



# Teachers expectations:

- **Safety first (Listen – Understand - act)**
- Arrive to class on time.
- Work hard. Do not waste your time.
- Complete and hand in assignments on time
- Show respect and care for the school equipment, students and teachers



# House Keeping

- Get to know the location of DGT resources: tools, equipments and electronic components that you are going to use in your DGT sessions.
- Know the pack-up procedure.
- Component storage is behind left side whiteboard – students do not access this unless they have teachers permission


# Digital Technology In NZC

- What is digital technology?

"The digital curriculum is about teaching children how to design their own digital solutions and become creators of, not just users of, digital technologies, to prepare them for the modern workforce."

Chris Hipkins, 2018 

## The New Zealand Curriculum

In the [Technology Learning area](#)  there are two new technological areas:

**Computational thinking for digital technologies** – Students will develop an understanding of computer science principles that underlie all digital technologies. They'll learn core programming concepts so that they can become creators of digital technology, not just users.



**Designing and developing digital outcomes** – Students will learn how to design quality, fit-for-purpose digital solutions.

# BYOD

Each student must have a device

Software and websites:

1- Begin by finding website – **Technology Student** – bookmark this page.

<http://www.technologystudent.com/index.htm>

Then click on electronics

2-Visit Tinkercad website for circuit drawing and simulation.

<https://www.tinkercad.com/things/aAnI5KczKhu-sizzling-waasa/editel?tenant=circuits>

# Electronic components and their symbols

- <http://www.technologystudent.com/elec1/compn1.htm>
- <http://www.technologystudent.com/elec1/compn2.htm>
- <http://www.technologystudent.com/elec1/compn3.htm>

# Batteries, LEDs and simple circuit



<http://www.technologystudent.com/elec1/battery1.htm>

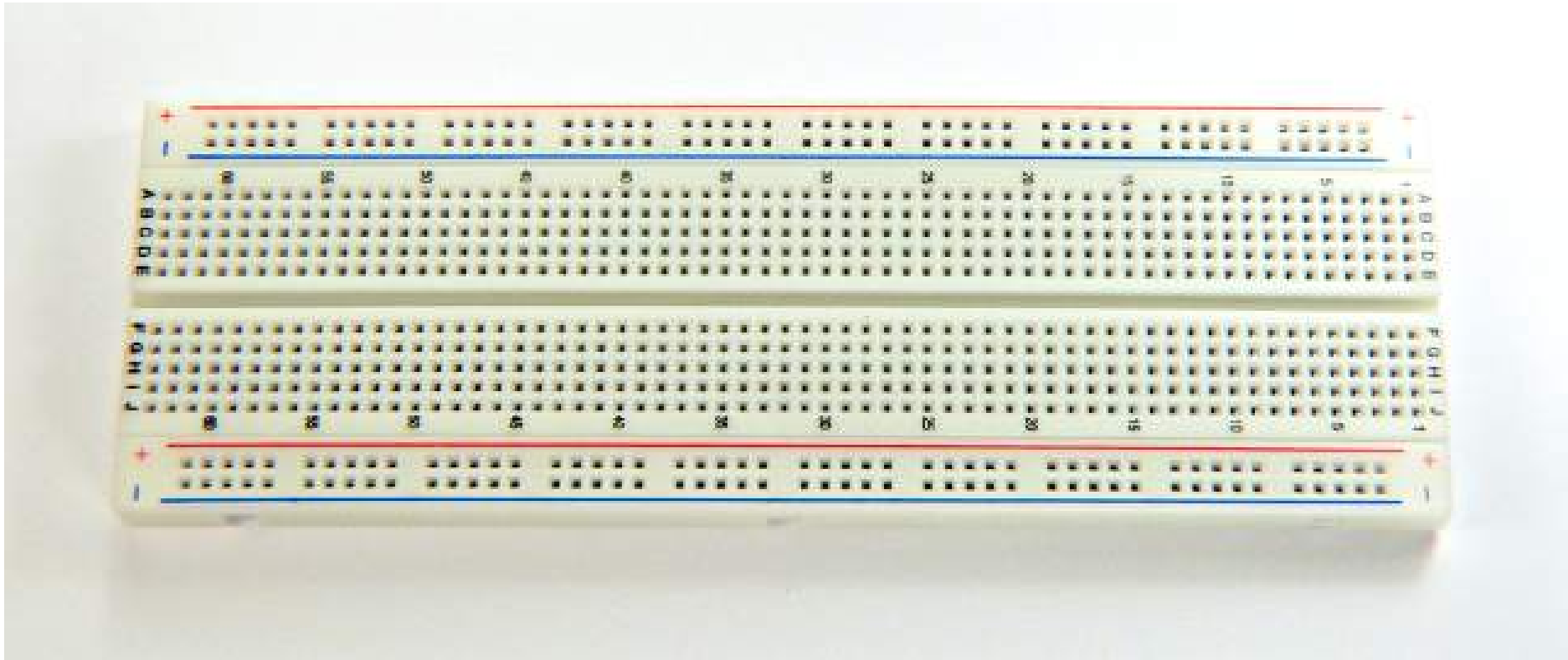
# Resistors



- 
- 
- 
- <http://www.technologystudent.com/elec1/resist1.htm>

# Breadboards

- <http://www.technologystudent.com/elec1/bread1.htm>



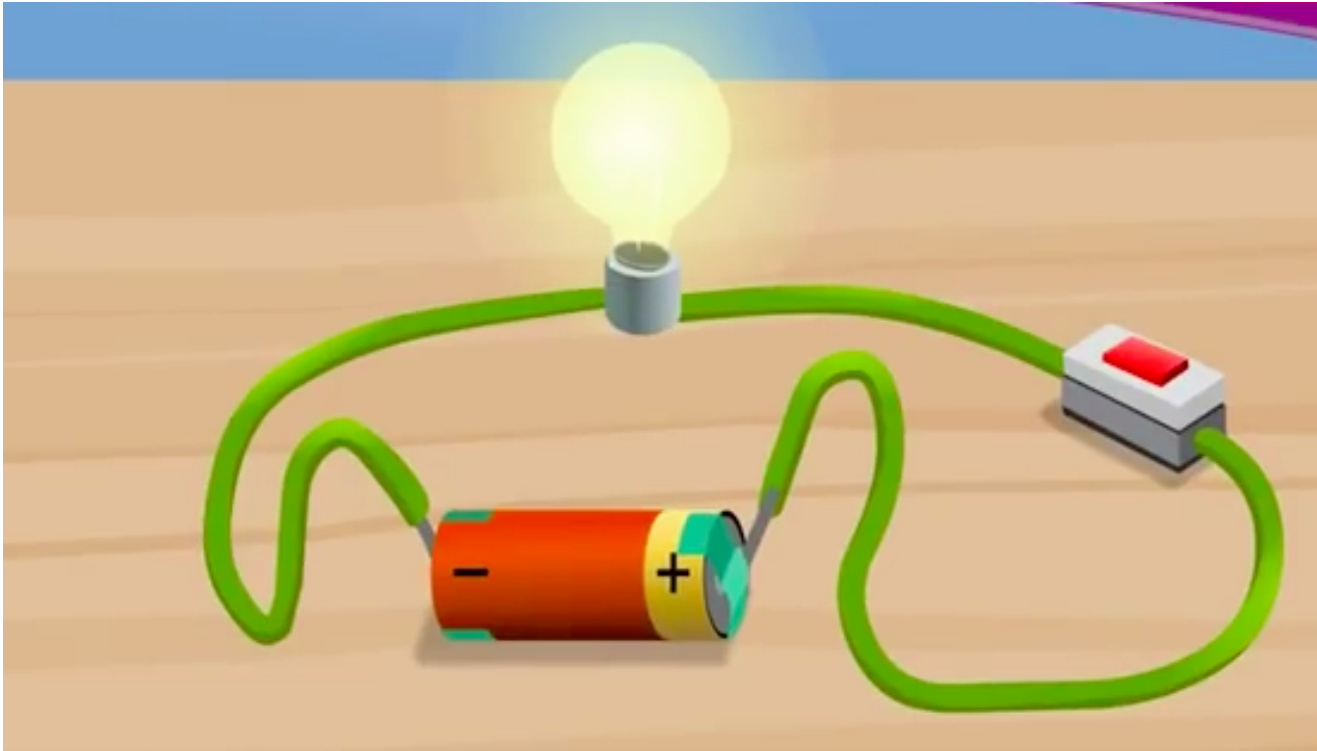
# The multimeter

- Measures the following:
- Voltage (V) in volts  
Resistance (R) in ohms  $\Omega$
- Current (I) in amps
- Transistors polarity (PNP, NPN)
- Continuity circuits





# Lets start with a simple electric circuit



- Click to watch

<https://www.youtube.com/watch?v=VnnpLaKsqGU&t=75s>

# Our first circuit project

1	Project container / box
As required	Solder
As required	Copper tape
2	470 Resistor
2	10k Resistor
1	1k Resistor
3	LEDs
1	LDR
2	Transistors (BC337)
2	10k potentiometer
2	100uF Electrolytic Capacitor

# The LEDs

For their first circuit, making an LED light up, you will need to be able to attach your components to the circuits.

## Notes:

- LED's are very sensitive to being 'wired' the wrong way round and having too much current.
- A 'protective resistor' is used to limit the current flowing through (much like a restrictor in you shower to reduce the amount of water being used).
- If you use different batteries then the protective resistors need to change.

$$3\text{v} = 100\ \Omega$$

$$4.5\text{v} = 270\ \Omega$$

$$9\text{v} = 470\ \Omega$$



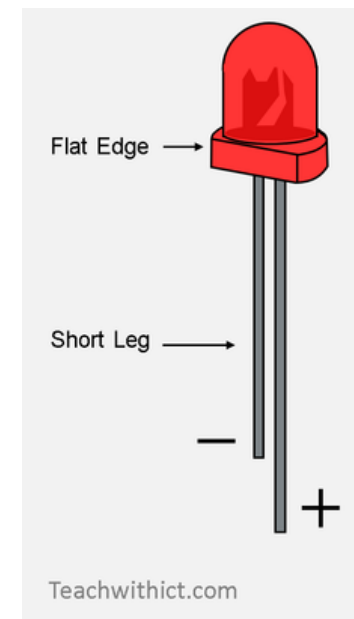
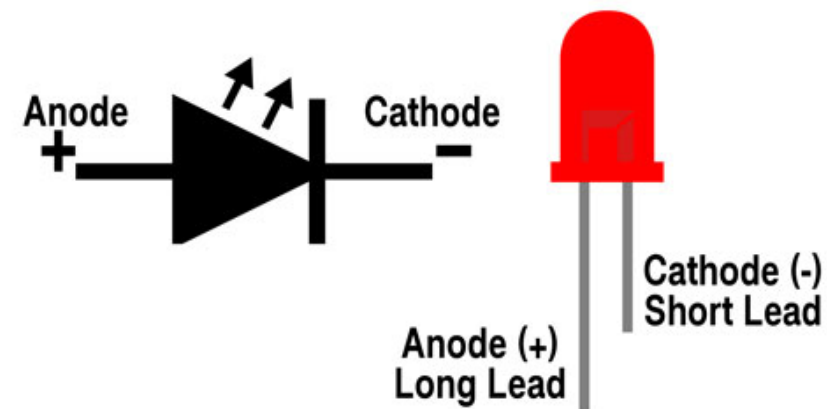
# Using the LED

LED's are polarised, you have to get them the right way round. They really don't like the current being put in the wrong way!

To make things easier, mark the cathode (the one pointing to 0v or ground with a marker pen. It then looks like a negative symbol

When you first pick up a 5mm LED you will notice that the legs are a different length. This makes it easier to distinguish which one points to the positive (anode) and which one points to the zero volts (cathode).

Unfortunately for us, we're going to cut the legs to equal length shortly. But.... Luckily, looking closely at the 'rim' at the bottom of the plastic you will see a small flat spot. That denotes the cathode (points to the 0V) side of the LED.



