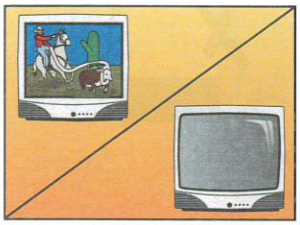
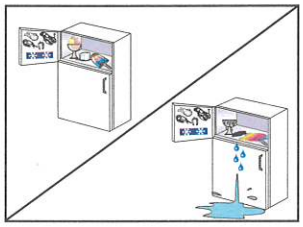
Electricity

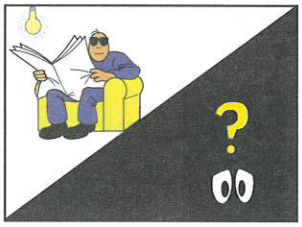
Get switched on to this — it's a powerful section.

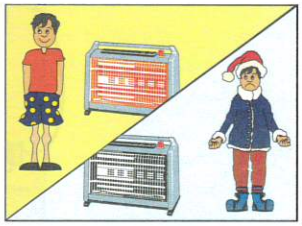
We get Electricity from the Mains or from Batteries

1) Many appliances (devices) in our homes use mains electricity to work. Without it our lives would be darker, duller and colder.

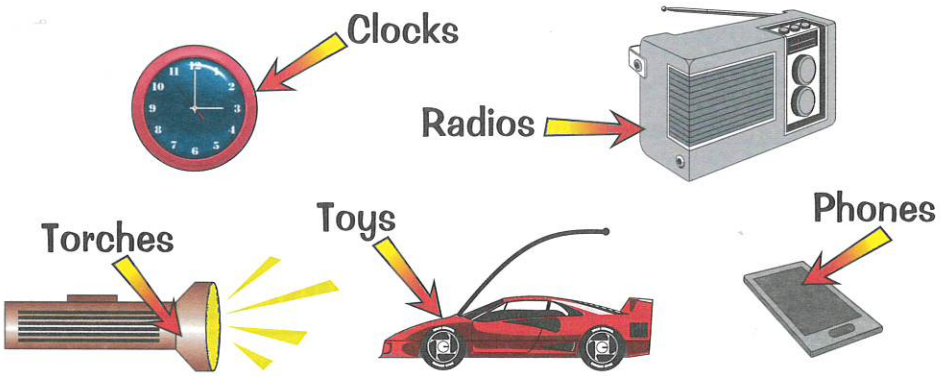

Televisions/Computers


Fridges/Freezers


Lights


Heaters

2) Smaller electrical appliances often use batteries which store electricity. These appliances can be moved from place to place. Batteries eventually run down and need to be replaced or recharged. Batteries are sometimes called cells.



Electricity can be Dangerous

An electric shock from a mains socket could kill you. Electricity from the mains is a lot more powerful than electricity from a battery.

NEVER stick fingers, pens or anything else into a mains socket.

NEVER touch switches with wet hands.

NEVER use electrical appliances near water.

ALWAYS hold the plastic part of a plug when plugging in and unplugging appliances.

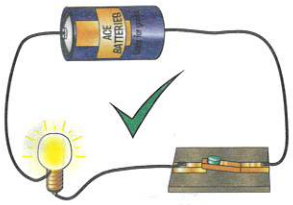
Safety Rules — deadly serious...

Think about all the things you use that run off electricity — it's amazingly useful. Without it we'd have no computers, no tellies, no mobile phones... But remember, you need to be careful when using electricity too — the safety rules aren't just for science lessons, they're for everyday life.

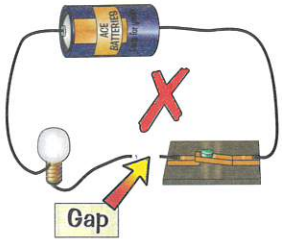
Circuits

Electricity can only Travel if there's a Complete Circuit

1) Electricity travels from the power source, such as a cell (battery), around a series of conductors (the circuit) back to the power source.



