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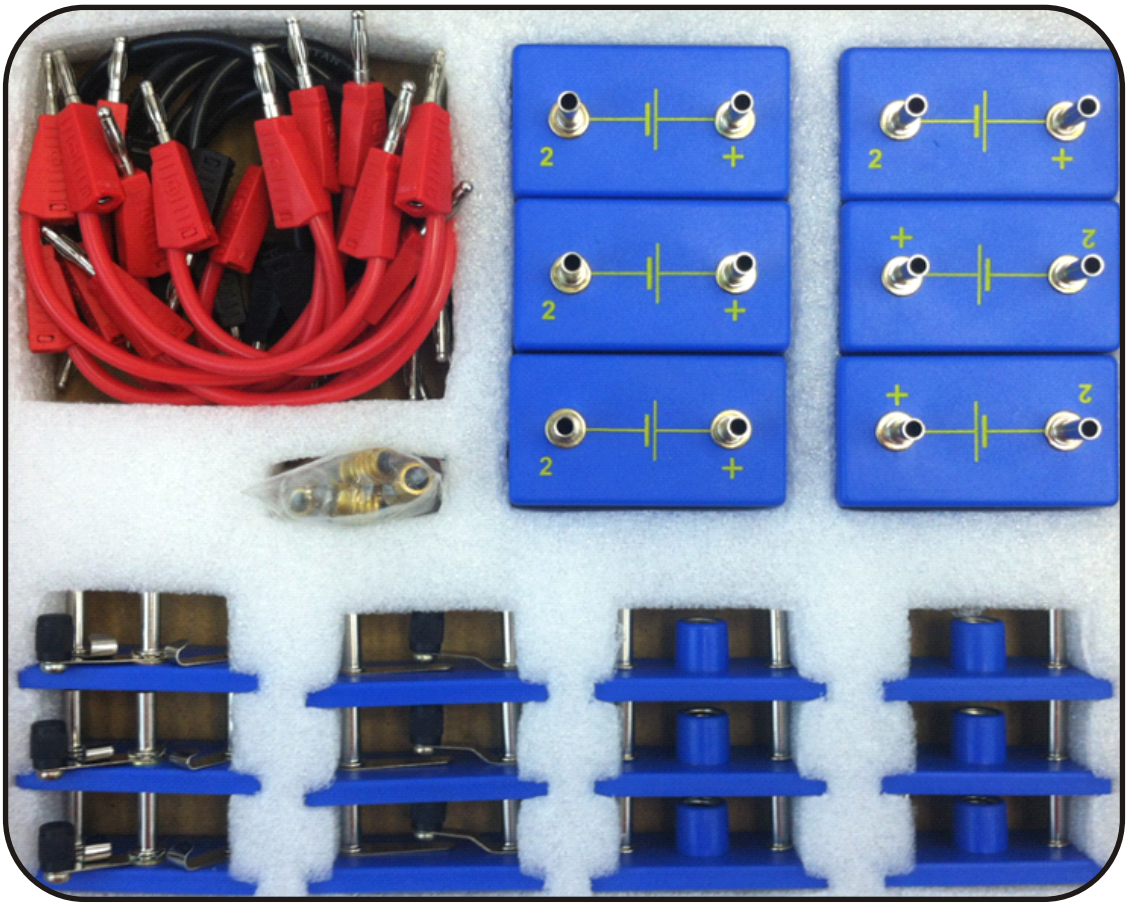
BASIC ELECTRICITY KIT - A

CAT NO. BKEPH2011



Experiment Guide

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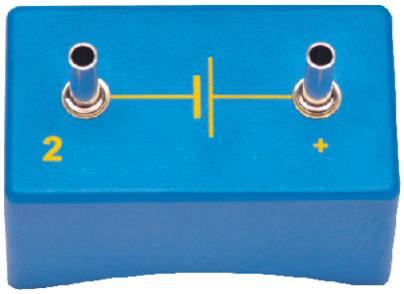
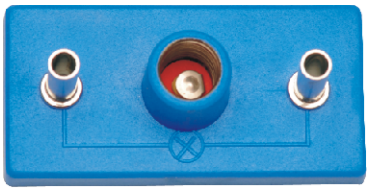
LIST OF COMPONENTS

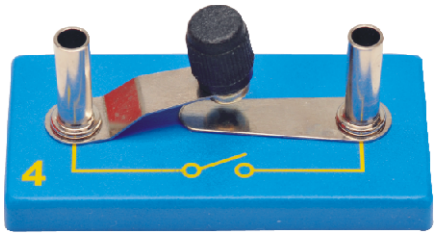
Cell Holders . . . . . 6 nos.



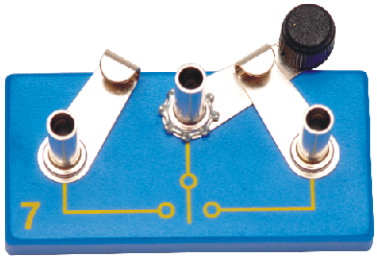
Bulb Holders . . . . . 6 nos.



