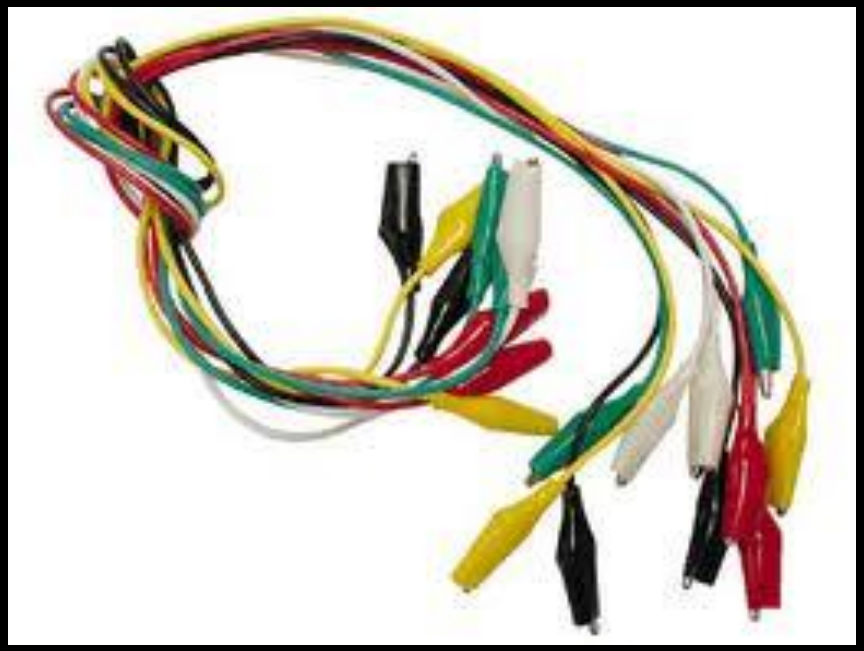
CHAPTER 6.2: CURRENT ELECTRICITY



These components are used in electric circuits.

TASK: Draw how you could make this lamp light.

Electricity will only flow through a **complete circuit**.

The battery, wires and lamp must make a closed loop. The loop includes the filament of the lamp.

BULBS... BBOOOOMMM!

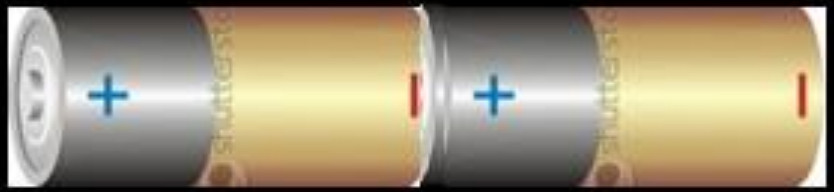
Do not forget that a filament bulb is made up of a small piece of metal that glows when electicity pass through it. If the metal (filament) is cut, then you do **not** have a complete circuit

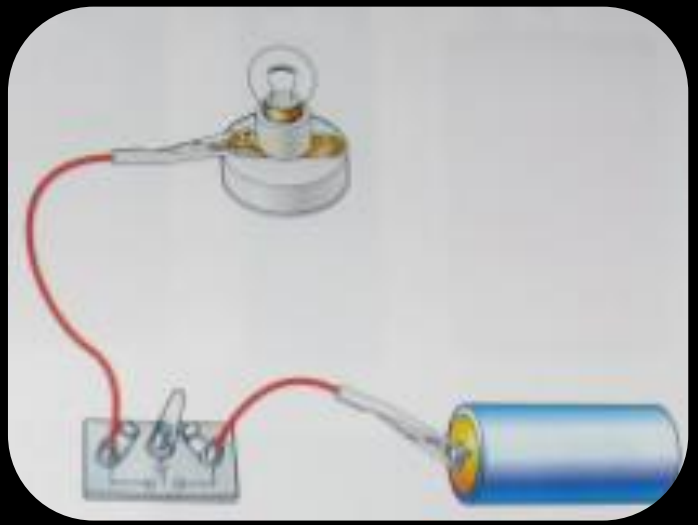
The cell

Sometimes we talk about batteries and sometimes we talk about 'cell'

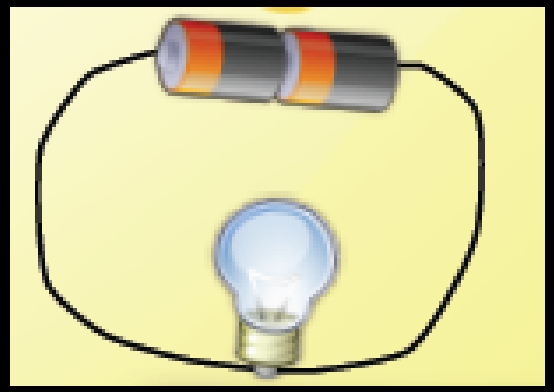
- A battery is made up of several cells.
- A car battery is made up of six cells.

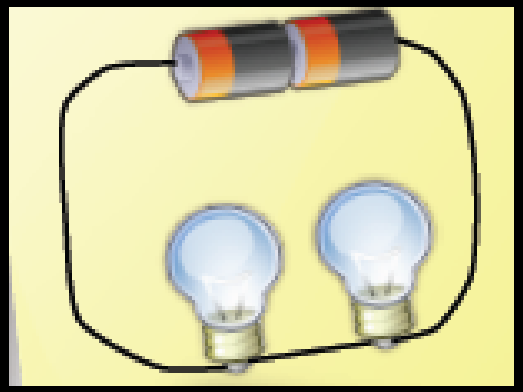
- When we use several cells in a circuit we have to be careful to connect them correctly- with the **positive** end of one connected to the **negative** end of the next cell.

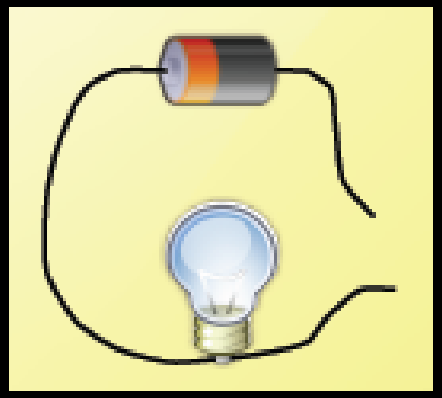


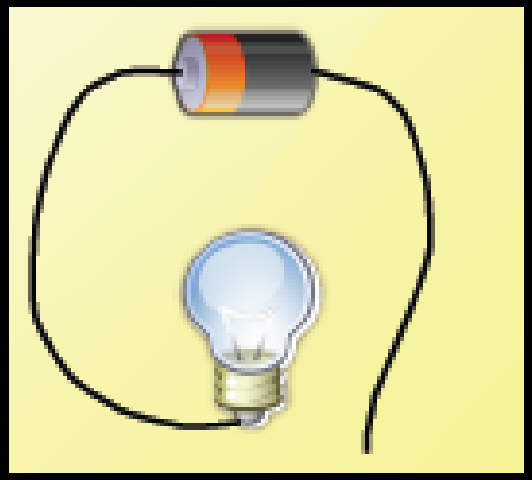


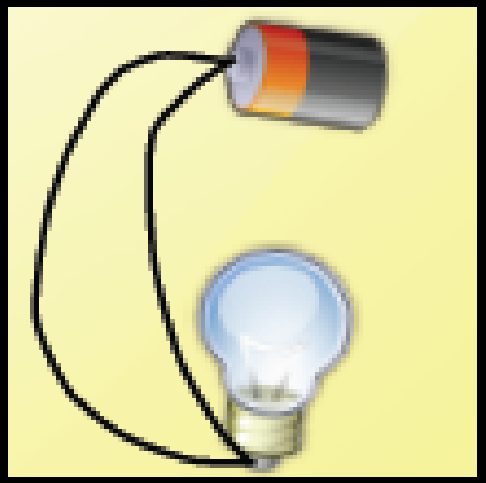
Explain whether or not the bulb lights and why.











Explain whether or not the bulb(s) lights and why.

WHAT DOES WHAT

What is the 'job' of the wires?

- To join the battery to the bulb… electricity flows in the wires.

What is the job of the battery?

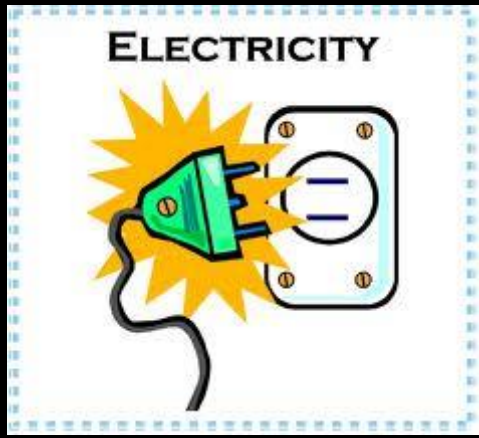
- To push an electric current through the wires and the bulb.

When does the bulb light?

- The bulb lights when the current flows through it

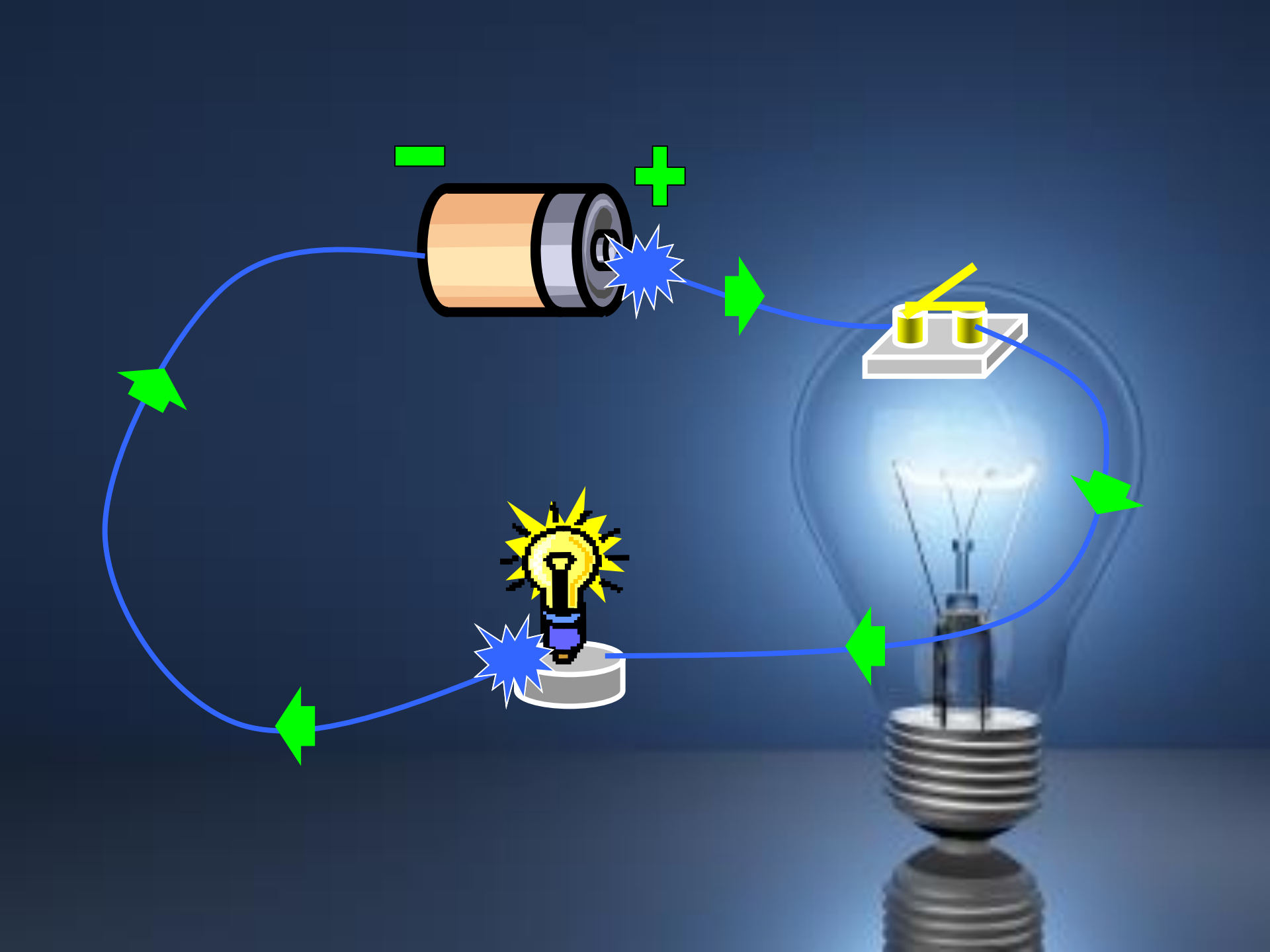
What happens in a circuit in terms of electrons?

Electrons flow from one place to another in a complete circuit. This is called the **CURRENT**!



What happens in a circuit in terms of energy?

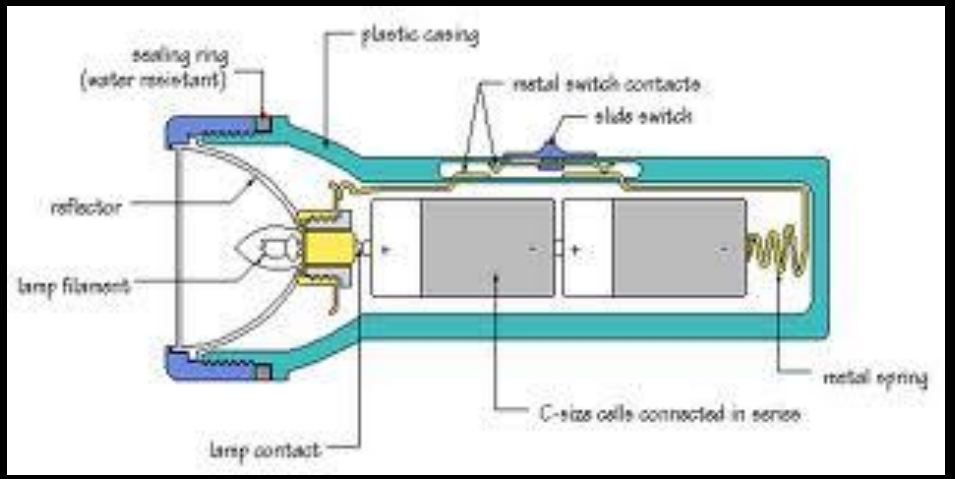
Chemical energy is changed into electrical energy.
Chemical energy comes from the battery.
The battery gives an "electrical push"…
This is called **VOLTAGE**



What happens in a circuit in terms of energy?

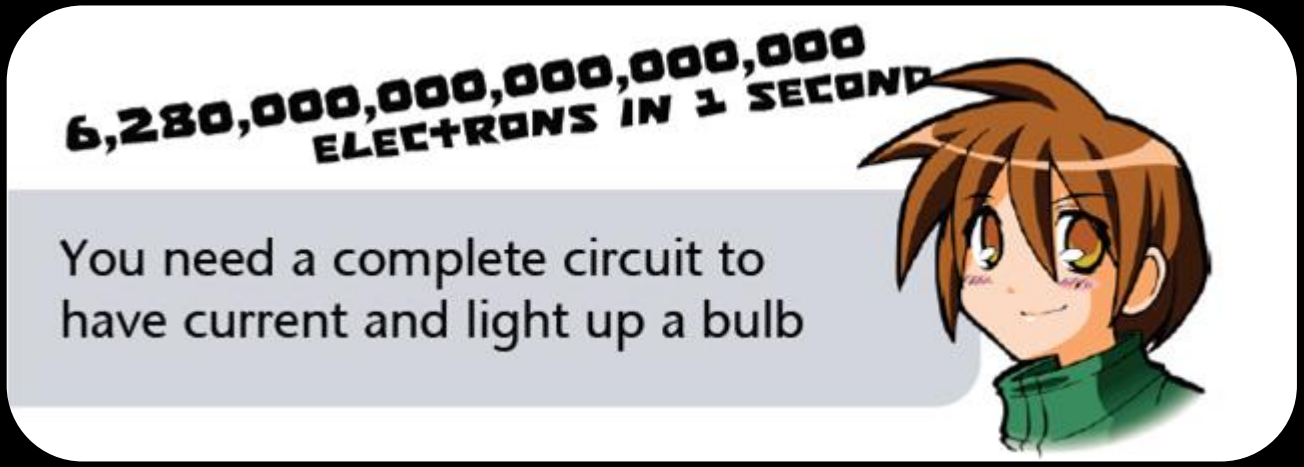
… When electrons flow from one place to another, **energy is transferred from one place to another.**

A torch battery only produces 1.5 V



Did you know?

When you switch a torch on, 6.28 billion billion electrons flow through the circuit every second!

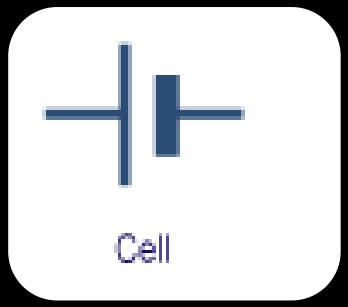


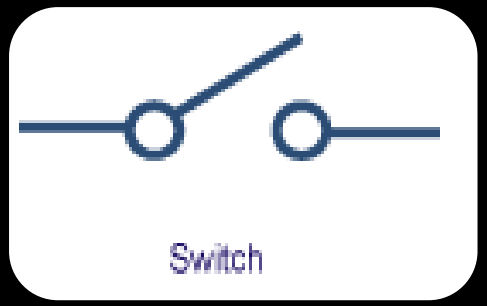
SYMBOLS

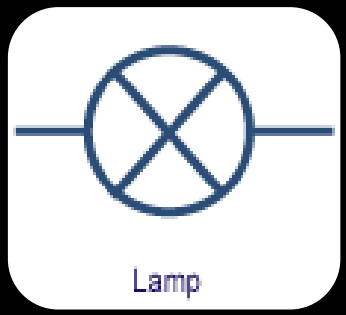
If we want to show a particular circuit in different areas of the world, we might get confused when communicating.

