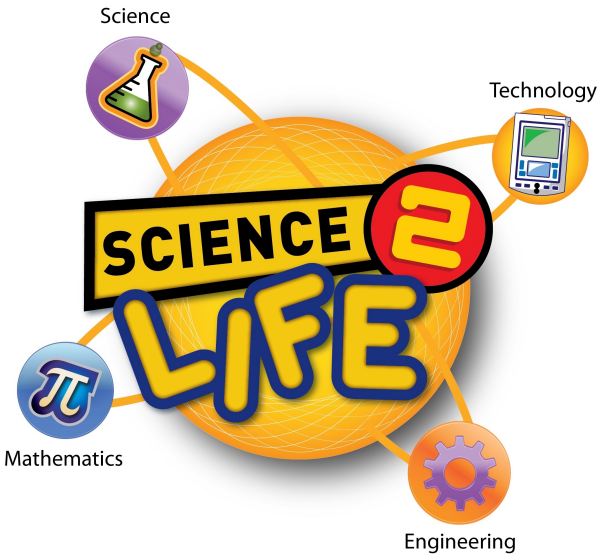
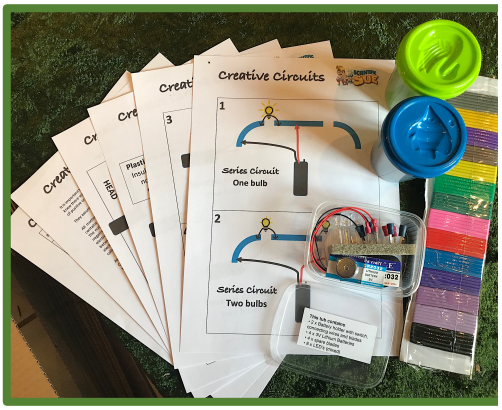
Check out our Energy Ball and Wandarama – both are excellent gadgets which help bring this topic to life!



CREATIVE CIRCUITS

Part of Science2Life's Science It! Programmes

Sue McGrath
BSc Hons PGCE CEd DASE MEd FInstP

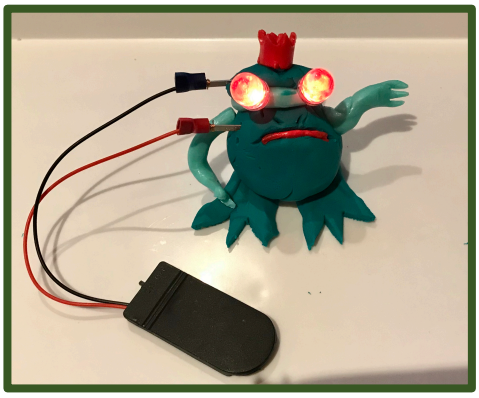


CONTENTS

140 g Conductive Craft Doh
90 g Insulating Modelling Clay
Small tub containing:

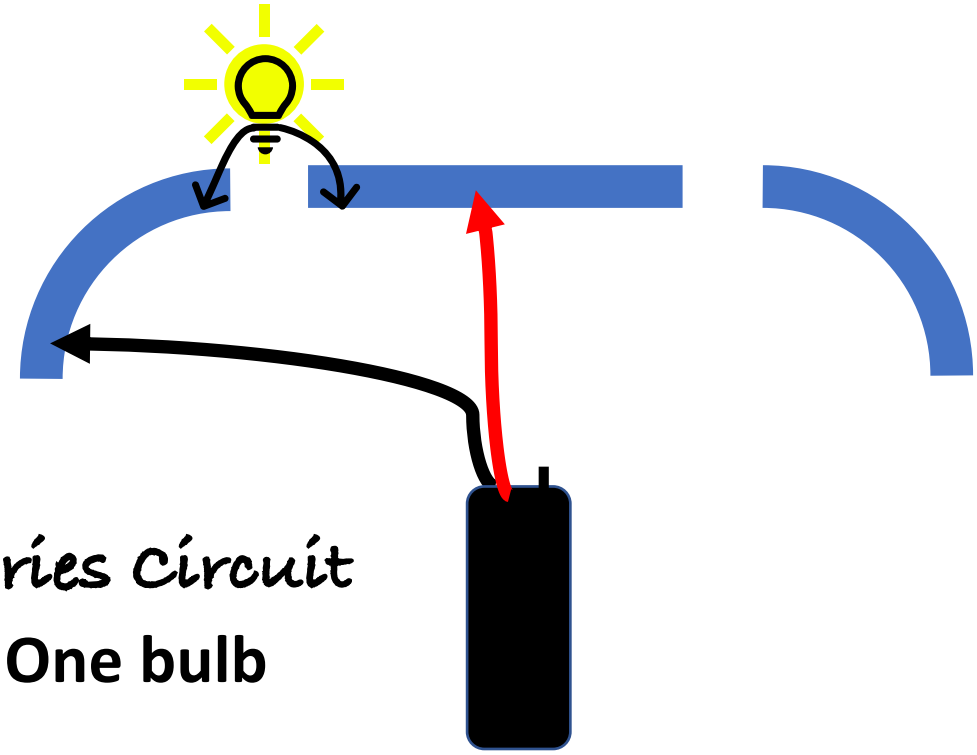
- 2 x Battery holder with switch, connecting wires and connecting blades
- 4 x 3V Lithium Batteries
- 4 x spare blades
- 6 x LED's (mixed)

Activity and Educational Notes – 8 pages!



