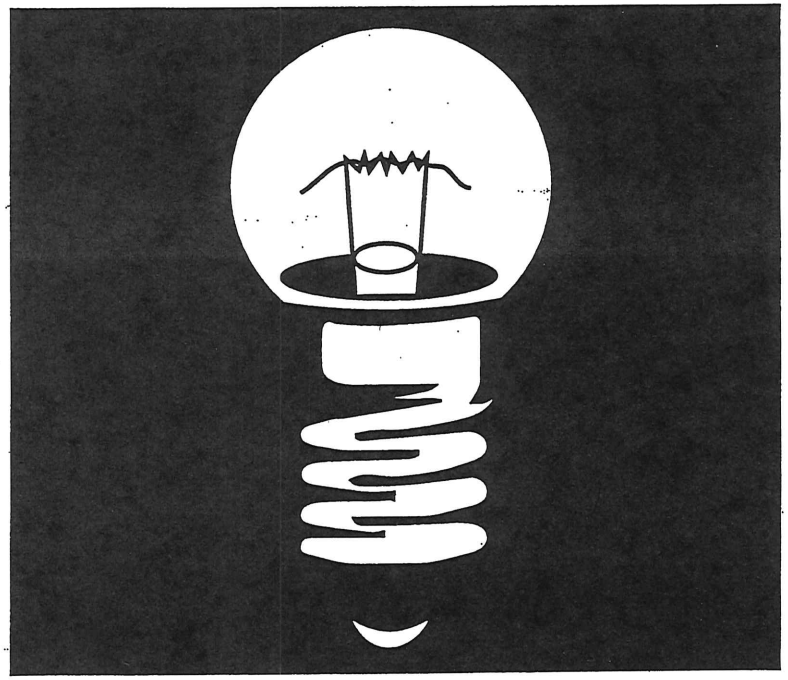
COMMOTION Group

Commotion House, Morley Road, Tonbridge, Kent TN9 1RA

COMMOTION Group

Introduction to ELECTRICITY

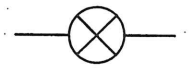
For Children aged 3 to 11



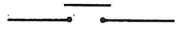
By M. Hughes

Contents

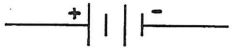
When we draw an electrical circuit we use symbols to represent the components used. Here are some of the common symbols. Get a friend to test you to see if you can remember them.



A light bulb



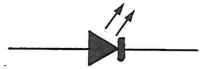
A push switch



A battery of cells

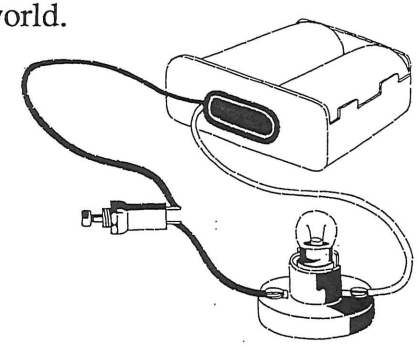
A motor

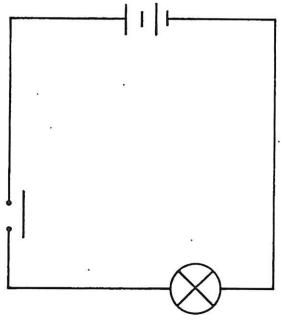
A buzzer



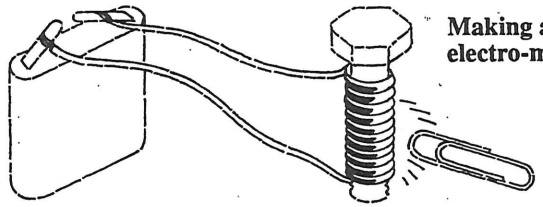
A Light Emmiting Diode or L.E.D.

We can draw a circuit using these symbols. It makes the drawing of a circuit much quicker to draw. Circuit symbols are like a language, these symbols are recognised all over the world.