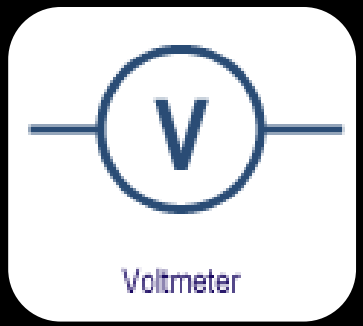
- So scientists agreed that particular symbols can be used instead of drawing complicated circuits!

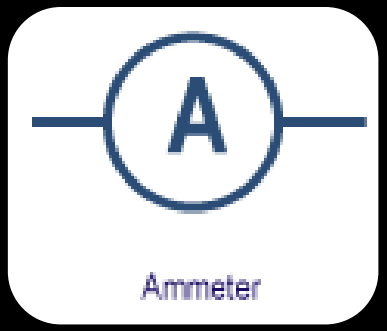
Also, it would be very difficult to draw circuits with the proper shape of batteries, lamps etc.

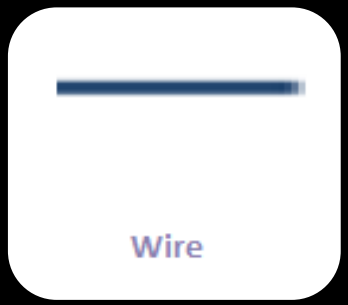






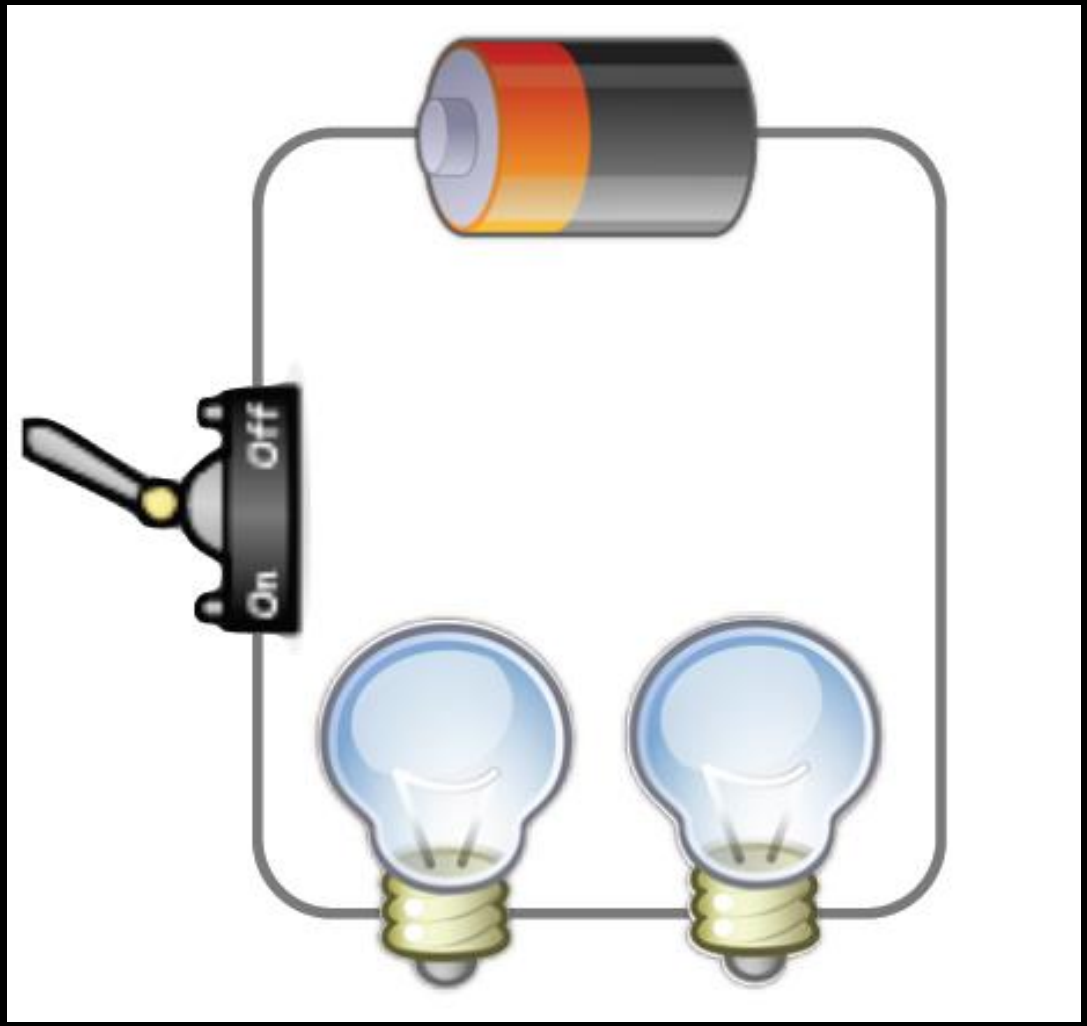




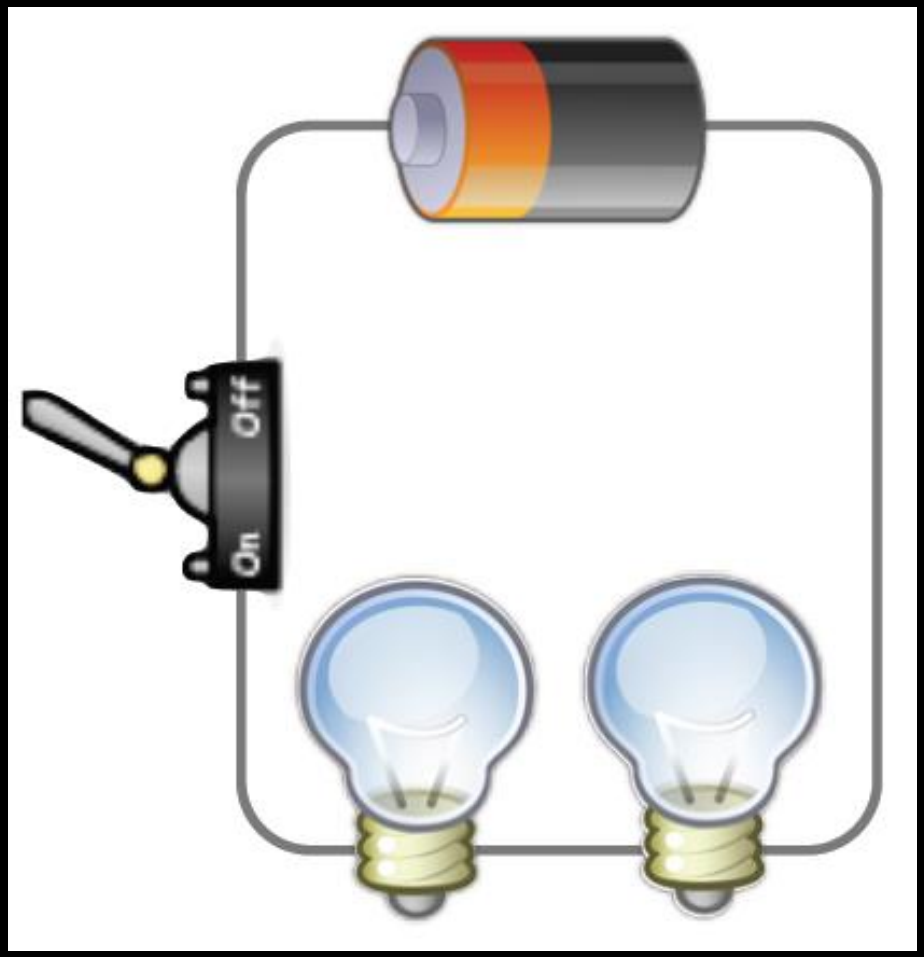


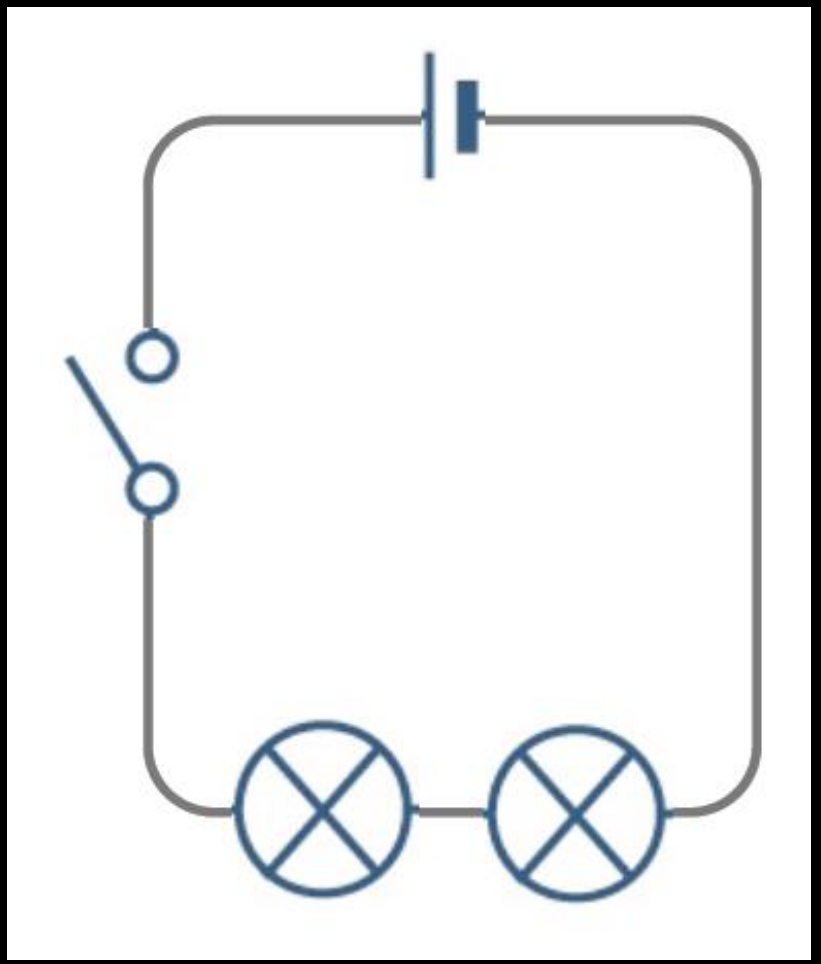
SYMBOLS

Draw the circuit using the symbols

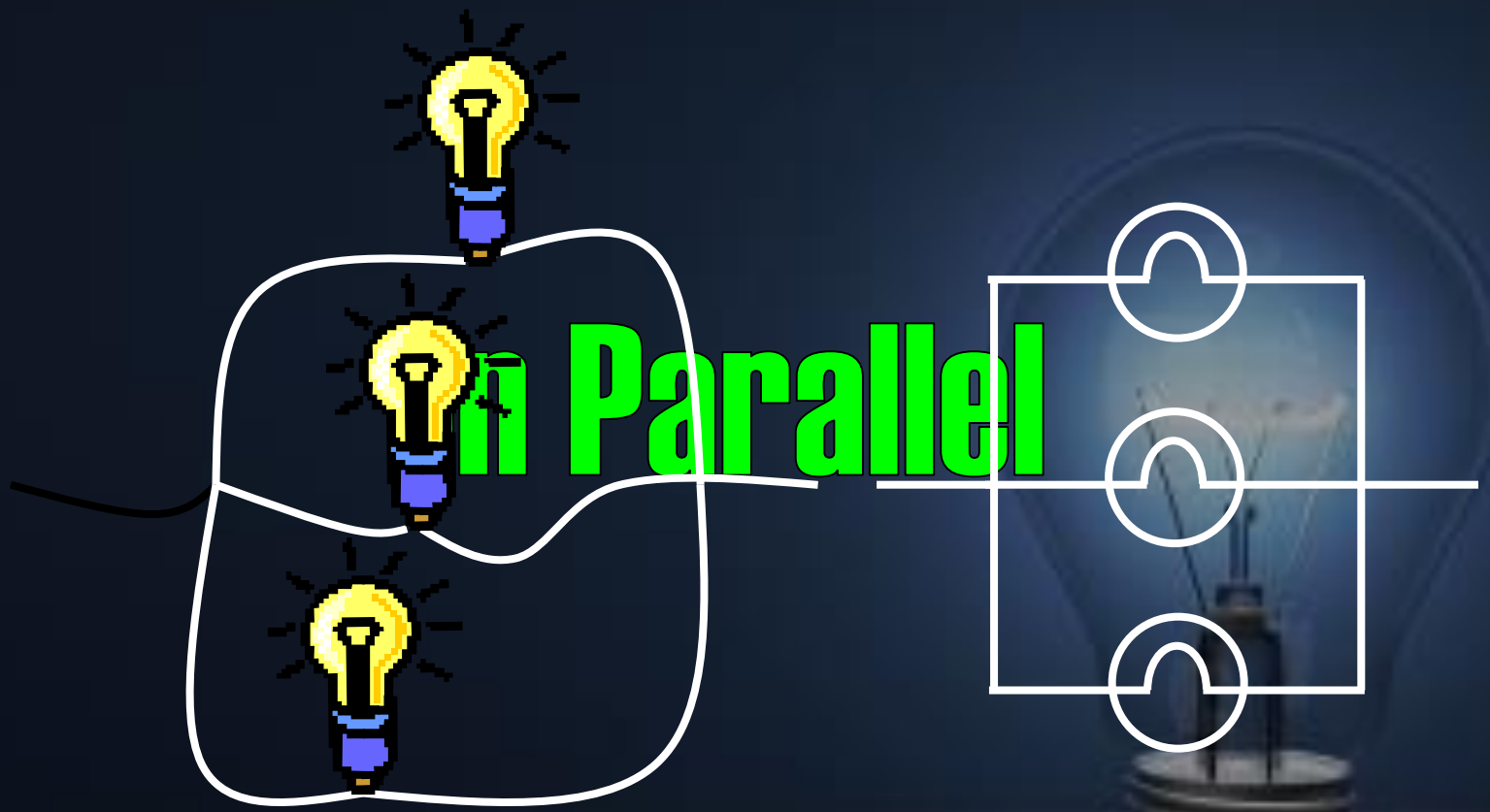


Circuit symbols

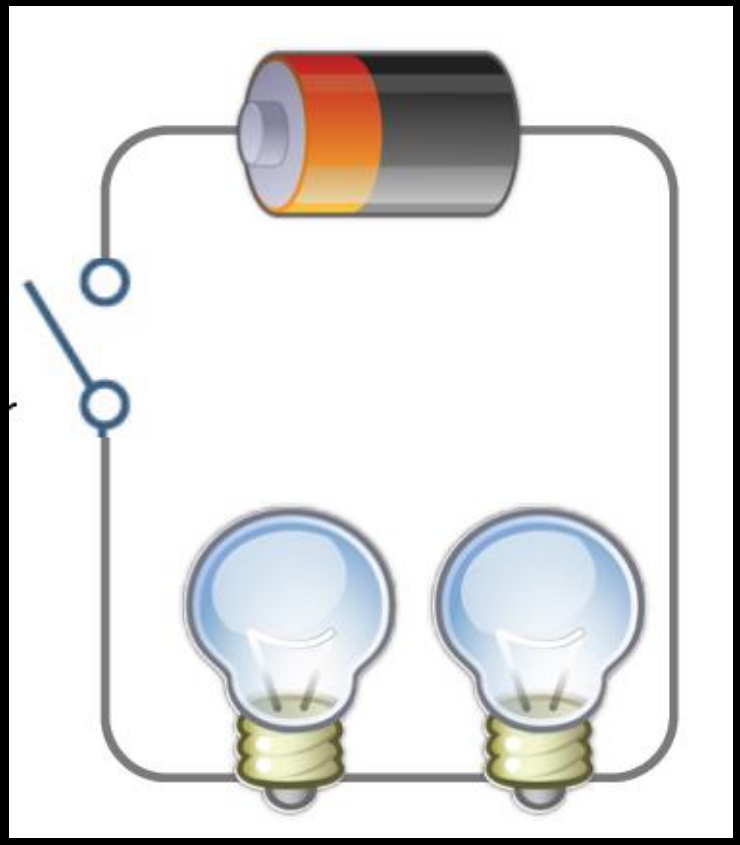




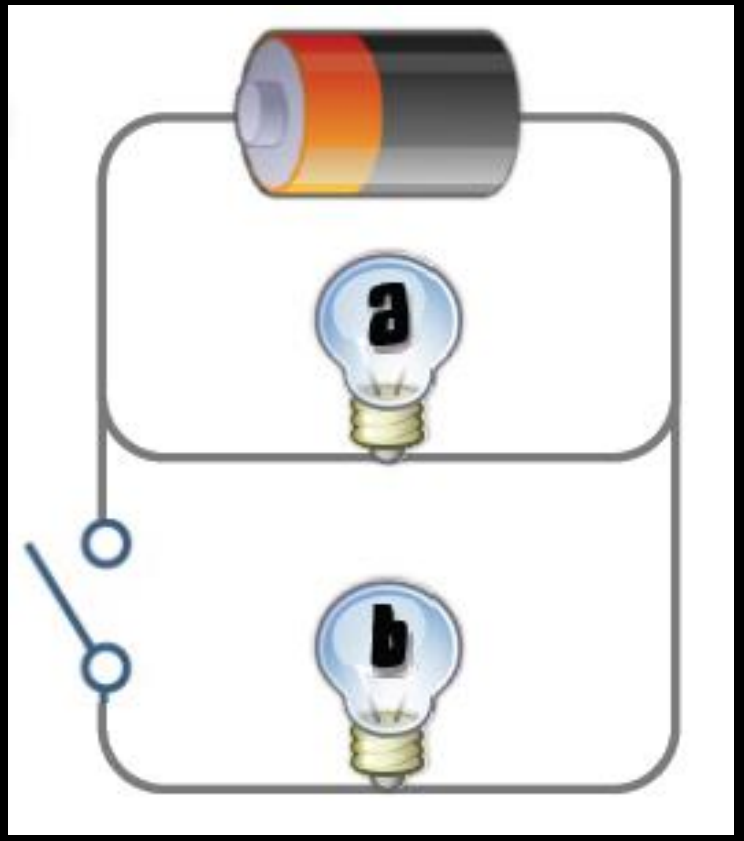

In Series


In Parallel

Series



Parallel



Can we measure current?

