Electronics

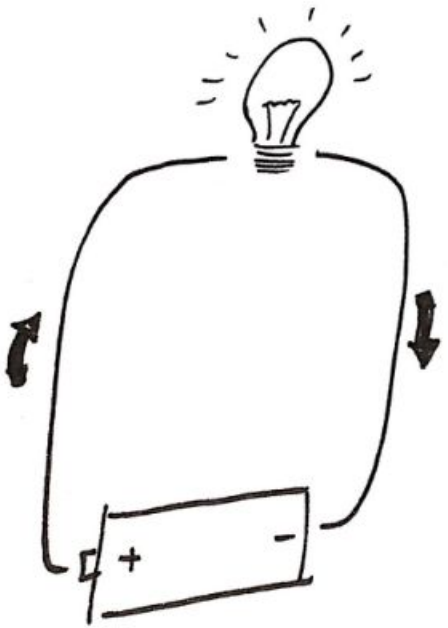
Electric circuits

Electric circuits >> What is an electric circuit

An electric circuit is made of a power source, which feed electricity to a load. The electricity flows between the elements through the conductors.

Load (light, motor, sensor)

Conductor (wire, breadboard)



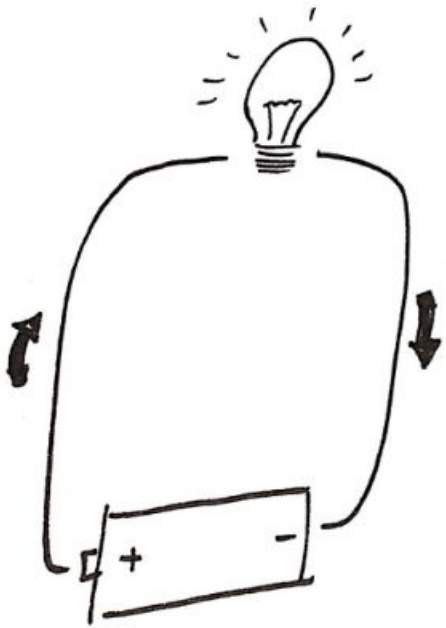
Source (battery, plug)

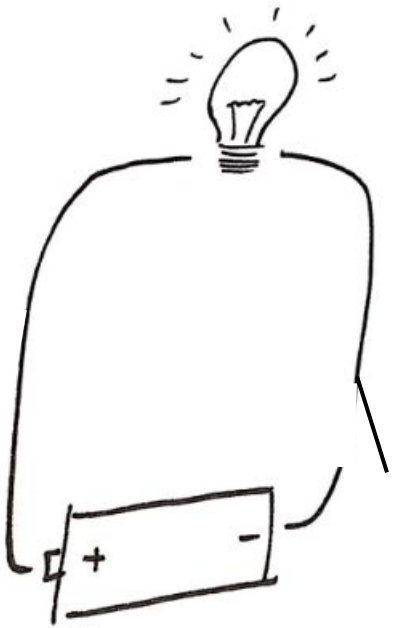
Electric circuits >> What is an electric circuit

The electricity flows from the point on the source with the most electricity (‘+’, power, V) to the point with the least (‘-’, ground).

There will only be a flow of electrons (=current) if the circuit is closed.

So we can stop the current by cutting off the circuit.





Electric circuits >> Electricity values

The voltage (V) is the potential of energy that the battery has. In an analogy to water, the more water in the tank the more pressure the water will have when it is opened.

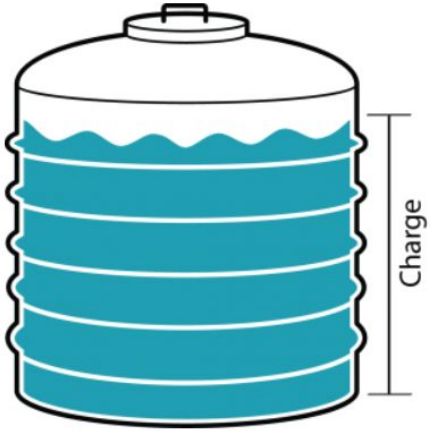


Fig. 1: Charge

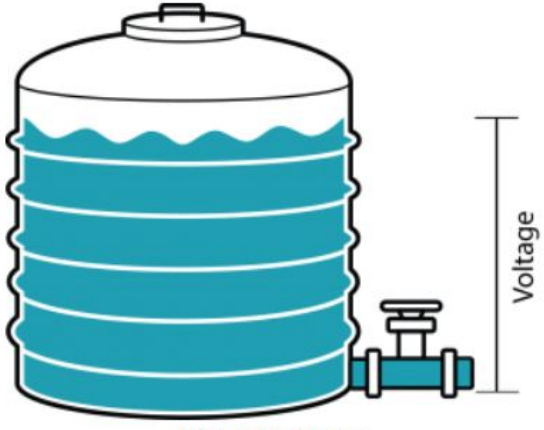


Fig. 2: Voltage

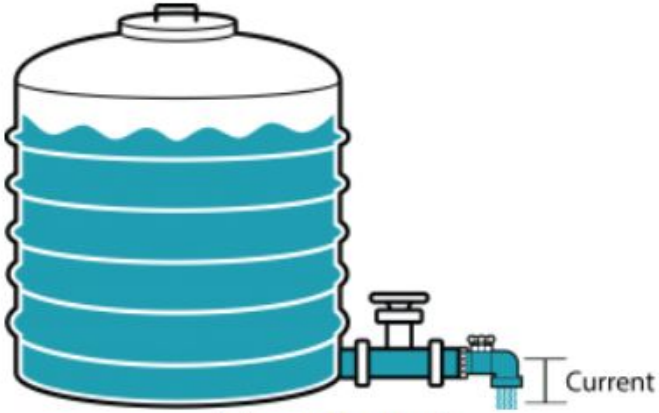
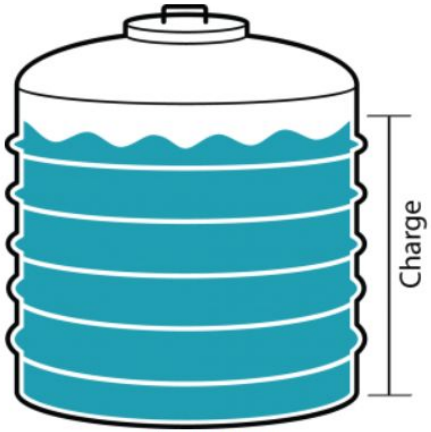


Fig. 3: Current

https://www.ecosoch.com/understanding-electricity/

Electric circuits >> Electricity values

The current (**Ampere(A)**) is how much water we're allowing to go through the pipe. We can increase and decrease this by changing the width of the pipe.