Press Switch . . . . . 3 nos.



Two Way Switch . . . . . 3 nos.



Connecting Leads. . . . . 18 nos.

Pupil's Book . . . . . 1 no.

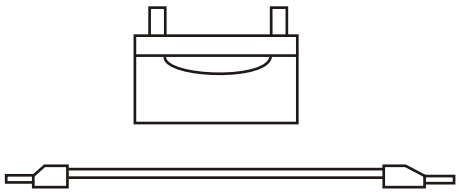
Experiment 1 SURVIVAL KIT

Here is a little problem for you to solve. Imagine that you have been accidently locked in the science labs. One night. No amount of shouting and banging seems to attract attention and to make things worse the electricity mains have been switched off. Stumbling around in the prep. Room you have managed to find the electricity kit and realize you can make a light which might help you find a telephone.

What is the smallest number of parts you can use to make one bulb light?

IN YOUR BOOK

1. Write down the date and the heading **- The simplest circuit.**
2. Draw a neat diagram of the circuit you have made.
3. Answer this question- Electricians often talk about electrical circuits. Look at the circuit you have drawn and explain why you think it is called a circuit.
4. Does it make any difference if you turn the cell round the other way in the circuit?(Remember- always answer in a sentence. For example you could start this one with the words, "when I turn the cell round the other way in this circuit……")



Experiment 2 TOO DIM!

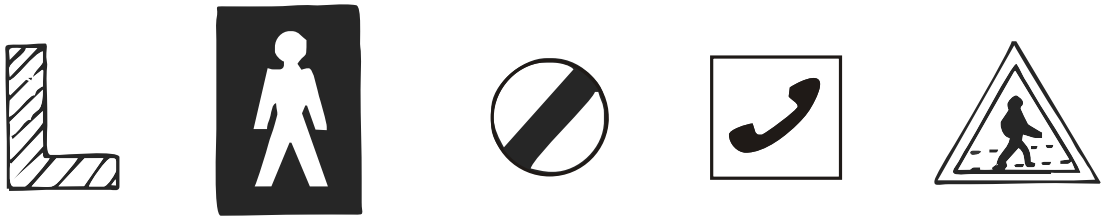
As you will have realized your home made torch is too dim to be of much use. With only 2 extra parts you can make the bulb brighter. Try this out on your circuit.

IN YOUR BOOK

1. Write down the heading - **Making the bulb brighter**
2. Draw a neat diagram of the circuit you have made.
3. Does it matter which way round the cells are connected? Try just turning one cell the other way round then described what happened.
4. Can you with only two more parts make the bulb even brighter? Draw the circuit in your book when you have made it work.
5. The bulb in your circuit should now be very bright. Why do you think it would be very unwise to add yet another cell to the circuit?

USING SYMBOLS TO SAVE TIME

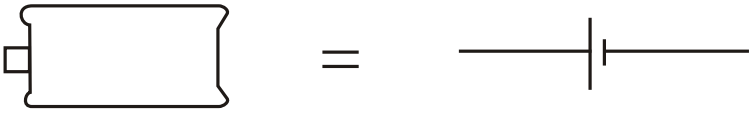
SOMETHING TO READ: Man has been using symbols for a very long time now. How well do you know your symbols? Do you know what these symbols mean?:



Symbols can save us a great deal of time. They take up less space than full descriptions and they can be read very quickly.

You will have noticed in the previous experiments that a great part of your time was taken up making drawings in your book. By using a special “electricians' shorthand” We can save time and also make diagrams that are easy to understand.

ELECTRICIANS' SHORTHAND



You have probably already noticed that the parts of the kit are marked with symbols. Here are some symbols to start with:-

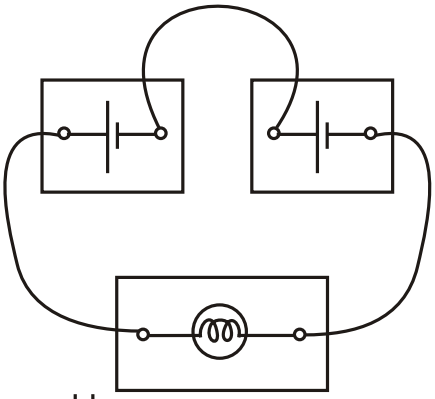
This is the symbol for a CELL. Notice that the long line is thinner than the short line. The longer thin line represents the positive(+) end of the cell, - the end with the “button” on the real thing. The short thicker line represents the NEGATIVE(-) end of the cell which is the end which is nearly flat on the real thing.

If two or more cells are connected together in a line they are called a BATTERY.

This symbol shows a battery made of three cells in a line.

