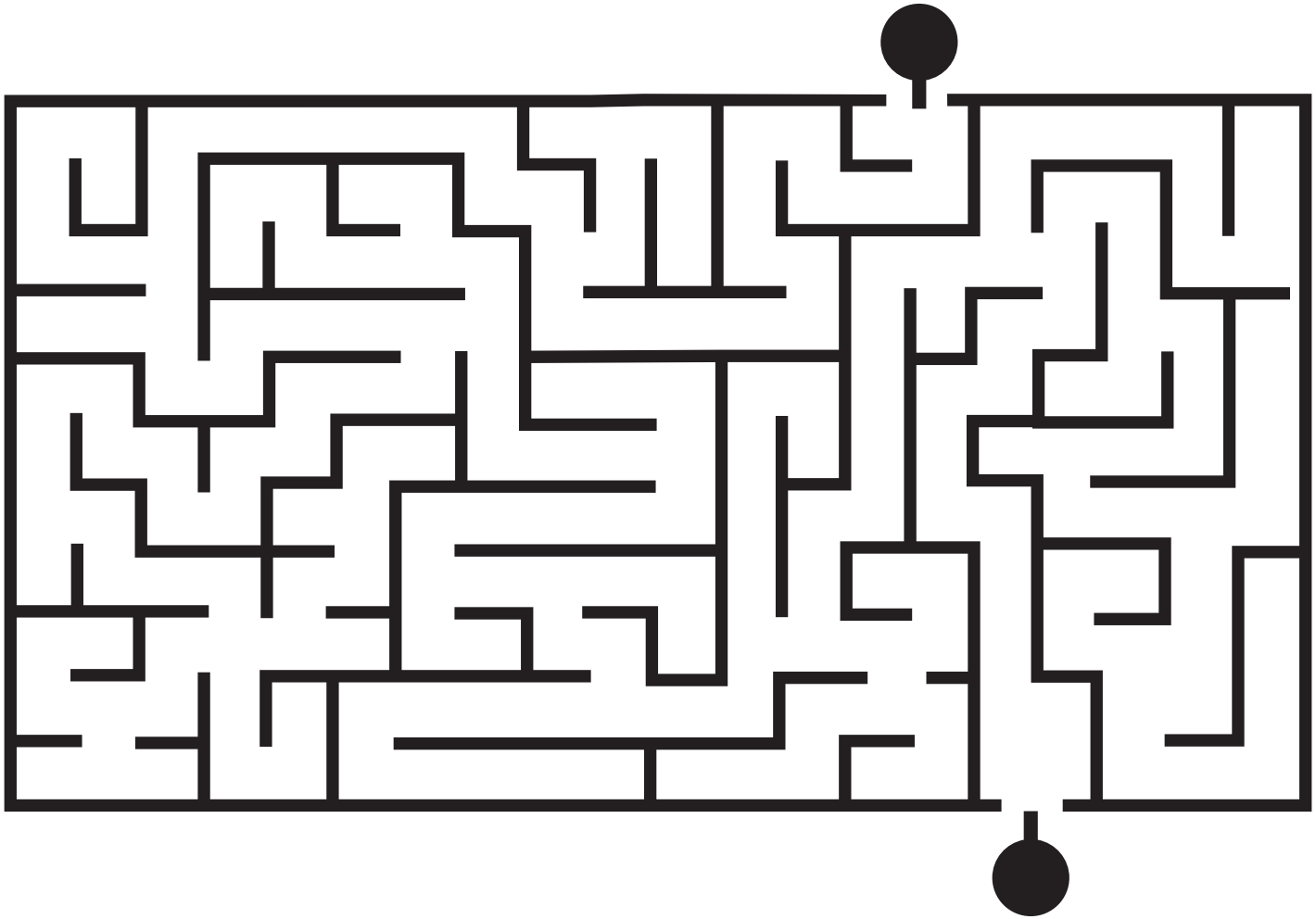
TIP: Copy the maze on a clean piece of paper from the picture on the following page.