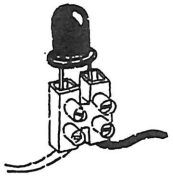
You can make an electro-magnet using the following components: a large battery, 5 meters of insulated copper wire and a large bolt.
Wrap the 5 metres of wire around the bolt and then connect the ends to a large battery. When the wires are connected to the battery and a circuit is made, the bolt will become magnetic; when they are removed the bolt will lose its magnetism.



Making an electro-magnet

There are some special small light bulbs called light emitting diodes (or L.E.D's. for short). As they do not have their own holders they need to be wired to the circuit using connector blocks. The advantages of using L.E.D's. is that they are very strong and will last for a long time if looked after. They are multi-coloured and can be used to make eyes come alight or model traffic lights look realistic. (Note. Never use more than 3 volts on large LED's because they will burn out.

L.E.D.



Connecting an L.E.D. using a connector block

L.E.D's must be connected the right way round to work. One leg is shorter than the other, this is the negative leg.

INTRODUCTION

The following booklet provides an introduction to the world of electricity. As a resource it offers background information to the teacher ,together with tasks and experiments for children presented in a clear and simple way. The sheets are copyright-free and so can be photocopied within the establishment of purchase. It is hoped they will be used by pupils to foster an interest in electricity, based upon sound basic concepts.

Electricity can be fun but it must be remembered that 'mains electricity' can kill. Whilst this should not be over stressed to the point of frightening pupils it should be discussed. The small amount of current contained within a battery is not enough to cause any harm,* so pupils can use them with confidence. Another way of providing extremely safe and cost effective power is to use a power supply such as a Commotion Powerbrick.

The components required to complete the activities and experiments contained within these pages can all be purchased from Commotion . A list of these items is provided below for your information. Alternatively the Commotion Primary Electricity Kit contains all the components you require to cover the practical tasks shown in this booklet in a school sized pack.

* NOTE Conventional batteries do not provide enough current to cause burns and are therefore safe. Some re-chargeable batteries can, if shorted- out, produce higher currents. In the event of this occurring the battery can get hot and may cause burns. Commotion sells a re-chargeable battery (Powerpack) which contains a safety cut-out making it completely safe in the event of any short circuit.

ELECTRICAL COMPONENTS

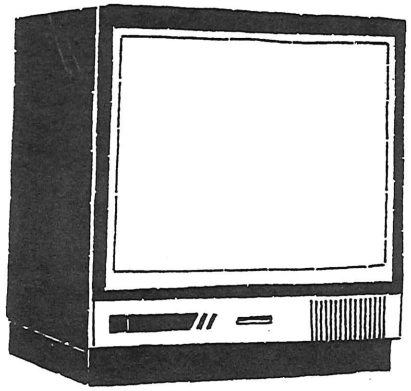
Below is a list of components recommended for use with this booklet.

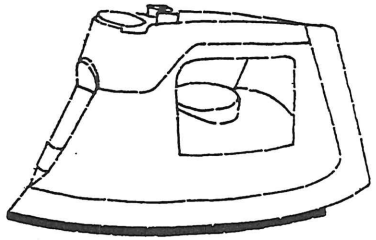
- Crocodile Clip Leads
- Automatic Strippers
- Reed Switches
- Battery Holders 2 X C Size
- Battery Holders 1 X C Size
- Push to Make Switches
- Push to Break Switches
- Motor Pulley
- Reel of Wire (Red)
- Reel of Wire (Black)
- Knife Switch
- Light Bulbs 3.5 Volt
- Light Bulbs 2.5 Volt Flashing
- Bulb Holders
- Connector Blocks
- Battery Snaps
- Motors 3 - 6 Volt
- Buzzer 3 Volt
- Light Emitting Diodes 8mm Red
- Light Emitting Diodes 8mm Green
- Light Emitting Diodes 8mm Yellow
- Micro Switch Roller
- Micro Switch Lever/Roller
- Tilt Switch
- Variable Resistor 10K Linear
- Cable Ties
- Electricians Screw Driver