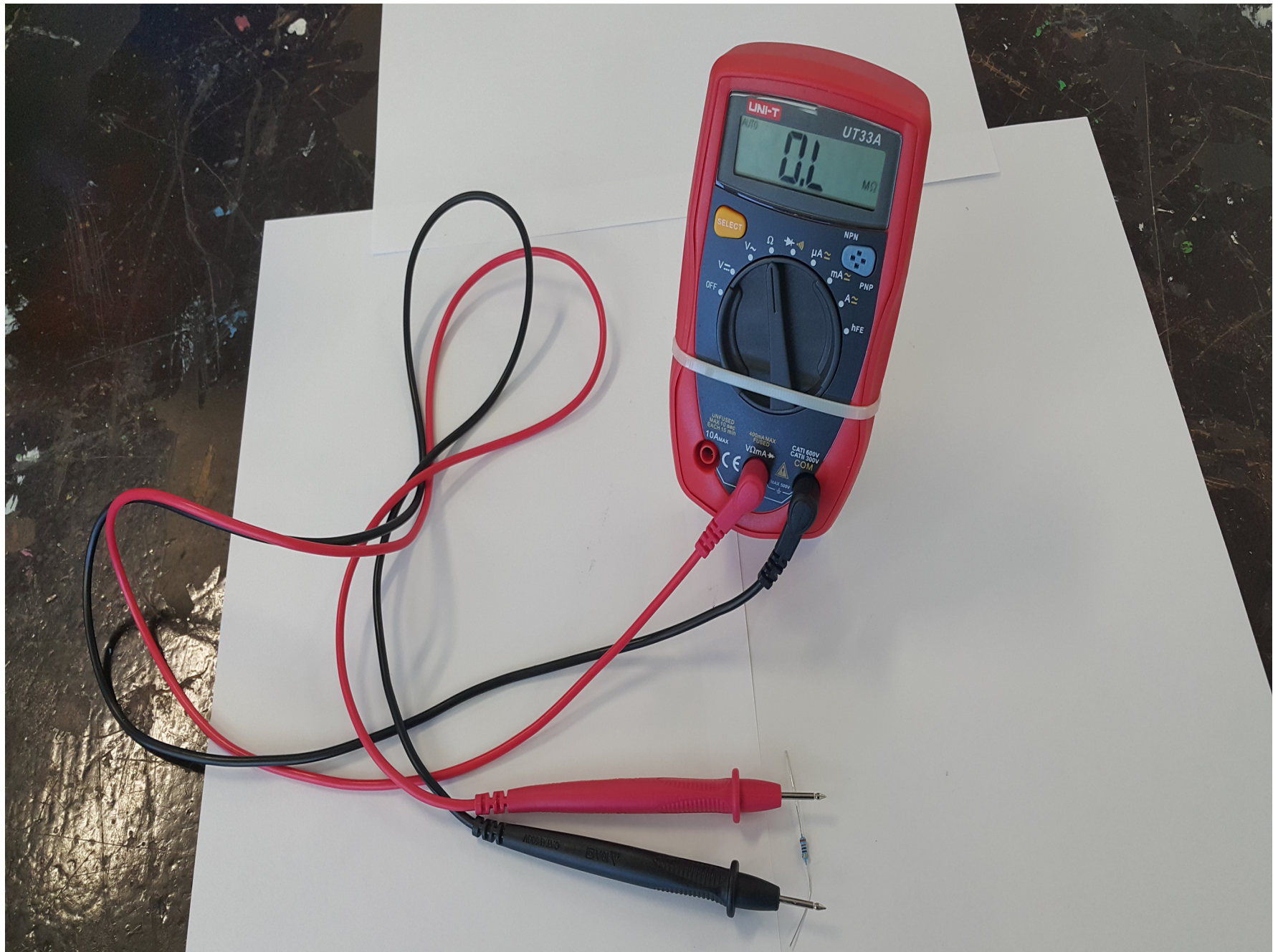
# Using the multimeter

## 1- Measuring voltage across a battery



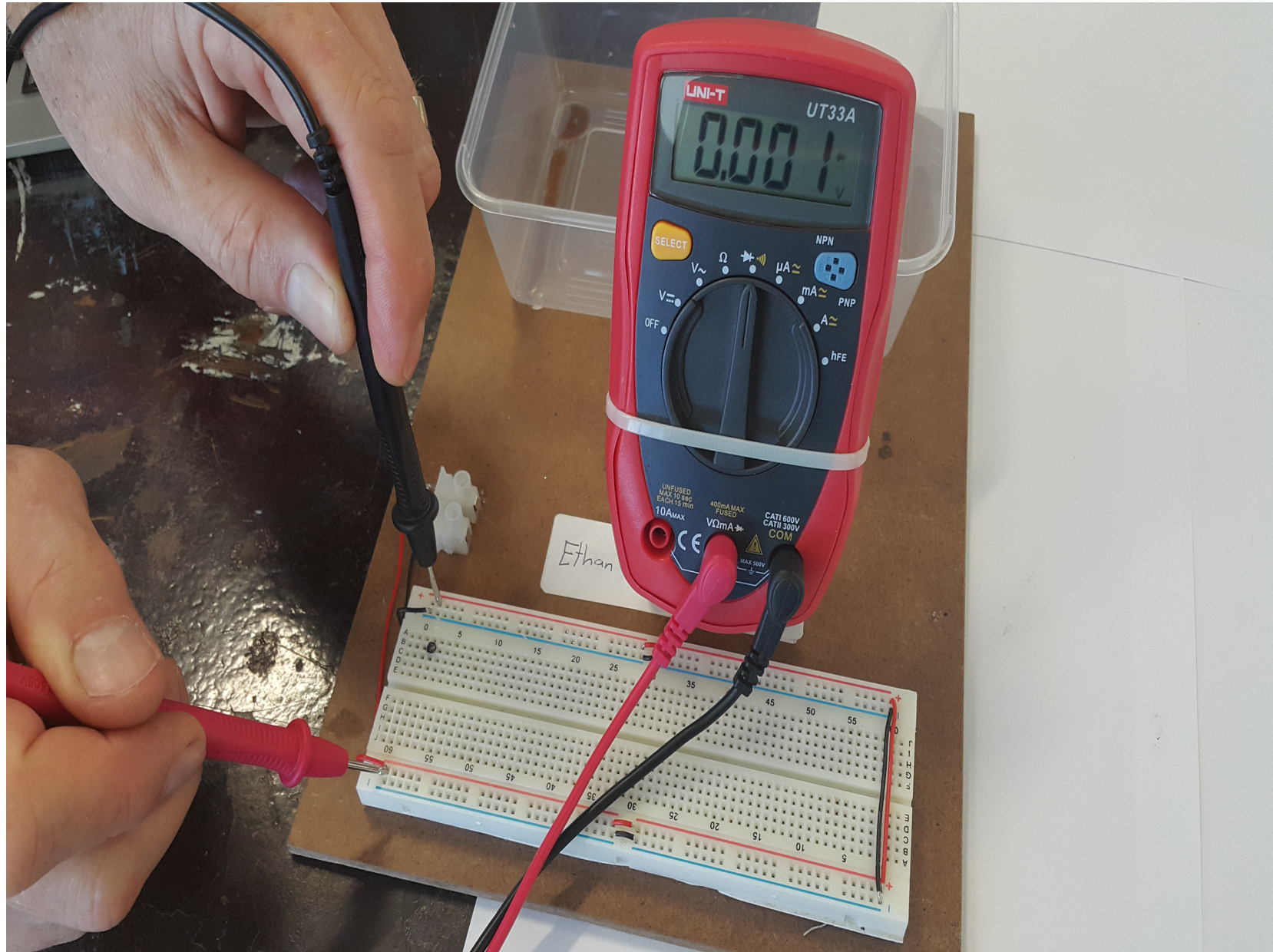


## 2- Measuring Resistance





### 3- Measuring Continuity Circuit



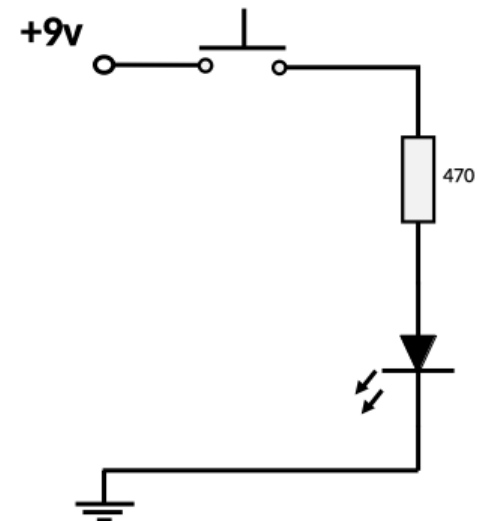
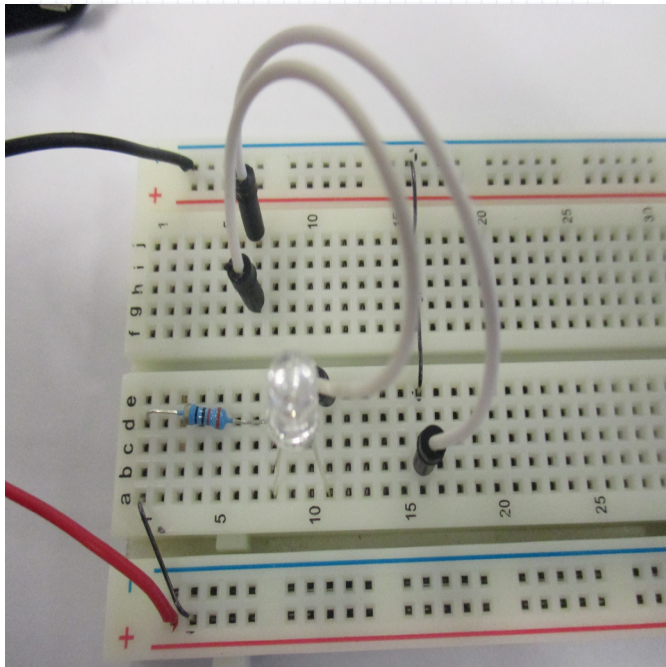
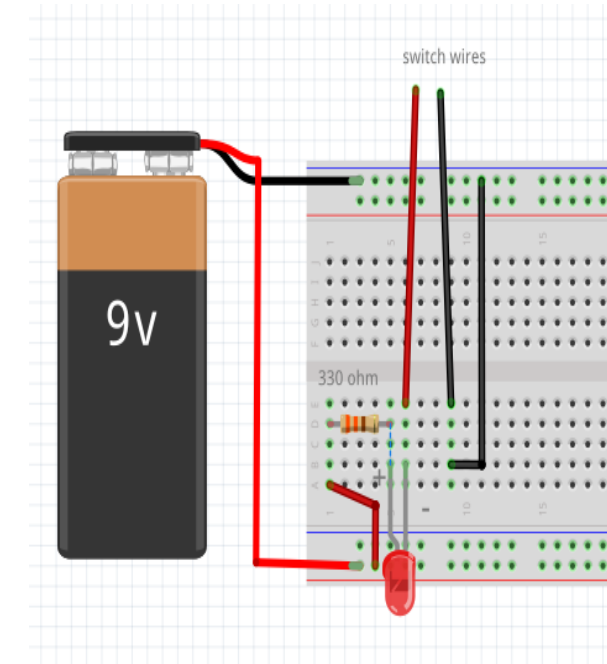
# Basic Circuit Measurements

Follow the instructions on these slides to build your breadboard circuits, make the measurements and answer the questions

- You can work together to make measurements using the multimeter, but you must **answer the questions individually**

Build the basic circuit on Tinkercad layout and then on a breadboard as per the photo shown here as a guide (use a multimeter set to  $\Omega$  to measure the resistor value)

- two hook-up wires are used for the switch, to enable the circuit to remain on the switch wires can be plugged into a common row as shown





## Task 1:

With your switch wires connected together and LED on, set your multimeter to measure voltage (**DC -**)