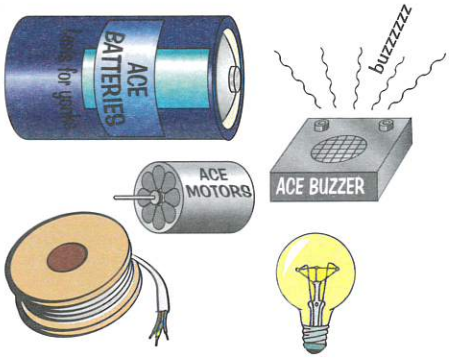
2) If there's a gap in the circuit no electricity will flow.



Simple Circuits can be set up using Components

Components are just things that can go in the circuit.
An electrical circuit needs:

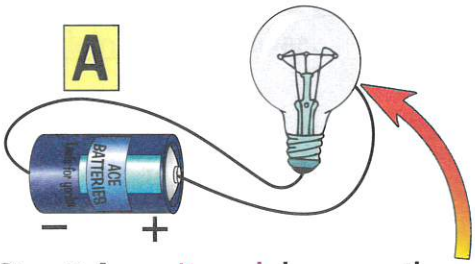
1) A cell (battery) with wires connected to both the positive (+) and the negative (–) ends.
2) Wires made of metal (of course).
3) An electrical component (device) such as a bulb, a buzzer or a motor.



The Batteries and Components must be set up Properly

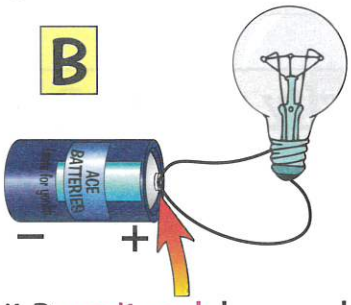
Batteries and components must be put together correctly for the circuit to work.

A



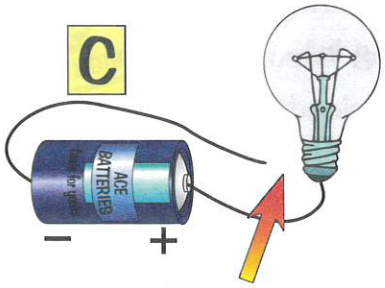
Circuit A won't work because the wire has been connected to the glass on the bulb (which is an insulator).

B



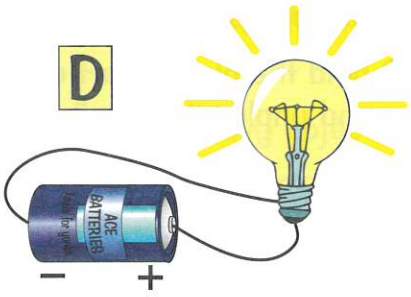
Circuit B won't work because both wires are connected to the same end of the battery.

C



Circuit C won't work because there is a gap in the circuit.

D

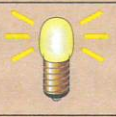
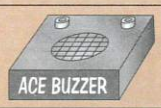
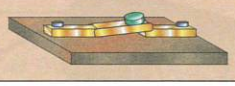


HOORAY! Circuit D will work (as long as the battery isn't flat).