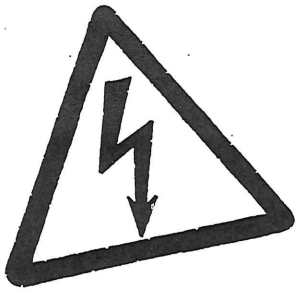
ELECTRICITY

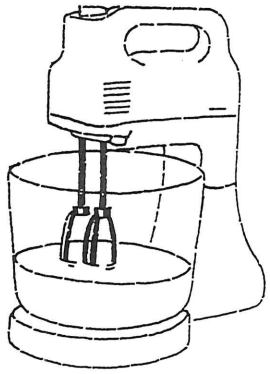
Many things in the home are powered by electricity such as the television, the food mixer, the iron, the stereo and the lights. These are powered by mains electricity. The mains power is 240 volts. Mains electricity is very powerful and can cause you serious harm.

NEVER PLAY WITH MAINS POWER!







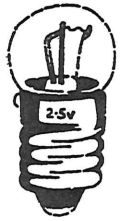


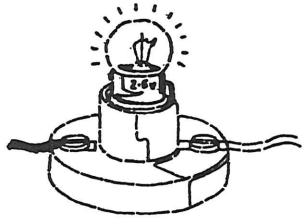
The power supplied from small batteries is not enough to cause you any harm. You can learn a lot of interesting things about electricity and have some fun in complete safety.

ELECTRICITY

There is a special type of light bulb which will automatically flash when it is connected in to a circuit. In the same way as a switch works, the light bulb constantly makes and breaks the circuit. It is fun to use a flashing bulb.

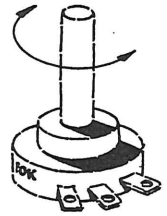
Flashing bulb

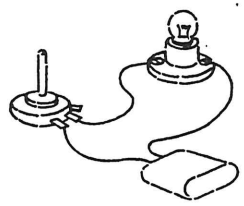




It can also be used to make other light bulbs flash. Simply connect the special bulb into a series (or line) of bulbs and because it flashes so will all the rest.

Find the component shown below . It is called a variable resistor. Try fixing it into a simple circuit which has one light bulb. By turning the rod you should be able to make the light bulb shine brightly and go dim.



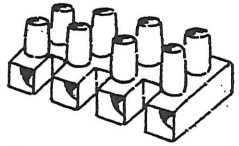


Variable resistor

What happens when you connect it to a motor or a buzzer ?

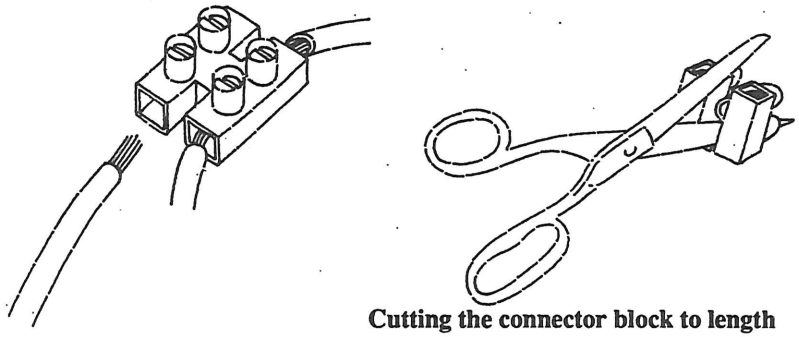
ELECTRICITY

Connecting electrical components using crocodile clips is easy to do but if we want to make a connection which is not going to pull apart, a connector block should be used



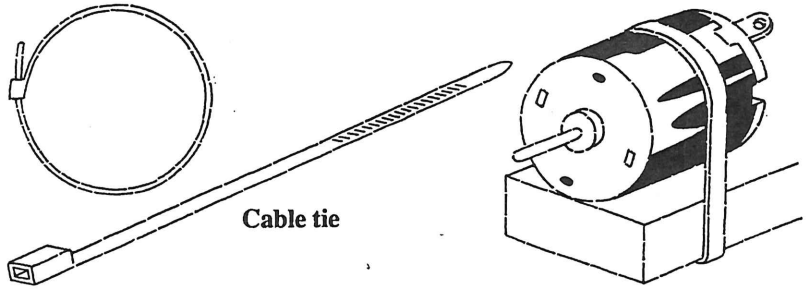
Connector block

Making a connection using a connector block is easy and secure. Simply undo the small screw, position the wire inside the block and then tighten the screw so it grips the wire.