Measure the voltage across the LED

Voltage =

Measure the voltage across the 470 ohm resistor

Voltage =

Measure the voltage across the +ve and -ve rails (the battery voltage)

Voltage =

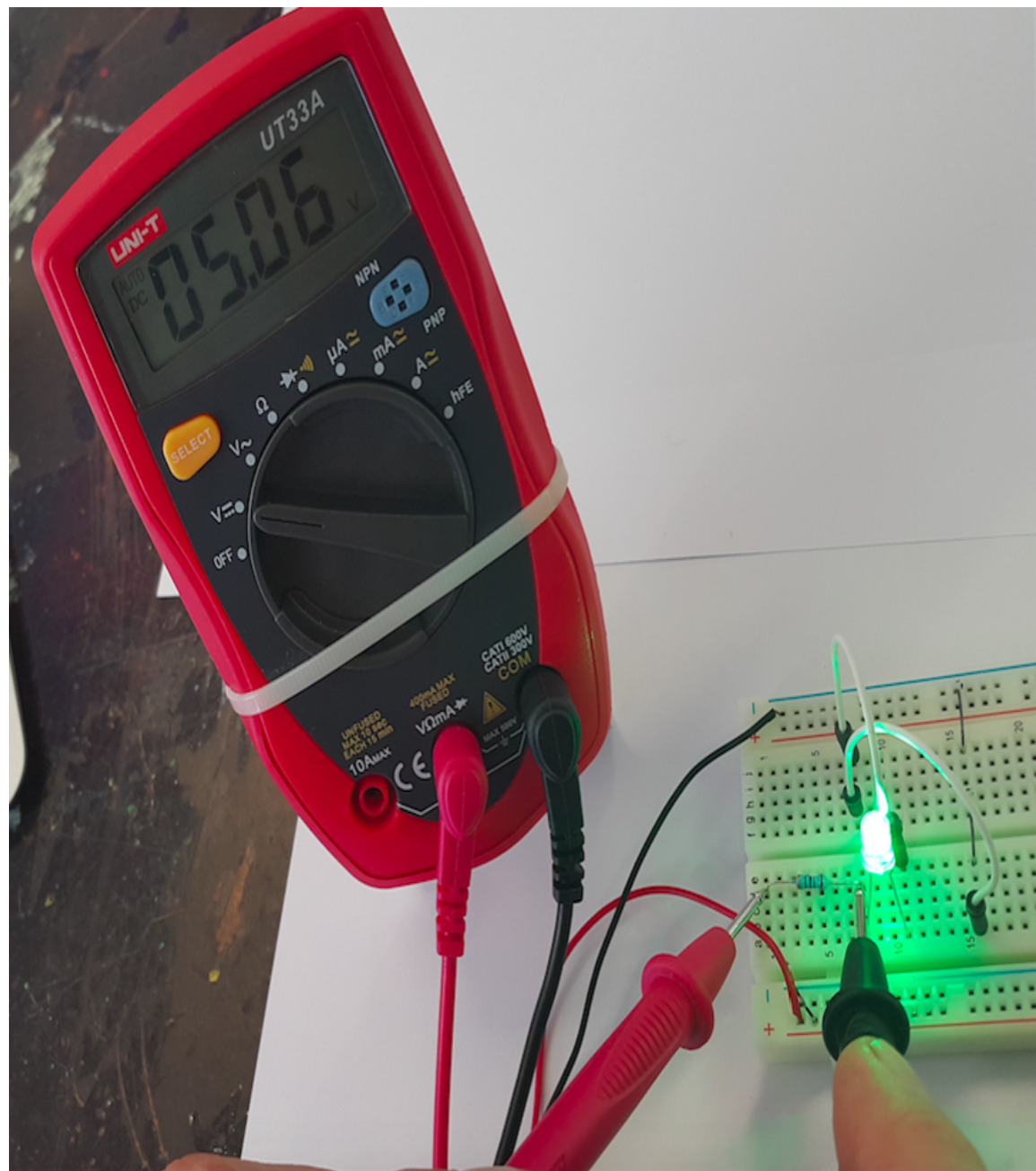
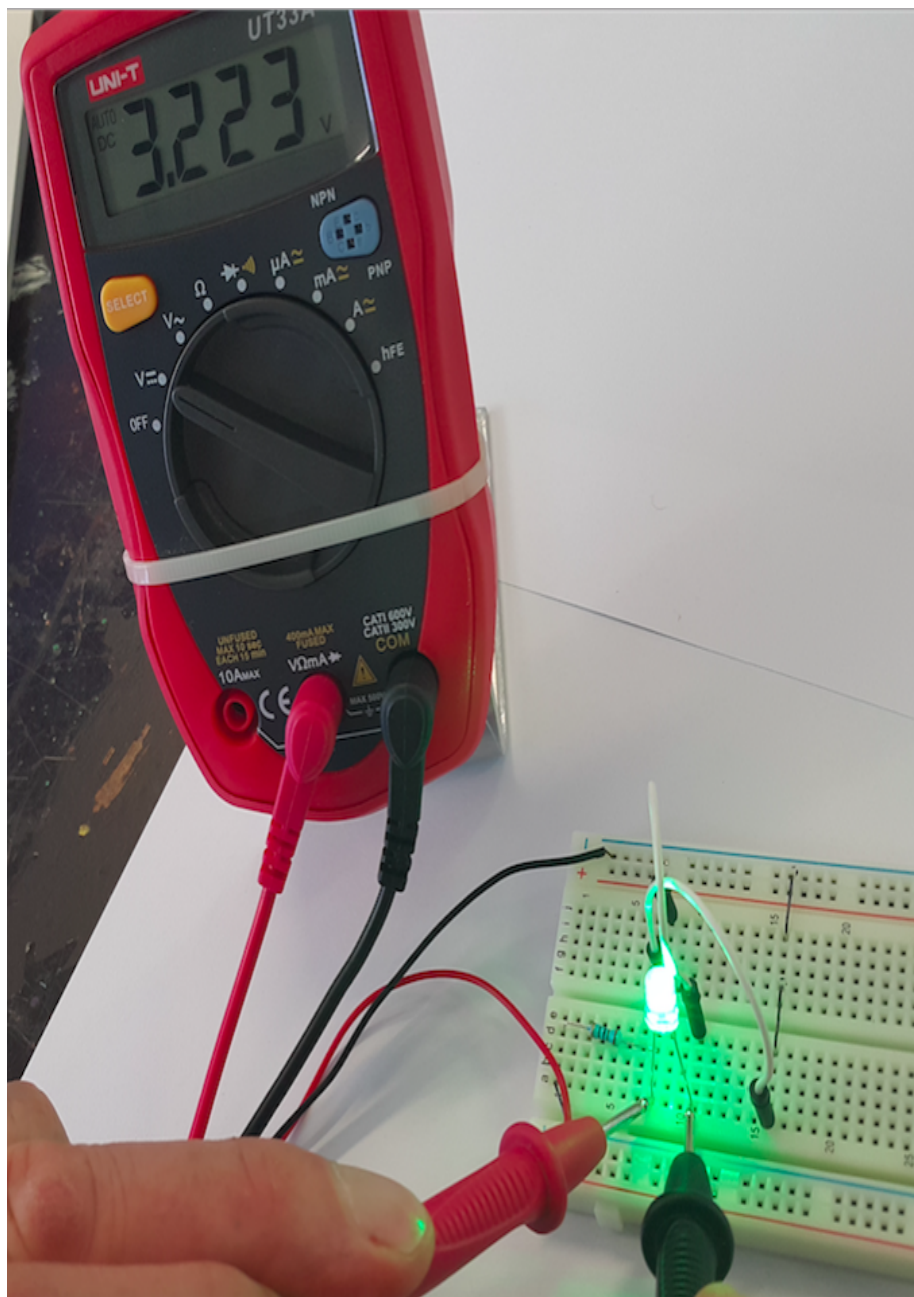
Add the voltage of the LED and resistor together

Voltage total =

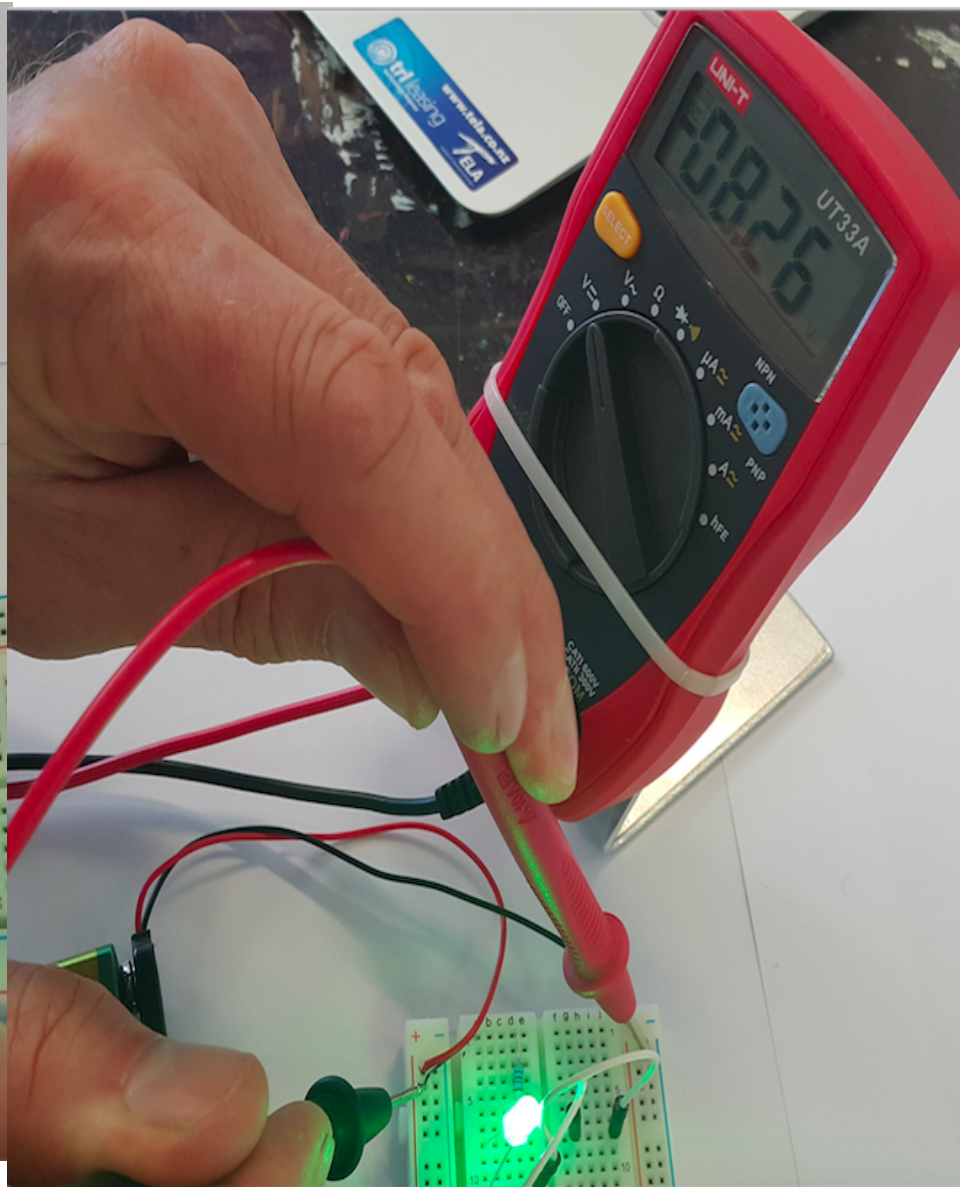
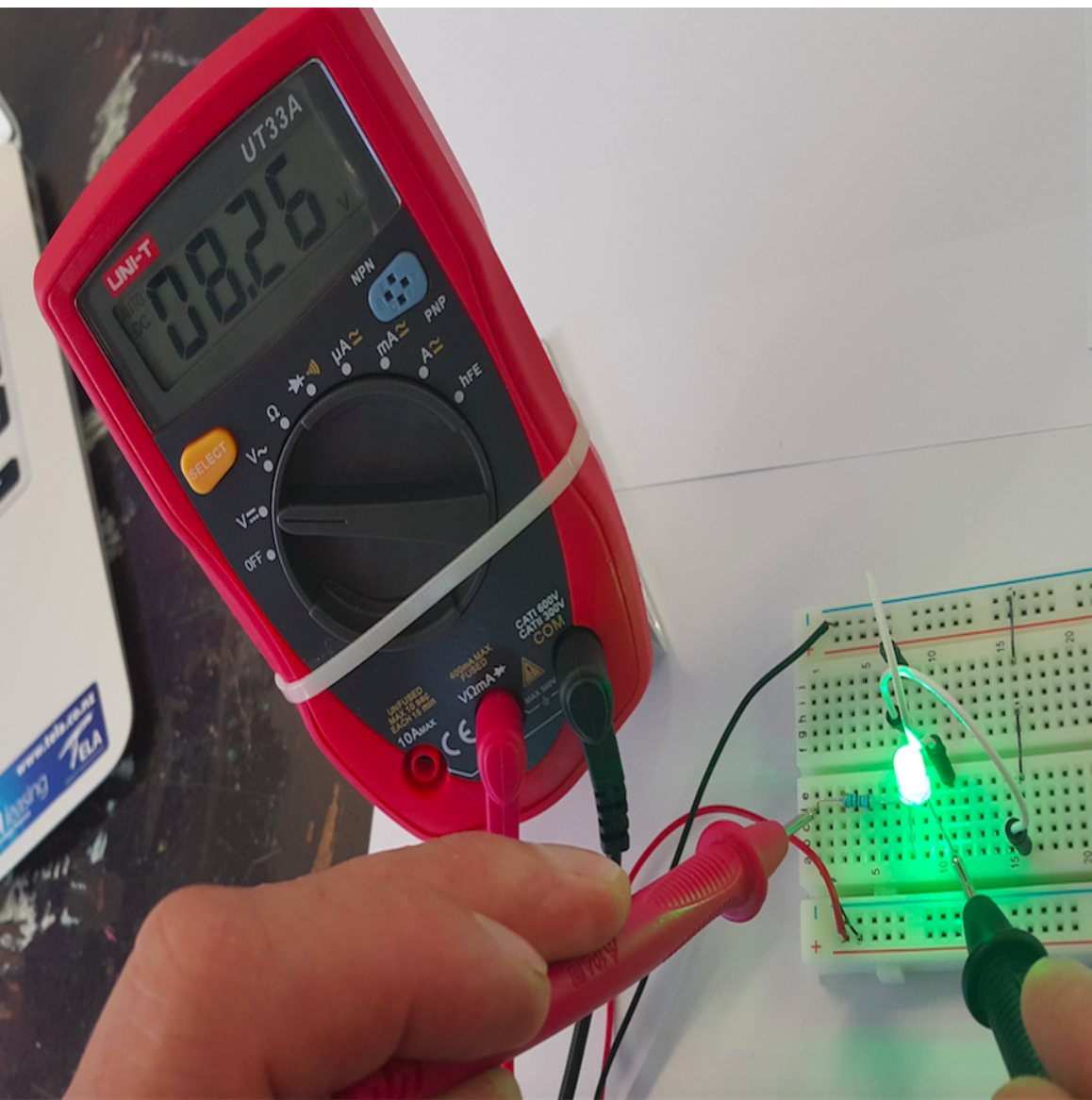
Deduct the voltage total of the led/resistor from the battery voltage