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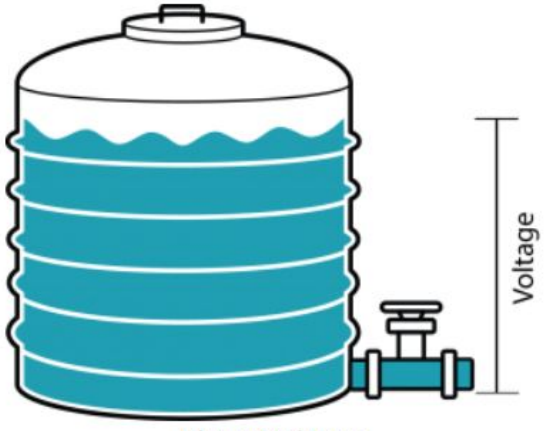

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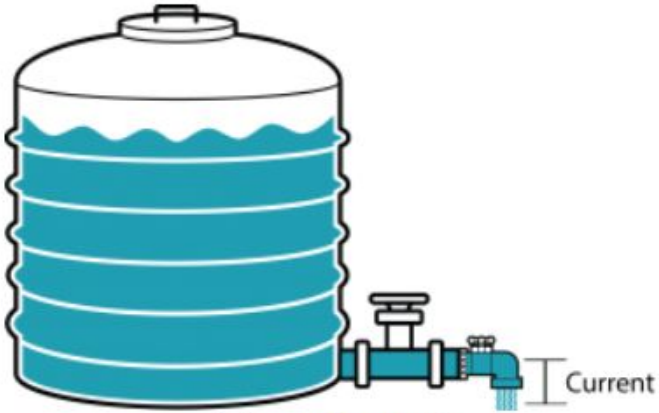

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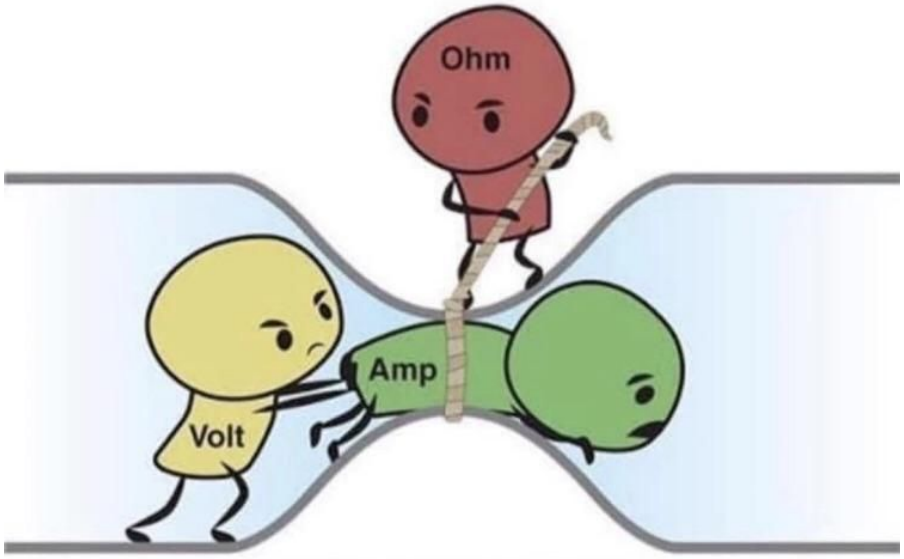
Electric circuits >> Electricity values



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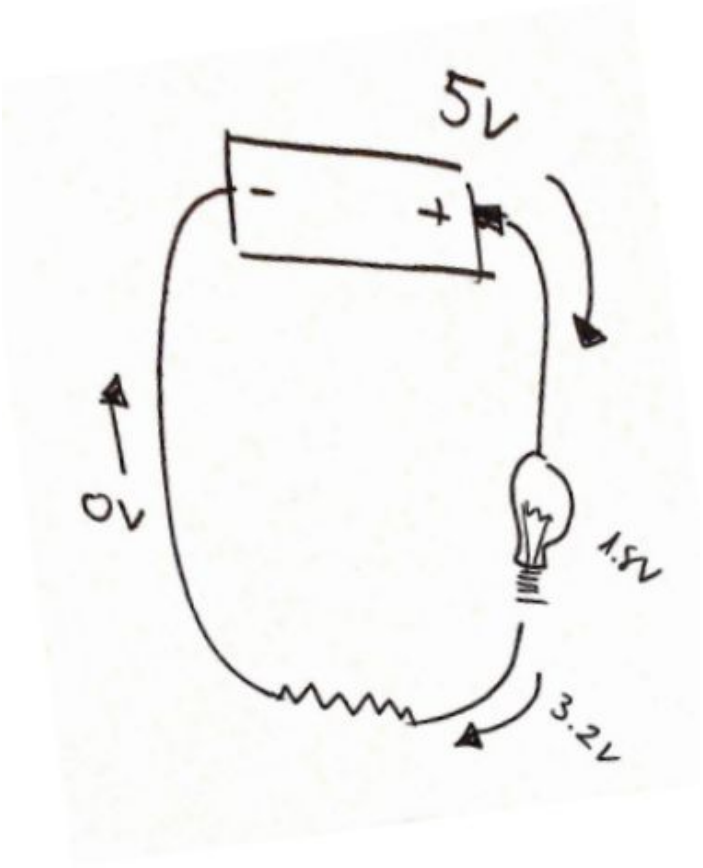
Electric circuits >> Loads, resistors

Not all loads are the same, and sometimes they need less current than the source provides.