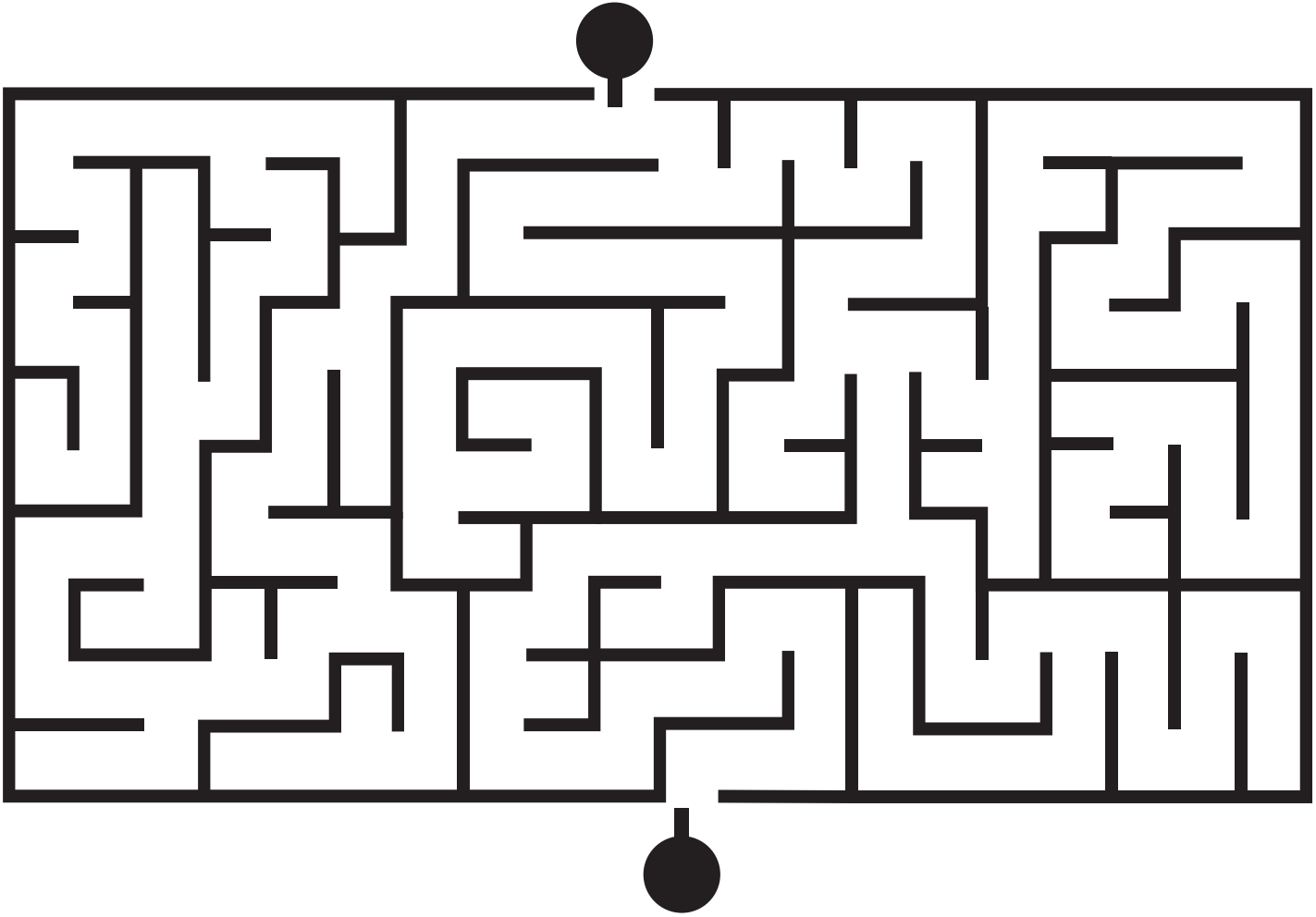
1.