The total voltage of the led/resistor should equal the battery voltage (within a few millivolts) does it?

If not, give a brief explanation of why this may be







# Soldering Irons

Everything about soldering:

<https://www.makerspaces.com/how-to-solder/>

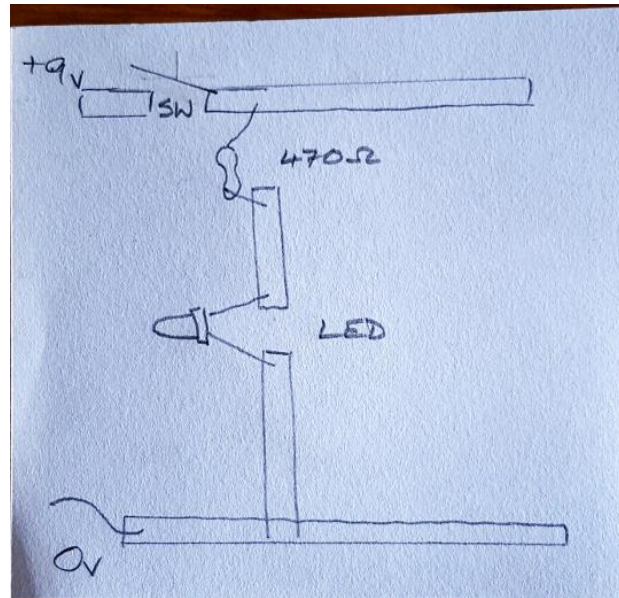


# Safe use of soldering irons

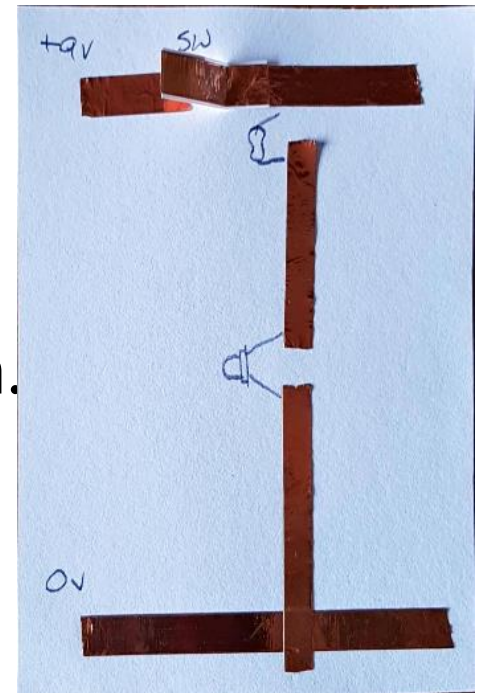
- Safety glasses MUST be worn when soldering.
- Soldering irons are hot and can burn badly. Nylon clothing can stick to the skin if heated.
- Solder can 'spit'. It is unlikely but it can happen – You MUST wear safety glasses.
- Fumes – Don't breathe them in, you won't get high, just sick! It is flux, the cleaning agent you are breathing in. Use a well ventilated area.
- Don't chew the solder! It's REALLY not good for you!
- Cleanliness is everything – make sure everything is clean.
- Tin the soldering iron tip – this makes the heat transfer much more efficient

# Soldering time

- draw a picture (track layout) of the circuit. As close to scale as possible.

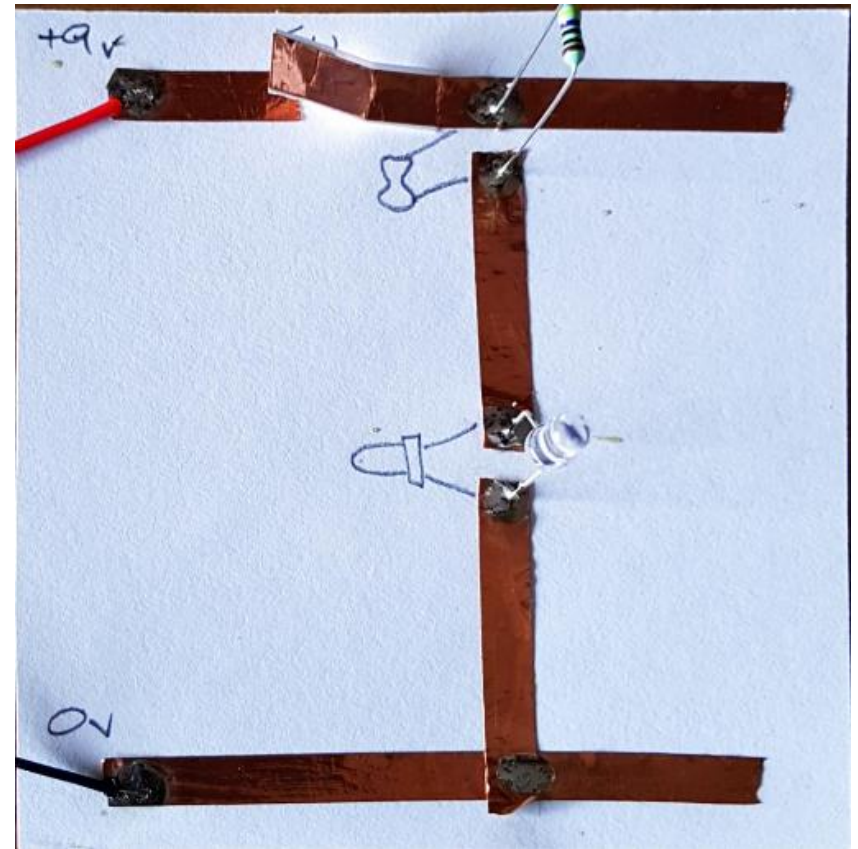


- stick on the copper tape and make the switch.





- All joints need to be tinned first.  
Then components are added



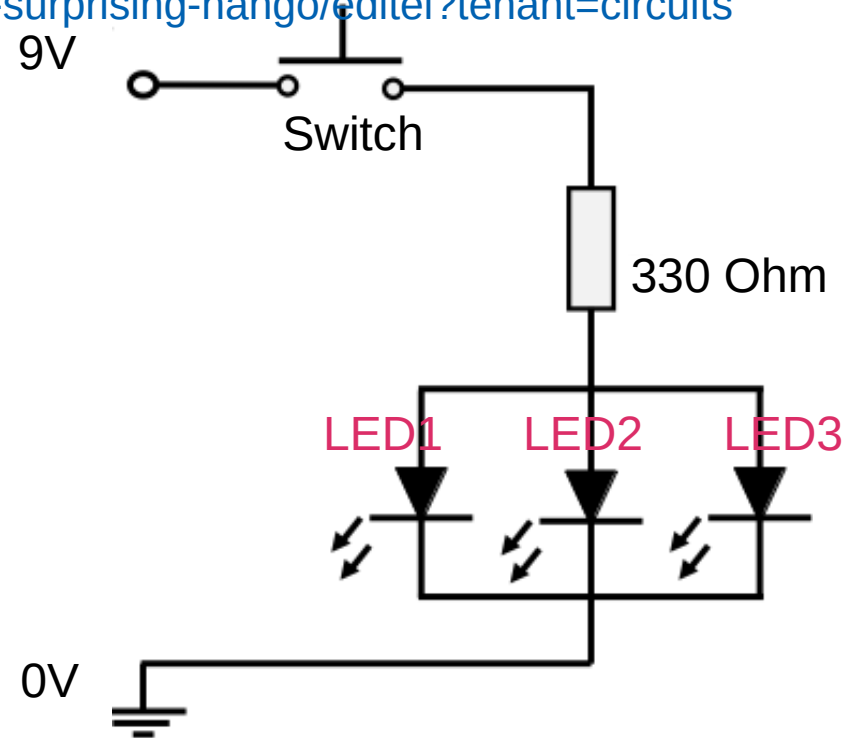
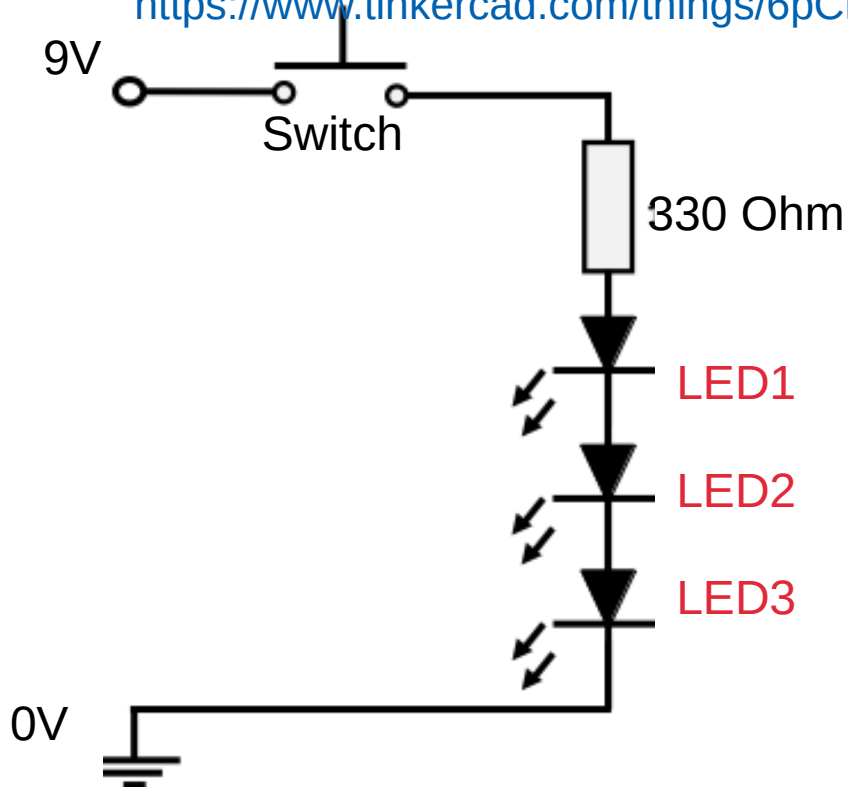
# Parallel and Series Circuits