But, if the current is too strong, it can ruin the load.

In order to “use up” the rest of the power we use a resistor.

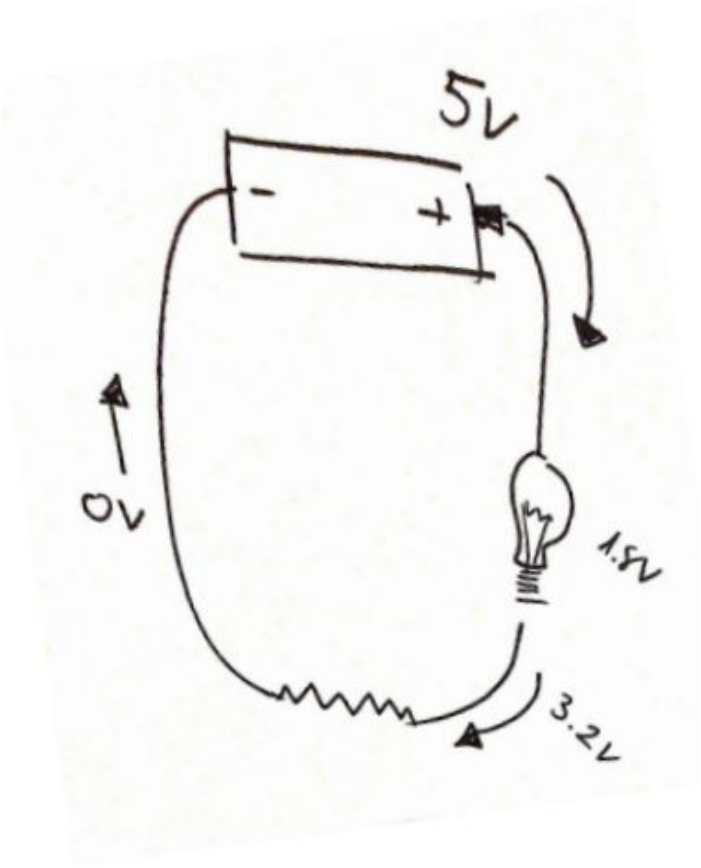


Electric circuits >> Loads, resistors

Not all resistors are the same, and we need to calculate which one we need to use, which will depend on the source and the load.

For this calculation we use Ohm's law:
V= IR

V = Voltage
I = Current
R= Resistance



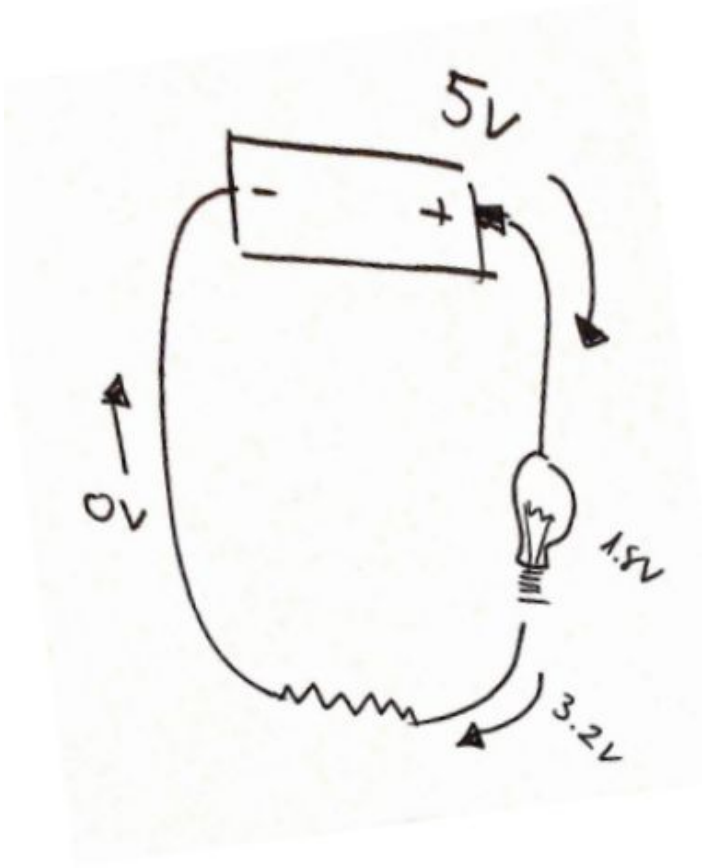
Electric circuits >> Loads, resistors

V= IR

V in this case is the amount of the voltage left in the circuit after the load has used its share. Therefore, the V value we need will be:
V= V (source) - V(load)

I will be the current needed for the load.

Once we have these two we can calculate the R.
R= V/I



Electric circuits >> Loads, resistors

We need to know the specific values of the V and I of our load. These will appear on its data sheet, which can easily be found on the internet.

LED - Basic Red 5mm

COM-09590 ROHS

$0.45

Volume sales pricing

- 1 +

ADD TO CART

Quantity discounts available

DESCRIPTION | FEATURES | DOCUMENTS

- 1.8-2.2VDC forward drop
- Max current: 20mA
- Suggested using current: 16-18mA
- Luminous Intensity: 150-200mcd

Electric circuits >> Loads, resistors

Our LED uses between 1.8-2.2 volts, so we'll say
V (load)= 1.8

The max current is 20 mA, which is milli-Ampere. We need the value in Ampere, so we divide by 1000. Therefore,
I = 0.02