Creative Circuits

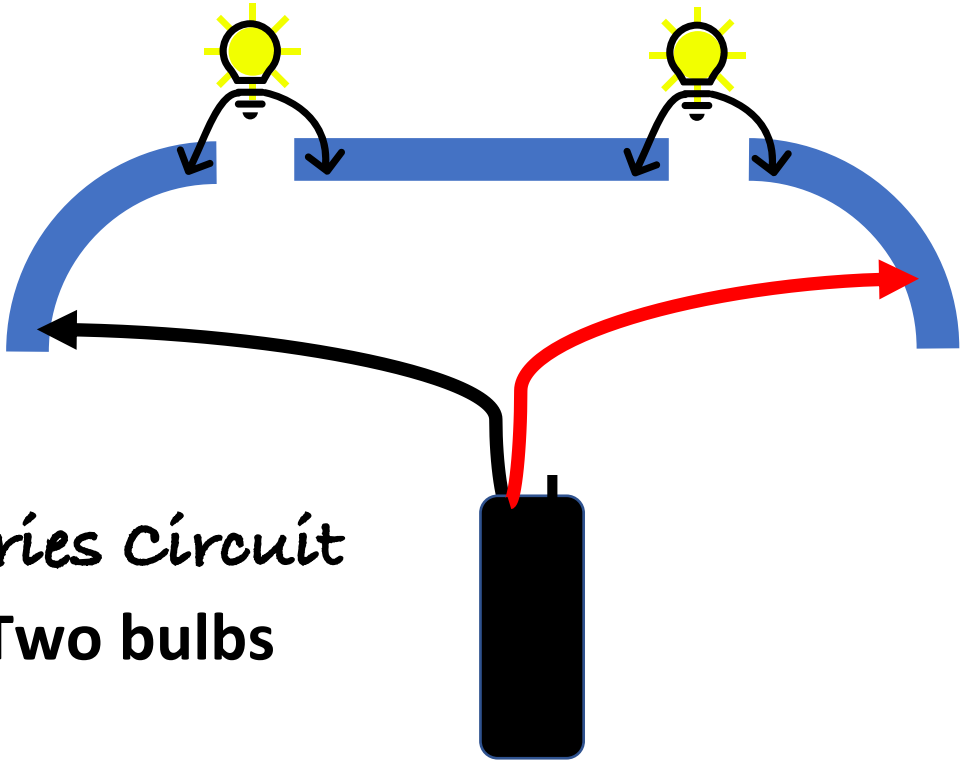
1



Series Circuit

One bulb

2



Series Circuit

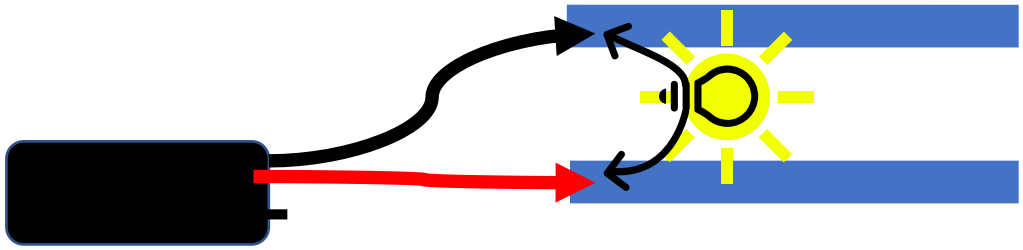
Two bulbs

Laminate this sheet or place in a poly pocket

Creative Circuits

Laminate this sheet or place in a poly pocket