- Draw the following circuits using Tinkercad:

Tinkercad:

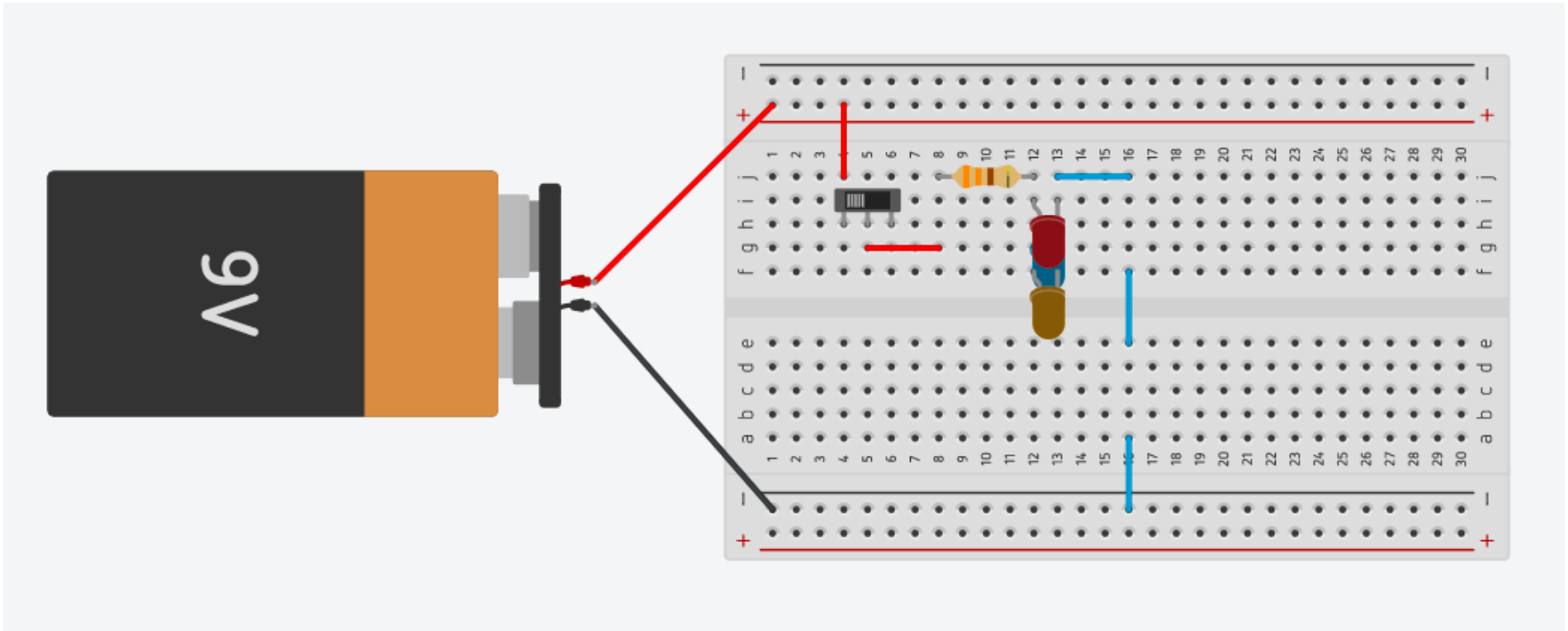
<https://www.tinkercad.com/things/6pCm4c0kQ0I-surprising-hango/editel?tenant=circuits>

<https://www.tinkercad.com/things/6pCm4c0kQ0I-surprising-hango/editel?tenant=circuits>





# LED Circuit In Parallel

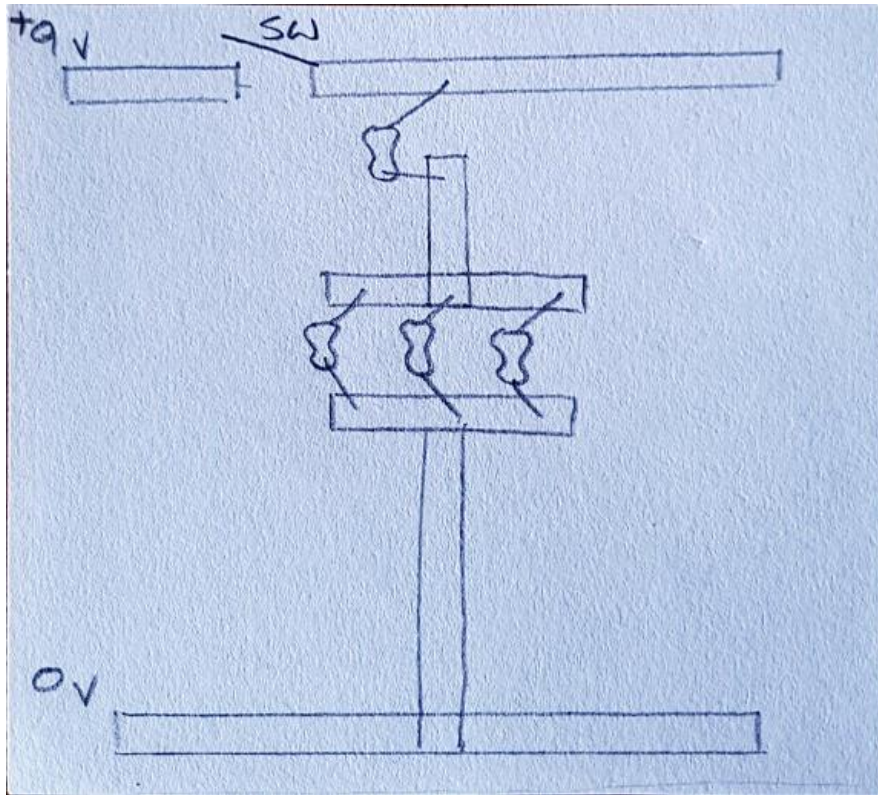


What happens when you press the switch? Three LED's?

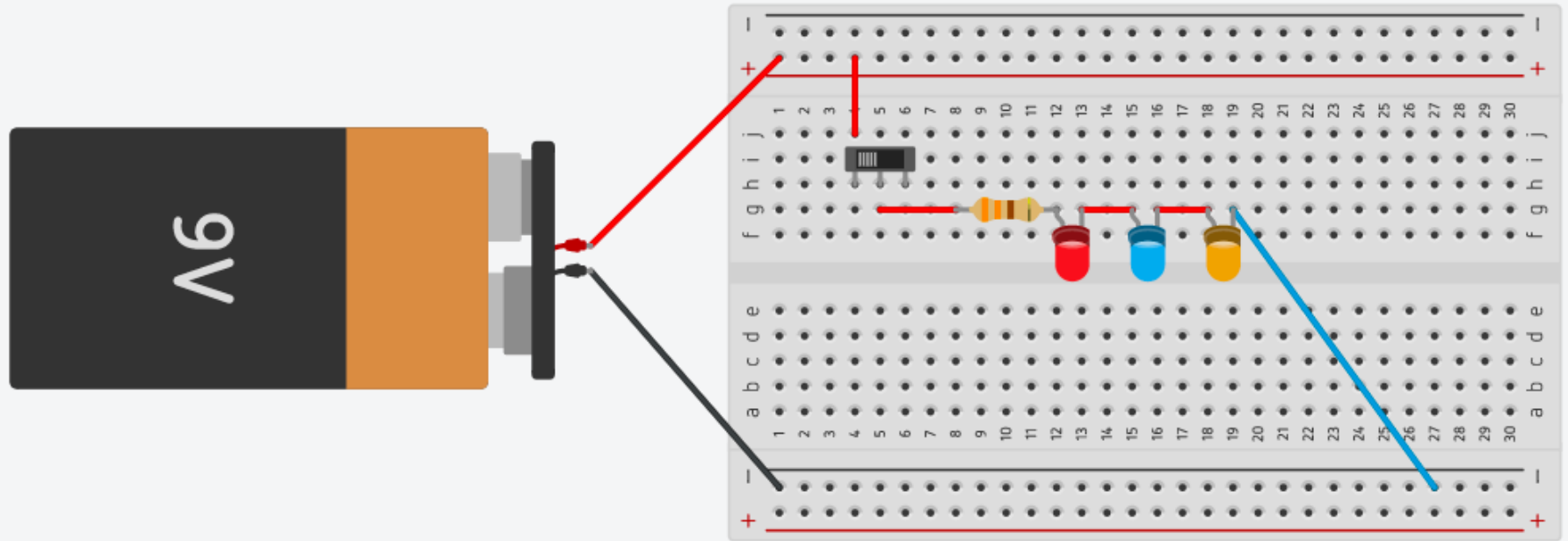
Measure the voltage across the resistor and the LED's

What happens when you remove one LED?

# Soldering Time



# LED Circuit In Series



What happens when you press the switch? Three LED's?

Measure the voltage across the resistor and each of the LED's

Compare the total to the supply from the battery.