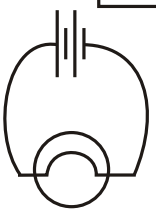
We also need a symbol for a bulb or LAMP:- 

When you set up your circuits, the leads would be bent between the parts of the kit. If you are making a shorthand drawing of a circuit, it is much easier to understand if the leads are shown as straight lines which are drawn across and down the page.

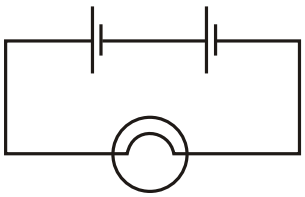


For example, in experiment 2 you set up a circuit which had 2 cells connected to one bulb like this:-

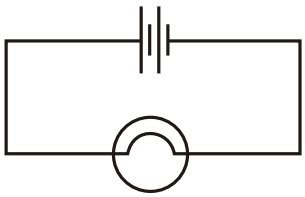
Here are three ways you could draw the circuit in shorthand:-



A - Wrong !



B - Wrong !



C - Correct !

IN YOUR BOOK

1 Write down the date and the title - **Electricians' shorthand**

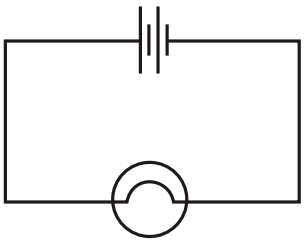
2 Draw the symbol for a cell. Explain which is the positive and which is the negative end. Write the word CELL beside the symbol.

3 Draw the symbol for a bulb(lamp). Write the word BULB beside the symbol.

4 Draw a circuit which shows a battery of three cells connected to one bulb.

Experiment 3 S.O.S.!

Here is the “shorthand” circuit that you used to produce a bright light. If you have taken your circuit to pieces, connect the parts to make the light work again.



You will remember that you made this light so that you could try to find a telephone to summon help.

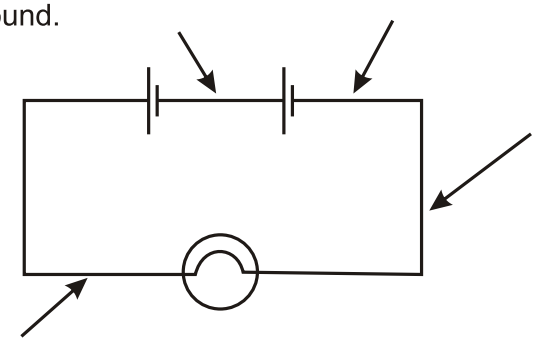
Unfortunately, the telephone you found has, like the lights, been disconnected over night. How can you summon help?

If you could flash your light at the window it might attract attention. What is the Morse code for S.O.S.? Have a look at the switch in the electricity kit- number 4.

Put this switch into your circuit so that when you press it the lamp lights and when you release the switch the lamp goes out again.

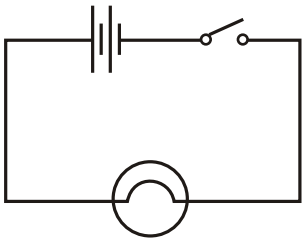
IN YOUR BOOK

1. Write down the title of this experiment- **Using a switch.**
2 Draw a shorthand diagram to show how you put the switch in the circuit. If you are not sure about the symbol for the switch, it is marked on the switch unit
3 Now have a look at the circuits that other groups in your class have drawn.
Did they all put the switch in the same place? Does it matter where the switch is put in the circuit? Try these different positions to find out, then explain in your book what you found.



Experiment 4 DIFFERENT KINDS OF CIRCUIT

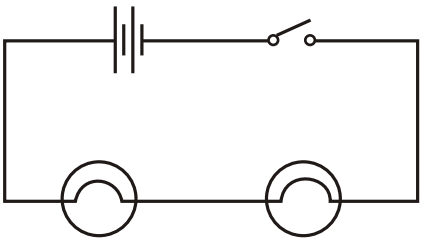
So far we have looked at fairly simple kinds of circuit with only one bulb connected to one, two or three cells “in a line ”

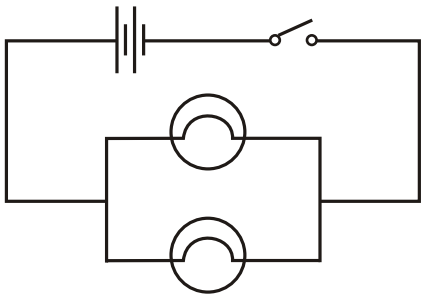


For the next experiment you need to start with the battery of two cells lighting a single bulb as before.