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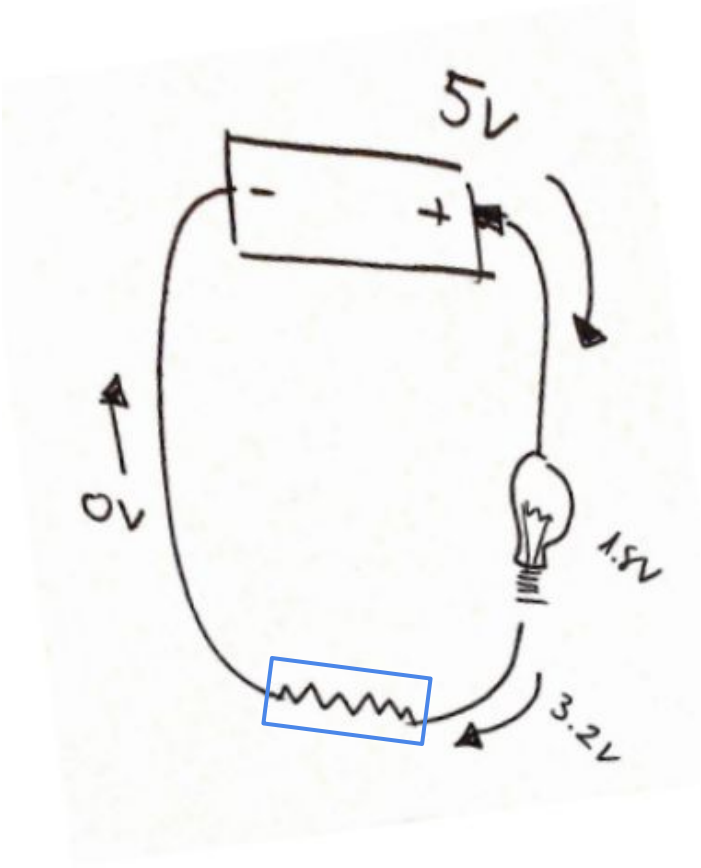
Electric circuits >> Loads, resistors

Now that we know the I and V values of the load, we can calculate the R.

V= 5V(source)-1.8V(load) = 3.2V

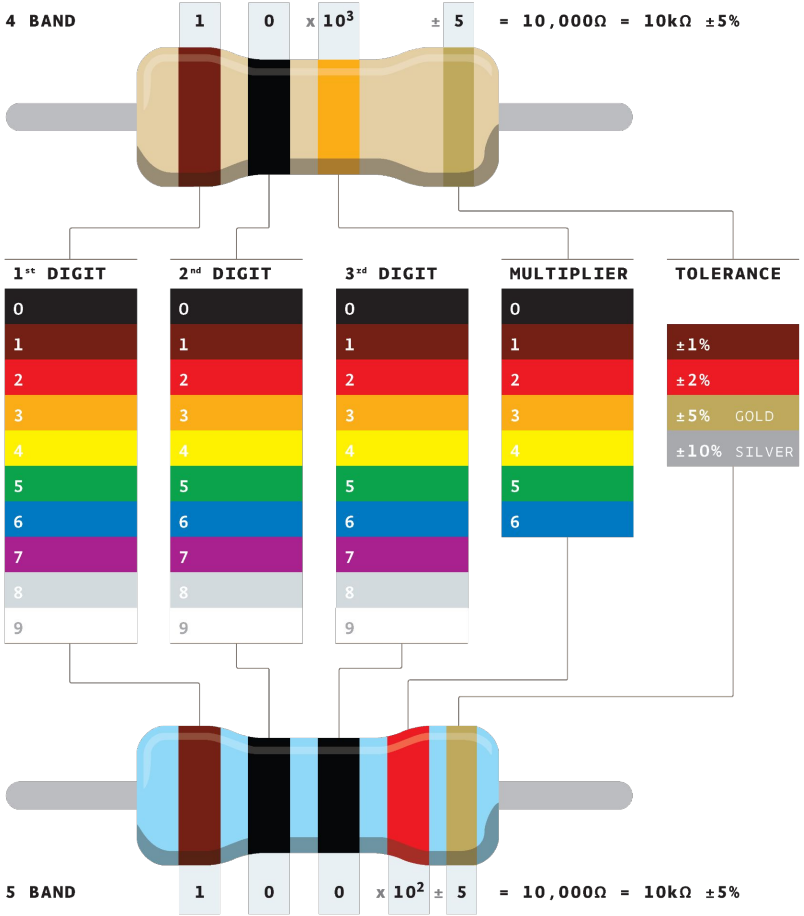
R= 3.2V/0.02I
R= 160 ohm

We need to use a resistor of 160 ohm.



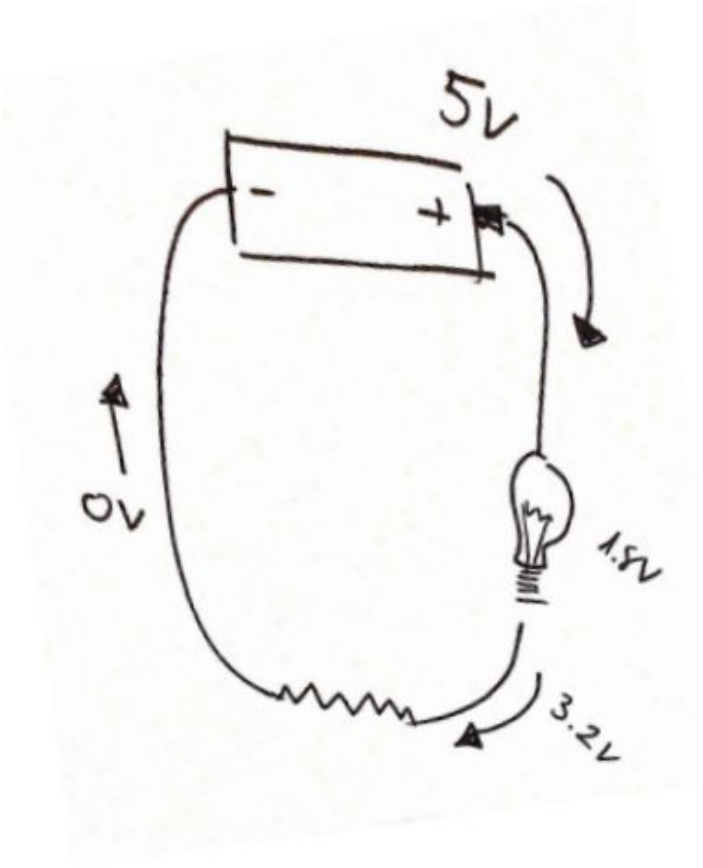
Electric circuits >> Loads, resistors

We'll use the closest resistor we have.
Resistors are coded by colour:



Electric circuits >> Loads, resistors

It doesn't matter if we put the resistor before or after the load, because it restricts the flow of the current for the entire circuit.