Cutting the connector block to length

Note: Cut the connector block to the required length before use.

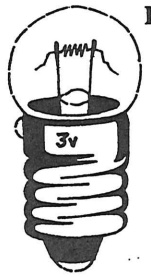


Cable tie

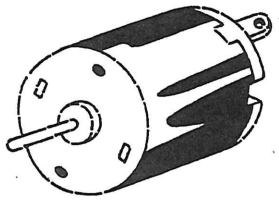
Cable ties are very useful when connecting a motor to a model.

ELECTRICITY

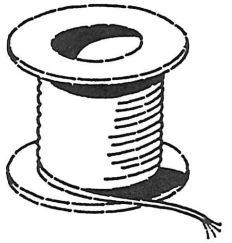
To make things work using electricity we need a battery which provides the driving force (push), measured in volts (V) and some components such as a light bulb, a buzzer, a switch, a motor and some connecting wire .



Bulb

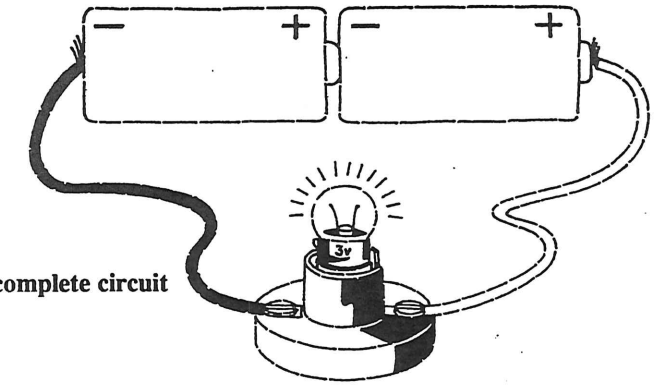


Motor



Multi-strand wire

The battery has a + and - connection. Electricity will only flow if there is a complete circuit.

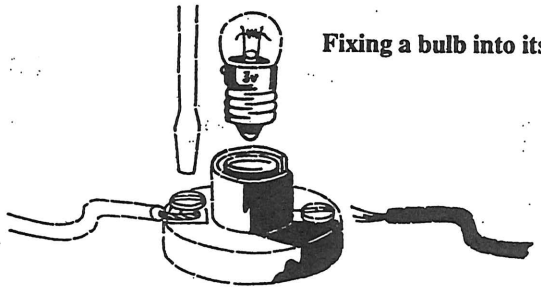


A complete circuit

Electricity flows easily through conductors such as metals.
It does not flow easily through insulators such as plastics.
The amount of electricity is measured in amperes or amps. (A)
The resistance to the flow of electricity is measured in ohms(Ω)

ELECTRICITY

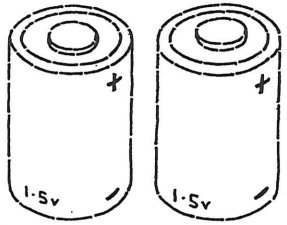
Light bulbs have a voltage rating written on them. They need this voltage to light them brightly. They screw into battern lamp holders. Wires can be fixed to the sides of the holders using the fixing screws and a small screwdriver.