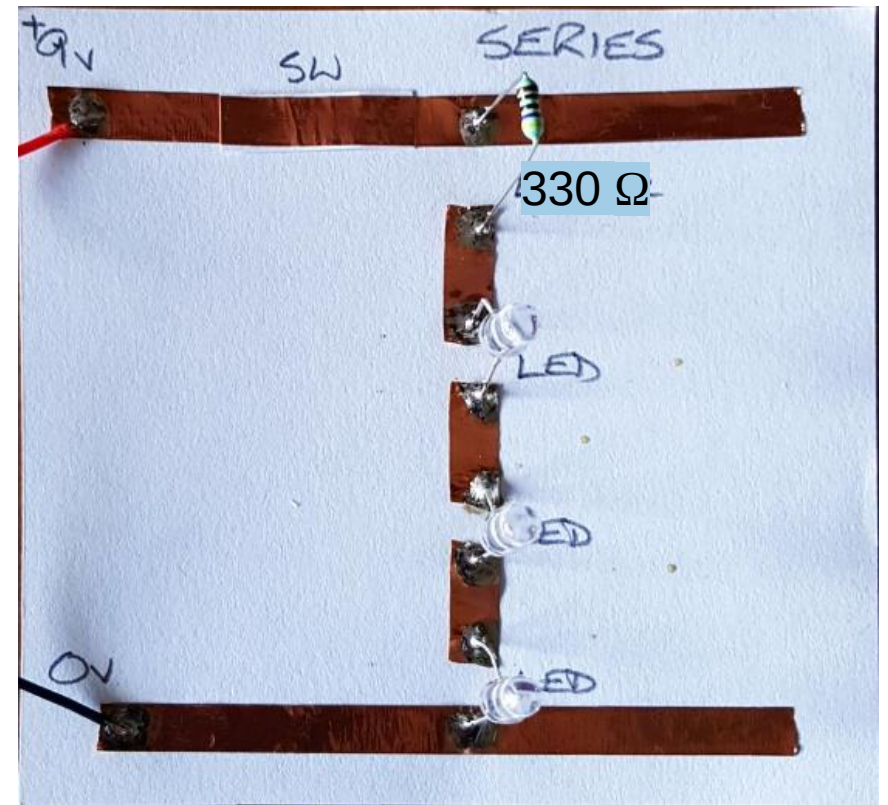
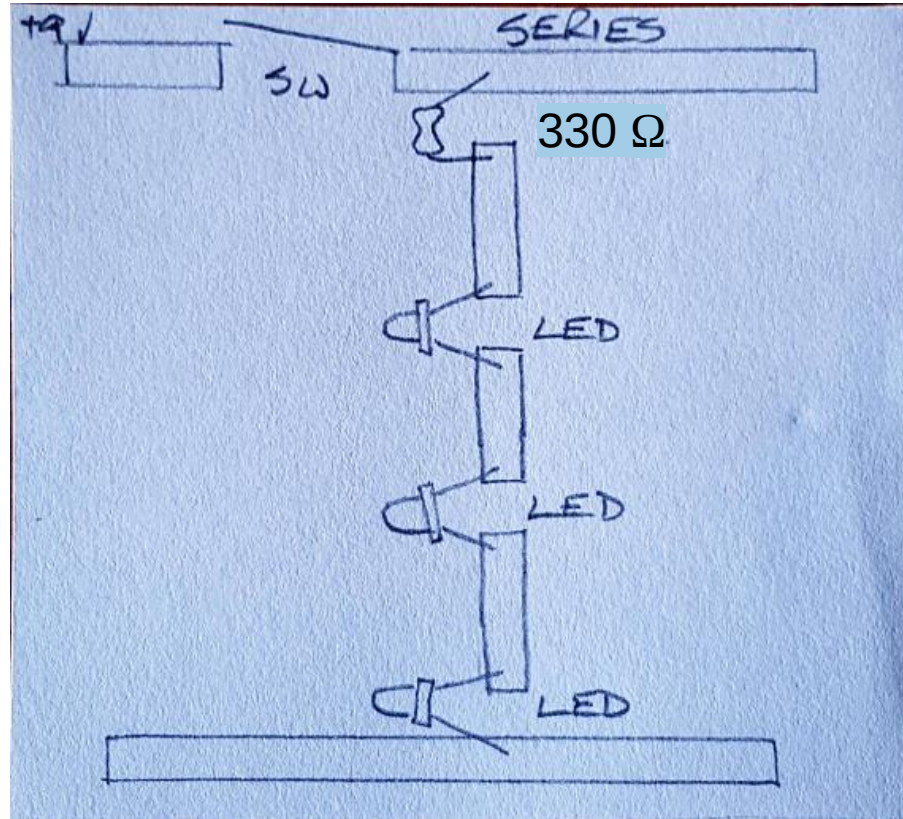
Why are the LEDs so dim or not even alight?

What happens if you swap from blue to red LED's?.

What happens when you remove one LED?



# Soldering Time



# Unit of measurements

Symbol	Name	Numeral
??	One	1.0

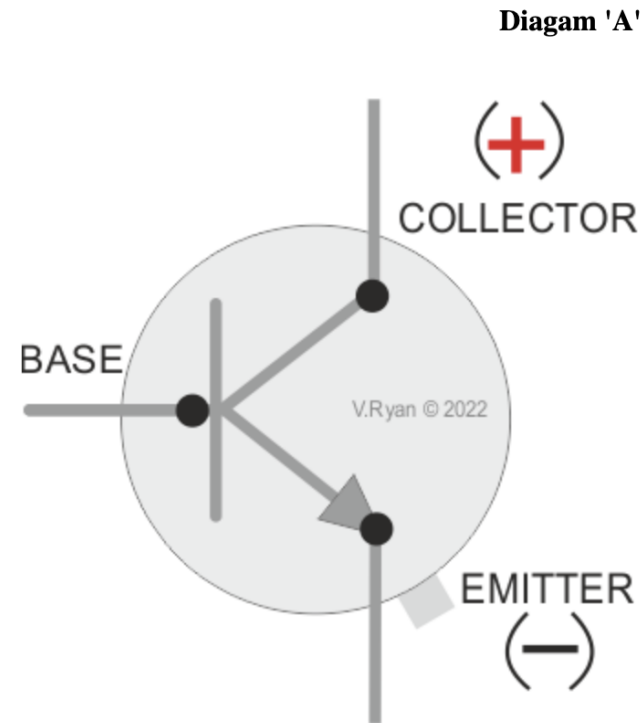
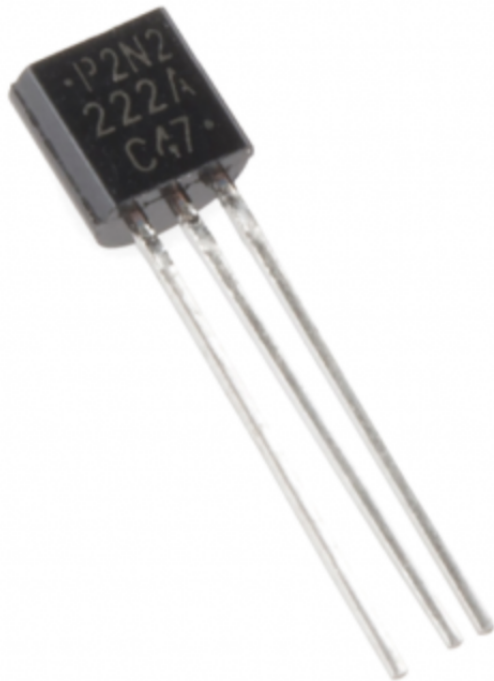
# Unit Of Measurements

<b>T</b>	Terra	1,000,000,000,000.0
<b>G</b>	Giga	1,000,000,000.0
<b>M</b>	Mega	1,000,000.0
<b>K</b>	Kilo	1,000.0
	One	1.0
<b>m</b>	milli	0.001
<b>μ</b>	micro	0.000 001
<b>n</b>	nano	0.000 000 001
<b>p</b>	pico	0.000 000 000 001

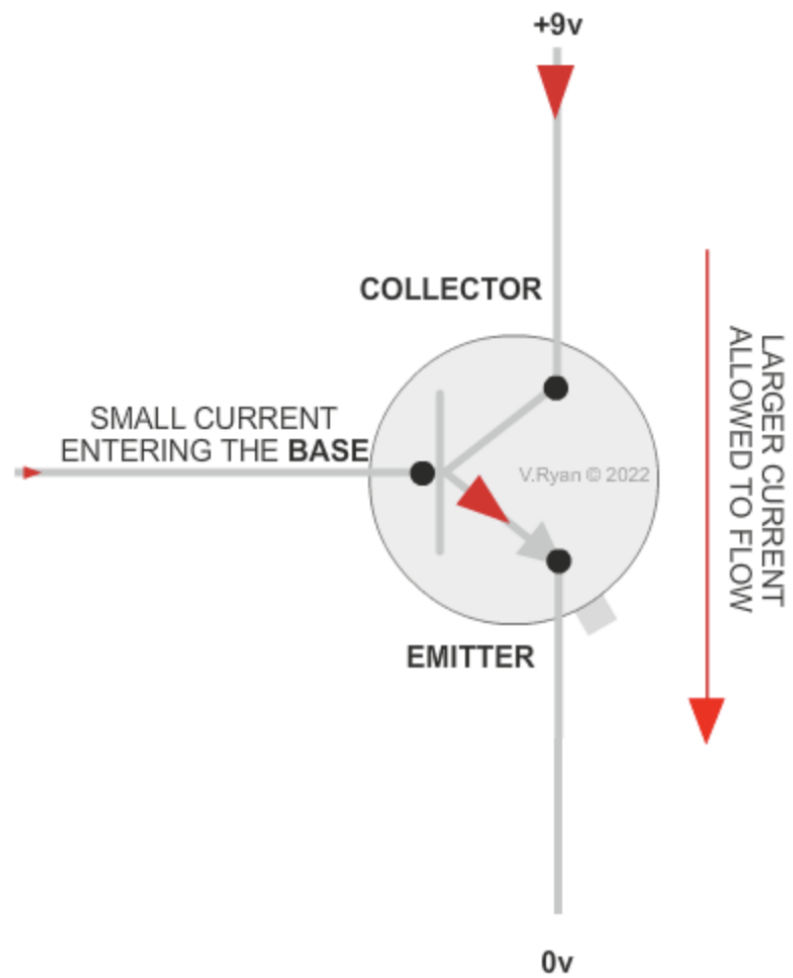
# Transistor as a switch

Transistors can be regarded as a type of switch, as can many electronic components. They are used in a variety of circuits and you will find that it is rare that a circuit built in a school Technology Department does not contain at least one transistor. They are central to electronics and there are two main types; NPN and PNP. Most circuits tend to use NPN. There are hundreds of transistors which work at different voltages but all of them fall into these two categories.

**Diagram 'A'** shows an NPN transistor which is often used as a type of switch. A small current or voltage at the *base* allows a larger voltage to flow through the other two leads (from the *collector* to the *emitter*).

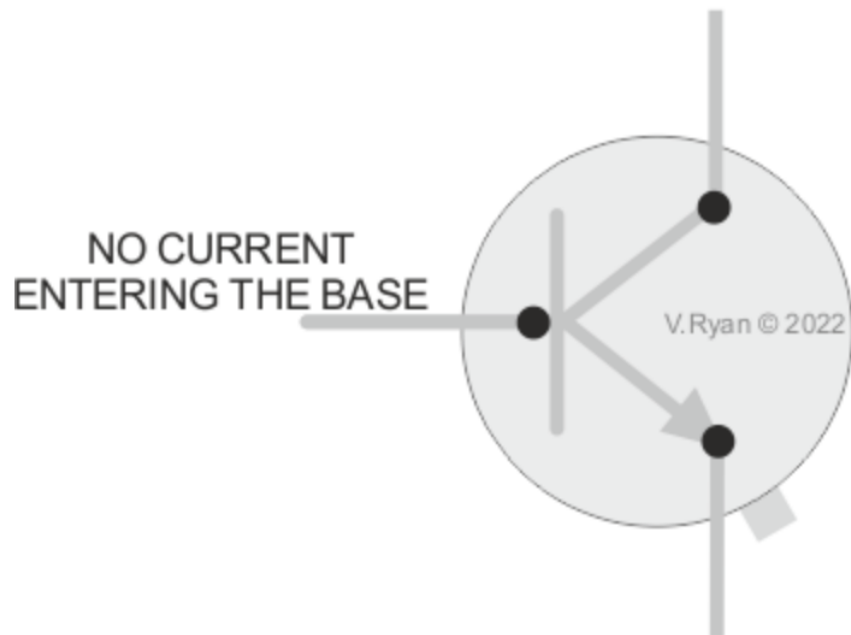


<https://www.technologystudent.com/elec1/transis1.htm>

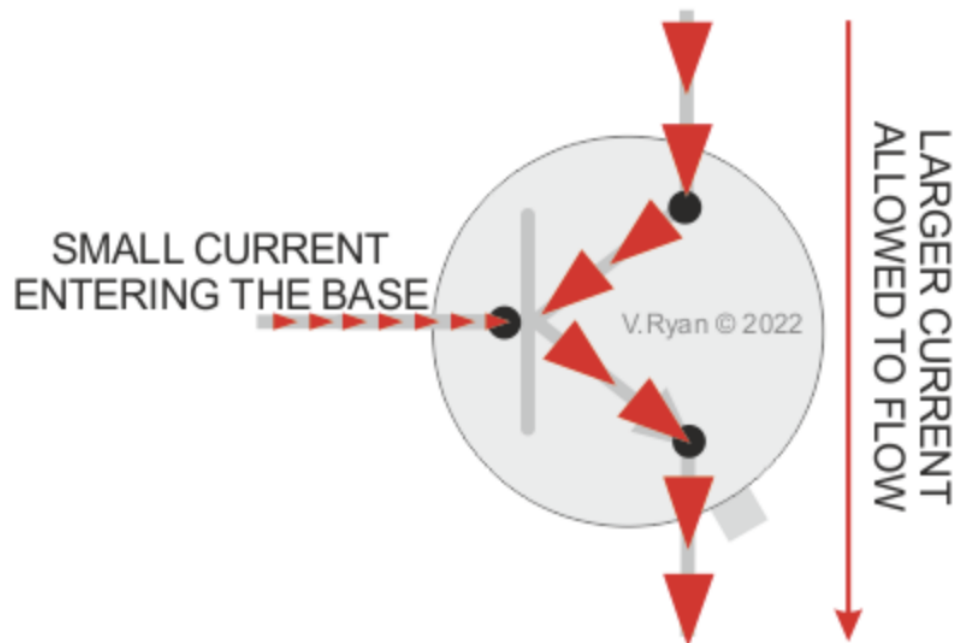




No current into the base. Larger current cannot flow through the collector and the emitter



Small current into the base. Larger current can now flow through the collector and the emitter.