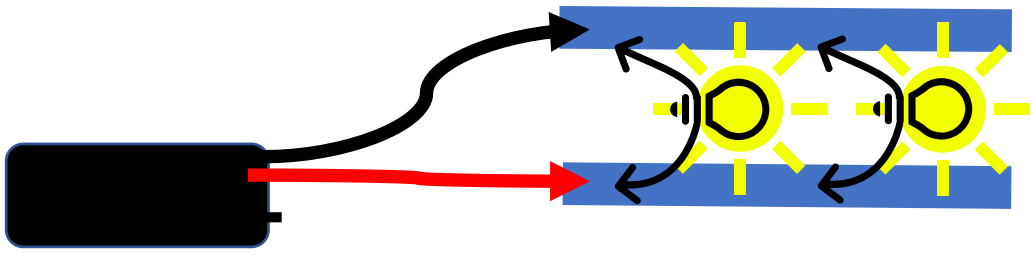
3



Parallel Circuit

One bulb

4



Parallel Circuit

Two bulbs

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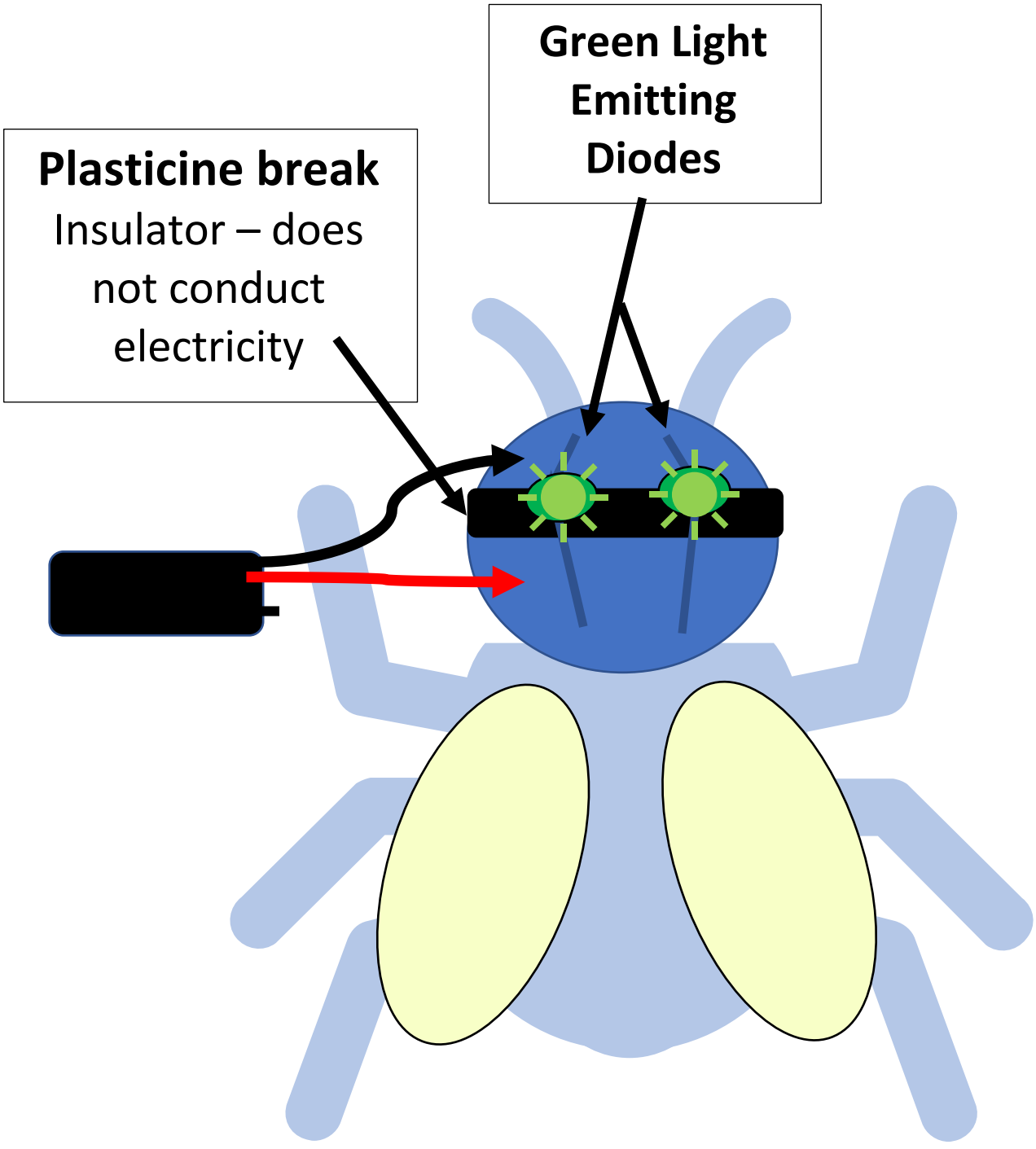
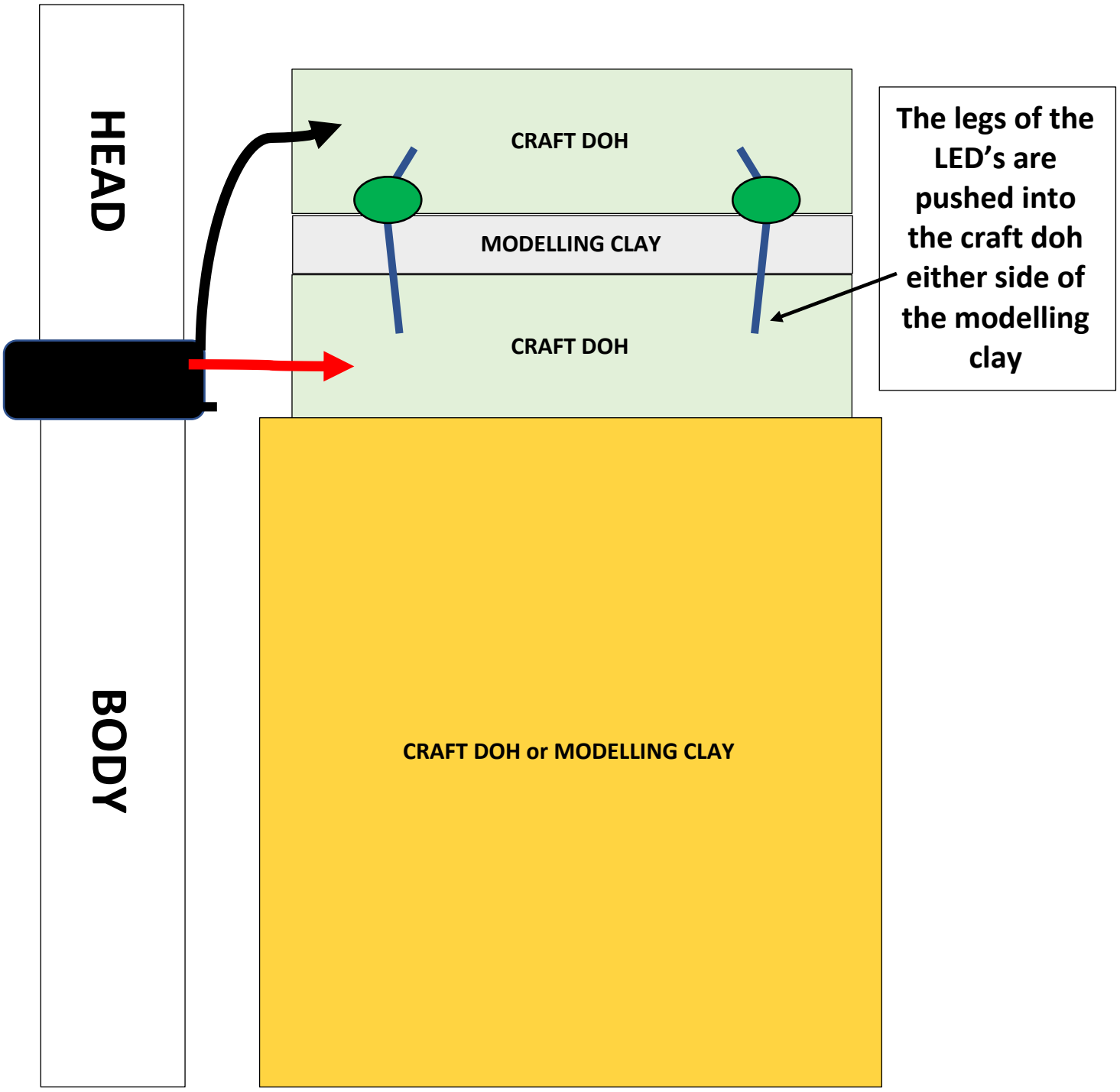