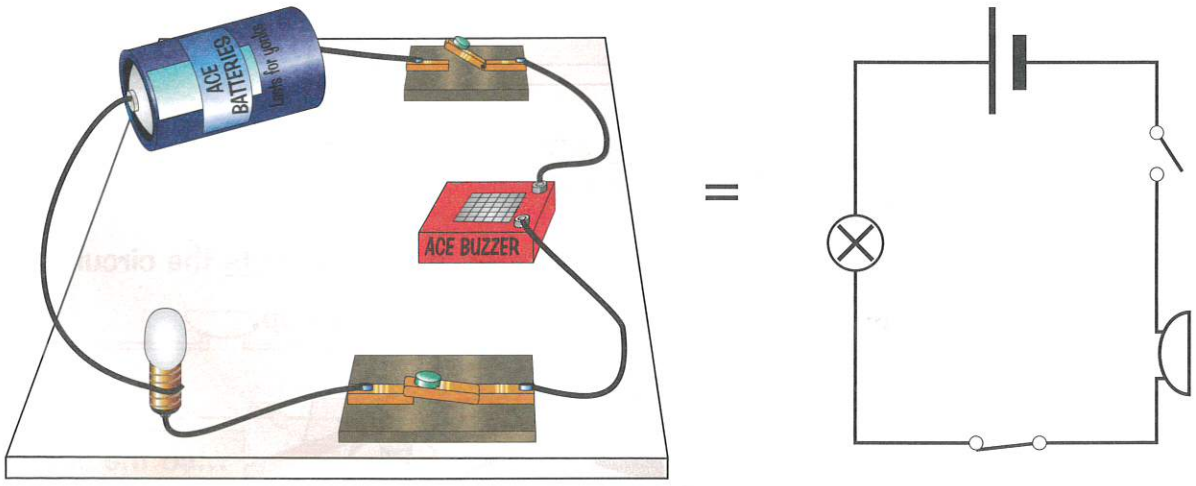
Circuit Diagrams

Circuit Diagrams use Symbols instead of Pictures

Make sure you know these symbols, and use them when you're drawing circuit diagrams:

Component	Picture	Symbol
Cell (battery)		
Two cells (batteries)		
Bulb		
Buzzer		
Motor		
Switch (off)		
Switch (on)		

Here's a circuit diagram showing a cell (battery), two switches, a bulb and a buzzer:



Use symbols in circuits — but do it quietly...

This electricity stuff does look a bit complicated, but if you remember the basic facts on these pages, you should be sorted. Electricity has to get from one end of the battery back to the other end of the battery for the circuit to work — no electricity will flow if there's a gap in the circuit. Circuit diagrams use symbols as a kind of shorthand, so get stuck in and learn all the symbols.

Conductors and Insulators

Materials are Either Conductors or Insulators

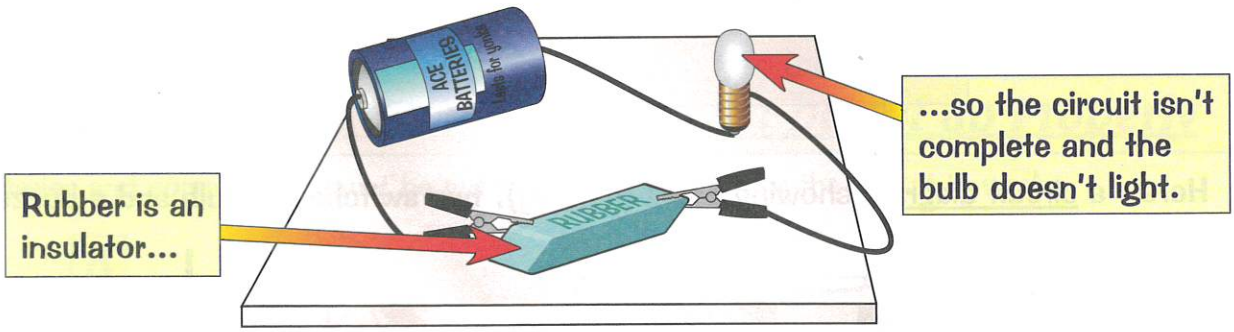
1) Electrical conductors allow electricity to pass through them.
2) Metals are good conductors of electricity.
3) Electrical insulators do not allow electricity to pass through them.
4) Wood, plastic, glass and rubber are all electrical insulators.

You Can Test a Material to see if it's a Conductor

To find out if a material conducts electricity, you can make a circuit using a battery, a bulb, some wires and a piece of the material.

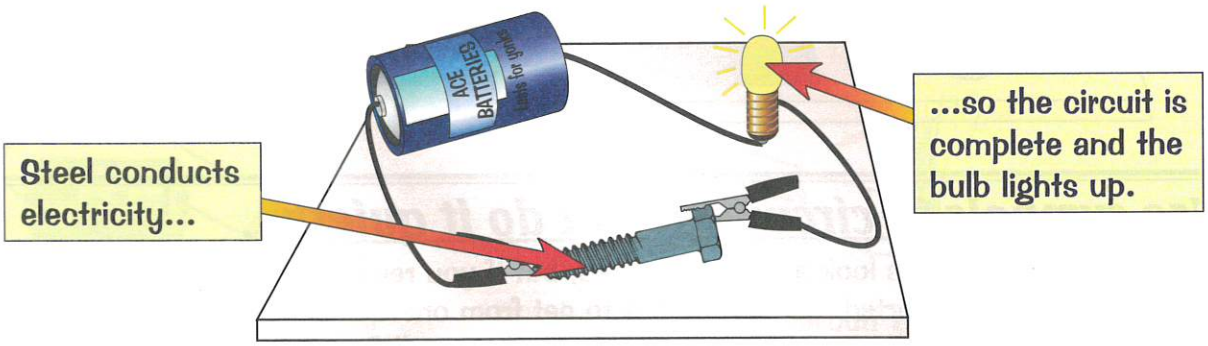
TESTING AN INSULATOR:

1) Electricity can only travel around a complete circuit of conducting components.
2) If the material that you're testing is an insulator, the bulb won't light up because electricity can't flow around the circuit.