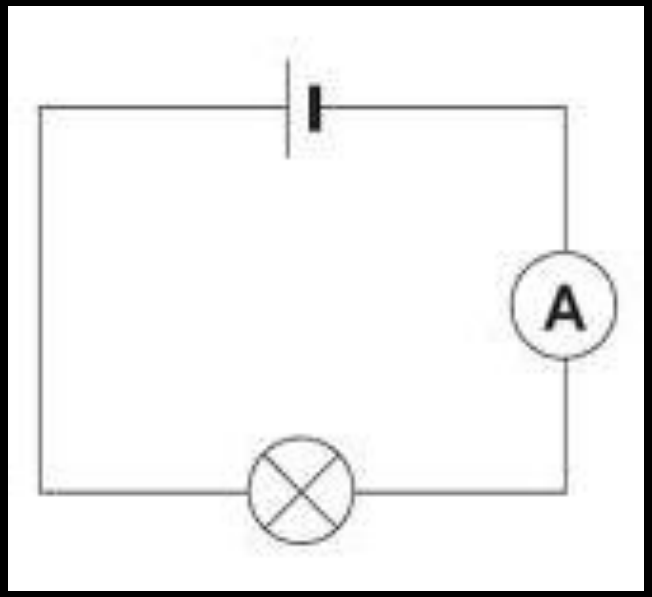
Yes, by using a device called the ammeter.

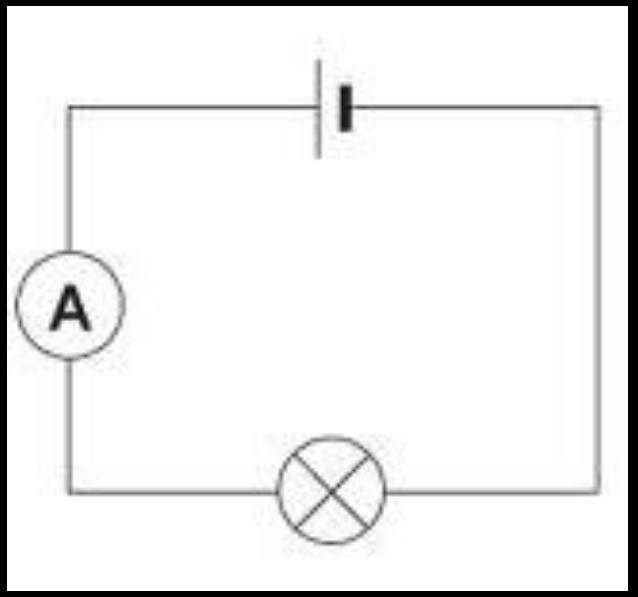
The ammeter measures current in amps.
The symbol for amps is A.

What will happen if the current is high?

- The ammeter scale is numbered 0-1A.
- The bigger the current, the further the needle moves along the numbered scale.

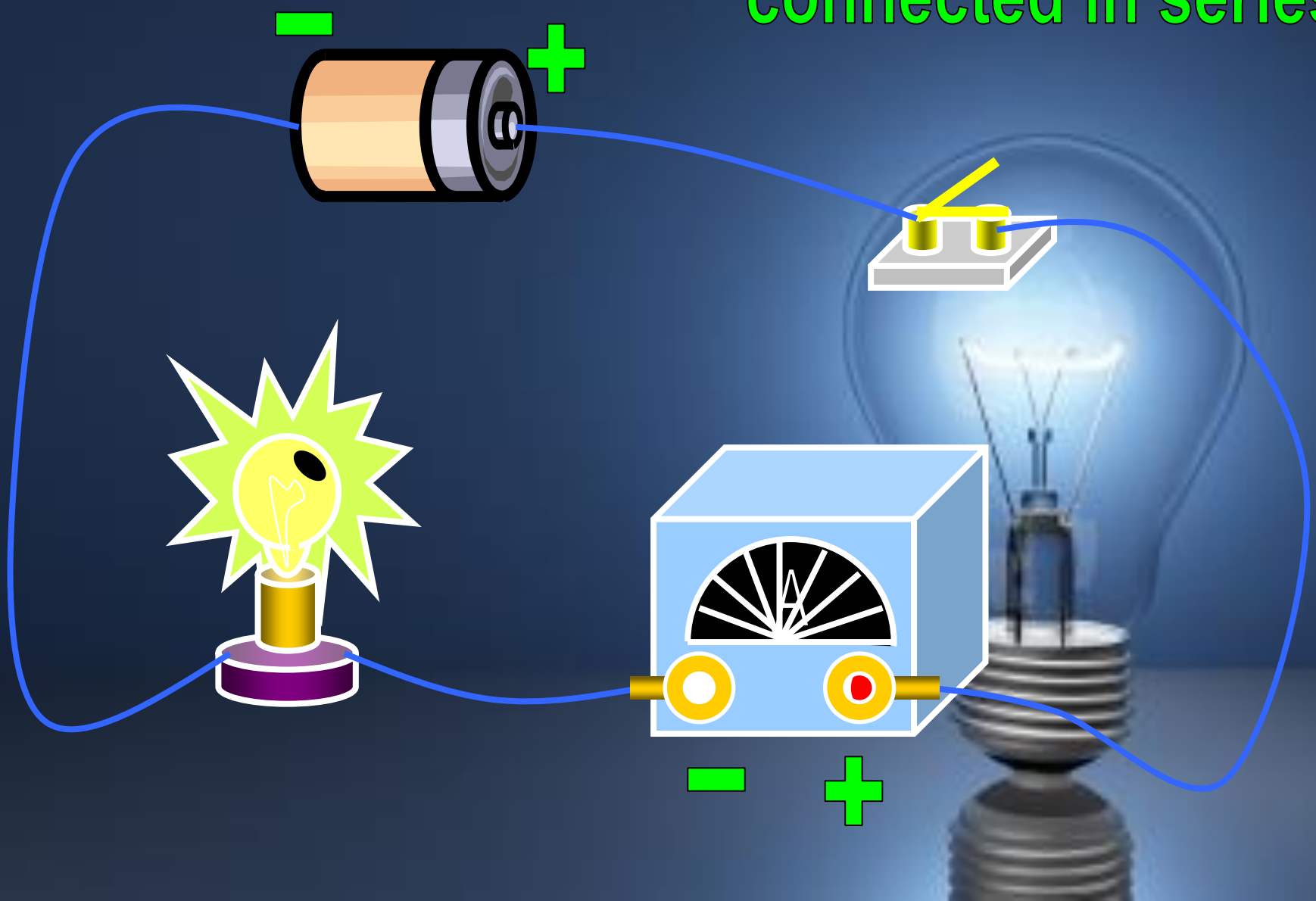
How is the ammeter connected?

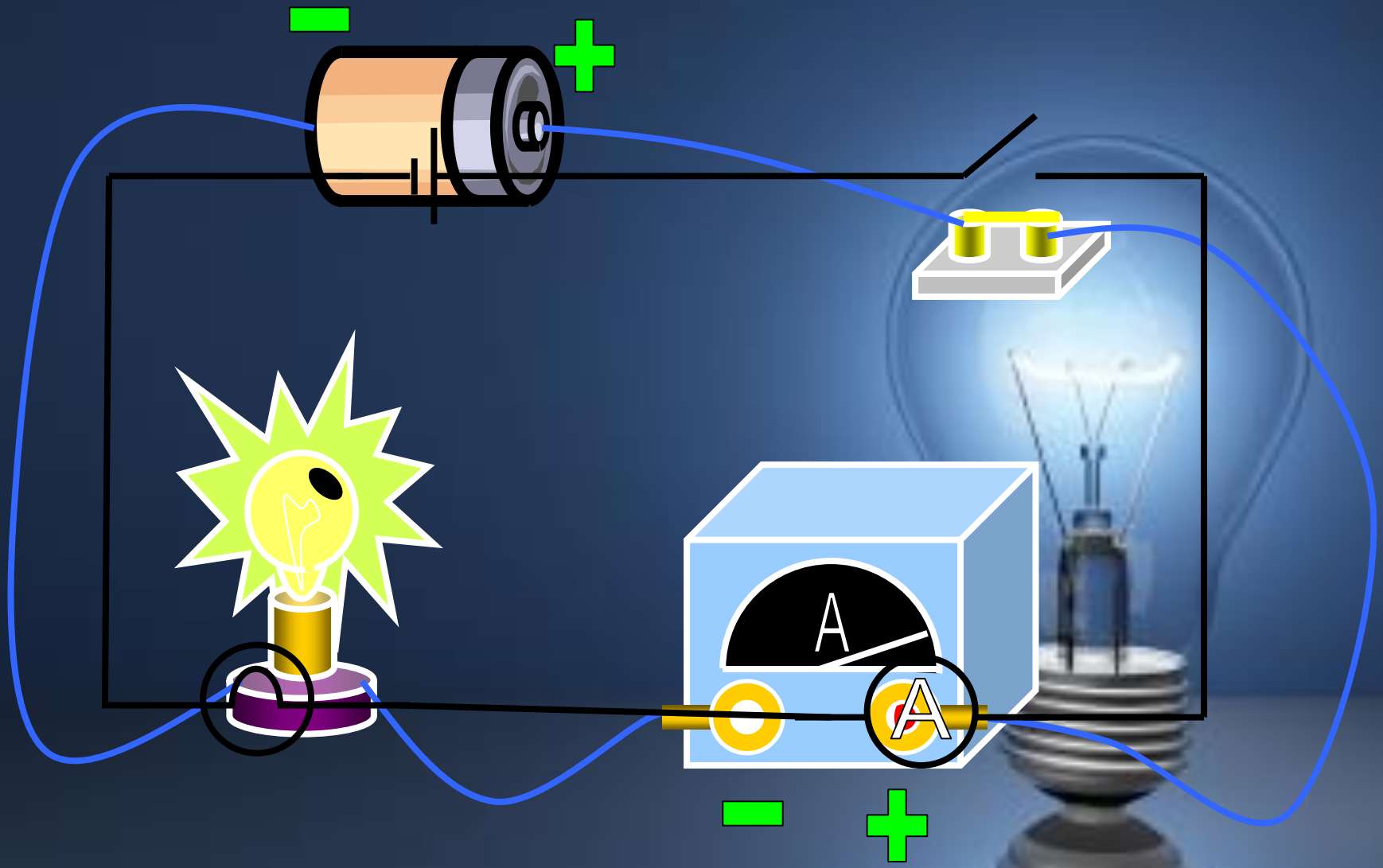




- It is placed before or after the bulb.
- It is part of the circuit, it is in **series**.

Ammeters are connected in series




A
A

Can we measure voltage?

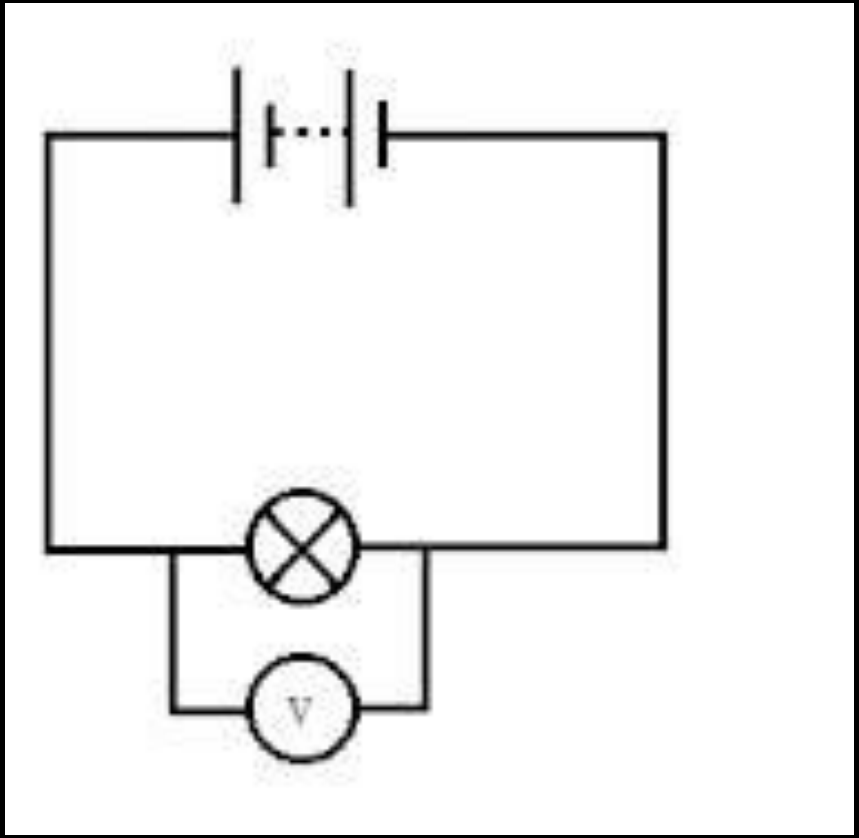
Yes, by using a device called the voltmeter.

The voltmeter measures voltage in volts.
The symbol for amps is V.

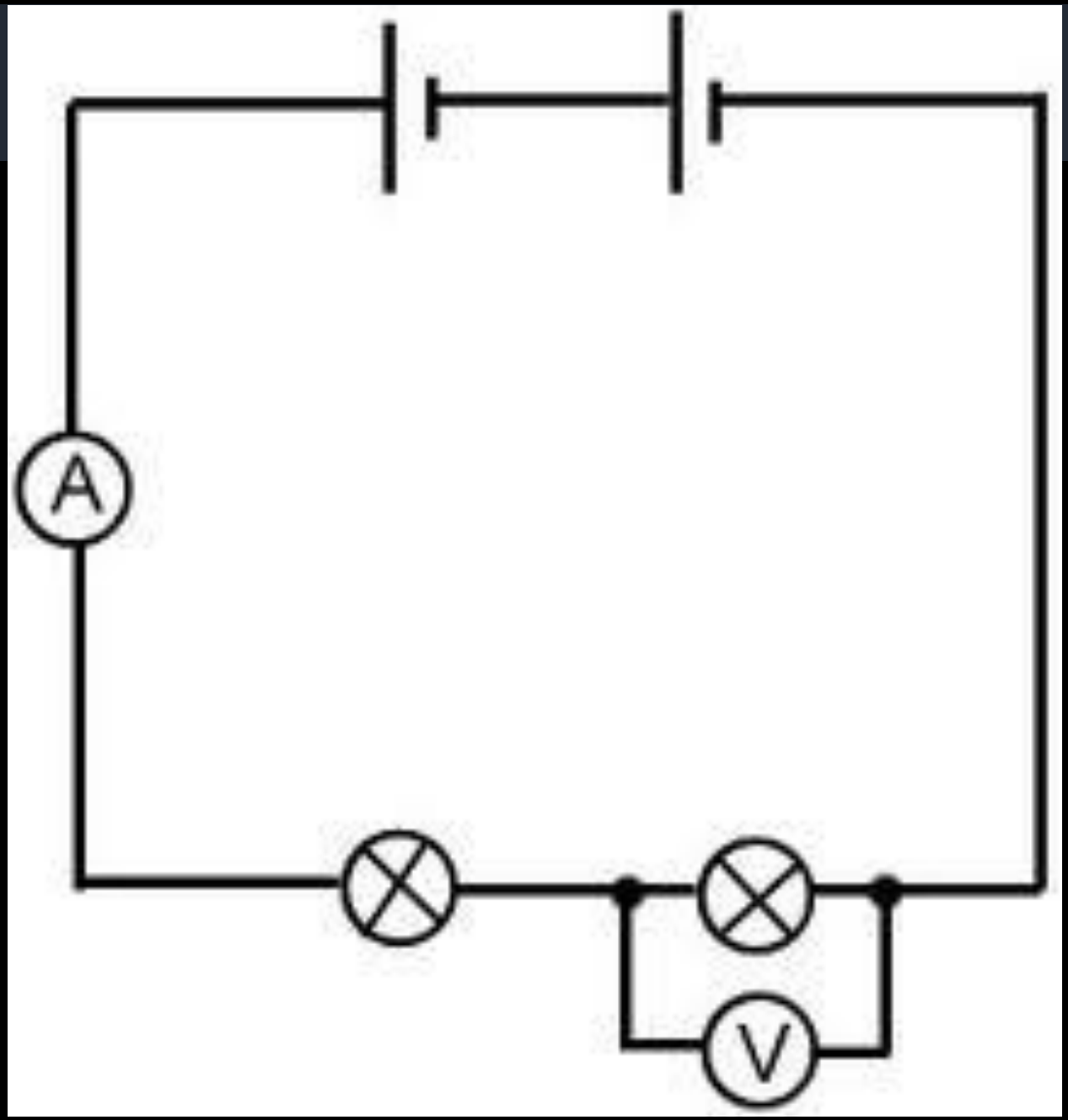
What will happen if the voltage is high?