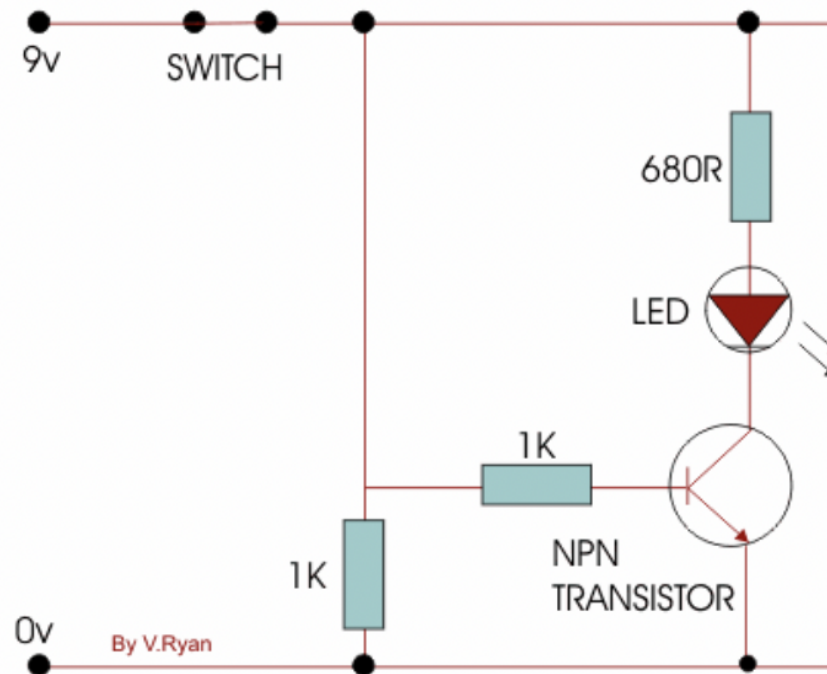


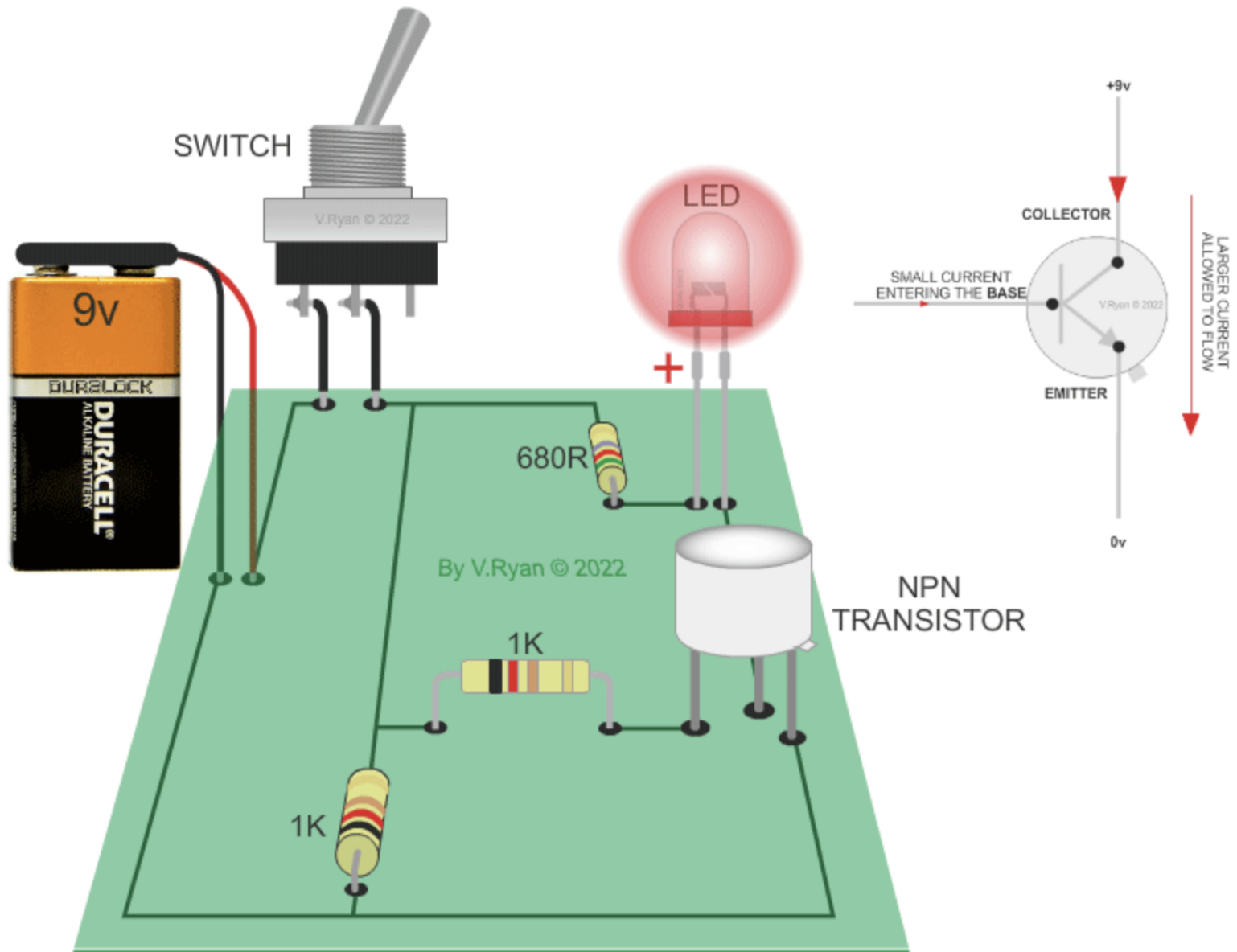
# How Does The Transistor Work?

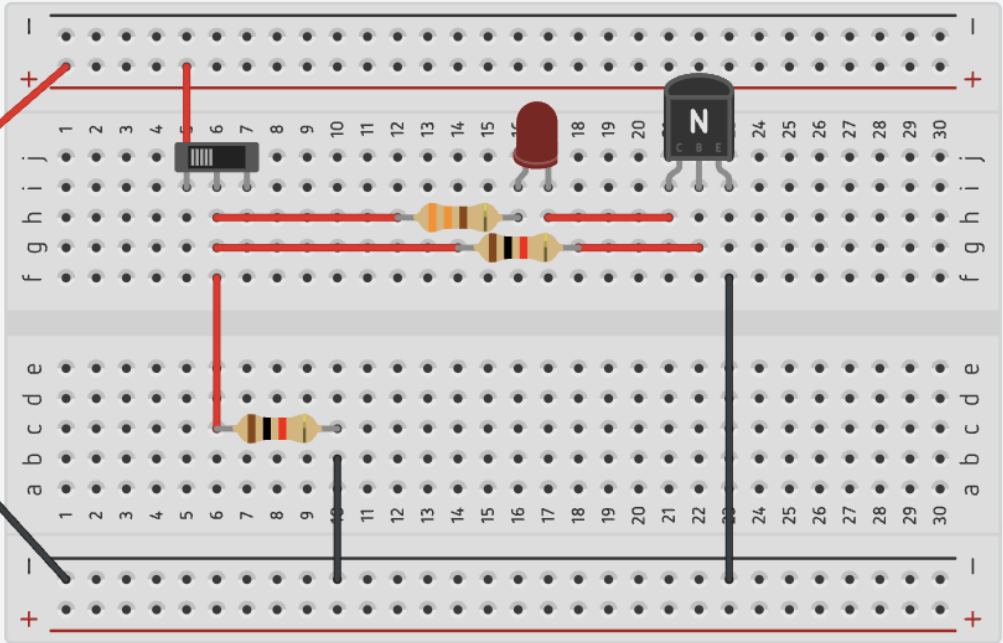
The circuit shown in **diagram B** is based on an NPN transistor. When the switch is pressed a current passes through the resistor into the *base* of the transistor. The transistor then allows current to flow from the +9 volts to the 0vs, and the lamp comes on.

The transistor has to receive a voltage at its '*base*' and until this happens the lamp does not light.

The resistor is present to protect the transistor as they can be damaged easily by too high a voltage / current. Transistors are an essential component in many circuits and are sometimes used to amplify a signal.