TESTING A CONDUCTOR:

1) If the material that you're testing is a conductor, it will complete the circuit.
2) Electricity will flow around the circuit and the bulb will light up.



Switches

You know how to make circuits — well you can use switches to control where the electricity goes and where it doesn't.

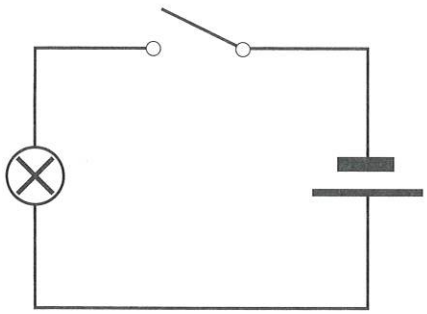
Switches Control the Flow of Electricity in a Circuit

1) Making a gap stops the flow of electricity.

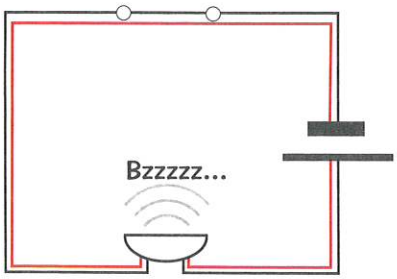
2) Closing the gap allows electricity to flow by completing the circuit.

Switches Control Part of a Circuit

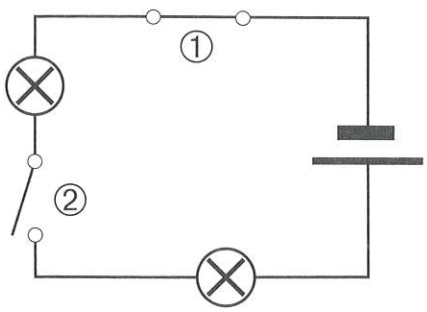
Take a look at the switches in these circuit diagrams — some are open and some are closed. See if you can work out if the bulbs will light or the buzzers will sound.



The switch is open so no current will flow. The bulb will NOT light.



The switch is closed, so current can flow. and the buzzer sounds. The red line shows the route the electricity takes.

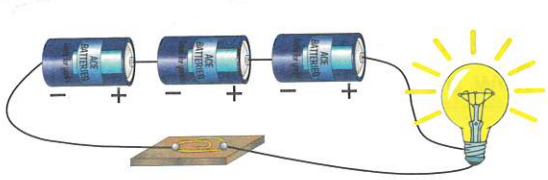


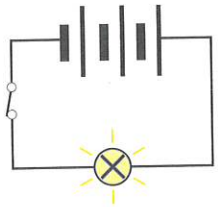
Switch ① is closed, but switch ② is open. Neither bulb lights because current cannot flow around the entire circuit.

Changing Circuits

Now it's time to look at some very slightly more complicated circuits — don't panic. You're just taking a simple circuit (battery, switch, wires and bulb) and altering the components.

Add More Batteries — the bulb gets Brighter



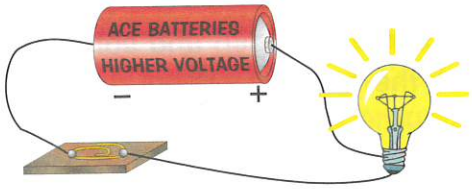


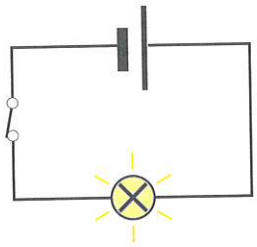
(If this circuit had a buzzer instead, it would be louder than with just one battery.)