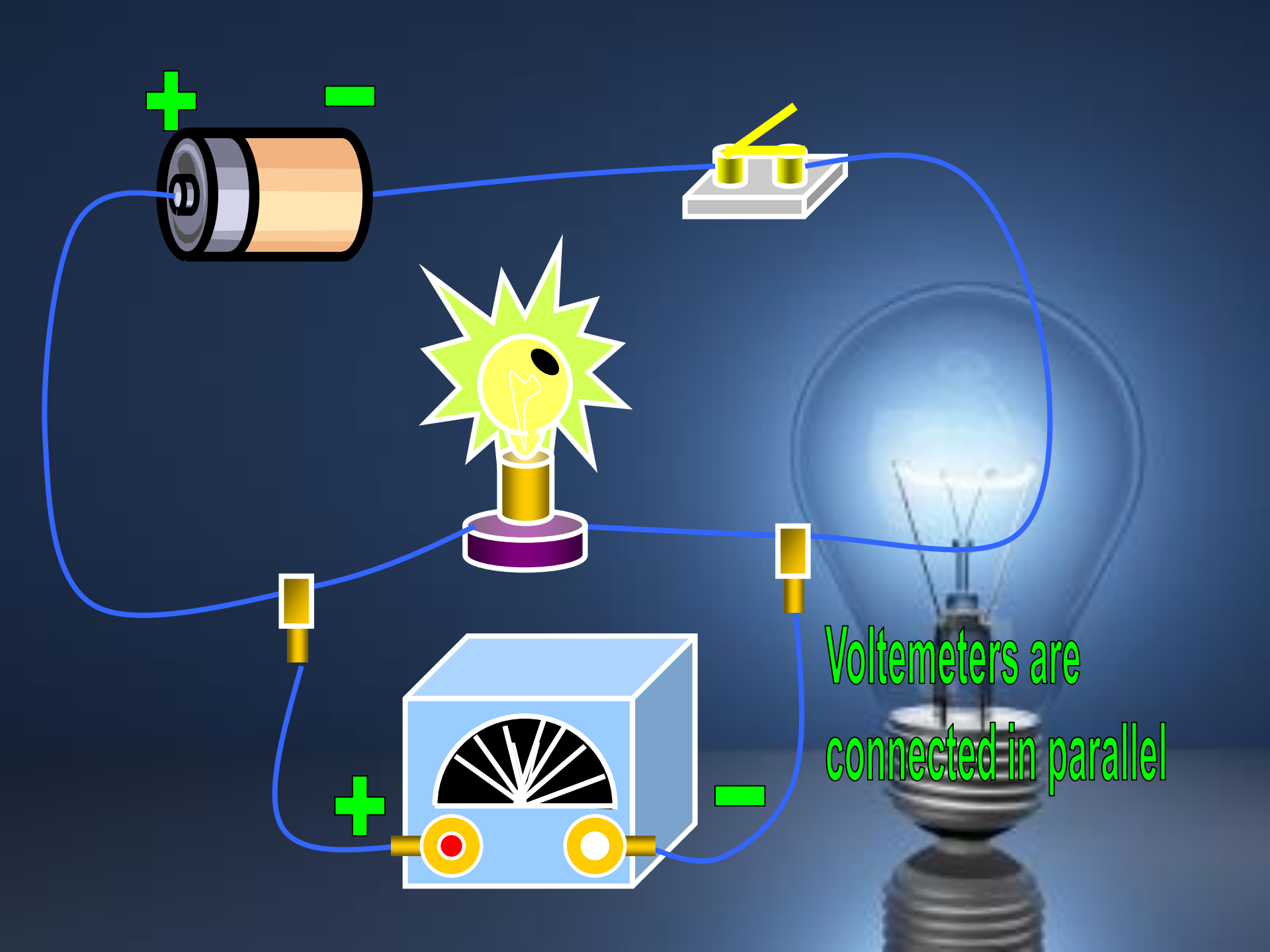
- The voltmeter scale is numbered.
- The bigger the voltage, the further the needle moves along the numbered scale.

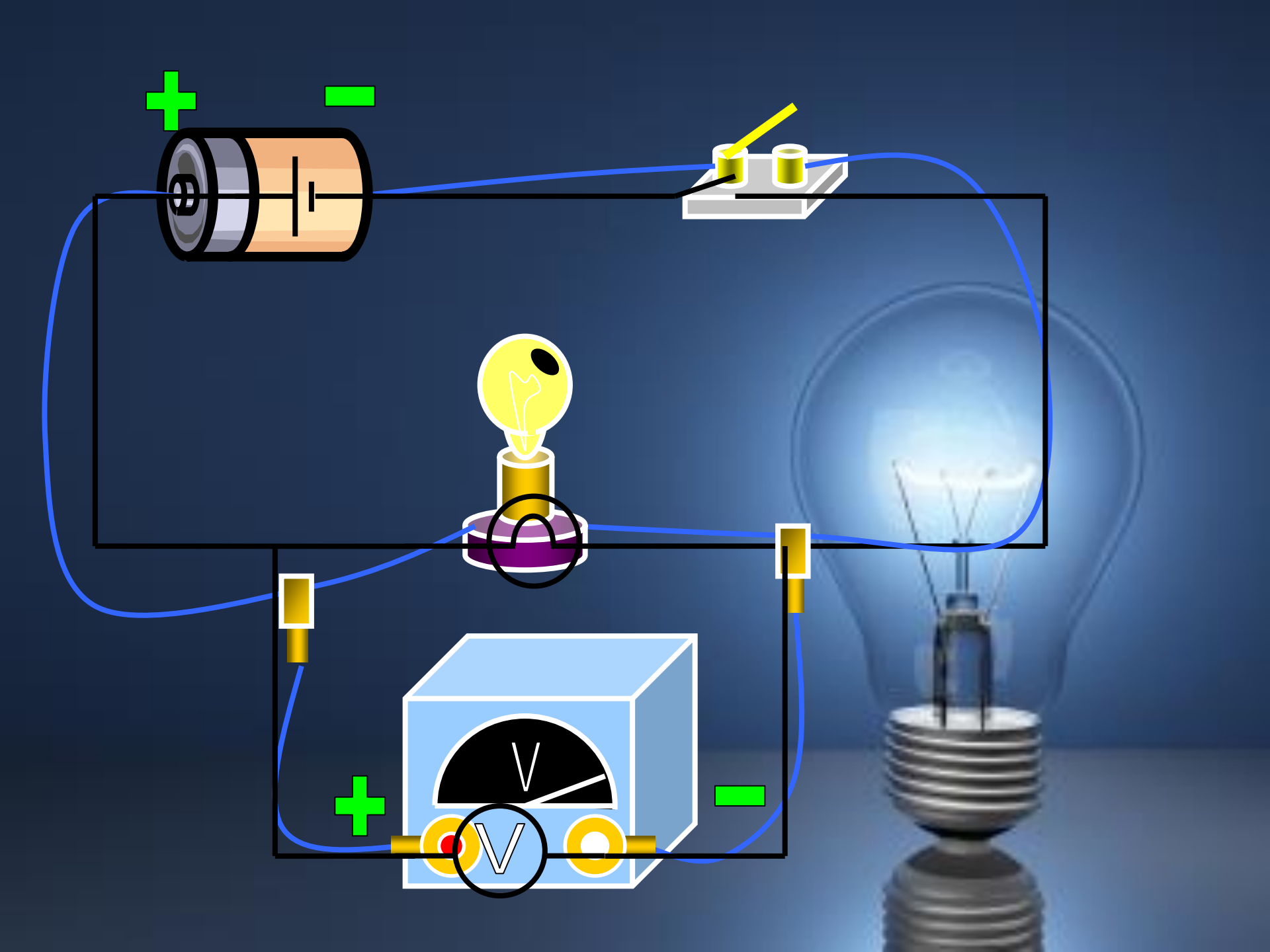
How is the voltmeter connected?



- It is placed before or under the bulb, in a separate loop.
- It is part of the circuit, it is in **parallel**.


A
V


Voltemeters are
connected in parallel

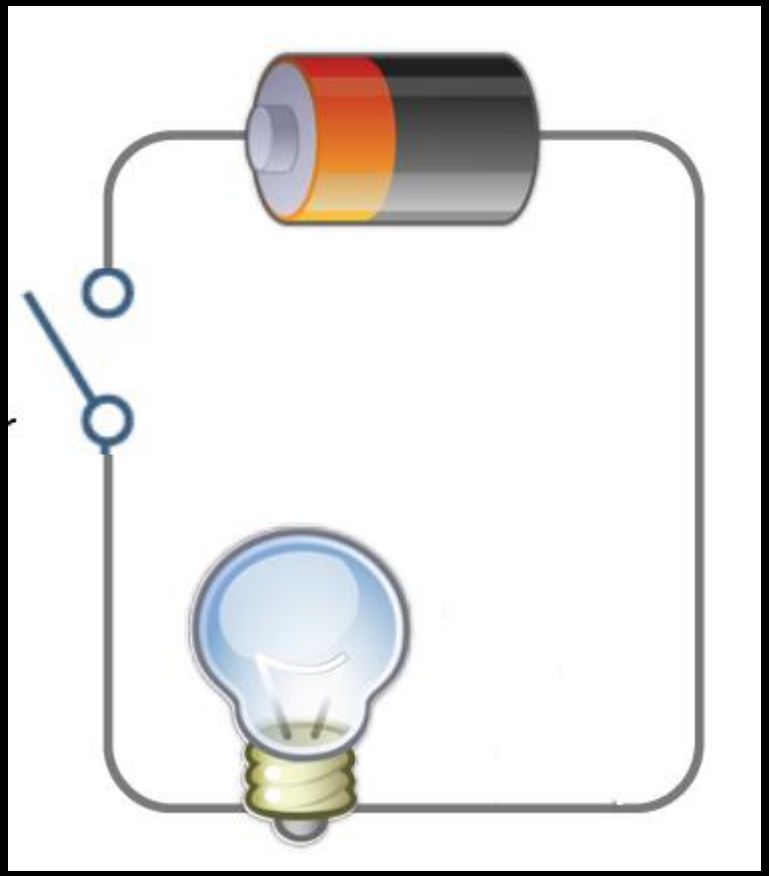

+
−
V
V
+
−

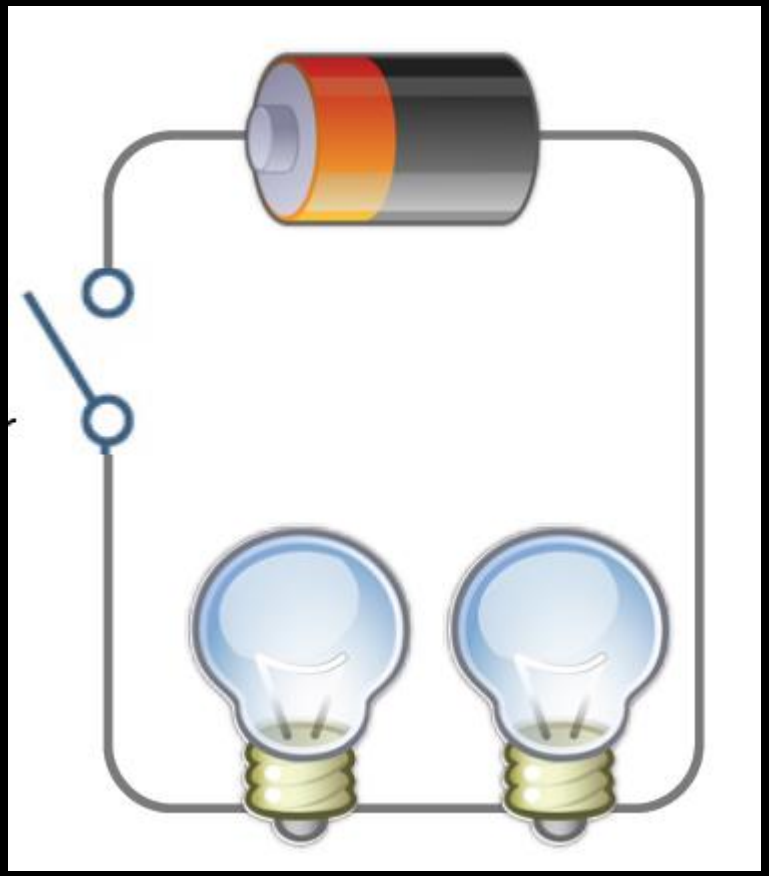
What do switches do?

They break the circuit…
…so we can switch things on and off.

Why doesn't a lamp light when the switch is off?

Because the circuit will **not** be complete!

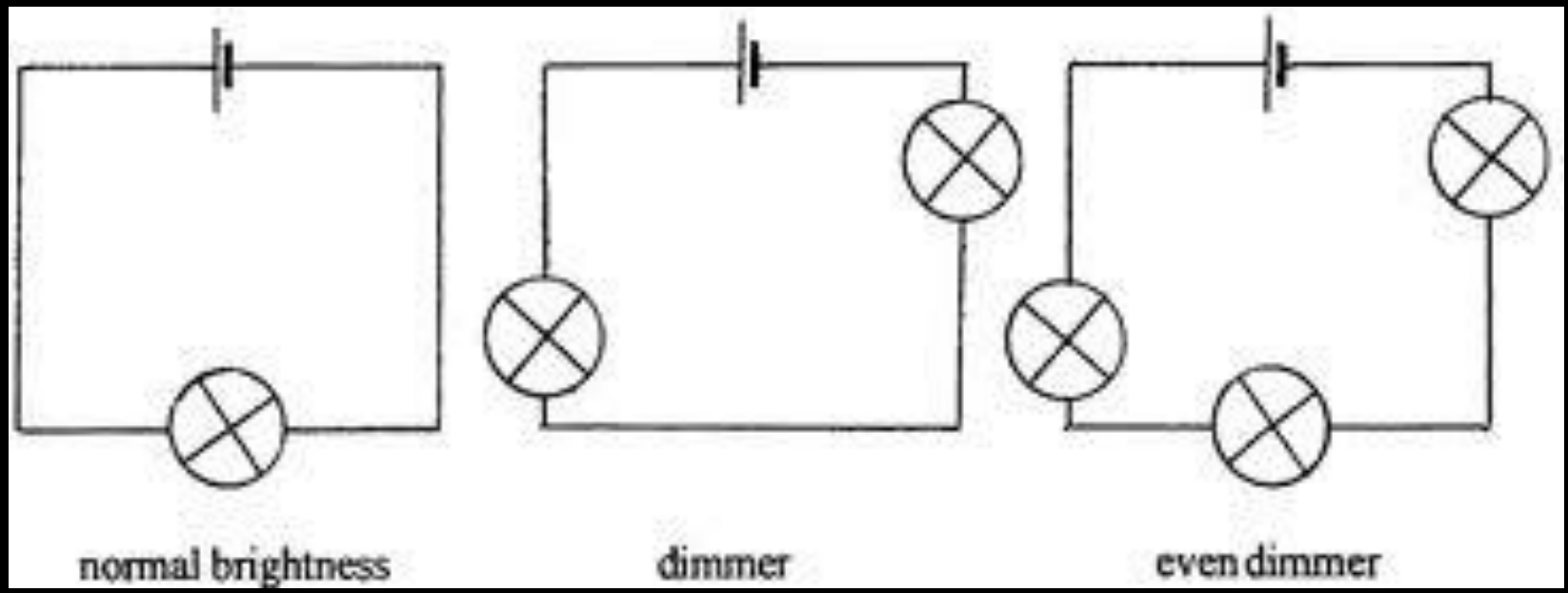


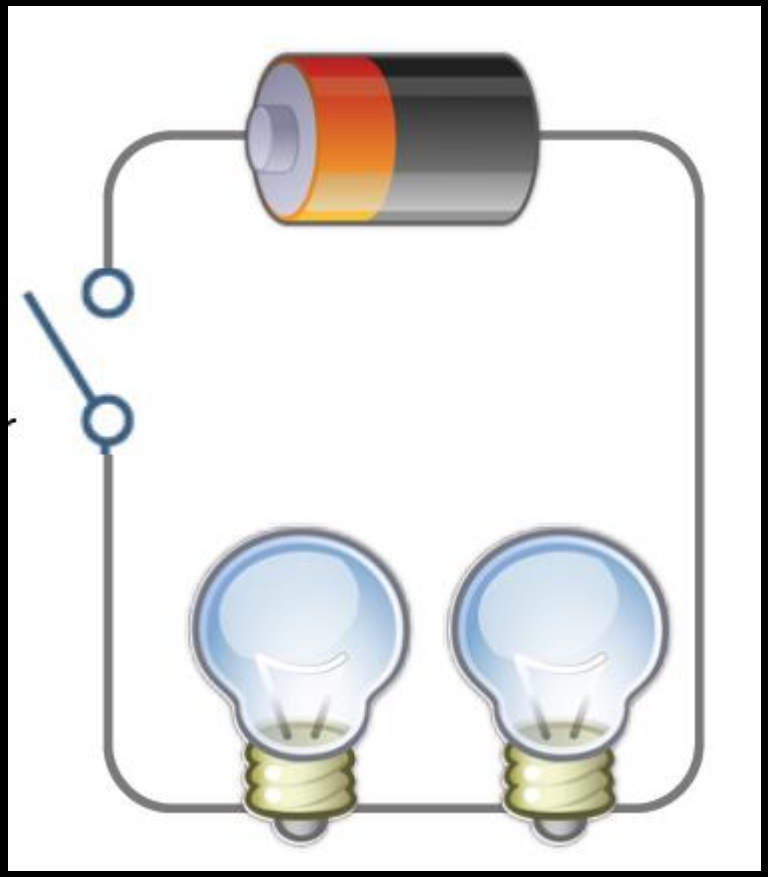


An extra bulb has been included. Do you think the bulbs will shine more or less brightly (once switched on)? Why?