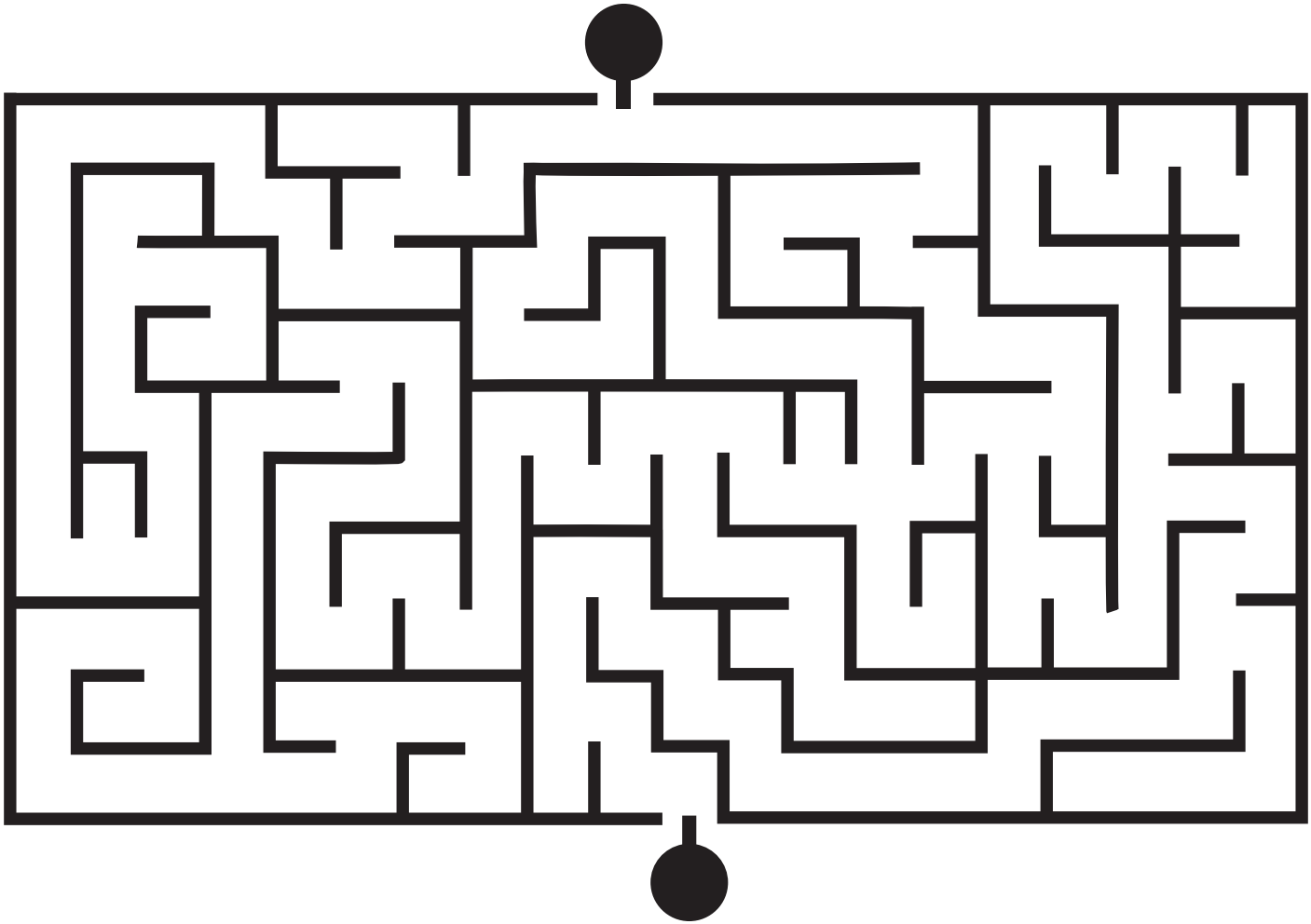


2.