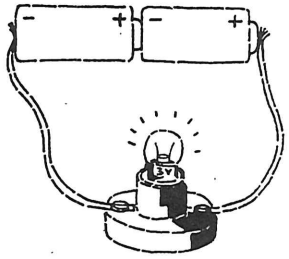


Fixing a bulb into its holder

Match the voltage of the component you wish to use with the voltage of the battery. You can add batteries together to increase the voltage to the required amount. Round batteries are 1.5 volts. Add 2 together to make 3 volts.

1.5v + 1.5v = 3 volts.





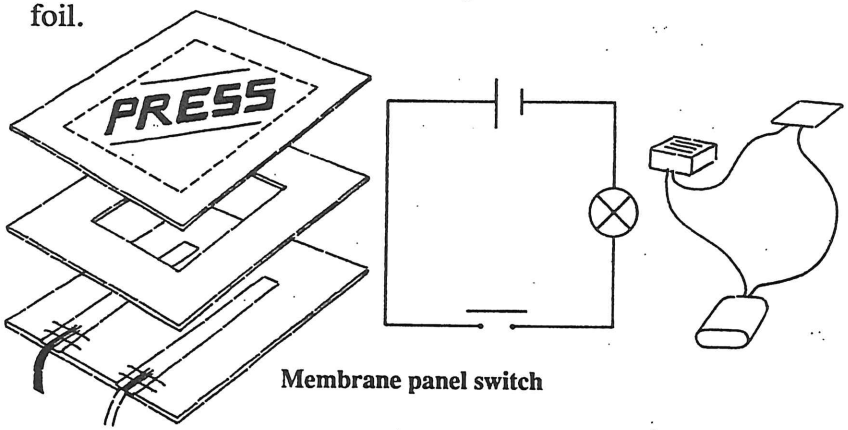
Try lighting a bulb with 1 battery. Now try lighting the bulb using 2 batteries. What do you notice ?

ELECTRICITY

You can make your own special switch using some card and aluminium foil. The switch is identical (but much larger) to the type found in a calculator and some computer keyboards. Its proper name is a 'membrane panel switch'

Calculator

Take three pieces of A5 card . On one piece stick down 2 strips of aluminium foil about 1c.m. apart. Fix the ends of the foil strips into your circuit in the same place that you would connect a switch. Use staples to connect wires to the foil.

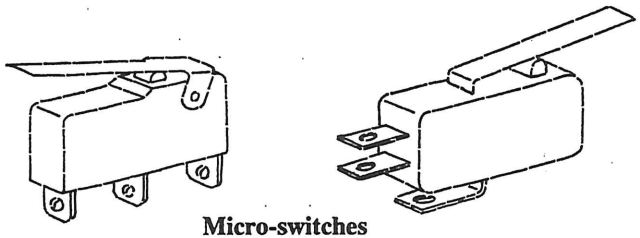


Membrane panel switch

On the underside of another piece stick a square of aluminium foil. Try touching the two halves together. The square of aluminium foil should bridge the gap between the two strips of foil thus making a good electrical connection.
If you insert a window of card into the switch it will keep the connections apart until a pressure is placed on the top layer.
Can you make this switch catch a burglar using a buzzer ?

A small container houses a special type of switch. It is called a reed switch. If you look closely at it you will notice two very thin wires inside the glass sleeve. Look even closer and you will see that they are not touching each other. When connected into a circuit in this state, no electricity will flow. Only when the two pieces of metal touch will the circuit be made. Try to make the circuit work with a reed switch in place. Tip: You will need a magnet.

Reed switch



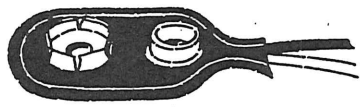
Micro-switches

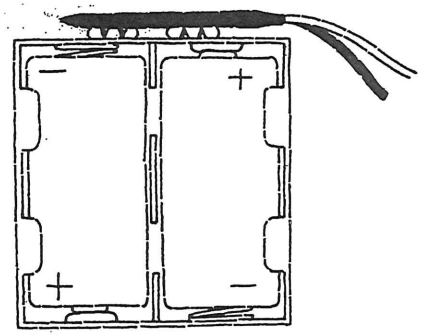
Another type of interesting switch is a micro switch. It is used in industry to automatically switch machines on and off. You will notice that there are three connections to the micro switch. Only two are required in a circuit so you will find that there is a puzzle as to which ones to connect to. Try wiring up a circuit and pressing the switch. You will find that one way the circuit will always be on until the switch is pressed, another way, the circuit will always be off, until the switch is pressed.