THE MORE BATTERIES — THE BRIGHTER THE BULB

Be careful though — too many batteries will destroy the bulb.

Use Higher Voltage Batteries — the bulb gets Brighter





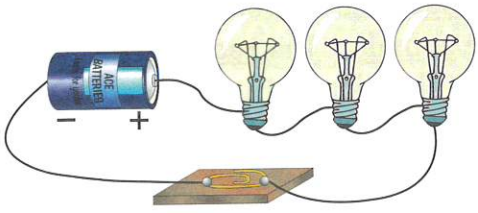
The higher the voltage of a battery, the more powerful it is.

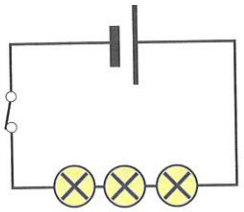
(Using a higher voltage battery would also make a buzzer louder.)

THE HIGHER THE VOLTAGE OF THE BATTERIES — THE BRIGHTER THE BULB

Again, be careful though — using a very high voltage will destroy the bulb.

Add More Bulbs — the bulbs get Dimmer





(Several buzzers would each buzz more quietly than just one.

Several motors would each turn more slowly than just one.)

THE MORE BULBS — THE DIMMER THE LIGHT

Add more Science to your life — you'll get brighter...

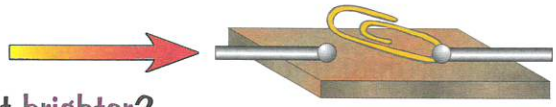
This stuff isn't too bad if you think it through. If you want to make a bulb brighter, you need to give it more power. That means using more batteries or higher voltage batteries. Adding more bulbs to a circuit means that each bulb gets less power, so they all get dimmer. The same ideas apply to all components — lamps change brightness, buzzers change volume and motors change speed.

Summary Questions for Section Nine

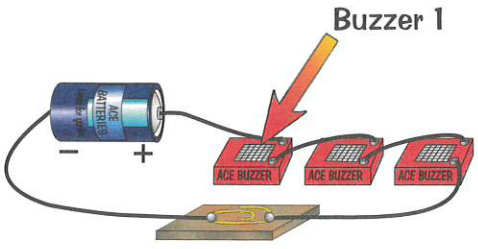
Electricity may seem like a tough topic but it's not nearly as bad as it looks. It's the circuit diagrams that make it seem frightening — but remember the diagrams are just an easier way to draw a picture of the real circuit. Practise drawing circuit diagrams containing switches, batteries and different components. Remember that the idea is to keep on bashing away at these questions until you can do all of them. If one or two look a bit tricky don't leave them out — go back and look through the section again, and keep trying. Ready? Three, two, one, GO...

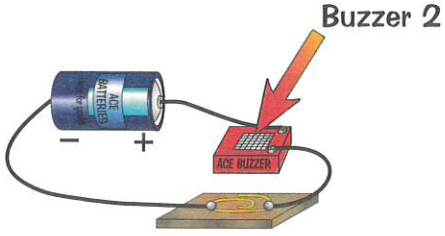
1) Name four things in your house that wouldn't work without mains electricity.
2) Why is it better for some appliances to use batteries?
3) Why must you not push things (other than plugs) into mains sockets?
4) What happens when a circuit has a break (or gap) in it?
5) Imagine you are making a circuit. Should you connect one wire to each end of the battery, or two wires to one end of the battery?

6) Name three electrical components used in simple circuits.
7) Imagine that someone has made a simple circuit using a battery, wires and a bulb. The bulb doesn't light up. Give three reasons to explain what might be wrong.
8) Draw a circuit diagram showing a circuit with:
a cell (battery), wires, an open switch and a bulb
9) Draw a circuit diagram showing a circuit with:
two cells (batteries), wires, an open switch and a buzzer.
10) What is a material that doesn't conduct electricity called?
11) Why are electrical wires made of metal?
12) Why is there usually a plastic coating around a metal wire?
13) How could you test a material to see if it conducts electricity?
14) How does a simple switch work?
15) Is the switch on the right ON or OFF?



16) How could you make a bulb in a circuit brighter?
17) Look at the two circuits below. Which will be louder — Buzzer 1 or Buzzer 2? Explain your answer.





The answers to these questions are on pages 101-102.