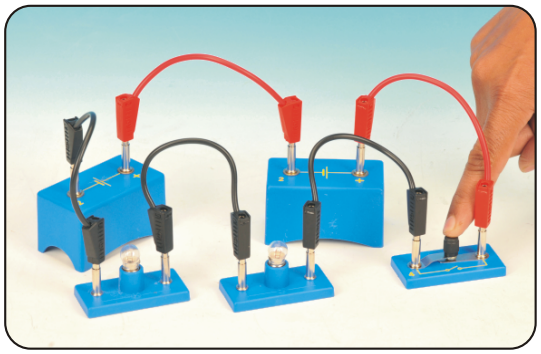
Now take another bulb and put it into the circuit so that both bulbs light. Strangely enough there are two different ways you can do this and both ways work. Before you look at the next experiment, see if you can find out for yourself the two ways that can be used.

SERIES AND PARALLEL

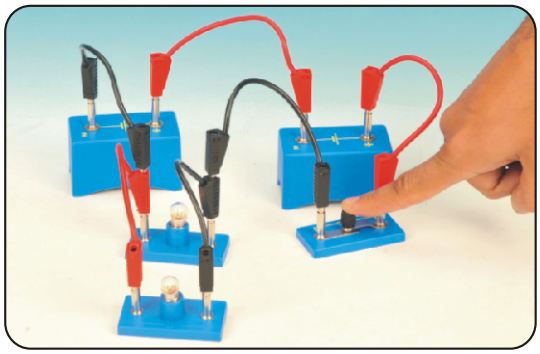




SERIES



PARALLEL



The diagram above show the two different ways you could make a battery light two bulbs. Connect your circuit up as shown in the left hand diagram.

A. Try unscrewing one of the bulbs to see what happens.

B. Add another bulb to the circuit. What happens to the brightness of the bulbs when you do this.

C. Find out how many bulbs you can add before you cannot see any light Now connect your circuit up as shown in the right hand diagram and repeat A,B,C with this circuit.

IN YOUR BOOK

1. Write down the date and title - **Series and parallel.**

2. Draw the following table in to your book. You need about half a page to do this so you may need to turn over on to a new page.

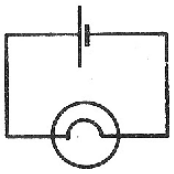
3. Fill in your results from A, B and C for the two experiments.

	SERIES CIRCUIT	PARALLEL CIRCUIT
A. What happen when you unscrew one bulb?		
B. What happens to the bulb brightness when you add another bulb?		
C. How many bulbs can you add before you cannot see any light?		

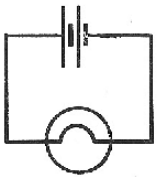
Experiment 5 MEASURING THE SIZE OF AN ELECTRIC CURRENT

We can use the brightness of a bulb to indicate the strength of current flowing round a circuit.

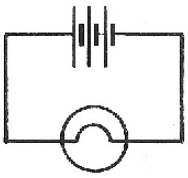
These diagrams show the three different readings we can use, low and high current. If you are unsure about these brightness, try the three circuits out.



Dim Bulb - Low Current



Medium Bulb - Medium Current



Bright Bulb - High Current

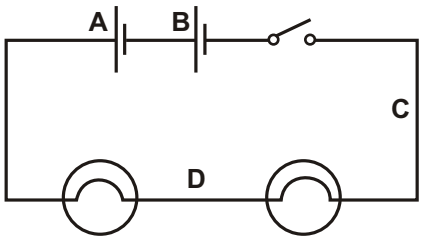
We are now going to use a bulb as a measuring instrument that will be used to find out

more about electrical circuits.

On a small piece of card write the words “Electricity flow indicator” Choose one bulb out of the kit and place this label beside it. From now on this bulb is going to be used to show how much electricity flowing in different types of circuit.

A. Does the current vary in different parts of a series circuit?

Set this circuit up then test the current at different parts by putting your electricity flow indicator bulb in to position “A”, then “ B” and so on round to “D” . Does the current vary in different parts of a series circuit?



Circuit No. 1

IN YOUR BOOK

1. Write down the date and the heading- **Measuring the size of an Electric current.**
2. Put this table in to your book:-

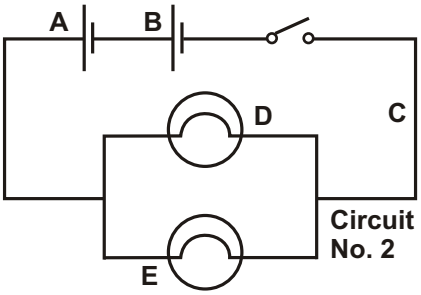
Circuit No.	Series or Parallel	Current at A	B	C	D
1.					
2.					

3. Put the results for experiments A (circuit 1) in to the table. Under columns A, B, C, D, write the results high or low current.

B. Does the current way In different parts of a parallel circuit?

Set this circuit up then test the current at A, B, C, D and E as you did before.