When we connect wire to the + or positive side of the battery we use red wire. When we connect to the - or negative side of the battery we use black wire. If the batteries are placed into a battery box they are automatically arranged so that they face in opposite directions.

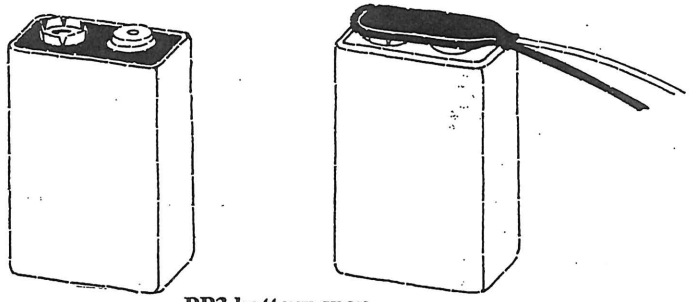
2 X C batteries in a holder

PP3 battery snap



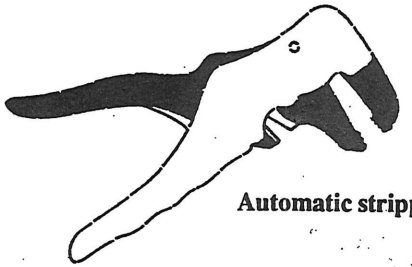


For ease of connection a battery snap is useful which snaps onto the end of the battery box. It has a red and a black wire which shows which wire is positive and negative.



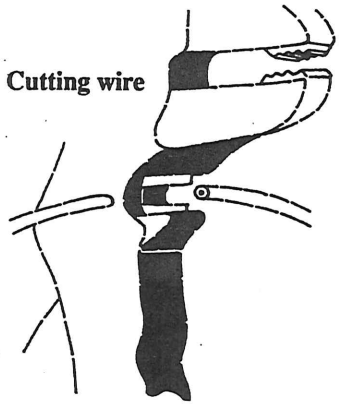
PP3 battery snap

If you decide to make a working electrical model you will need to know about cutting and connecting wires. A special tool called automatic wire strippers will help you to cut and strip wires before making an electrical connection.

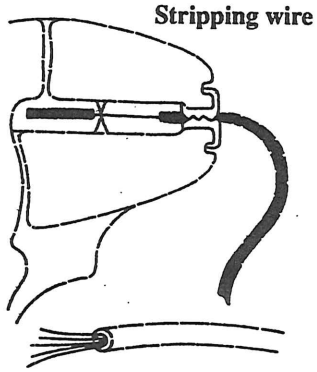


Automatic strippers

To cut the wire use the small scissor cutting blades at the throat of the tool.



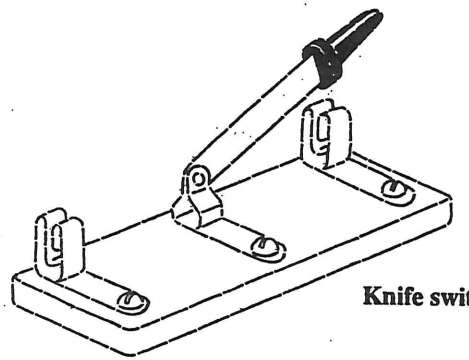
Cutting wire



Stripping wire

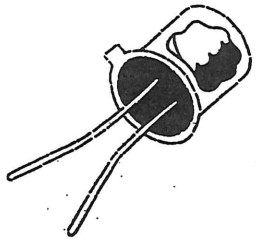
When you make an electrical connection using wire, you will need to strip the plastic casing away from the metal core. The special tool provided will do this automatically. Place the wire into the jaws of the tool and squeeze the trigger. The wire will be stripped bare, ready to be connected.