LG50 SPY MISSION

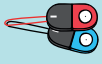

1x buzzer

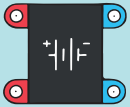

1x transistor PNP

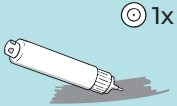

1x transistor NPN


1x resistor 1kΩ

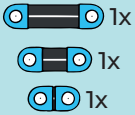

1x resistor 100kΩ


1x
1x


1x battery


1x conductive pen

1x

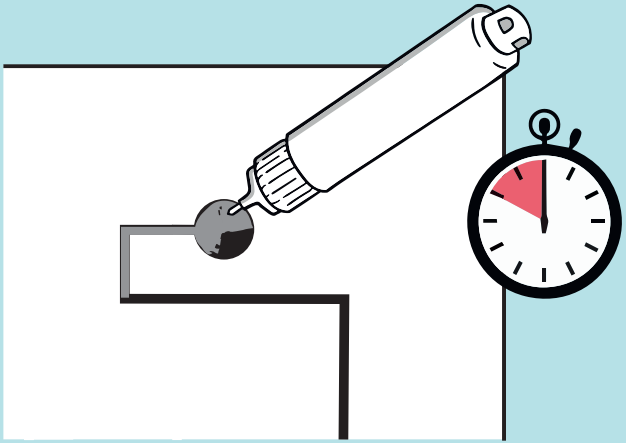

1x
1x
1x


paper

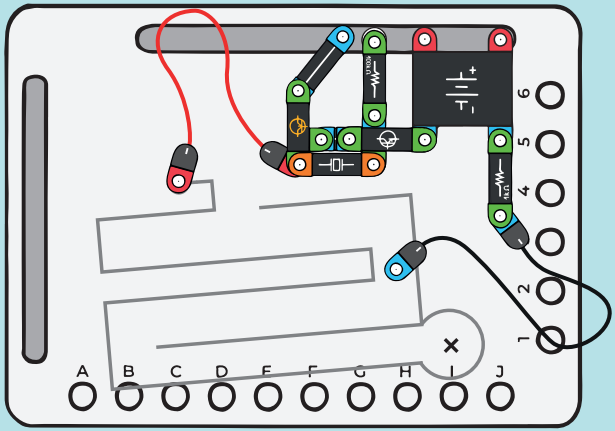
Take on the role of a secret agent. The aim of this game is to go through the corridor, drawn with conductive ink, without touching its walls. When the wire connection touches the wall, it closes a simple electrical circuit and sounds the buzzer. The aim of this game is to go through the maze carefully, so the alarm does not go off and the agent is not detected. You can get a harder variant of the game by narrowing the corridor or adding obstacles.

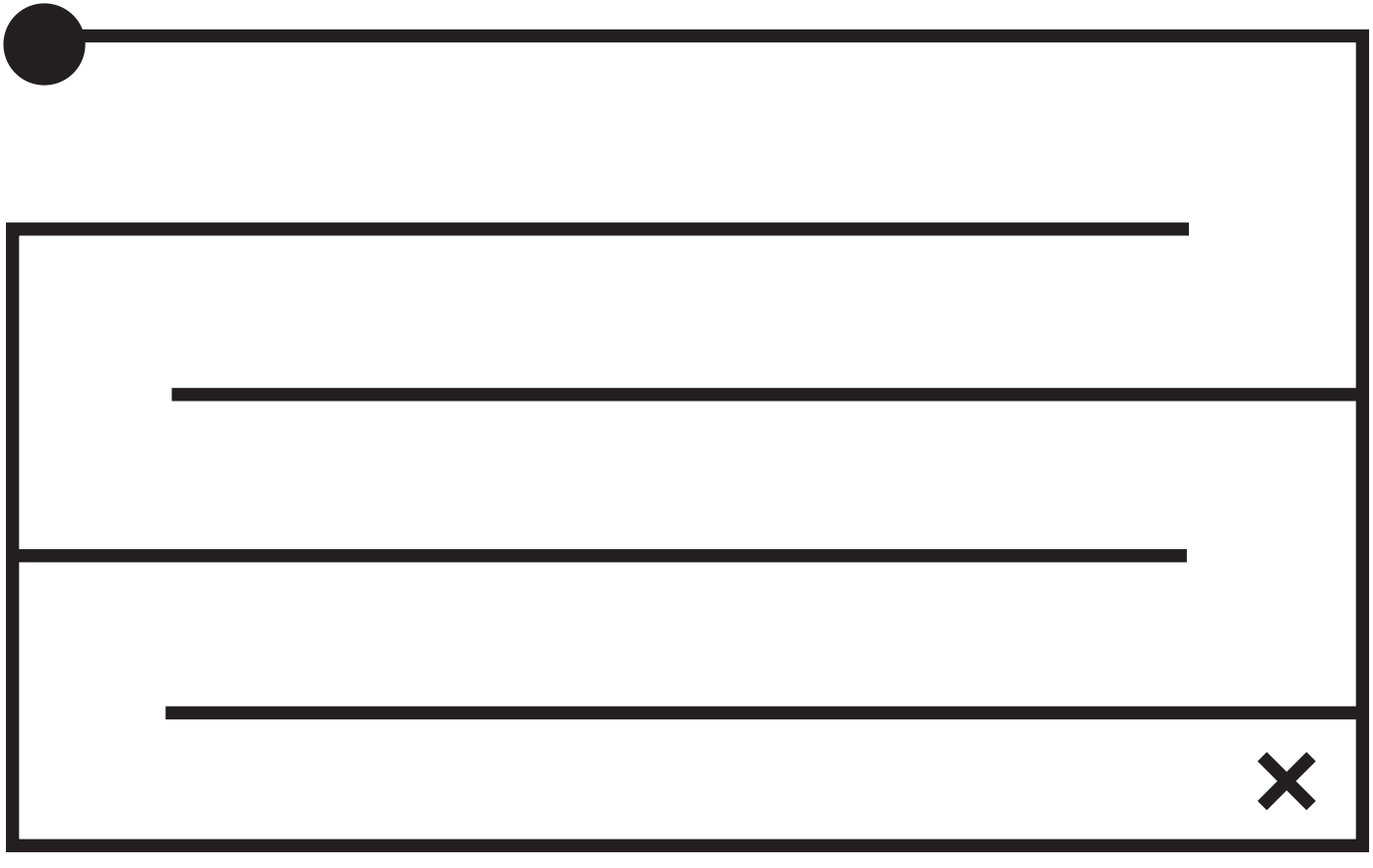
TIP: Copy the path on a clean piece of paper from the picture on the following page.