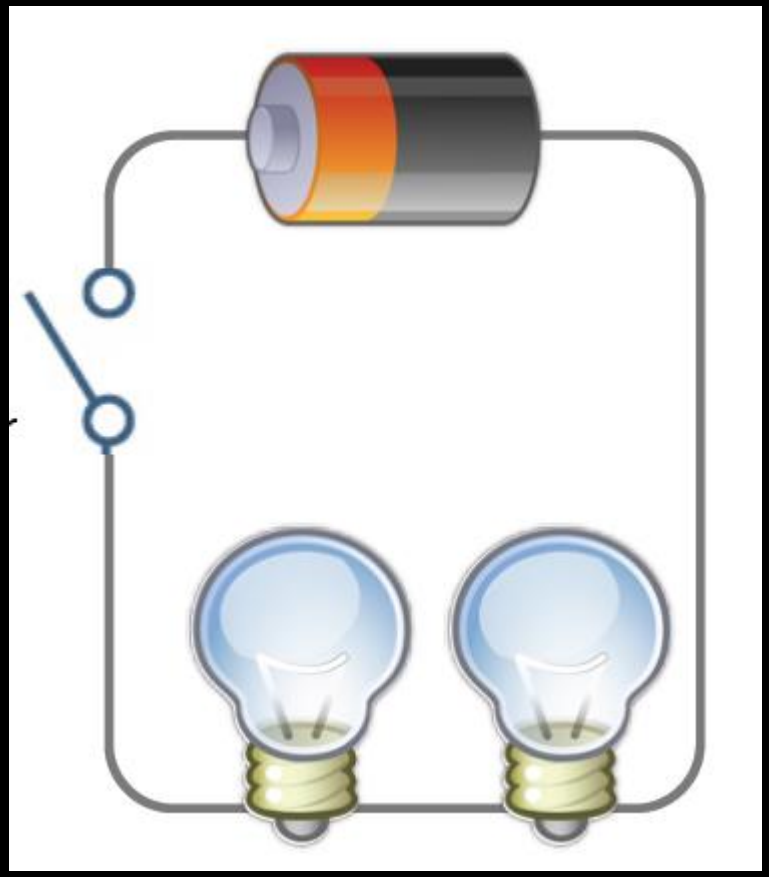
When bulbs are connected in **series**, the brightness decreases. This is because the **voltage splits** between each bulb.

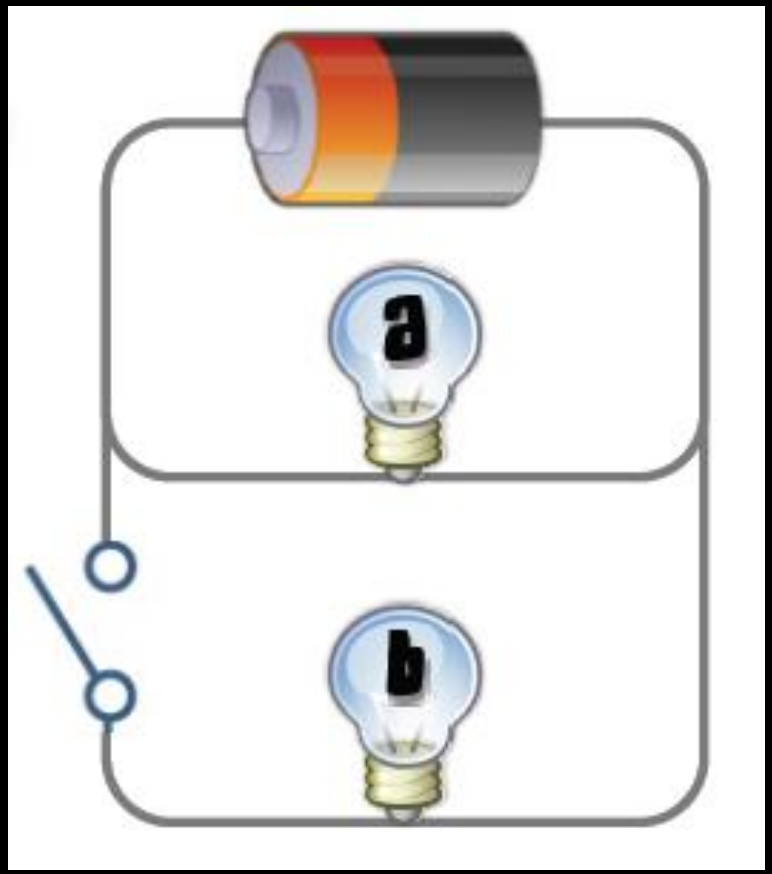
When bulbs are connected in series, the **current** arriving at each bulb will be the **same**.





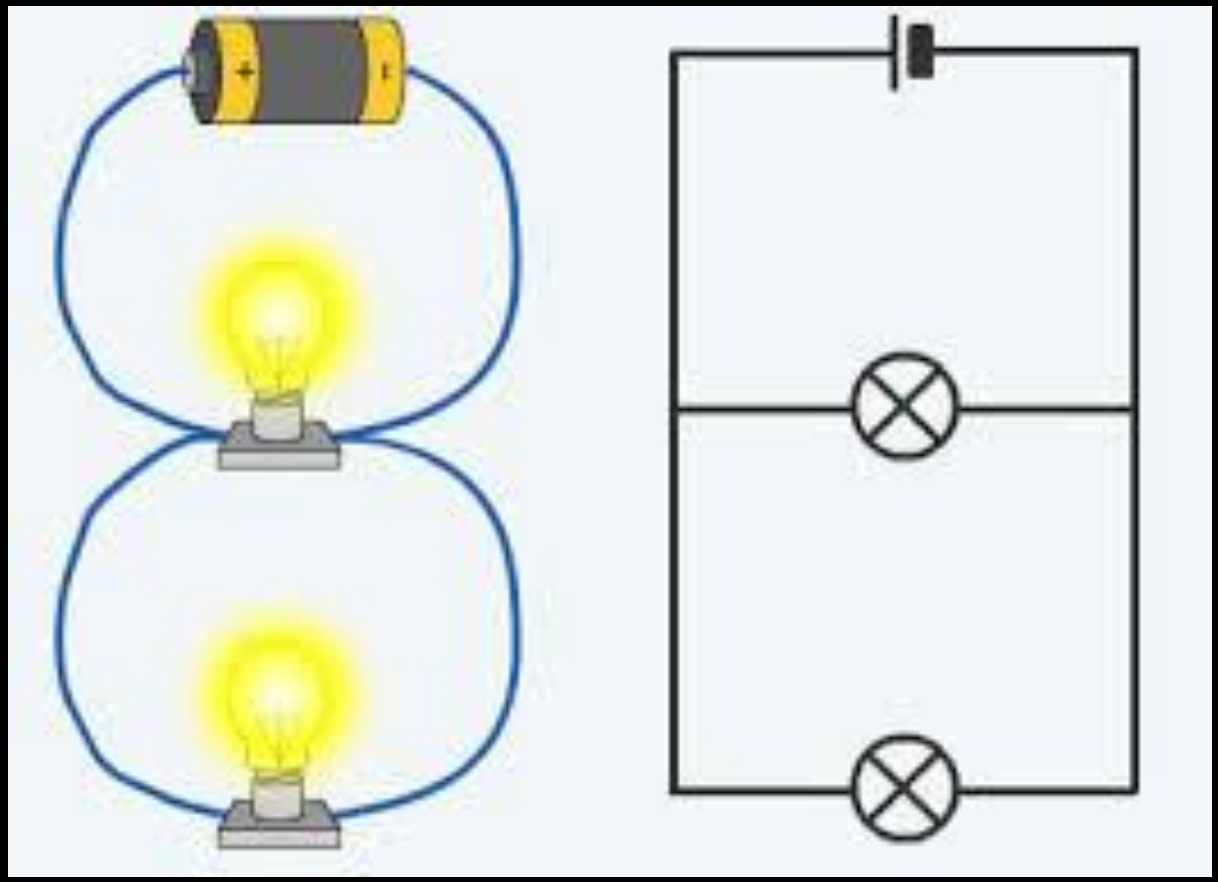
How else can we connect two lamps and a battery?



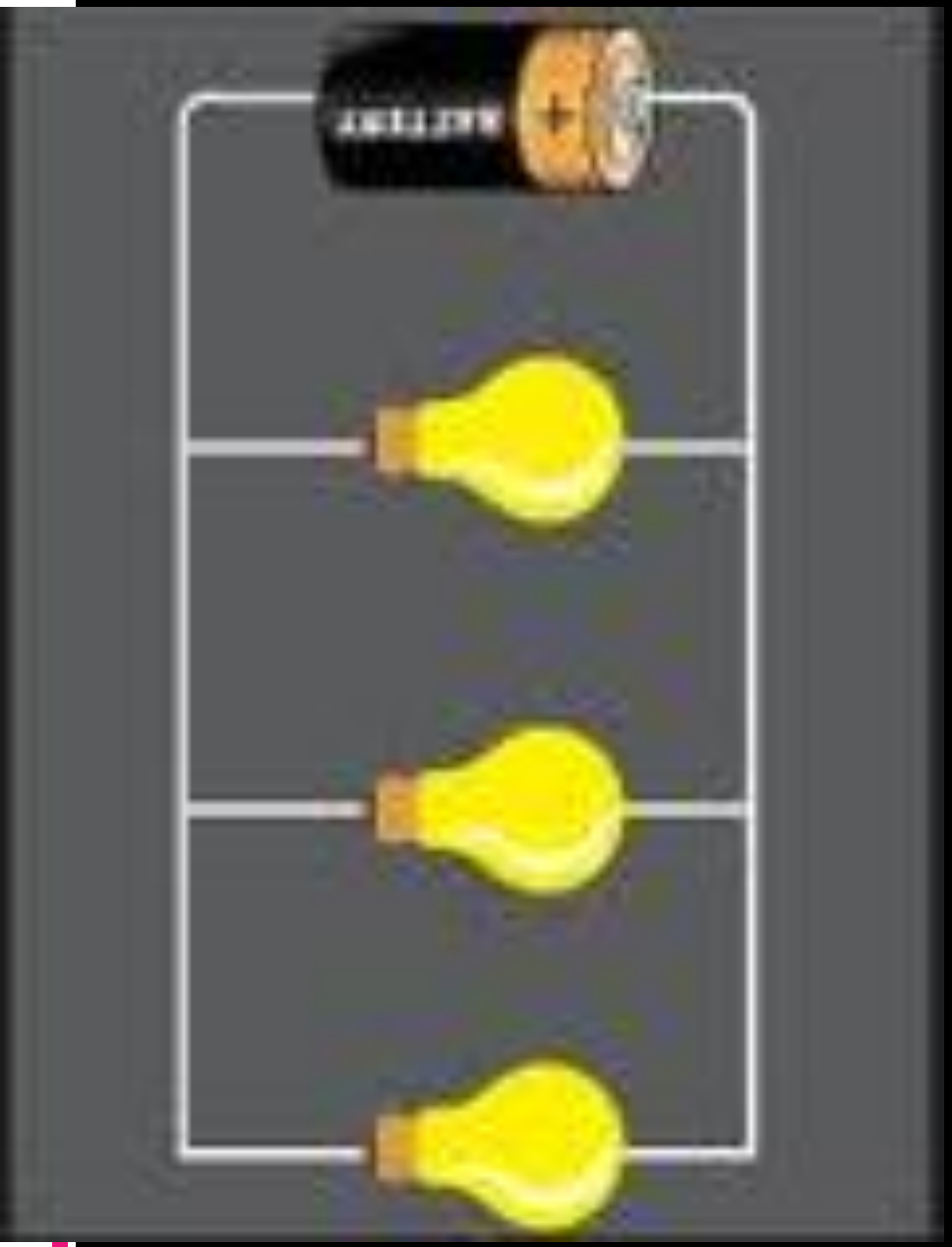


We can connect two lamps and a battery in series (left) or in parallel (right).

Parallel Circuit



An extra bulb has been included. Do you think the bulbs will shine more or less brightly (once switched on)? Why?



When bulbs are connected in **parallel**, the brightness remains the **same**. This is because the **voltage** **arriving at each bulb will be the same.**

When bulbs are connected in parallel, the **current** arriving at each bulb will be the **split** between each bulb.

SUMMARY

	Series	Parallel
Current	SAME	SPLIT
Voltage	SPLIT	SAME

Draw two circuits which are in series and in parallel. Each circuit must have three bulbs and a battery.

SERIES

PARALLEL

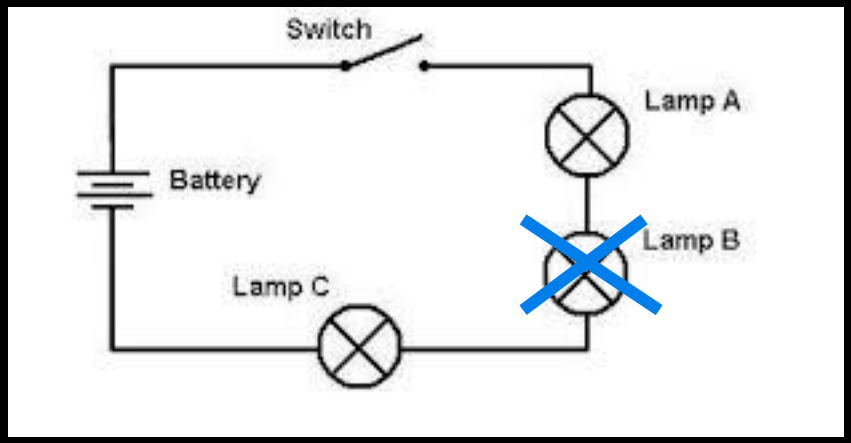
your turn!!!

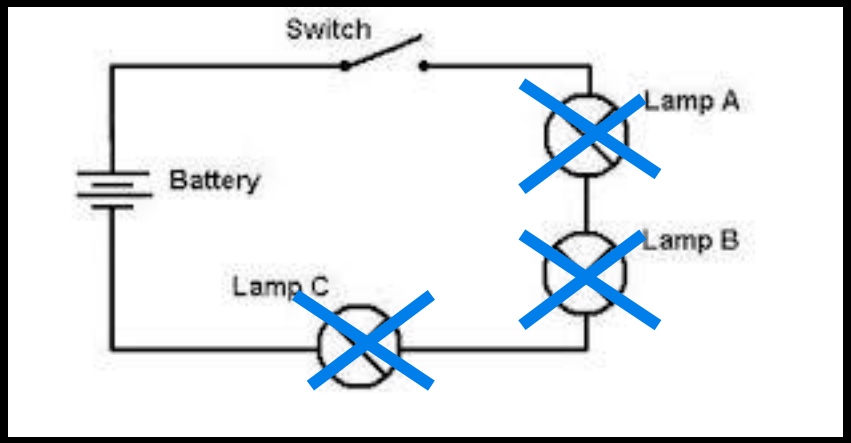
You can now try to build up your own circuits (series and parallel), using symbols for each component used.

Series Circuits

In Series

- When a bulb stops lighting, the rest of the bulbs stop working.