A knife switch looks like the diagram below. Try wiring it up.

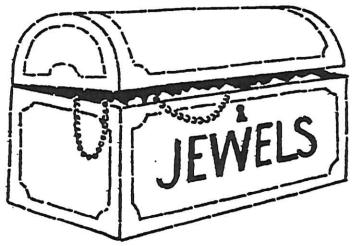


Knife switch

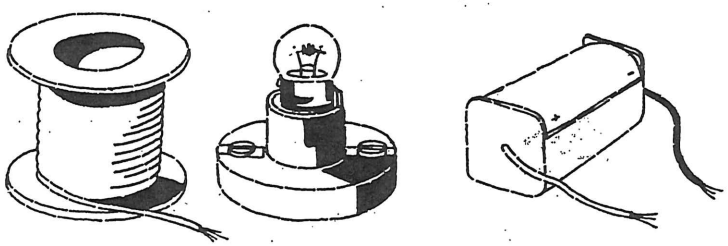
To protect your valuables try wiring up a circuit using a tilt switch. It is a small container which holds a very special metal that is liquid at room temperatures called mercury. Mercury is a very good conductor of electricity. When the contacts are made inside the tube by tilting the device,the alarm will be sounded.
(Treat this switch with special care as mercury is poisonous.)



Tilt switch

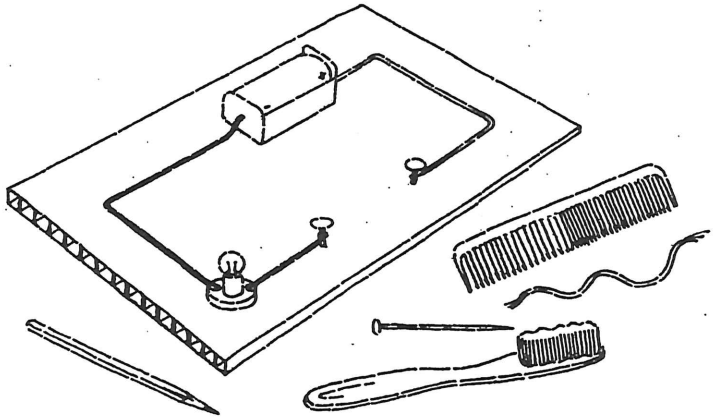


Using some wire, a light bulb in its holder, a battery in a battery box and two drawing pins make the circuit shown below. You can build the circuit on a piece of card or corriflute.



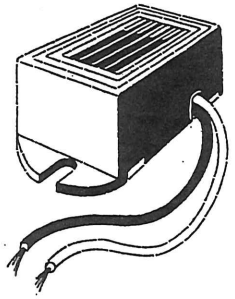
Multi-strand wire Bulb 1 X C battery holder

Because the circuit is open, the bulb will not light. If however a conductor is placed across the gap in the circuit, then electricity will flow and the bulb will light. Use the circuit to test if common objects found around the classroom will conduct electricity.

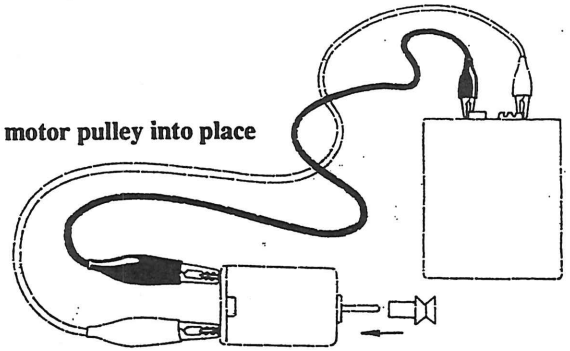


Testing conductivity

Find a component which looks like a small plastic box with two wires coming from it, one black and one red. It needs 3 volts to make it work. Can you find out what it does ? Try to connect this component both ways to the battery (i.e. the red wire to the positive and the black to the negative side of the battery and vice-versa) Does it still work ?