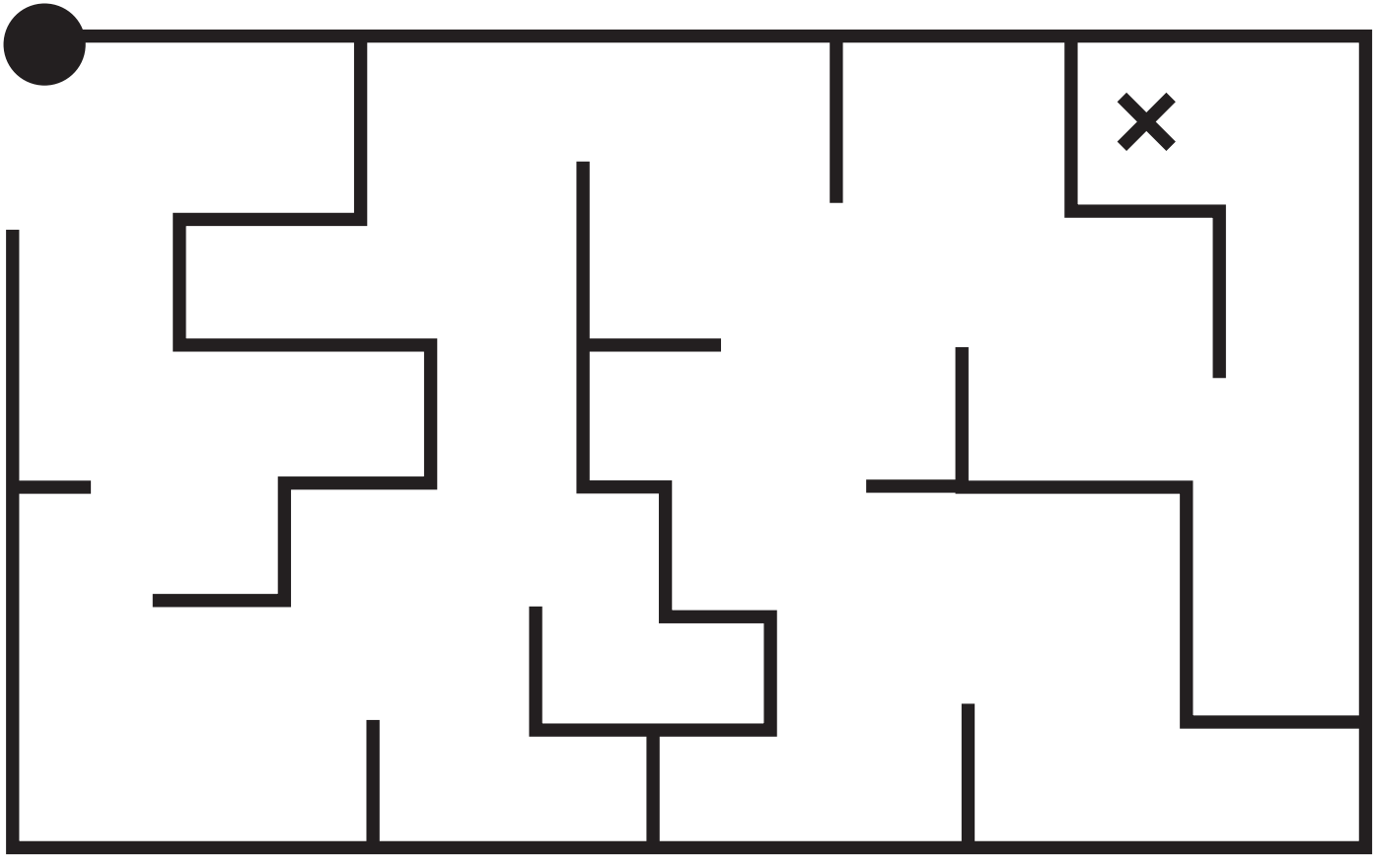
1.