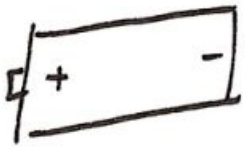


Electric circuits >> Types of circuits

If we want to have more than one load in our circuit, we can incorporate them in two ways:

Series circuit

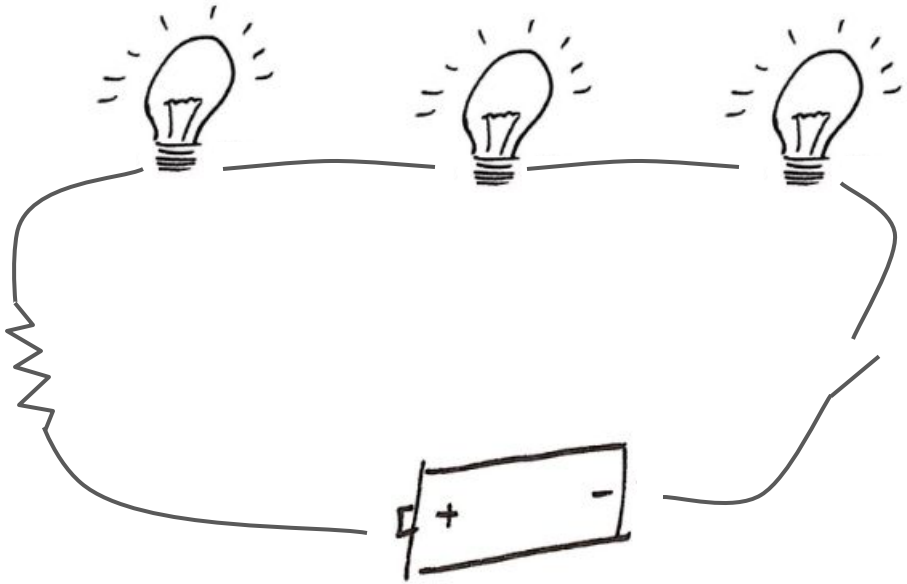
Parallel circuit



Electric circuits >> Types of circuits

Series circuit means we connect the loads one after the other.

- The current has to flow through one before continuing to the next
- The loads have to have the same electrical consumption
- If one load fails, the circuit won't be complete and none of them will work
- A switch will turn all of them off together



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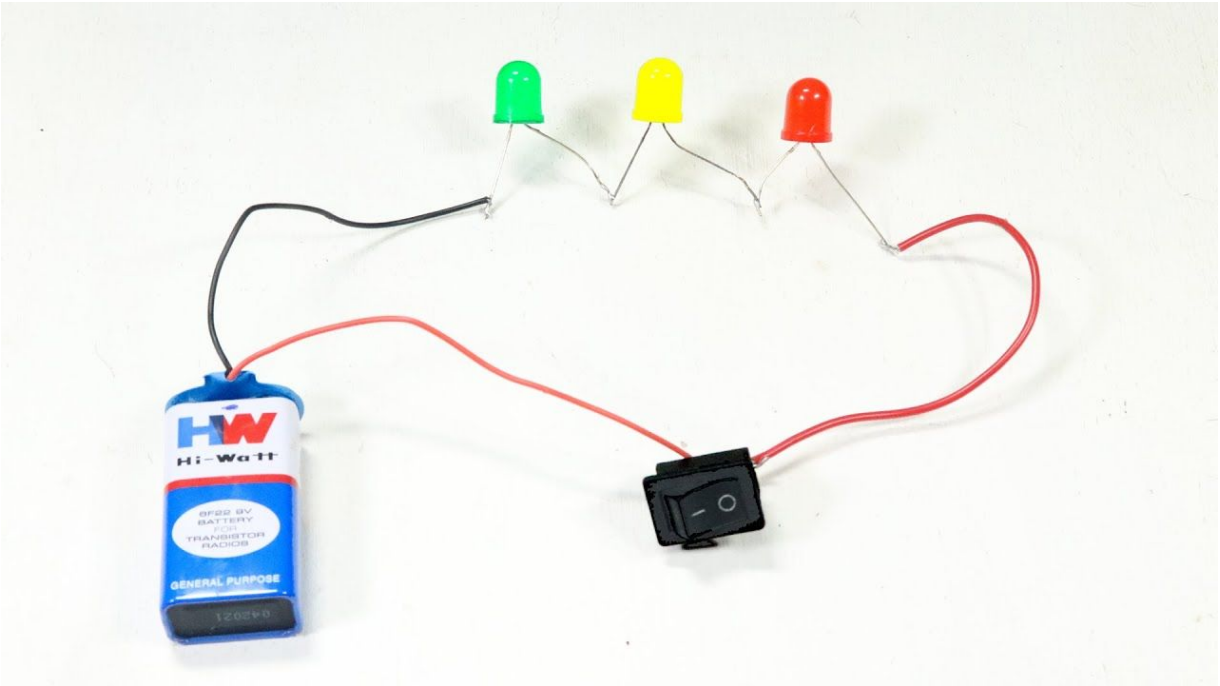
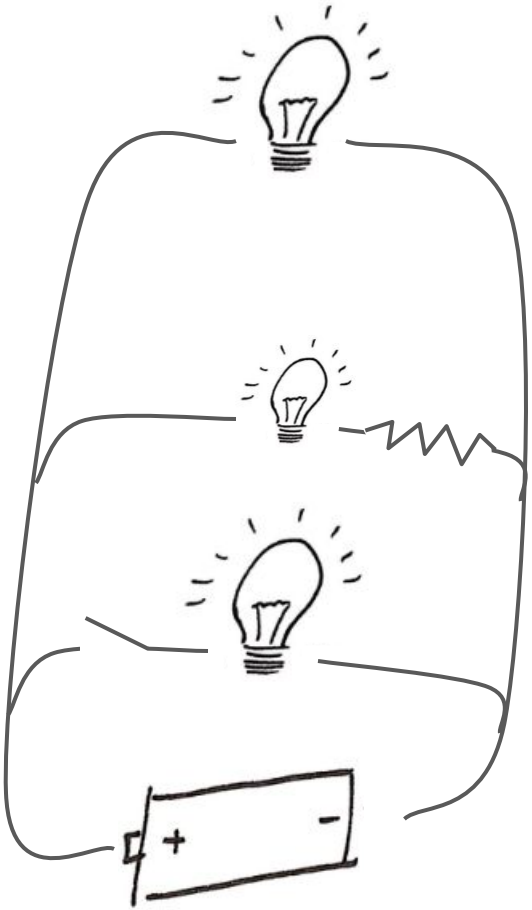