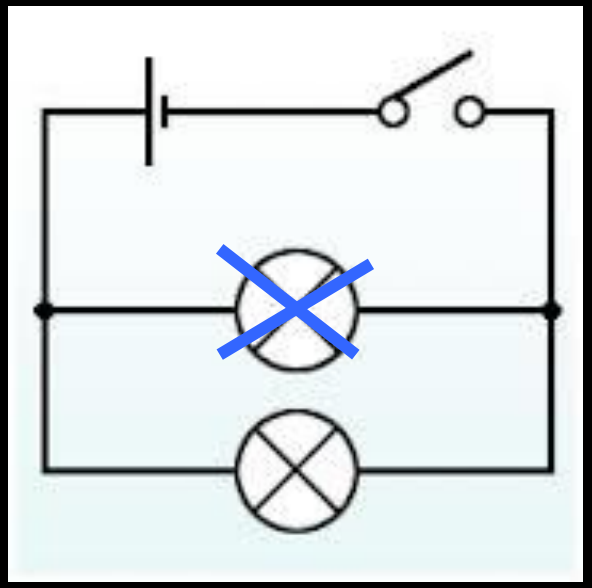


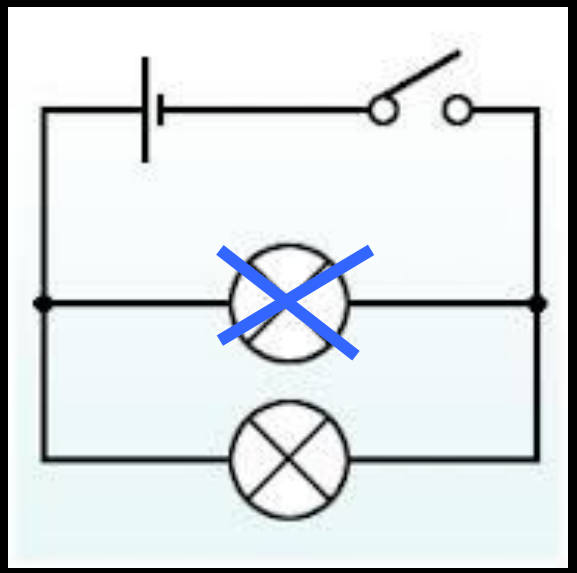


Parallel Circuits

In parallel

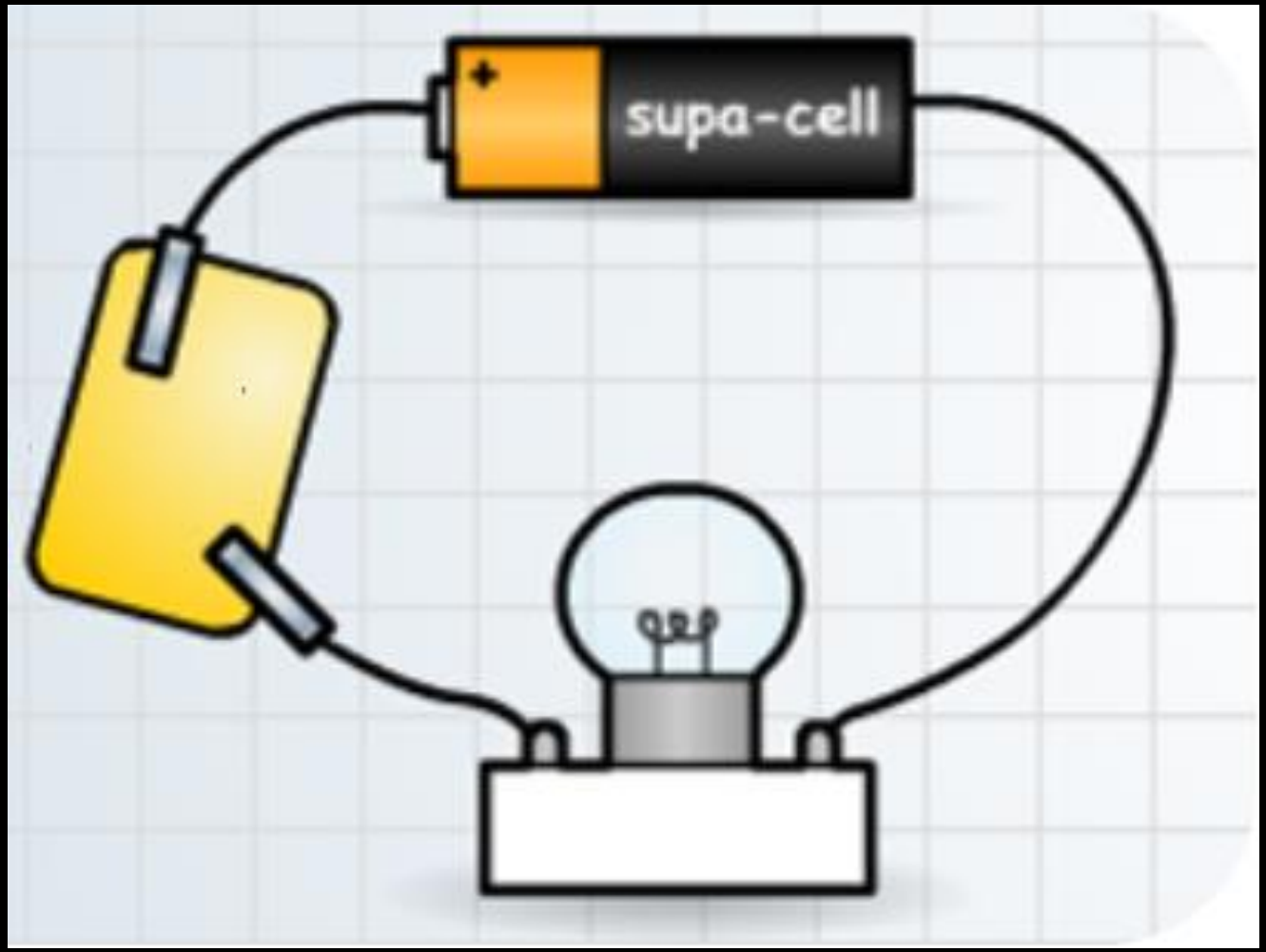
- When a bulb stops lighting, the rest of the bulbs remain lighting.





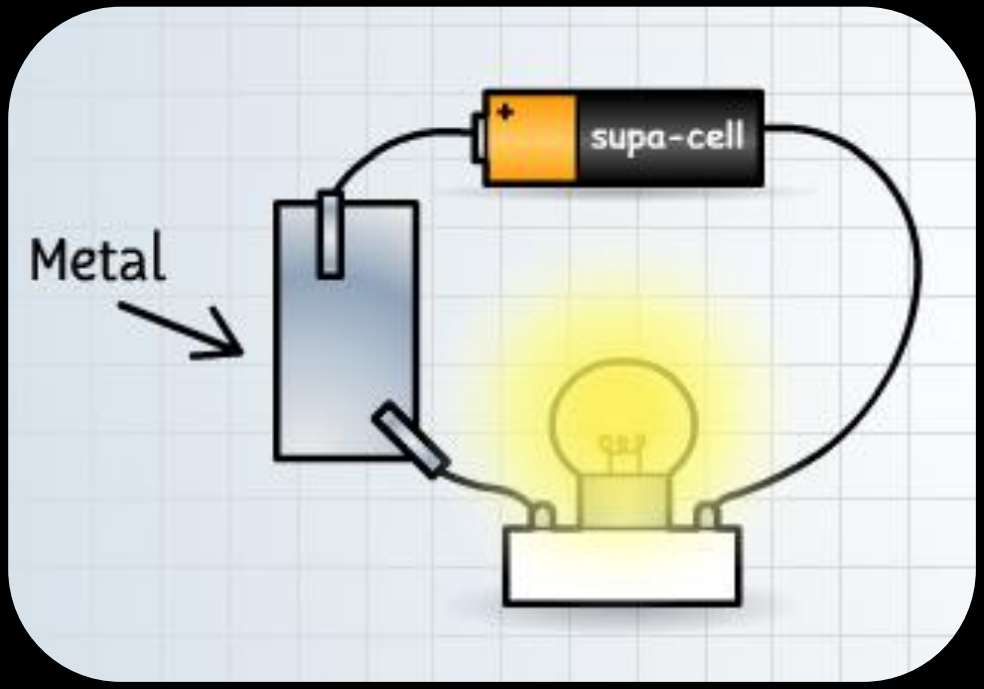
Why is it EXTREMELY dangerous to touch a socket with metal?

What would happen if a piece of metal was put into the circuit?



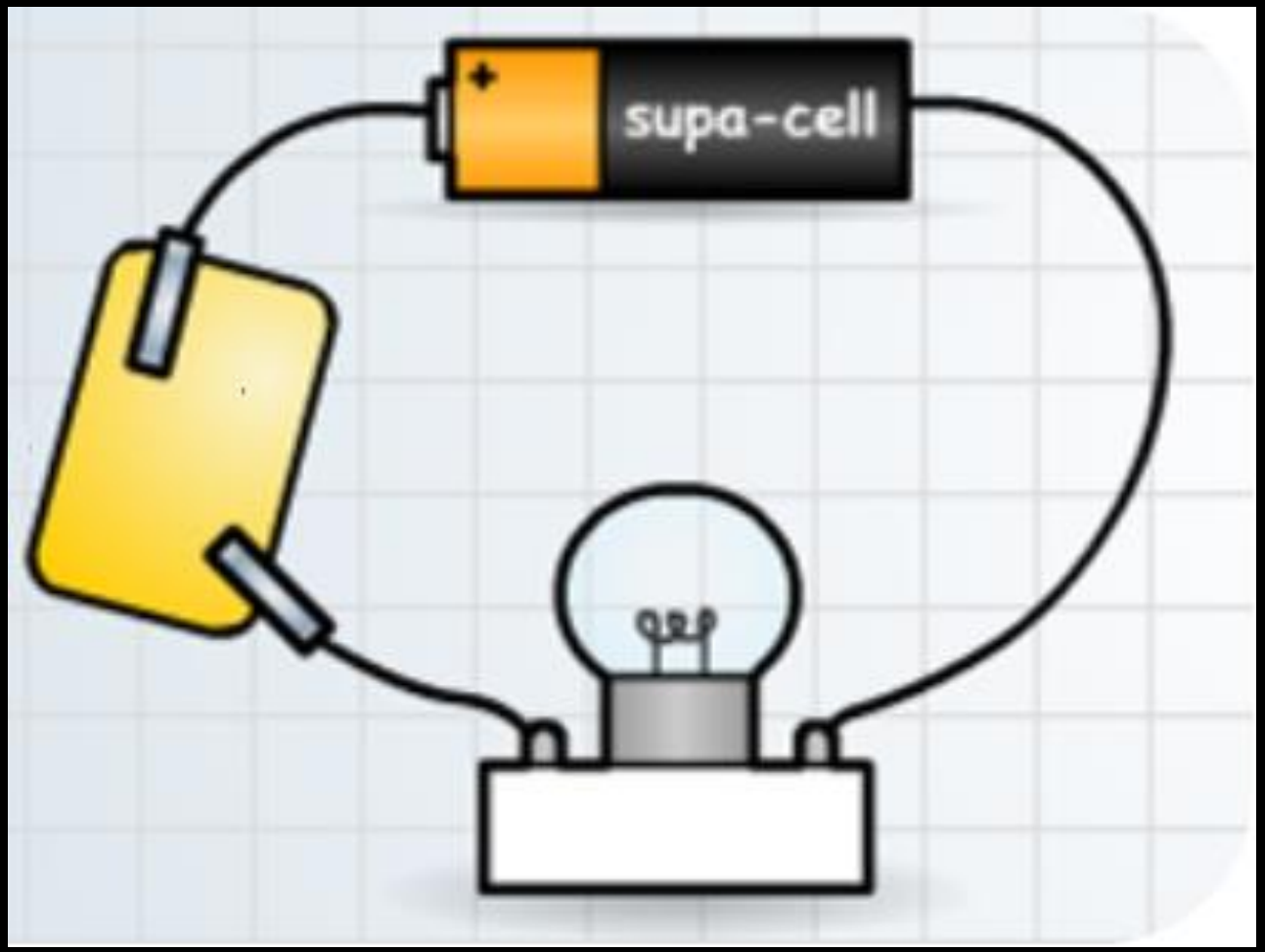
Conductors

The piece of metal in this circuit allows electricity to travel through it, so the bulb lights up.



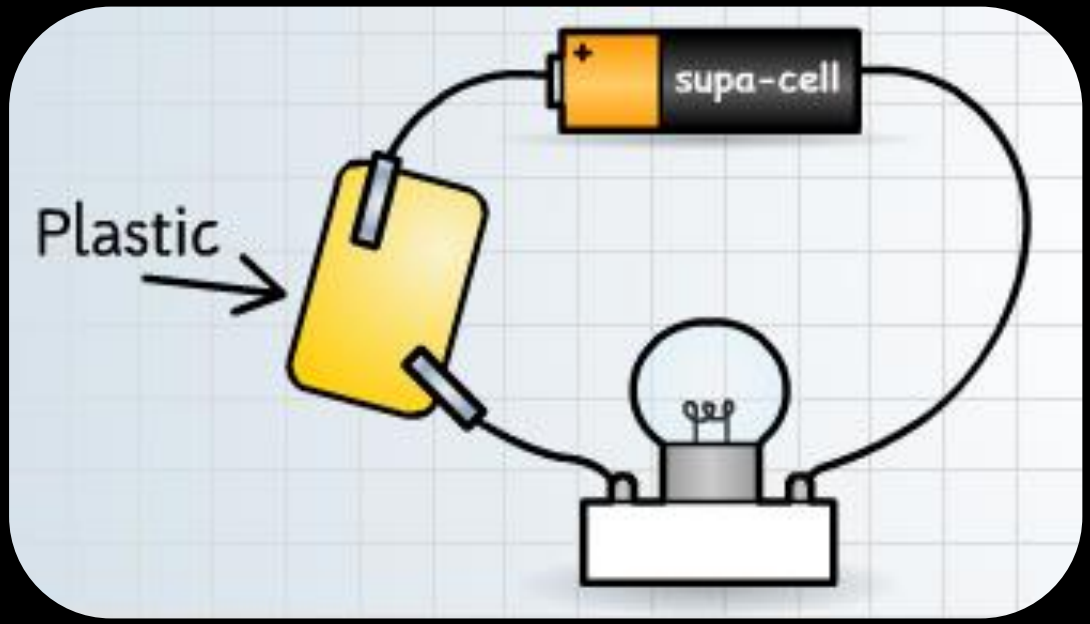
Some materials will allow electricity to travel through them. We call these materials **conductors**.

What would happen if a piece of plastic was put into the circuit?

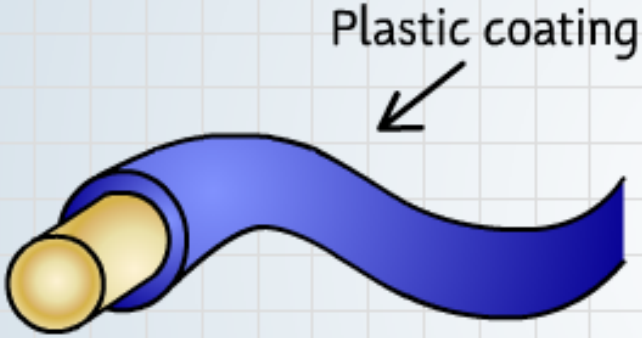


Insulators

There are lots of different insulators, such as plastic, rubber or glass. The plastic does not allow electricity through, so the bulb does not light up.



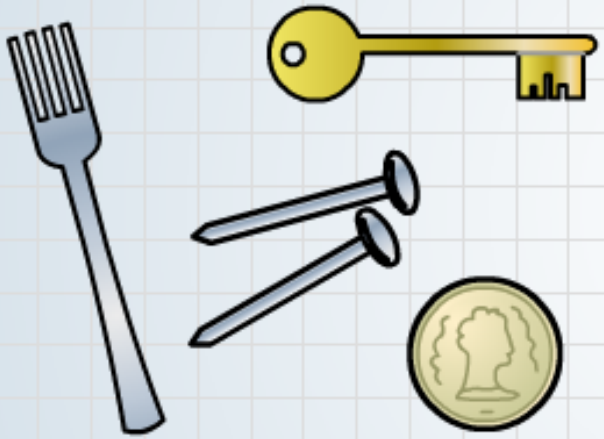
Other materials do not allow electricity to pass through them. We call these materials insulators.



Some wires have a plastic coating. In fact, the wires you use in class probably do.

The copper is a conductor and carries electricity. The plastic is an insulator and stops electricity from travelling into other objects that touch the wire.

Back Next



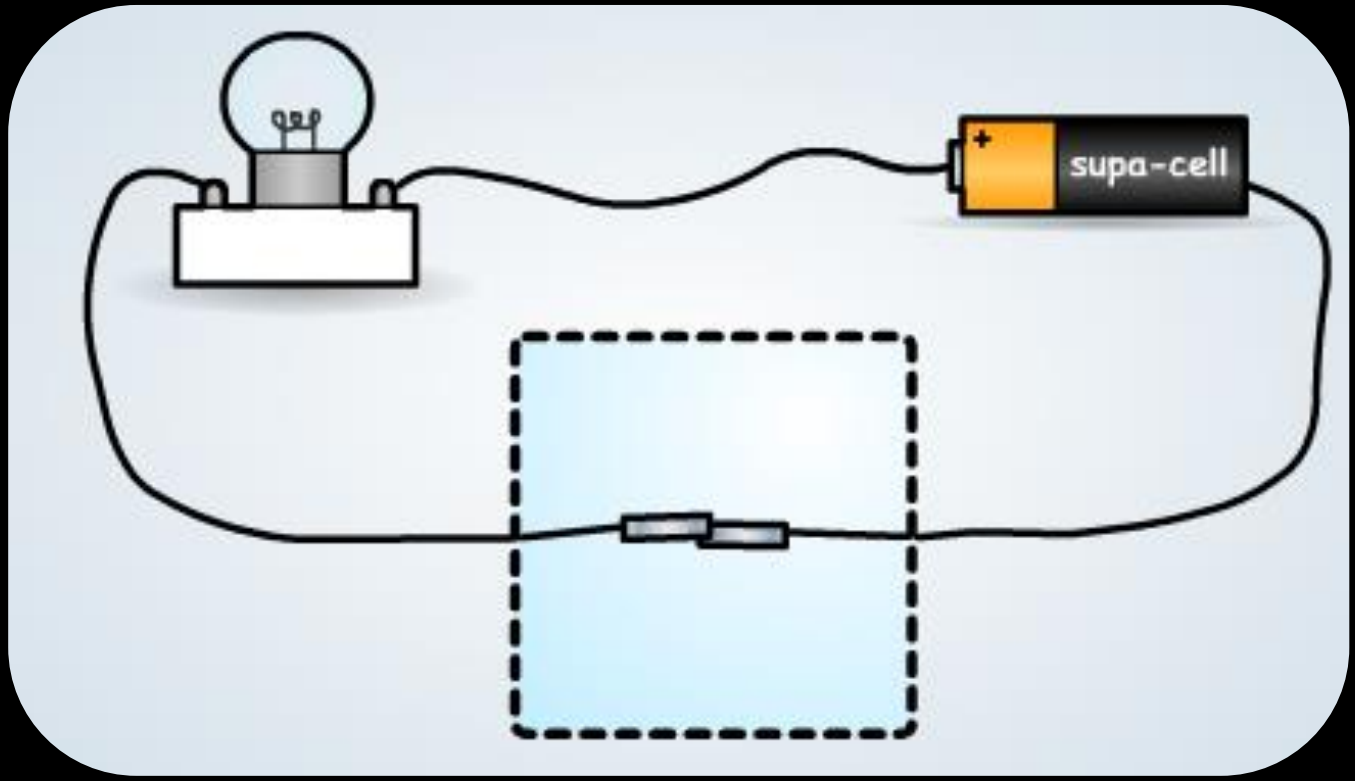
Metals like steel, copper, iron, gold and silver are very good conductors.