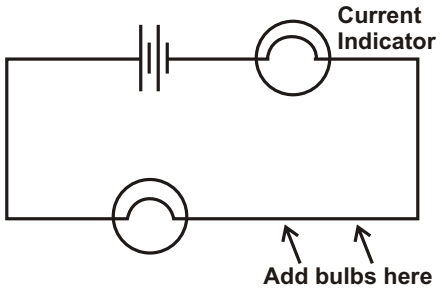
Put the results in to your table (circuit number 2)

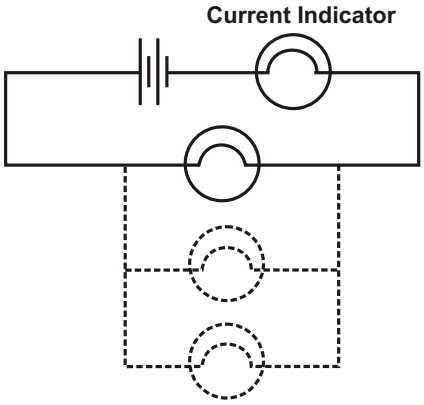


Circuit No. 2

C. What happens to the current if you add bulbs to a series circuit?

Set up the circuit as shown and note the brightness of the current indicator bulb. Add a bulb in series and see what effect it has on the current. See how many you can add before an extra one seems to make no difference.





What happens to the current if you add bulbs to a parallel circuit?

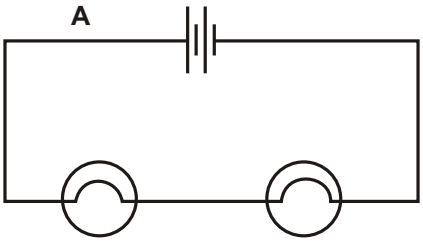
With the circuit set up as shown, note the brightness of the current indicator bulbs. Add one then two bulbs in parallel (shown dotted) and see what effect they have on the current round the circuit.

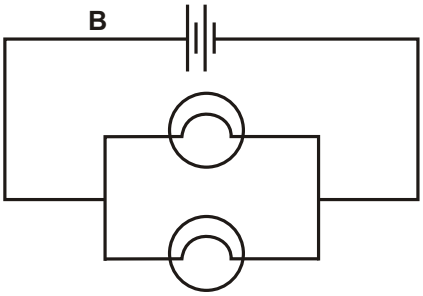
IN YOUR BOOK

4 What happens to the current round a circuit if more bulbs are added in series?

5. What happens to the current round a circuit if more bulbs are added in parallel?

6. Look carefully at these two circuits:-





If both were fitted with a new battery and switched together, which battery would "run down" first, A or B? Explain your answer (Remember to answer in sentences. For example, this answer could start:- I think battery *……...would run down first because*……..)

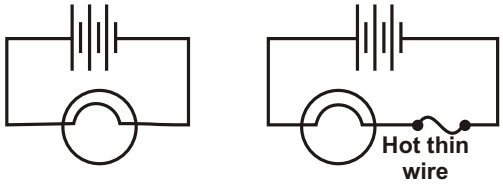
SOME IMPORTANT INFORMATION

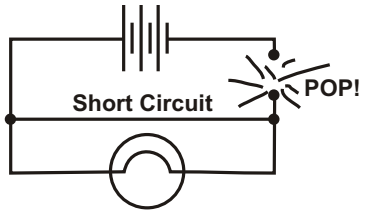
In the last experiment you will have found out two important pieces of information.

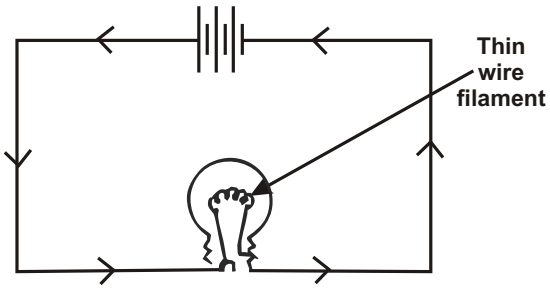
1 Thin pieces of wire can get hot when electricity passes through them. If the current is very large the wire will melt.

2 A short circuit causes a large current to flow round a circuit.

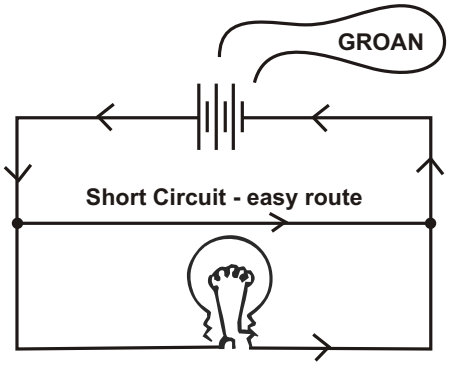
If we study a short circuit more closely, we can see why such a large current flows.