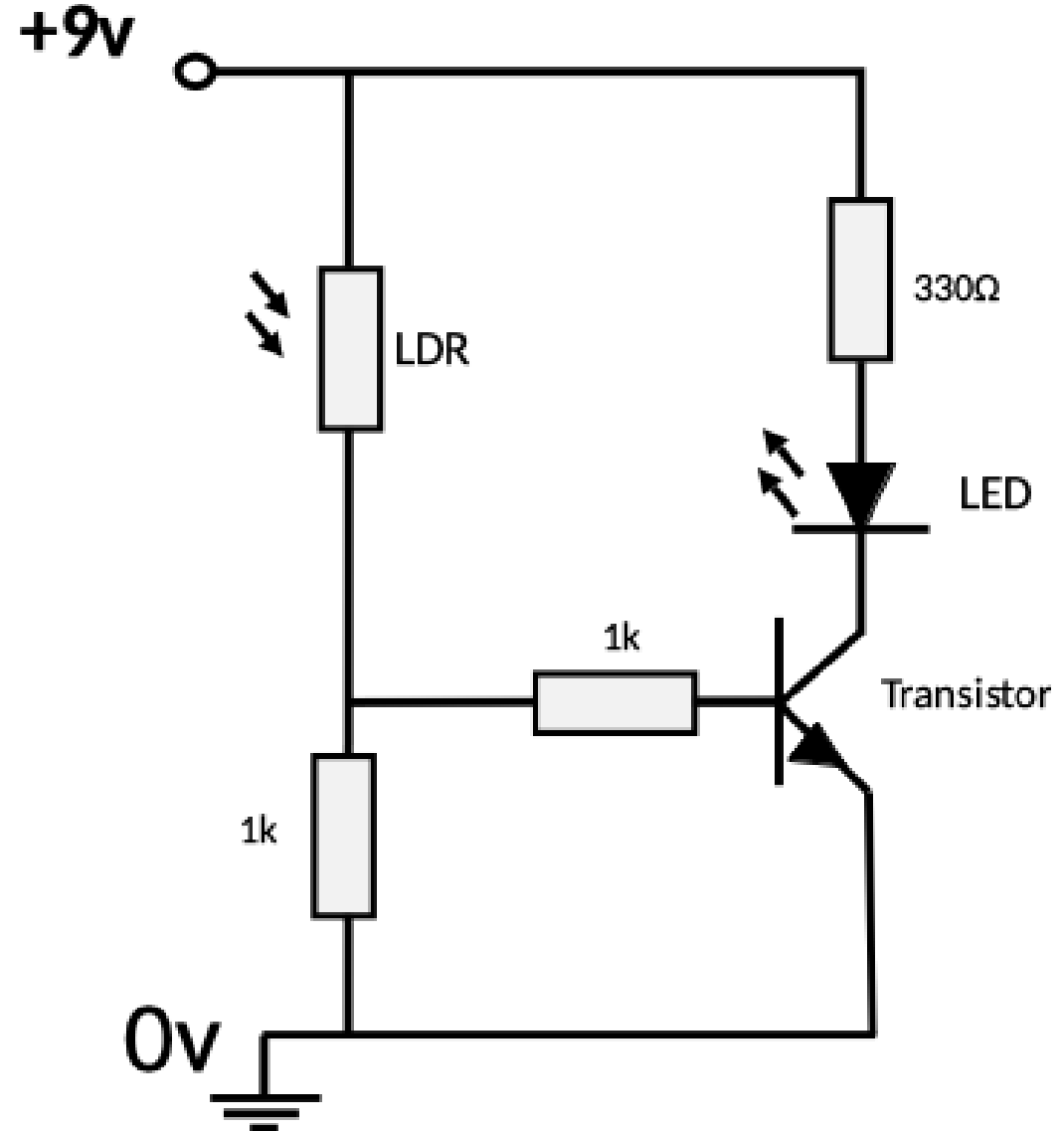


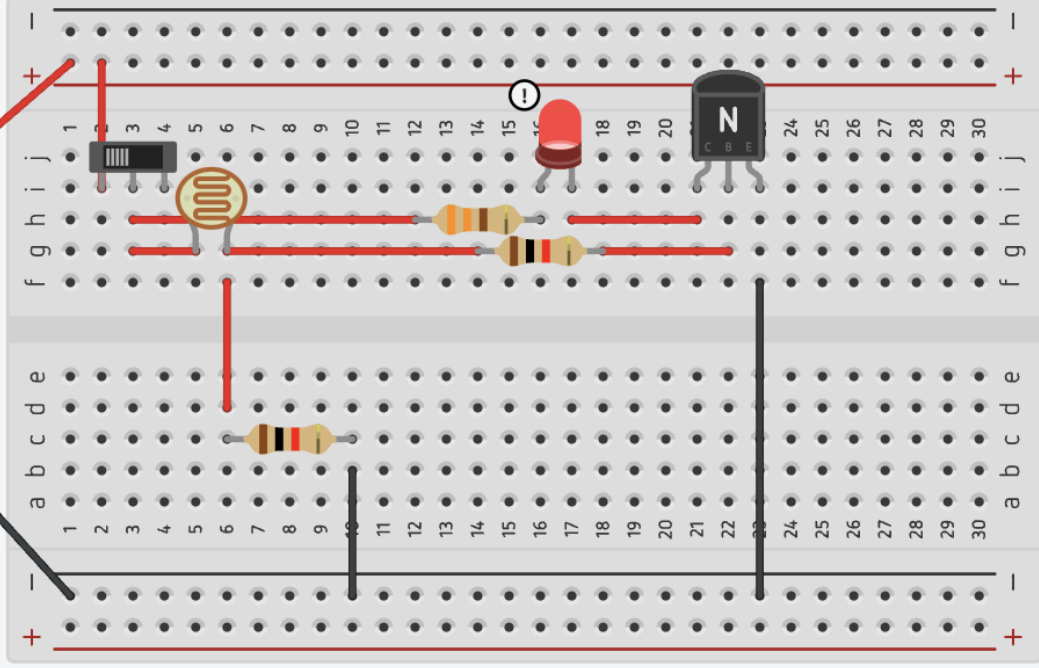


# Transistor – LDR Circuit

Construct this circuit and simulate using:

- Tinkercad
- Bread board
- Copper tape on cardboard

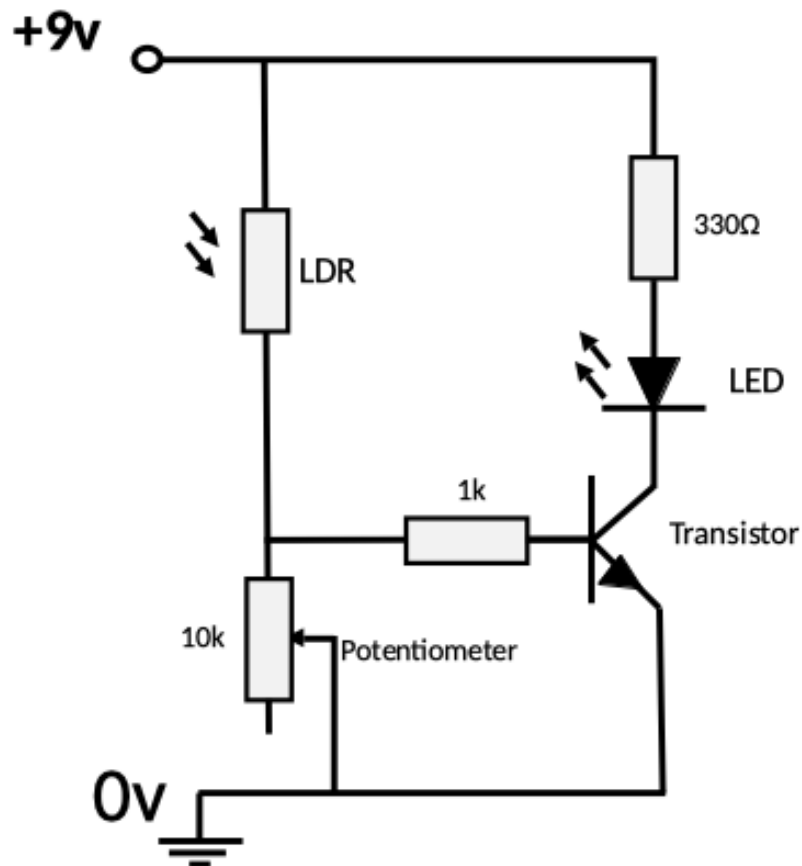


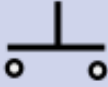









# Using potentiometer — Variable resistor

- Replace the 1K resistor with Potentiometer



Component List		
	PTM	Push To Make Switch – makes a circuit when pushed
	Resistor	Creates electrical resistance
	LED	Light Emitting Diode – A diode that emits a certain frequency of light (colour)
	Earth	Earth, zero volts, and ground (GND) are all the same common reference point
	LDR	A resistor whose resistance depends upon the amount of light falling on it. Light Dependant Resistor
	NPN Transistor	A transistor can be used as an amplifier or an electronic switch

# Capacitors



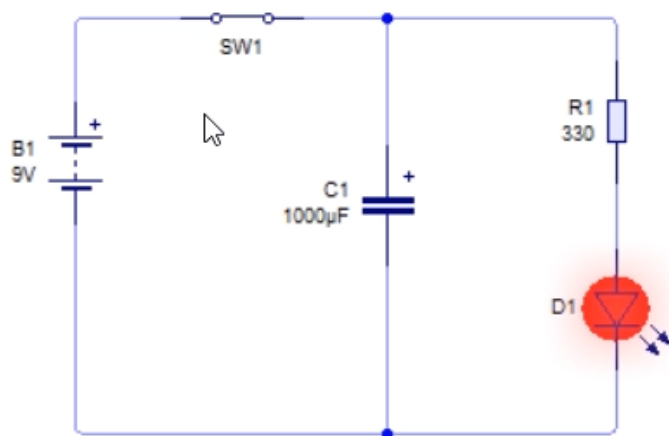
<https://www.technologystudent.com/elec1/capac1.htm>

# HOW A CAPACITOR WORKS

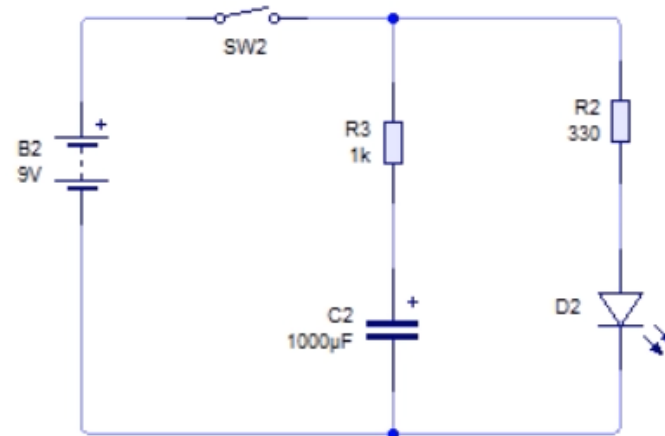
When the circuit is switched on, the LED emits light and the capacitor charges up. When the switch is turned off the LED stills emits a light for a few seconds because the electricity stored in the capacitor is slowly discharged. When it has fully discharged it's electricity the LED no longer emits light. If a resistor is introduced to the circuit the capacitor charges up more slowly but also discharges more slowly. What will happen to the light ?

CAPACITOR DISCHARGE - [www.technologystudent.com](http://www.technologystudent.com)

Using Circuit Wizard Software - By V.Ryan 2019

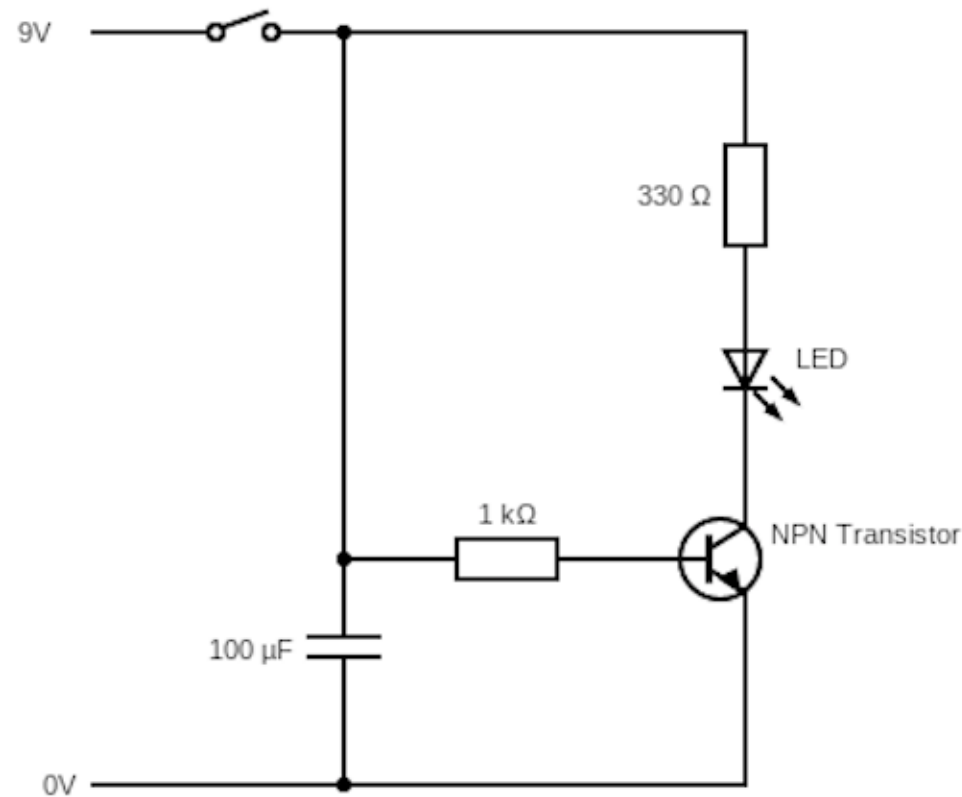


CAPACITOR DISCHARGES AND ILLUMINATES LED  
FOR APPROXIMATELY TWO SECONDS  
WHEN THE POWER IS TURNED OFF



1K RESISTOR ADDED AND CAPACITOR  
CHARGES AND DISCHARGES MORE SLOWLY  
LED STAYS ILLUMINATED FOR LONGER

# Transistor – Capacitor Circuit



Draw the circuit using Tinkercad circuits and then assemble on your breadboard. When done... Use the copper tape, components and soldering to make it.