Graphite which is a type of carbon, also conducts electricity, but most conductors are metals. Graphite is what pencil 'lead' is made from.

Move forward one screen

How can you test whether something is a conductor or insulator?

How to test whether something is a conductor or insulator



Why is it very dangerous to touch a switch with wet hands?

Examples:

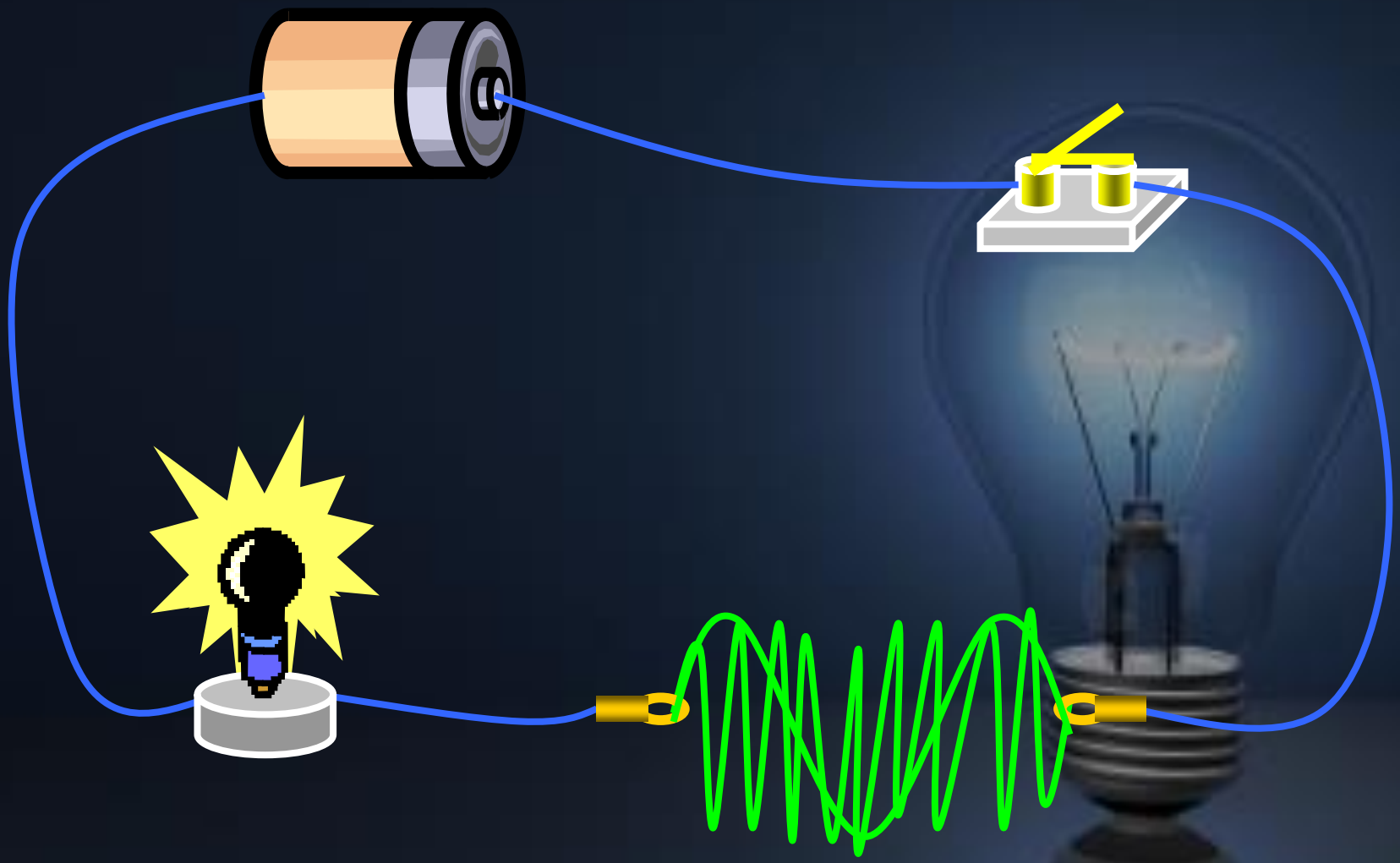
- Examples of conductors:
  - All metals
- Examples of insulators:
  - Plastic, rubber, wood

Resistance

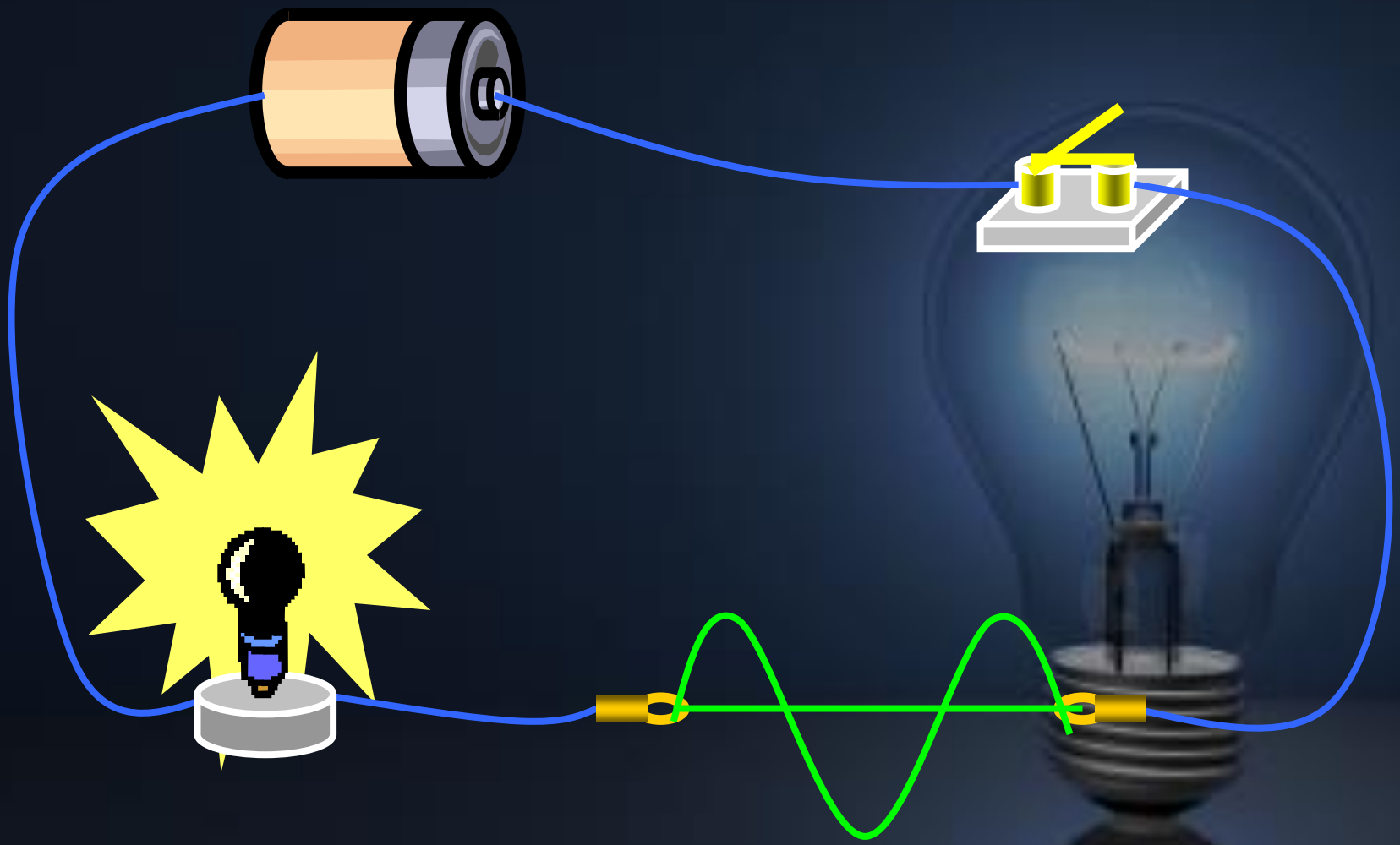
- Resistance is a way of saying how difficult it is for current to flow in a circuit.
- The more the resistance, the less the current.
- The less the resistance, the more the current.