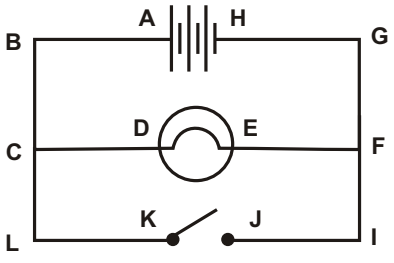


In this simple circuit the electricity has to flow through the bulb. If you look at a bulb closely you will see that the electricity passes through an extremely thin wire called a FILAMENT. As you have already learned, very thin wires have a very high resistance than thick wires. So this resistance will keep the electrical current down to a safe value.



If we add an extra lead to SHORT CIRCUIT the bulb, the electricity will take the easy route round the circuit. So instead of flowing through the high resistance filament, it will go through the low resistance short circuit. Because the resistance is very low, the current will be very high. If the circuit is left on, the battery will be run down very quickly.

Sometimes, short circuit are not as easily seen as in the circuit we tried. We need to check a circuit before we switch on to make sure there are no “shorts”. If the electricity can travel from one side of the battery to the other without passing through parts such as bulbs, resistors or motors, You have a short circuit.



Look closely at this circuit. When the switch is pressed there will be a short circuit. Can you trace the short circuit route?

IN YOUR BOOK

1 . Write down the date and the title- **Circuit safety.**

2. Copy the last circuit diagram and show on it, with arrows, the route taken by the electricity through the short circuit.

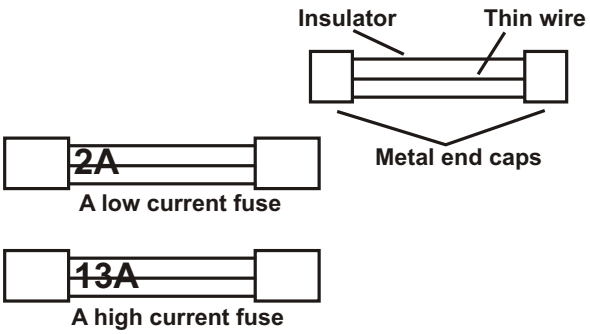
3. Explain what happens to a battery if it is short circuited.

MORE IMPORTANT INFORMATION

Fuses: A short circuit in a mains electrical circuit can be very serious. If mains equipments start to take too much electricity the wires may well become so hot that they start a fire. It is very important to protect all the wiring in a house so that, if a short circuit does occur, the electricity will be switched off automatically.

A piece of wire, thinner than the circuit wiring is used in all electrical circuits. It is called a FUSE.

Most modern electrical equipment is fitted with cartridge fuses. The thin piece of wire is inside the tube. If you look at some fuses you will see that there are different types. The wire inside the fuse has to be thick enough to carry the current the equipment normally takes without burning out. However, it must not be too thick otherwise it might not burn out when the equipment tries to take too much current.



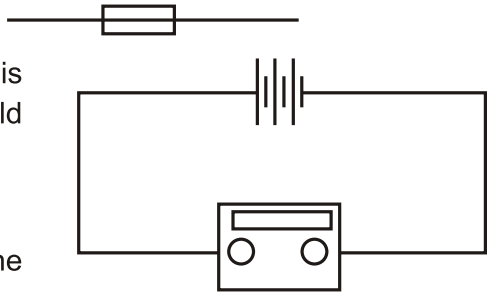
Equipment such as electrical heaters take a large current so are fitted with thick wire fuses, e.g. ”13 amp”, but low current equipment such as lights or a television set need a thinner wire fuse, e.g. ”2 amp”.

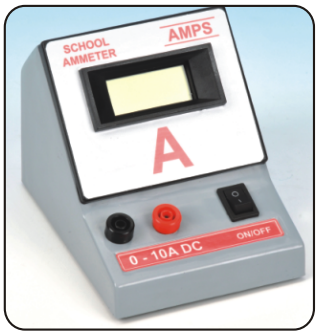
IN YOUR BOOK

4 Explain in your own words why it is important that an electrical circuit should be fitted with a fuse.

5. Copy this symbol for a fuse:-

6. Redraw this diagram and using the symbol above, add a fuse to the circuit.





Experiment 6

MEASURING ELECTRIC CURRENT WITH AN AMMETER

In experiment 5, you measured the amount of current in a circuit by the brightness of a bulb. Unfortunately, this is not a very accurate method because it is difficult to see small changes in brightness. Electricians measure the size of an electric current by using an instrument called an AMMETER. The meter measures current in AMPERES but this is written AMPS for short.

NOTE : ***You have to be very careful in the way you use an ammeter. Each one is designed to measure up to a certain amount of current. If too much current is passed through, it is quite likely the meter will be damaged.***

Two simple rules must be followed:-

1. **NEVER** connect an ammeter across a cell or battery:-

2. **ALWAYS** check your circuit for any SHORT CIRCUITS before connecting the ammeter.