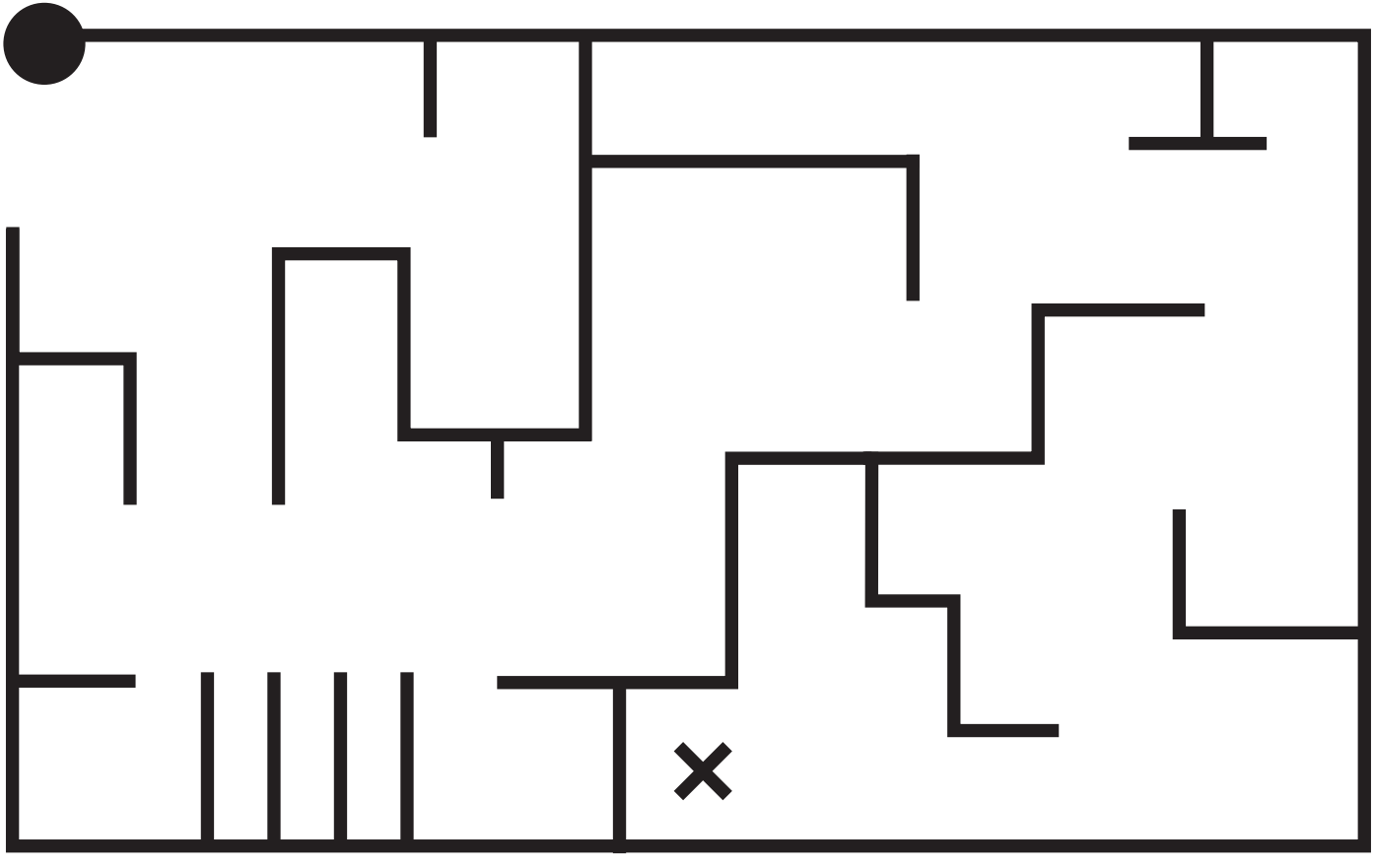


2.





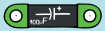


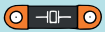


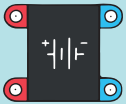
LG60 LASER GUN I.