Scientific Sue's Playdoh Fly

Playdoh conducts electricity

Creative Circuits



REMEMBER:

CRAFT DOH conducts electricity - CONDUCTOR

MODELLING CLAY does not conduct electricity - INSULATOR

Creative Circuits

Light-emitting diode facts

A **light-emitting diode** (LED) is a device made from a material called a **semiconductor** that produces light from electricity. They are called semiconductors as they need certain conditions for them to be able to conductor electricity.

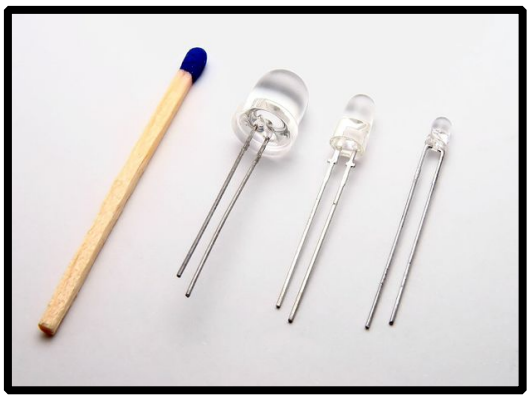
All metals conduct electricity however, some like copper and silver are better conductors than other metals like tin or lead.

Materials which block the movement (flow) of electricity, like rubber or plastic, are called insulators. Insulators are often used to protect people from electric shock.

Semiconductors are the foundation of modern electronics. Electronics is the study and use of electrical parts and circuits. These electronic components control electricity for useful purposes such as computers, televisions, electronic toys and cars.

LED's last a long time; they can be produced in many different colours and most have the benefit of making light and not heat; making them more efficient than the incandescent light bulbs.

For LED's to work the electricity must be pushed through the diode in one particular direction only. To help us know this direction they are made with one 'leg' longer than the other.