IN YOUR BOOK

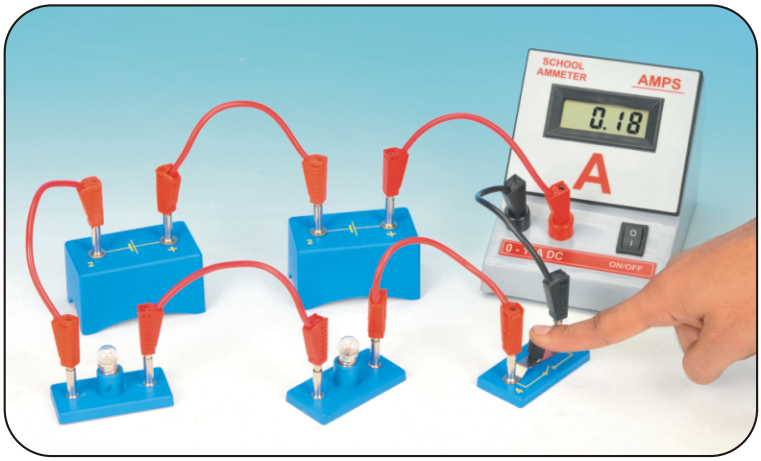
1 . Write down the date and title- **Measuring electric current with an Ammeter.**

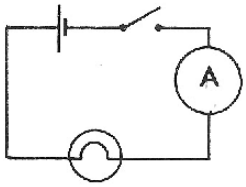
2. Copy the following table in to your book:-

Circuit No.	No. of cells	No. of bulbs	Series or parallel	Current in amps

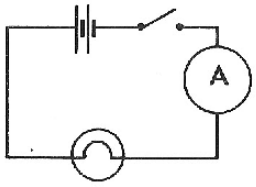
Set up each of the following 8 circuits in turn. For each, note the current reading on the ammeter then fill in the results in the table in your book .

IN YOUR BOOK





Circuit No. 1



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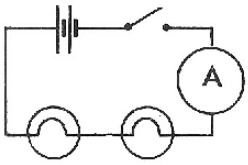

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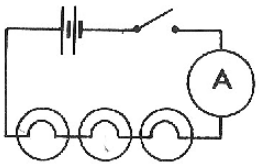

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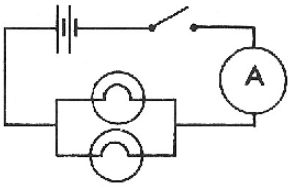
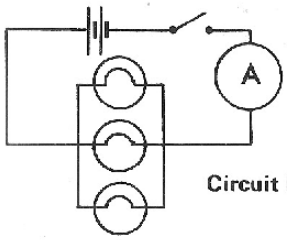
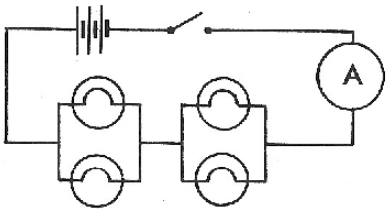


Circuit No. 6



Circuit No. 7

Circuit No. 8



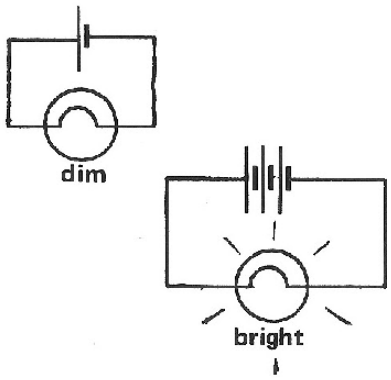
3. What happens to the current round a circuit if more cells are added in series?

(Remember-answer in a sentence. e.g. As more cells are added in series, the current……).

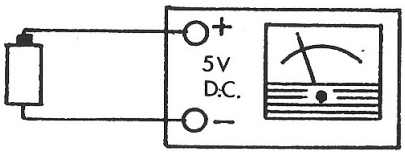
4 What happens to the current round a circuit if more bulbs are added in parallel?

5 Which of the circuits above would run the cell or battery down in the shortest time?

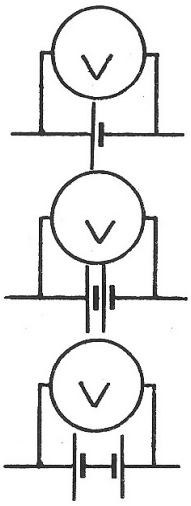
Experiment 7 MEASURING THE DRIVING FORCE OF BATTERIES



In several experiments so far you have found that you can increase the "driving force" of a battery by adding more cells in series, the more current flows round a circuit. In the last experiment, we learned how to use an AMMETER to measure the CURRENT round a circuit.



Very often, electricians need to measure the "driving force" of a cell, battery or other electricity supply. To do this they use an instrument called a VOLTMETER which measures the "driving force" in VOLTS. There is no need to break a circuit before connecting a voltmeter. The voltmeter is connected ACROSS the battery you wish to measure. (This is something you must NEVER do with an ammeter so be careful not to mix them up!)