1x transistor PNP

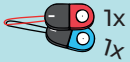

1x transistor NPN


1x capacitor 100μF

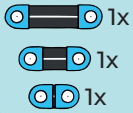

1x buzzer


1x battery


paper and pencil


1x


1x conductive pen


1x

1x

1x


1x resistor 1kΩ


1x resistor 100kΩ

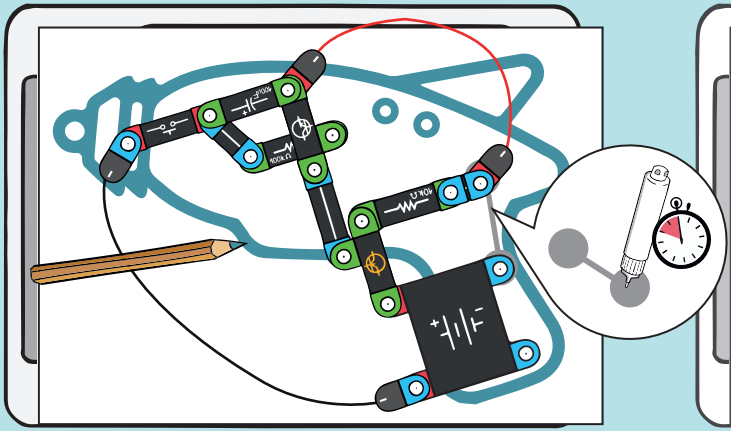

1x resistor 10kΩ


1x button

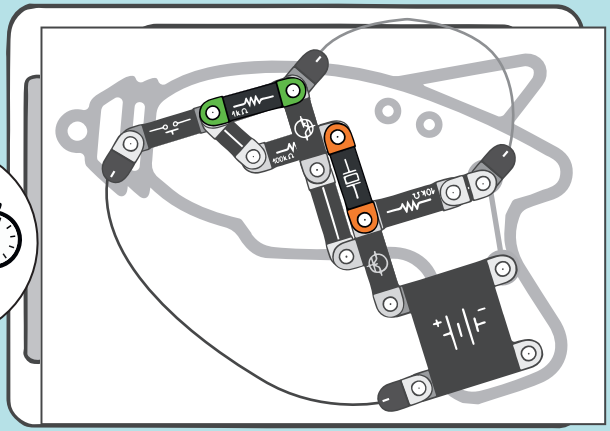

1x

A buzzer with a variable pitch can be used as the sound effect of a laser gun shot. The tone depends on the charge level of the capacitor 100 uF. By pressing the button, we charge the capacitor and thus generate the highest tone. As the capacitor discharges through the 1 kΩ resistor, the tone decreases until it disappears. The same repeats by pressing the button again.

1.



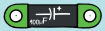
2.



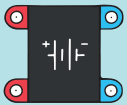
LG70 LASER GUN II.


1x transistor PNP

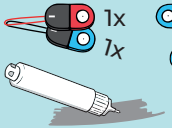

1x transistor NPN

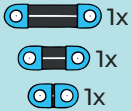

1x capacitor 100μF


1x buzzer


1x battery


paper and pencil


1x conductive pen


1x

1x

1x

1x


1x resistor 1kΩ


1x resistor 100kΩ

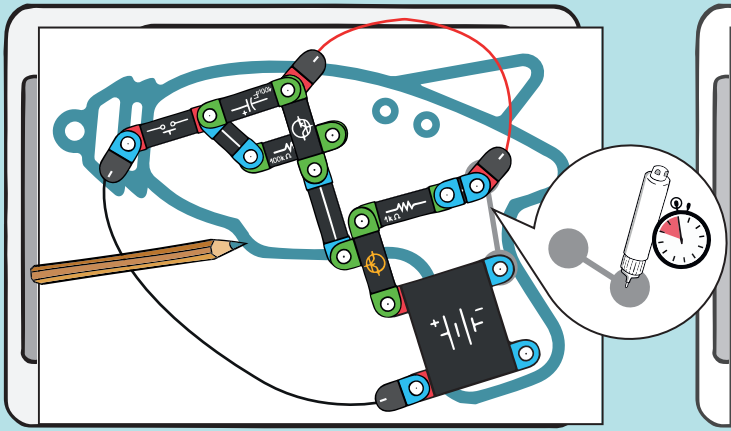

1x resistor 10kΩ


1x button

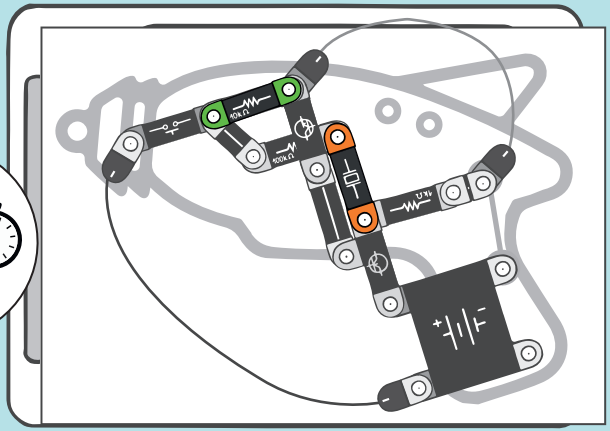

1x

By increasing the tone drop time, we can change the sound effect of the shot. While in the first case the sound of the shot was very short, by increasing the resistance value of the resistor discharging the capacitor 100 uF to 10 kΩ we achieve a longer lasting effect of the shot, which is suitable as a stronger weapon effect.