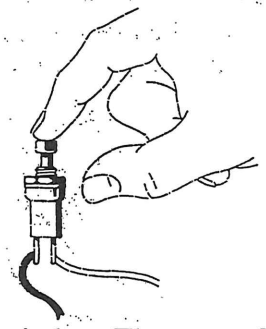


Connect a small motor to a battery. Using wires with crocodile connectors on them will make this task easier. Once you have made it work see if you can make it rotate the other way.



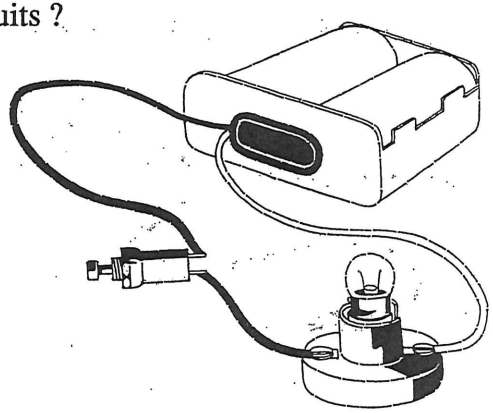
A small plastic pulley which fits on the end of the motor spindle will help you to connect the motor to any model that you make using an elastic band as a pulley.

When we connect the battery to our circuit it starts to work. To control when things will come on and go off we need to add a switch. A switch makes and breaks the circuit.



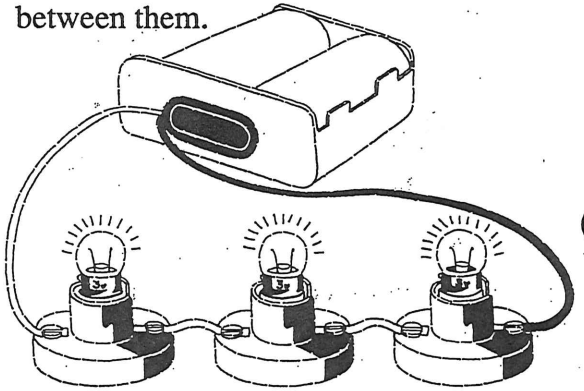
Push switch

Find several types of switches. The type of switch shown in the diagram can have a red top and a black top. Connect up the circuit as shown fitting both the red top and black top switches. Find out how they are different. Can you think of uses for these circuits ?

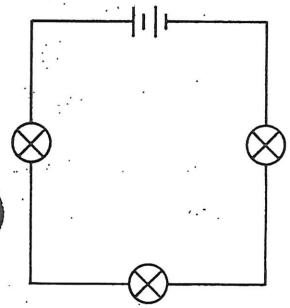


Using your imagination could make your own simple switch? The following things could be of use: a piece of wood, two drawing pins and a paper clip ?

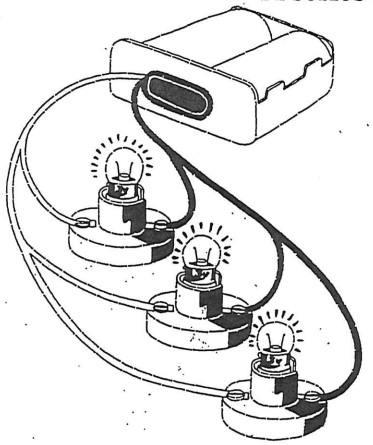
Electricity will flow around a circuit if the components are arranged one after another (series circuit). It will also flow through several components at the same time if they are arranged together (parallel circuit). Try building the two circuits shown below and see if you can spot any difference between them.

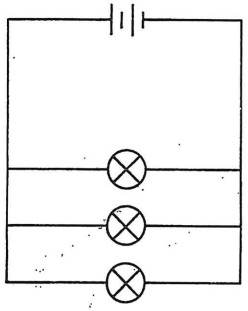


A series circuit.



Circuit diagram





Circuit diagram

A parallel circuit