Electric circuits >> Types of circuits

Parallel circuit means we connect the loads in different loops

- The current flows separately to each load
- If one load fails, the other will still work
- We can place a switch to control each separately
- Each load can have a different current



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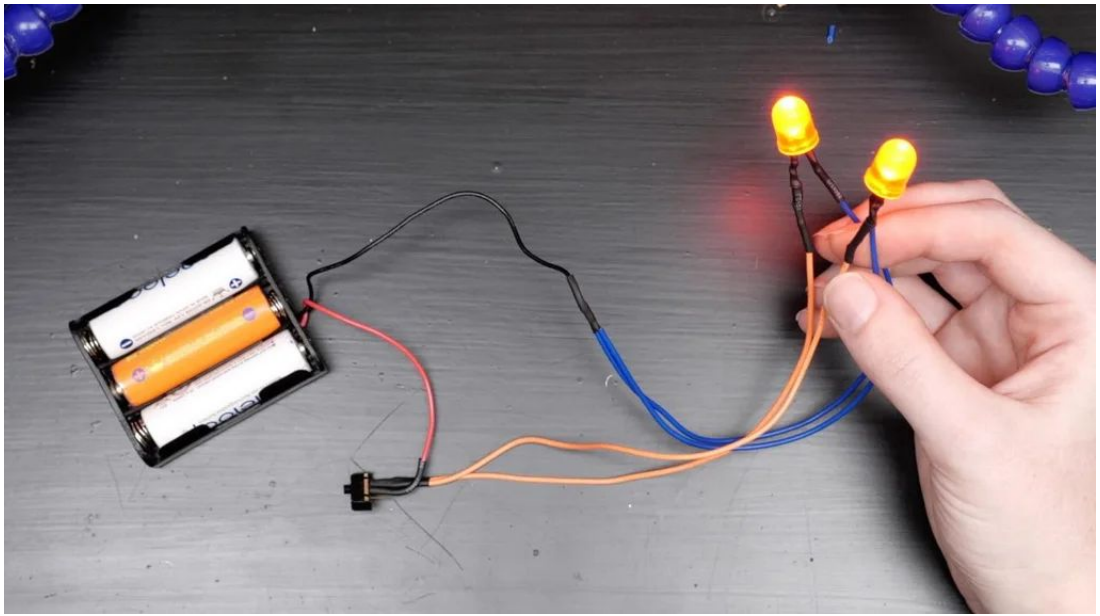
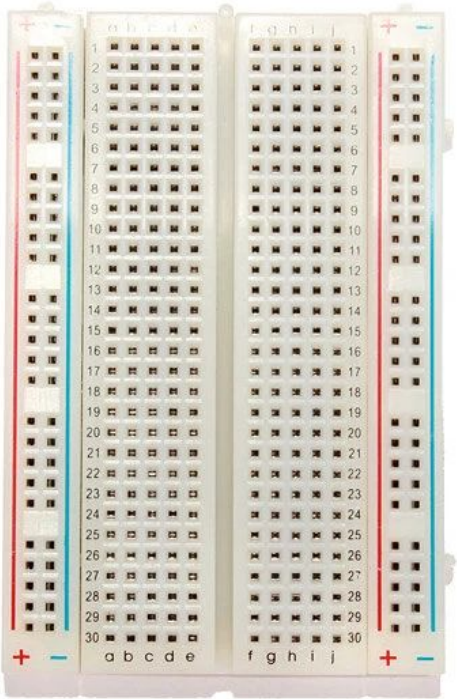


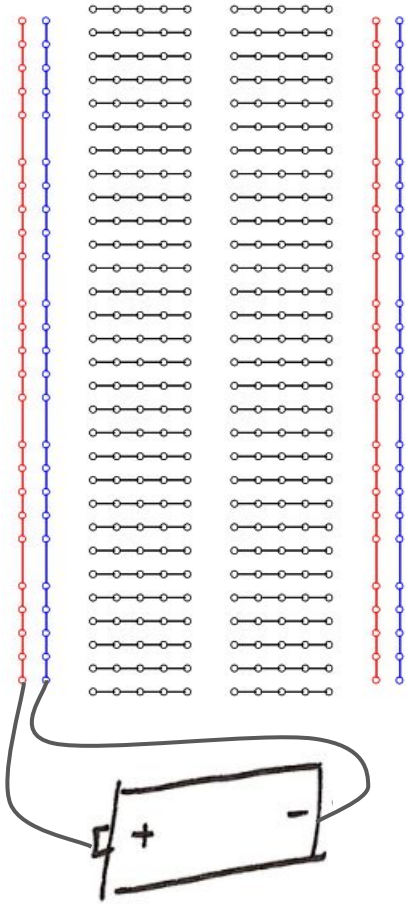
Electric circuits >> Types of circuits

Breadboards are used to simplify wiring for either type of circuit, but especially for parallel circuits.

We connect the source power (‘+’, V) to the red line, and the ground (‘-’) to the blue line.