First of all, try connecting a voltmeter across a single cell as shown here. Note the reading In volts.

Can you guess what the reading will be if you use the voltmeter across TWO cells in series? Try it to see if you are right.

Turn one of the cells the wrong way round. Is there any driving force available when the cells are connected this way?

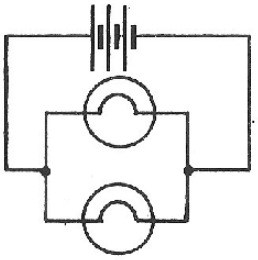
IN YOUR BOOK

1. Write down the date and heading- **Measuring the Driving Force of Batteries.**
2. Show, with a diagram, how a voltmeter is connected in a circuit.
3. Write down the voltage readings you obtained with one then two cells.
4. How many cells do you think you would find inside a 9 volt transistor radio battery.

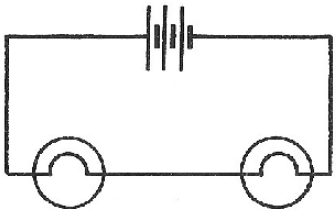
Experiment 8 MORE ADVANCED WORK WITH SWITCHES

Here are some switching problems for you to solve.

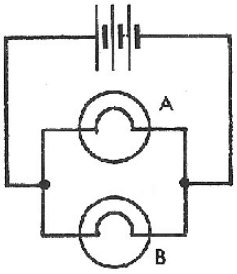
Look at each of the following circuits in turn. Beside each one there is a switching problem for you to solve. Try the circuit out and when you have to be put in the circuit, redraw the diagram with the switches included. You need a date and title in your book before you start.



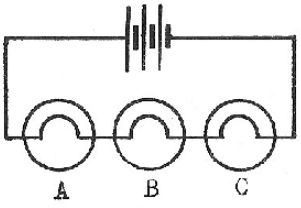
Place a switch so that one lamp stays on all the time but the other only lights when the switch is pressed.



Place a switch so that both lamps are on until the switch is pressed. When the switch is pressed, one lamp goes out.

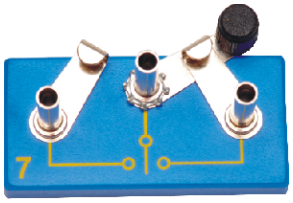


Use two switches in this circuit so that when one switch is pressed, lamp A lights up and when the other switch is pressed, lamp B lights up.



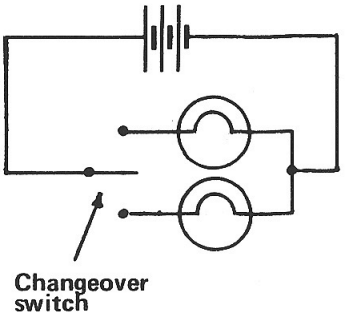
Use two switches in this circuit so that when one switch is pressed ALL the lamps light but, if the other switch is pressed only lamp C lights up.

SOMETHING TO READ:

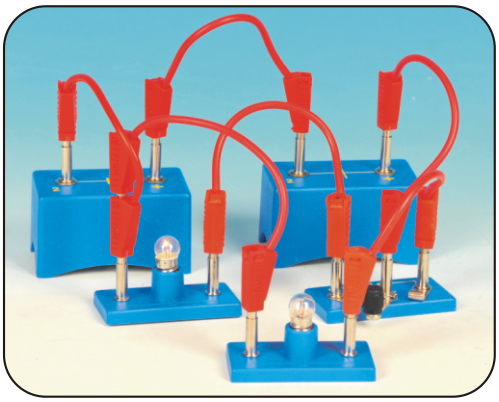


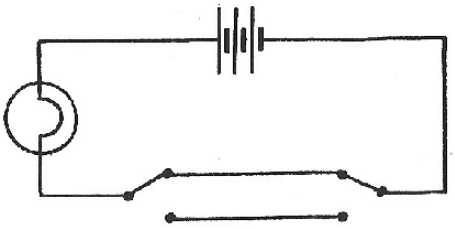
A different type of switch

Part number 7 in your electricity kit is called a CHANGEOVER SWITCH.



This type of switch can be used to make electricity flow two different ways depending on the way it is set. You can try the switch out on this circuit to see how it works. You should be able to light one lamp or the other. If you set the switch in its mid position, neither lamp will light.





Set up the circuit shown here with two changeover switches. This circuit is unusual in that two switches are used to control only one light bulb.

This type of light switching circuit is very common in houses. Try moving each switch in turn to find out what special properties they have.

IN YOUR BOOK

5. Draw a diagram which shows how changeovers switches can be used in a circuit to control one light from two different positions.
6. How is such a circuit used In a house?

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