Length of wire vs. Resistance

Length of wire vs. Resistance

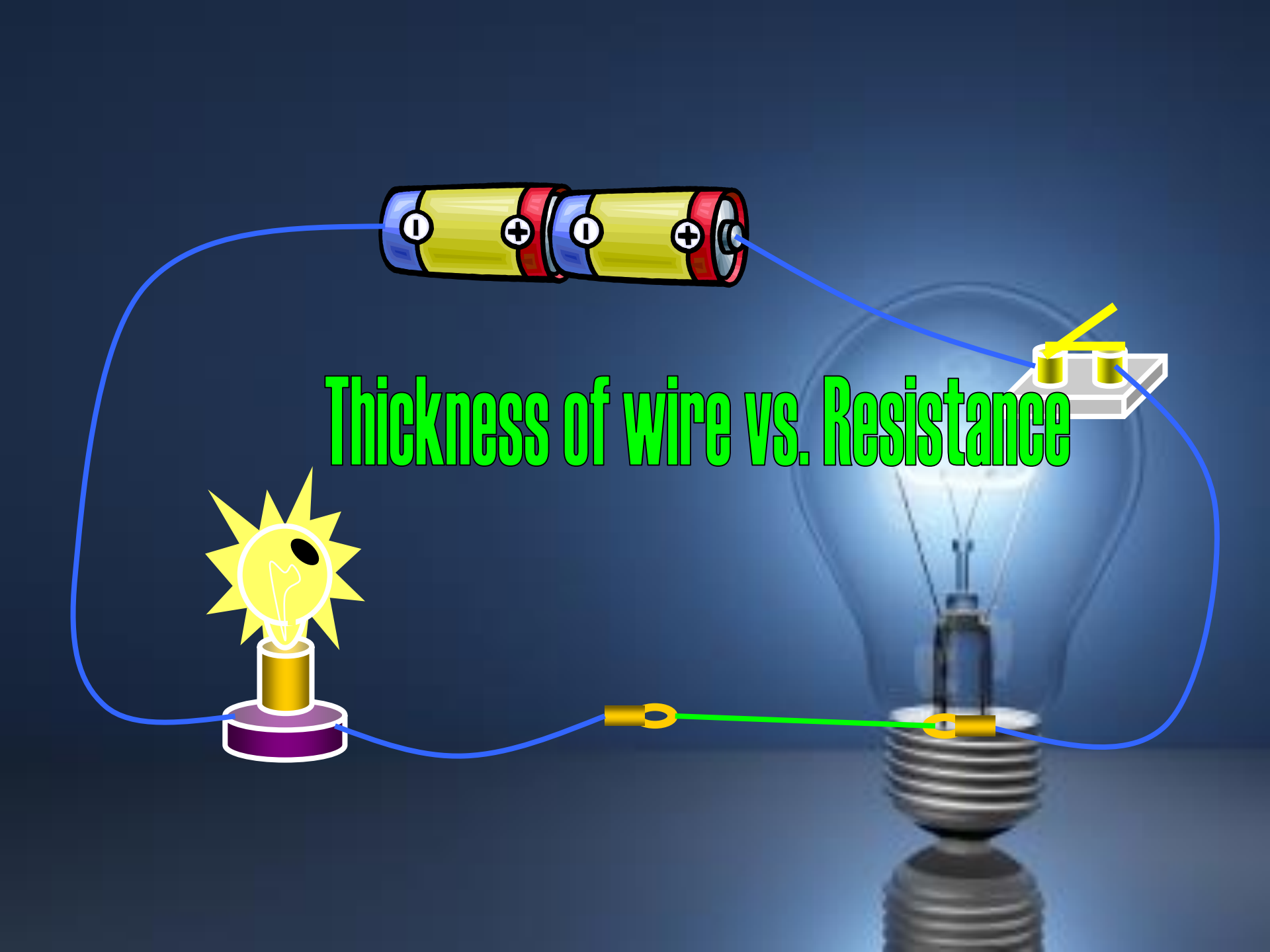


Length of wire vs. Resistance

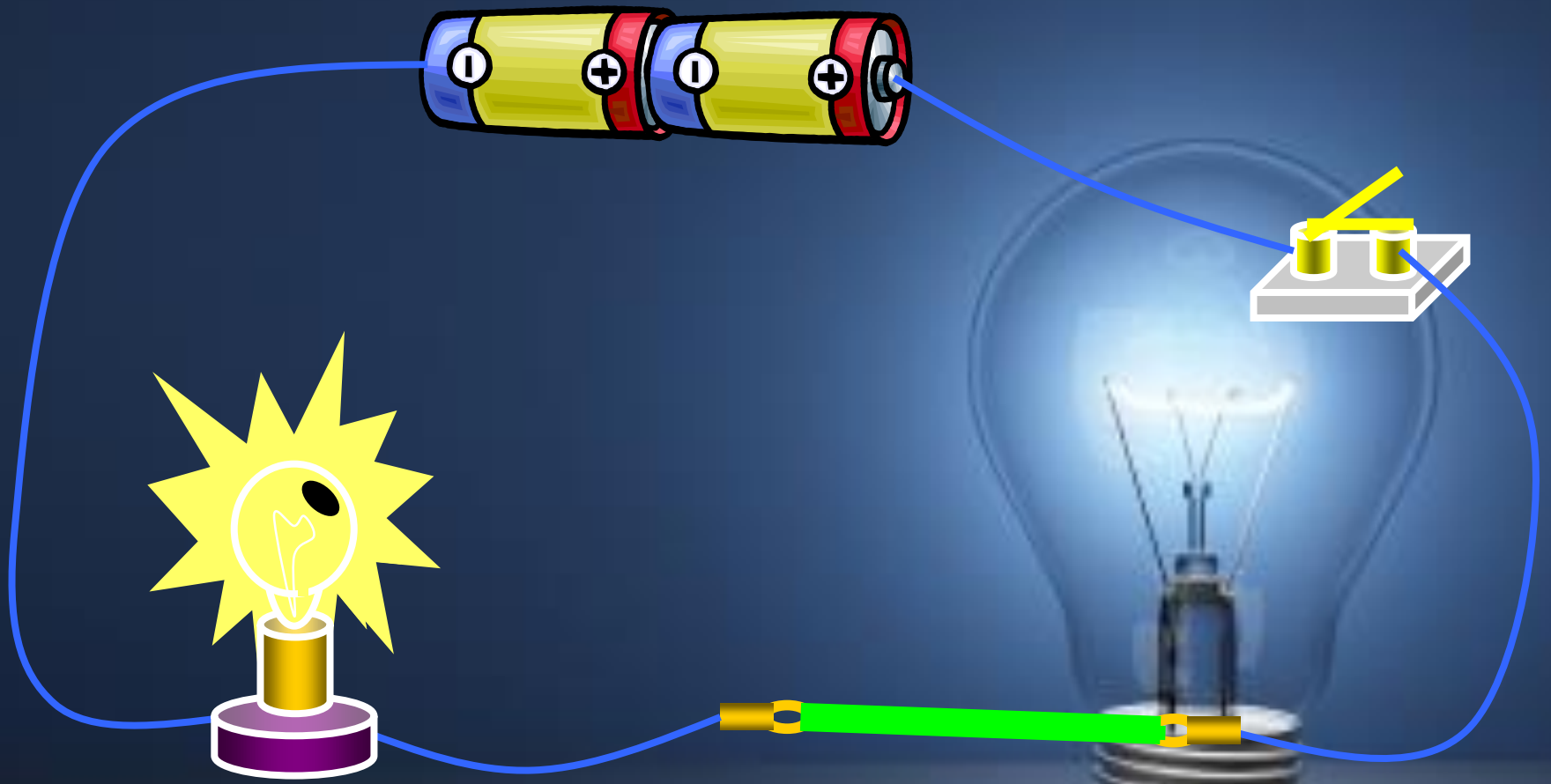


Conclusion

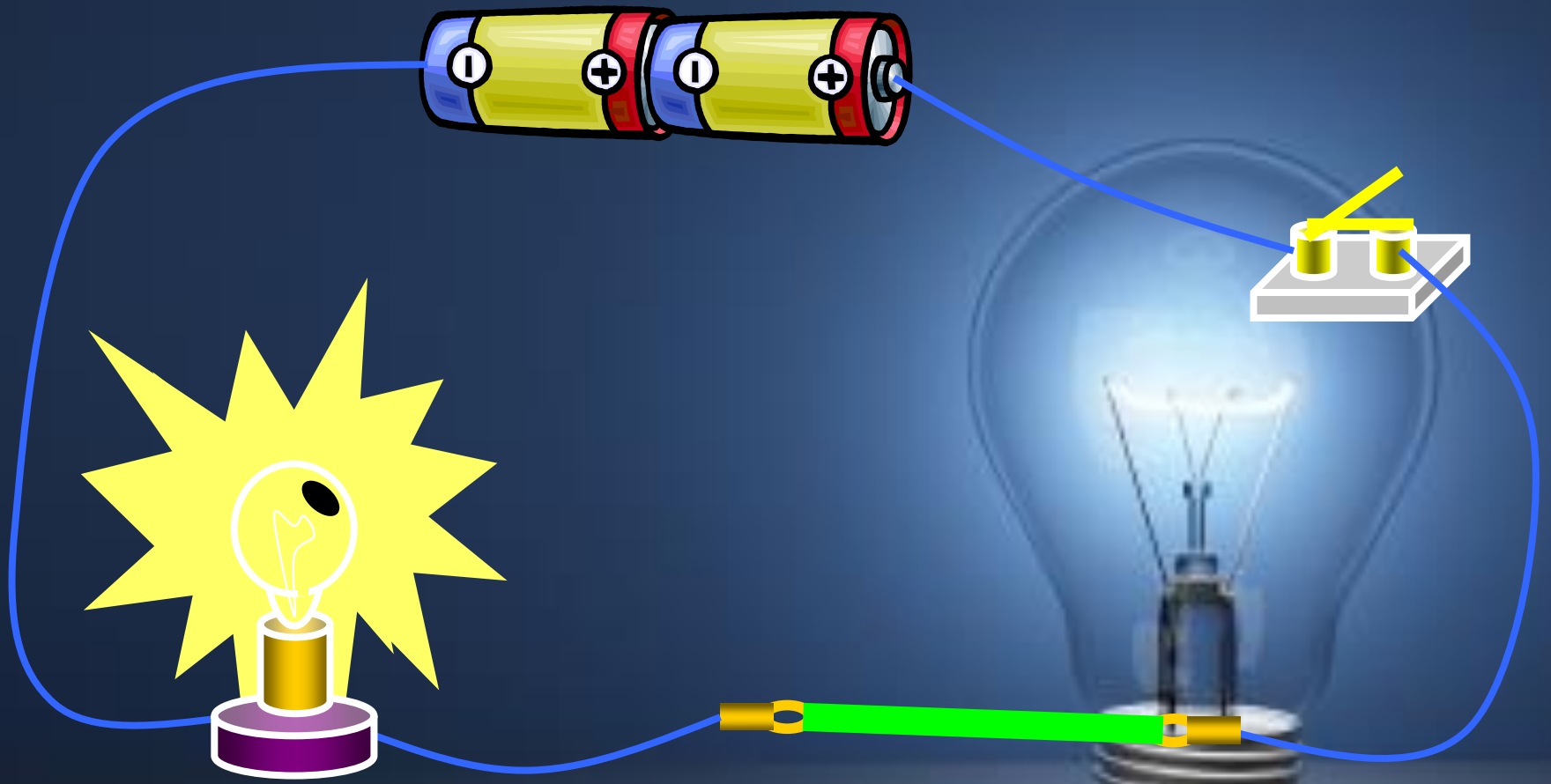
The longer the wire, the more the resistance.


Thickness of wire vs. Resistance

Thickness of wire vs. Resistance



Thickness of wire vs. Resistance



The resistance of a wire depends on:

	What the material is made up of	How long it is	How thick it is
Low resistance	Good conductor	Short	Thick
High resistance	Poor conductor	Long	Thin

Important:

- Something that has a high resistance will produce heat.
- Conductors in a kettle:
  - The conductor in the wire is copper, which has a very low resistance. As a result a lot of current is allowed to flow through the wire.
  - The heating element of a kettle is made out of nichrome. Nichrome has a very high resistance and as a result produces a lot of heat. This heat is then used to heat up the water.

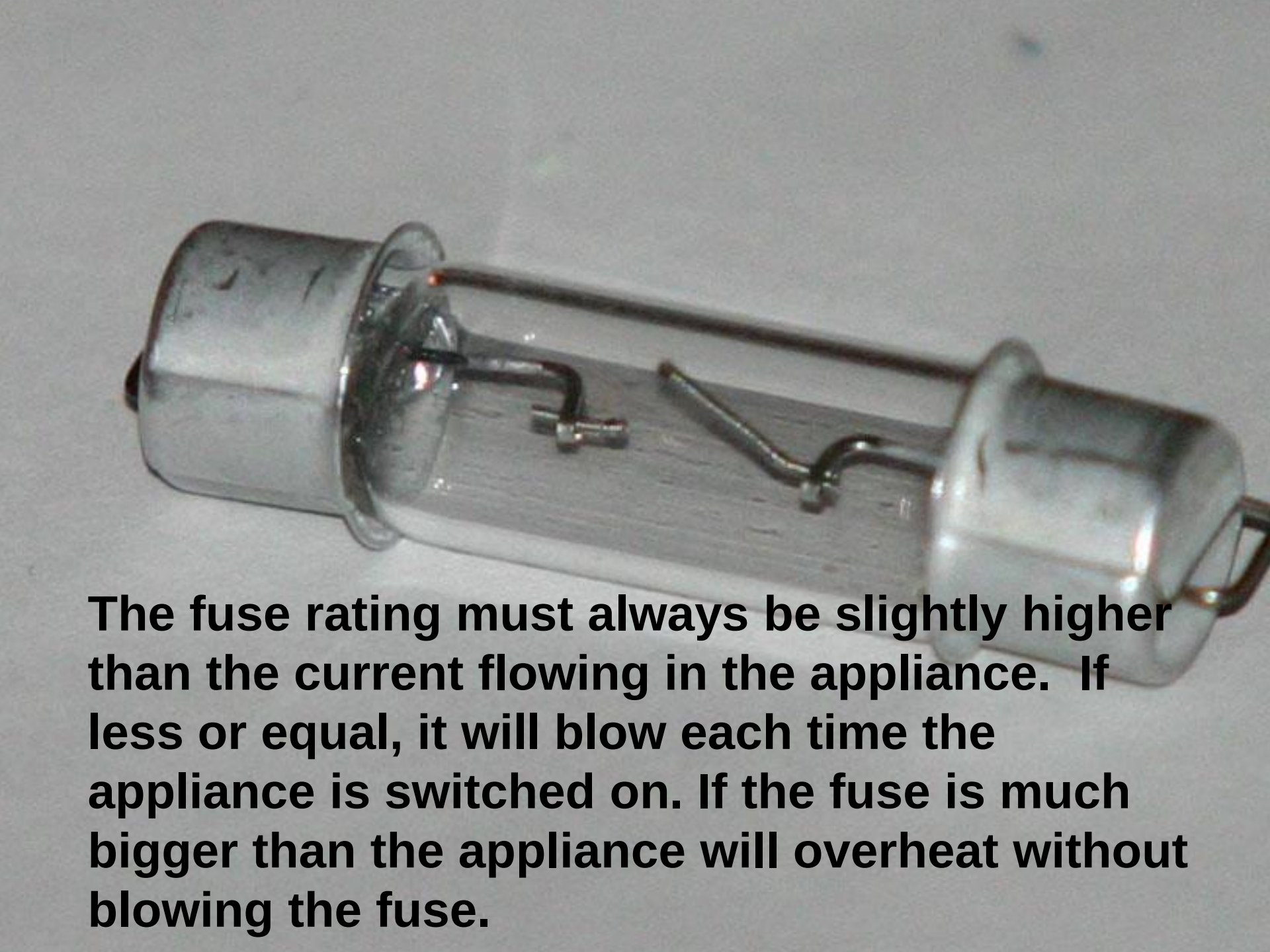
What would happen if the current being carried by a wire is too high?

- Fire
- The electric appliance would become damaged

The Fuse

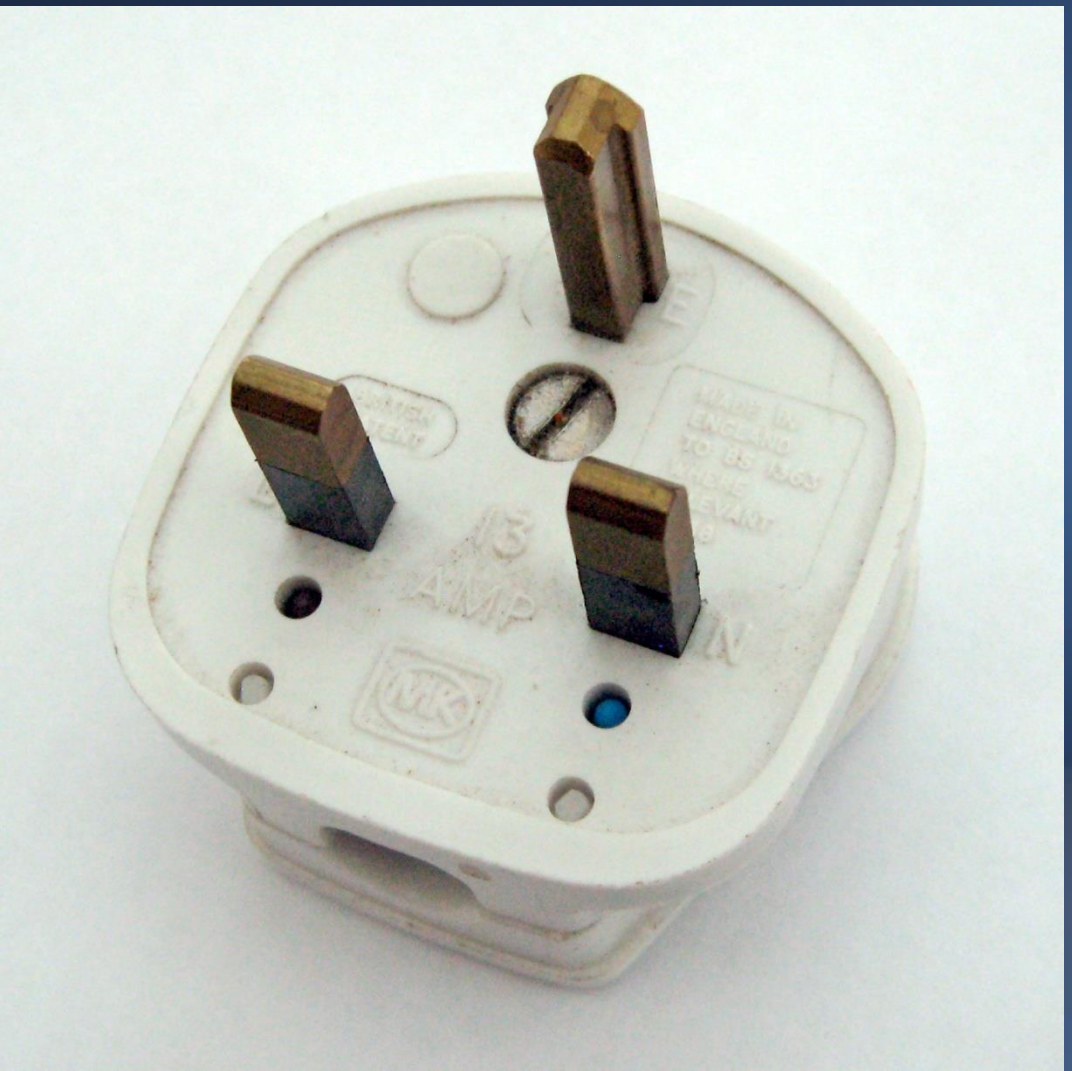
A fuse is a thin, short length of wire. When a current exceeds a certain value, the fuse overheats, melts and breaks the circuit (blows).

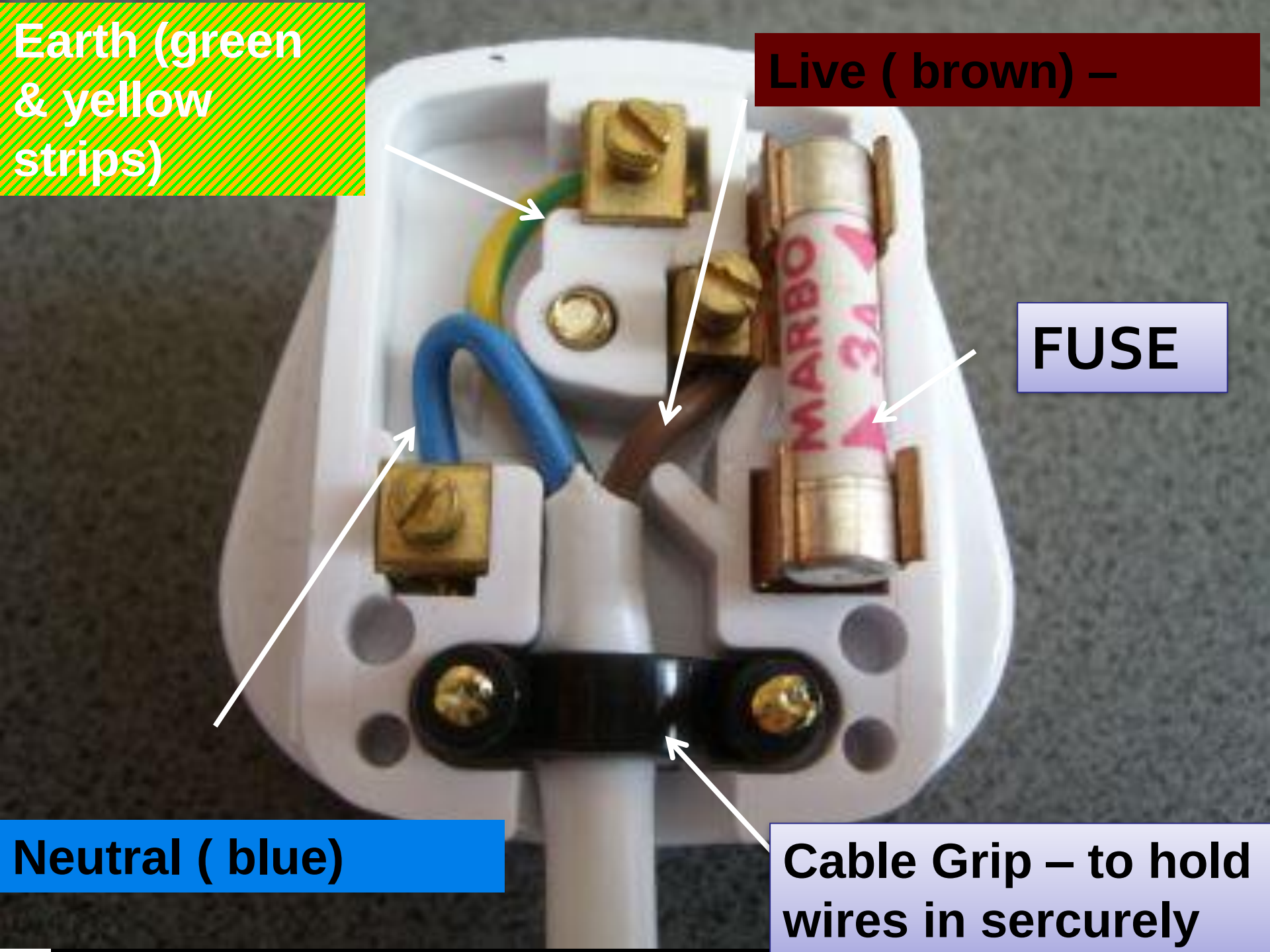
The most common fuse sizes are 3A, 5A and 13A (an electric cooker can have a 30A fuse).



The fuse rating must always be slightly higher than the current flowing in the appliance. If less or equal, it will blow each time the appliance is switched on. If the fuse is much bigger than the appliance will overheat without blowing the fuse.

The Plug




Earth (green & yellow strips)
Live (brown) –
FUSE
Neutral (blue)
Cable Grip – to hold wires in sercurely

The Plug – Summary

There are 3 wire in a plug:

1) **The Earth Wire** (safety precaution – excess current / charge flows through the earth wire so that you do not get a shock when you touch the appliance)
2) **The Neutral Wire** (electrons that lack energy flow through)
3) **The live Wire** (carries current – electrons full of energy)

Never tamper with electric wires, plugs or appliances!

Even with mobile chargers you risk electrocution… so always use things safely!

Safety in Electricity

Dealing with Electricity? Don't Take a Chance

Follow These Do's & Don'ts for Your Safety

DO

Seal all unused electrical outlets.

DON'T

Pull a plug out with its cord.

DO

Throw away or repair electrical items that have damaged cords.

DON'T

Touch electrical appliances with wet hands.

DO

Before repairing any electrical appliance, remember to unplug it.

DON'T

Put fingers or metallic objects in electrical outlets.

DO

Plug in only one high-watt appliance at a time to avoid overloading it.

DON'T

Use any kind of electrical appliances close to water.

SDP
Same Day Pros