1.



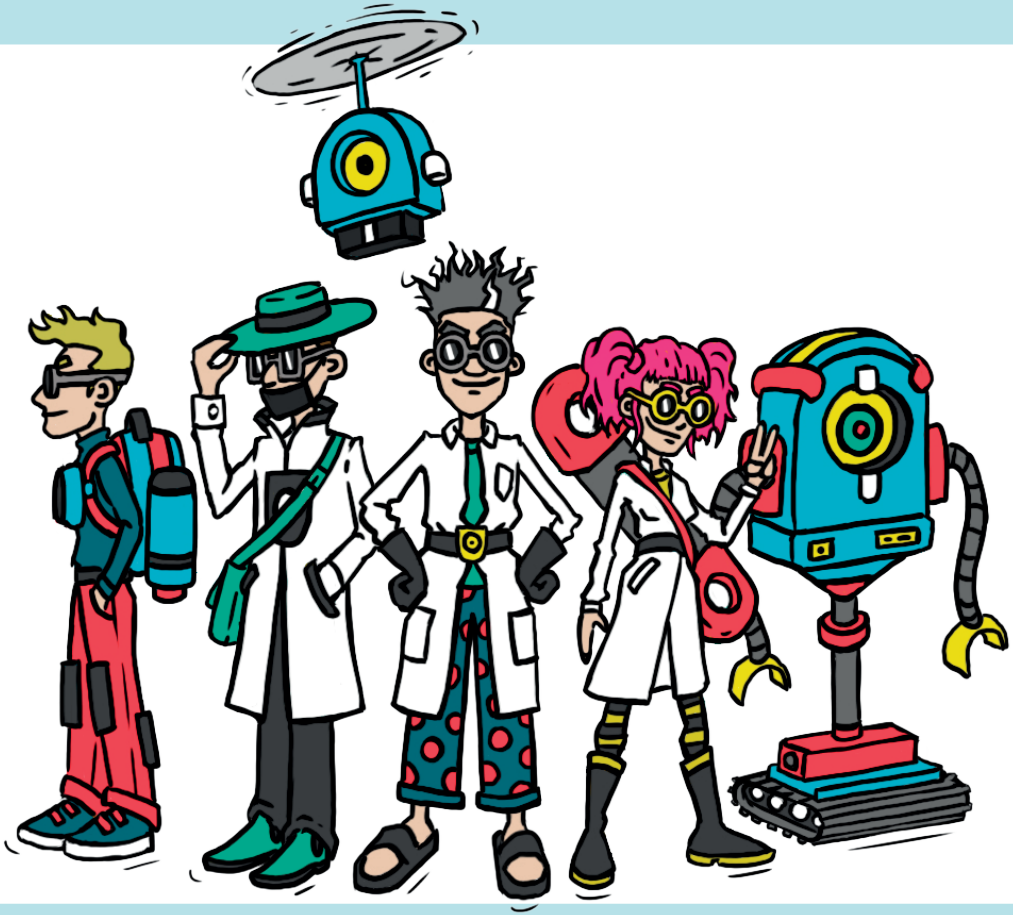
2.



You have made it!

I hope you have had a great time. If you do not have enough yet (and I hope you don‘t), do not forget that you can find more projects on our website!

www.boffinmagnetic.com/community/projects



Did you know that Boffin magnetic has two other friends?

Their names are **3Dsimo** and **Noyce Joyce.**
Each of these friends has different super powers. Boffin Magnetic is a young genius. 3Dsimo is a handyman who repairs everything and substitutes an entire workshop. On the other hand, Noyce Joyce can turn any electronics into a kit that is either functional, beautiful or can even be worn.

3Dsimo web: www.3dsimo.com
Noyce Joyce web:www.noycejoyce.com

BOFFIN LITE

LED

photoresistor

lightbulb

diode

100nF capacitor

100µF capacitor

100kΩ resistor

1kΩ resistor

10kΩ resistor

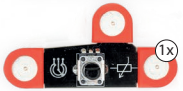
1MΩ resistor

NPN transistor

PNP transistor

buzzer

microphone

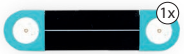


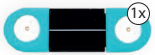
potentiometer

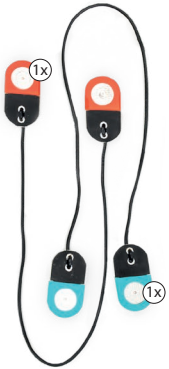
switch

button

battery







conductive pen

cleaning brush

You can purchase other components at: **www.boffinmagnetic.com**