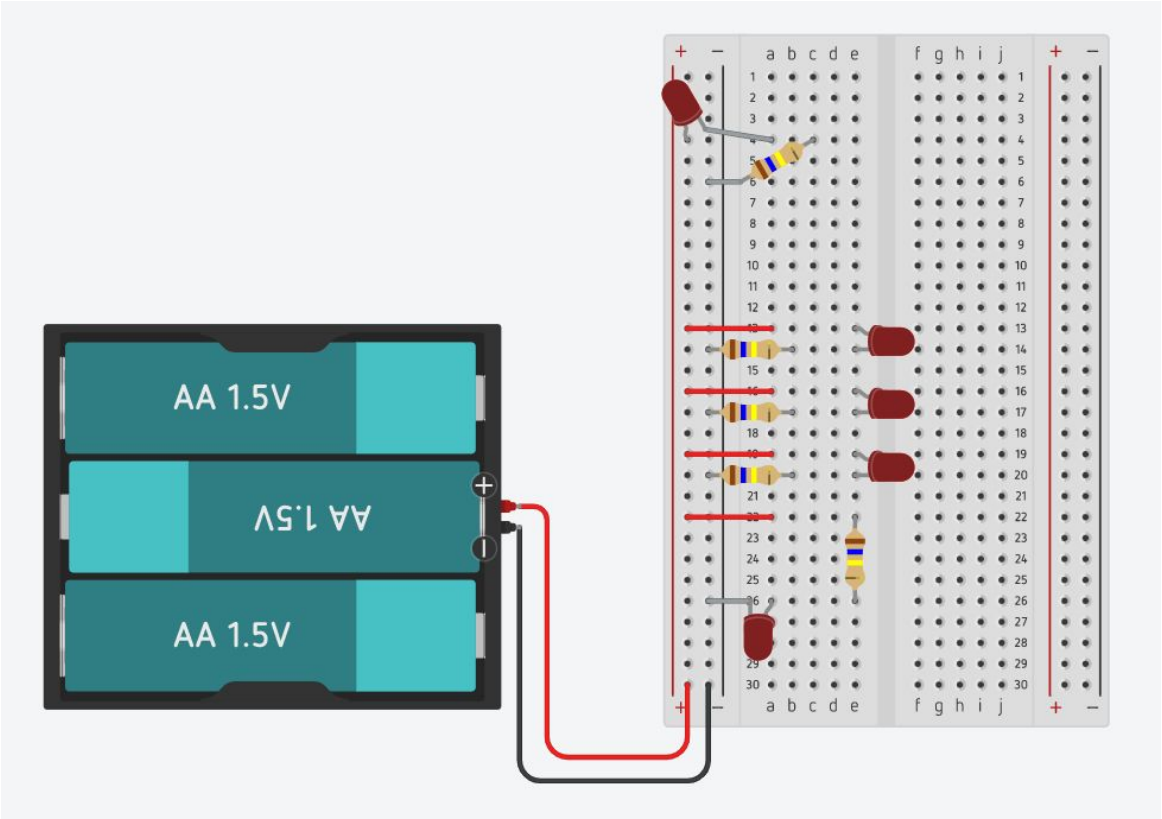
This allows us to connect (almost) as many loads as we want.





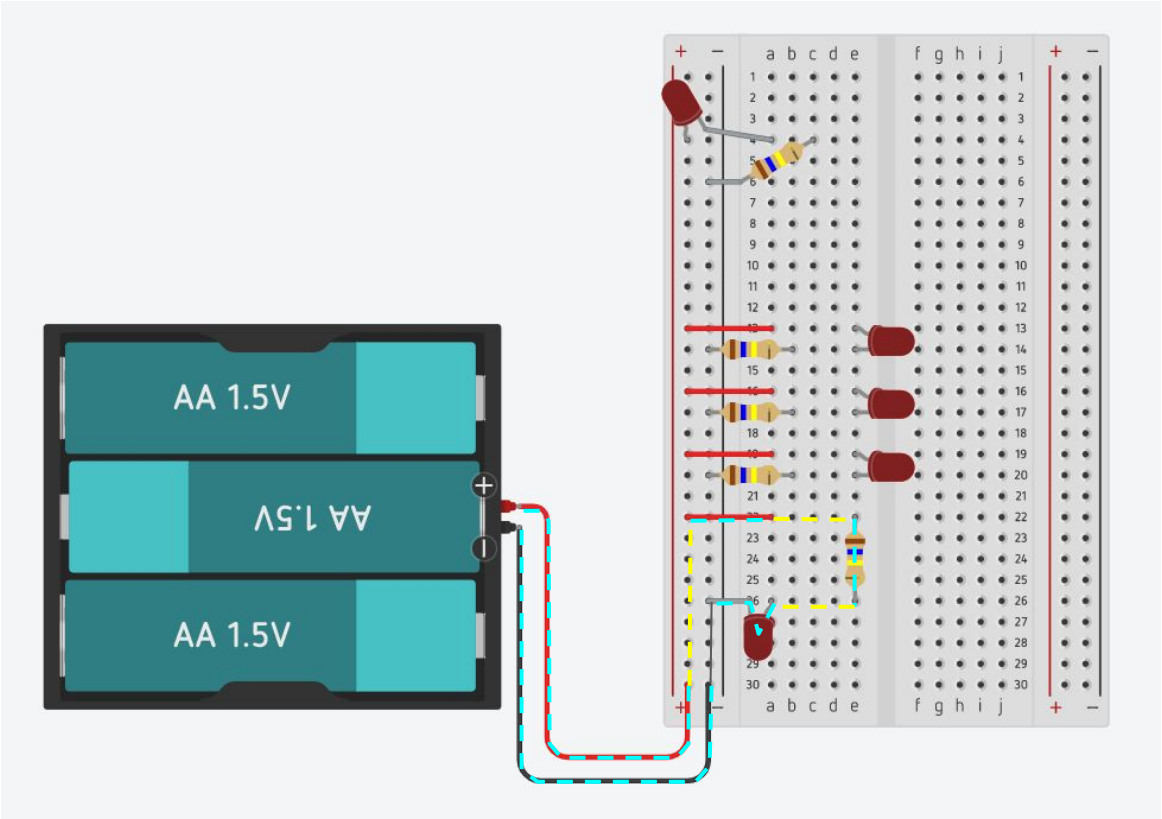
Electric circuits >> Types of circuits

We can use the breadboard in all sorts on ways, and they will all work as long as the load connects to the + line and the - line.



Electric circuits >> Types of circuits

The circuit will be completed by our elements, and connections inside the breadboard.