Light-emitting diode Facts for Kids. Kiddie Encyclopedia: 8mm, 5mm and 3mm sizes

The colour of the light emitted depends on which chemicals the semiconducting material is made from.

The longer 'leg' must always be connected to the positive + side of the battery. To help us know which wire comes from the positive side of the battery we colour it RED

Creative Circuits

A little bit of wonky history!

It is important to know that when the early scientists were experimenting with electricity, they knew there was a movement of charged particles but didn't know whether it was a movement of positive or negative charged particles.

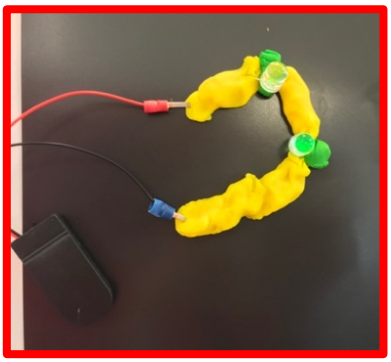
They assumed that it was positive and were WRONG!.

All matter is made up of atoms, and an atom has a centre called a nucleus. The nucleus contains positively charged particles called protons and uncharged particles called neutrons. The nucleus of an atom is surrounded by negatively charged particles called electrons. The negative charge of an electron is equal to the positive charge of a proton, and the number of electrons in an atom is usually equal to the number of protons. When the balancing force between protons and electrons is upset by an outside force, an atom may gain or lose an electron. When electrons are 'lost from an atom, the free movement of these electrons is called an electric current.

As your children move into secondary education, they will come across the term current. Current states electricity flows from the positive end of the battery to the negative end, due to the historical mistake; this is the opposite to the actual flow of electrons! However, rather than rewrite all of the books, scientists have agreed to keep the conventional signs for flow of current but also understand that the actual flow of negatively charged particles (electrons) in solids, is in the opposite direction. It is also important to note we don't tend to worry about direction the charges move in because all we really care about is that these particles move and carry energy – the direction of movement is actually inconsequential.

Series Circuit

When a second bulb is added into the series circuit you will notice the brightness of the bulbs diminishes. If you put a third bulb in series you may have to go into a darkened room to actually see any light at all.



The voltage of the battery is 3 V.

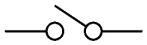
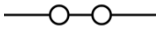
This voltage is shared across all of the components put into a series circuit. Hence the push on the electrons gets smaller and small and thus the energy output also gets smaller.

The benefits of a series circuit are that the battery lasts longer than when the bulbs are arranged in a parallel design.

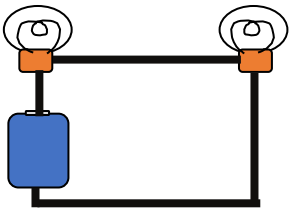
1 bulb	**– Full brightness**
2 bulbs	**– 1/2 brightness**
3 bulbs	**– 1/3 brightness**

Creative Circuits

A circuit always has a battery but it can also contain other electrical components, such as bulbs, buzzers and motors.

Battery	
Wire	
Bulb	
Switch on	
Switch off	

When drawing circuit diagrams, rather than drawing detailed components and wiggly lines we use simple symbols to represent the different components and always draw wires as straight lines.

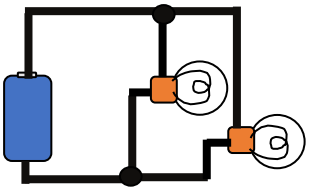


Can you draw this circuit using the proper symbols? The wires have been done for you. You now need to change the bulb symbols, the battery symbol and add a switch.

Parallel Circuit

In our parallel circuit you will notice the brightness of the bulbs always stay the same brightness whether there are 2, 3 or 10!

The downside of a parallel circuit is that the energy of the battery is used up faster.



Can you redraw this diagram using the fewest number of straight lines?

Scientific Sue's Challenge

Don't want to make a bug?

Then don't! You can create anything you wish however my challenge is for whatever is made you need to add lights which can be switched on or off.