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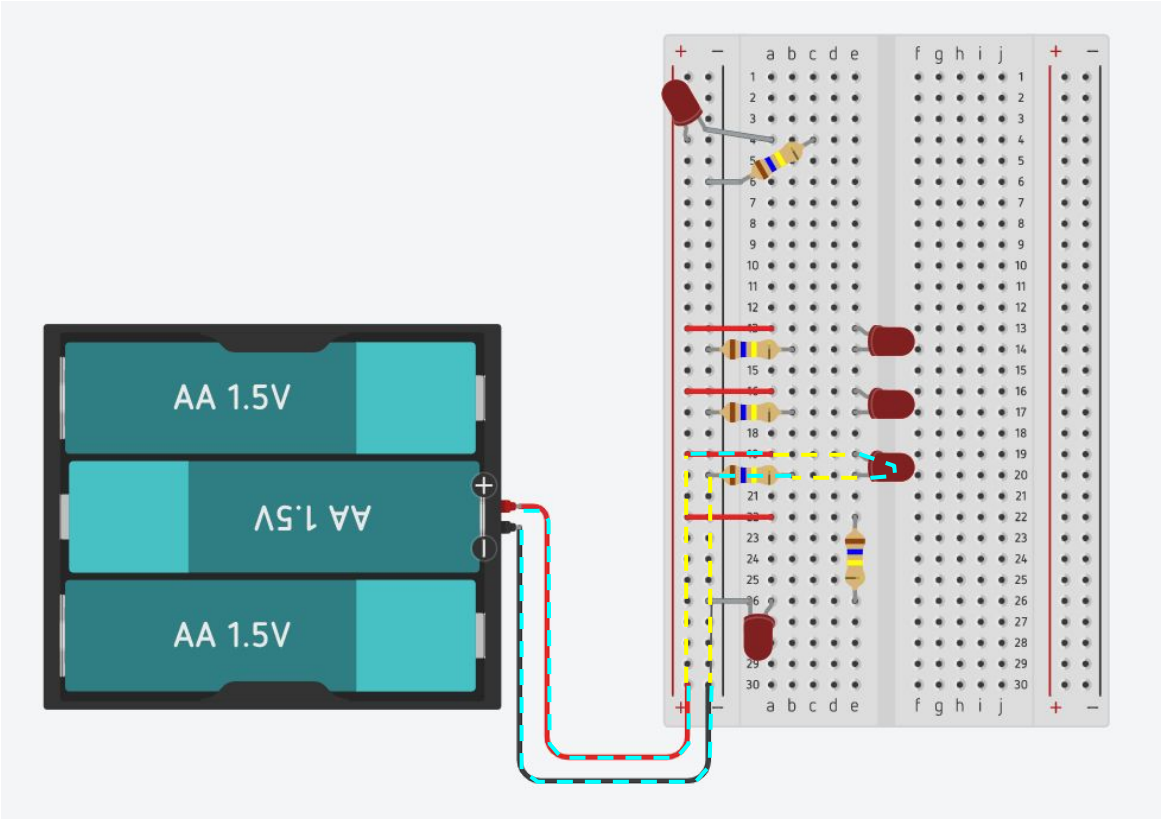

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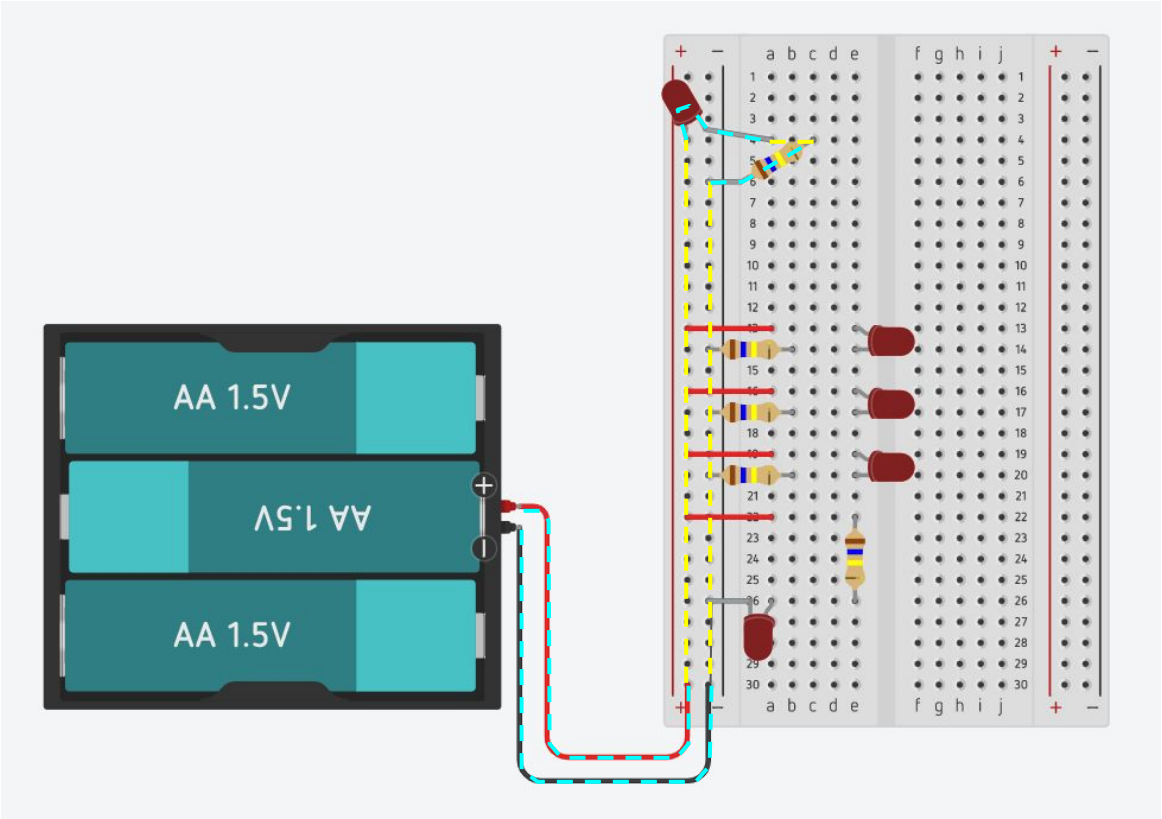

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