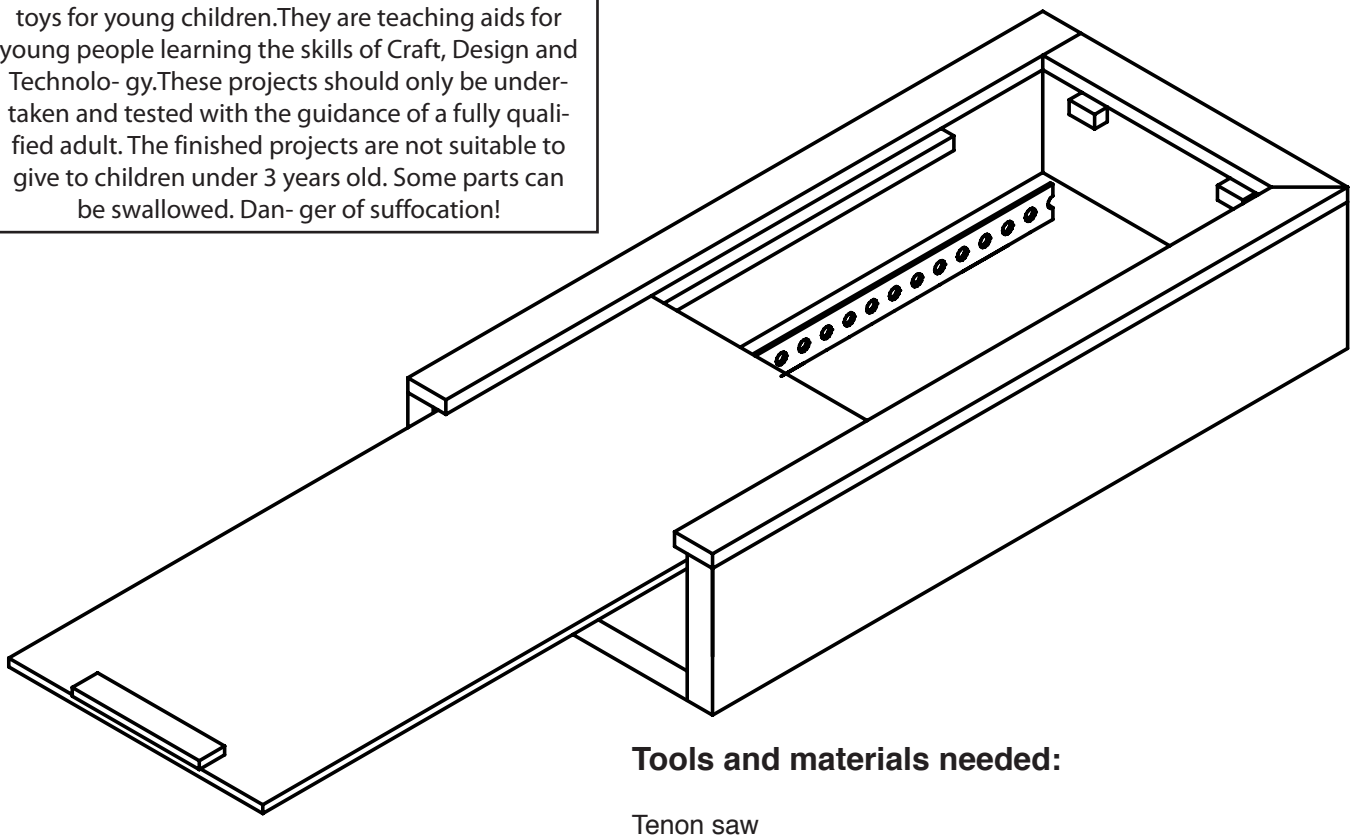
105.015

Electronics - Construction box

Please Note

The OPITEC range of projects is not intended as play toys for young children.They are teaching aids for young people learning the skills of Craft, Design and Technolo- gy.These projects should only be undertaken and tested with the guidance of a fully qualified adult. The finished projects are not suitable to give to children under 3 years old. Some parts can be swallowed. Dan- ger of suffocation!



Tools and materials needed:

Tenon saw
Fret saw
Screwdriver
Bradawl
G Clamp
Wood glue
Paint brush
Screwdriver

Contents

1x Poplar plywood	3x100x250mm
4x Pine strips	10x50x250mm
1x Pine strip	10x40x250mm
2x Pine strips	5x5x200mm
2x Pine strips	5x15x250mm
1x Pine strip	5x15x125mm
2x Angle strips	200mm
4x Cheese head screws	3,9x9,5mm
2x Plywood	6x75x100mm

Please Note

Due to the manufacturing process of the bulb holders, the inner contact tab may stand a little proud.
We recommend pressing the contact tab down with a small screwdriver, before inserting the bulb.

Planning and Making

Please read through the guide before starting the project.

1. The base of the box is made up from two pine strips each 10 x 50 x 250mm glued together on their long edges and set on a flat surface to dry.

2. The two outer walls are made from the remaining strips (1) 10 x 50 x 250mm set in a upright position and glued to the long sides of the base on the outside. This will then form a U shape.

3. The strip (2) 10 x 50 x 100mm serves as the rear wall and is glued into position on the base between the side walls.This is cut from the pine strip 10 x 50 x 250mm.

4. The front wall (3) 10 x 35 x 100mm is made and glued in the same way. This is cut from the remainder of the pine strip 10 x 50 x 250mm in step 3.

5. The runners for the lid (4) 5 x 5 x 200mm are glued to the inside of the side walls, so that they are 5 mm down from the top edge and are level with the front wall of the box.

6. Finally add the top edging strips (5) 5 x 15 x 255mm shortened to 250mm so that they protrude 5mm into the box to form a slot for the lid to run in.An alternative design is to cut the corners with a mitre saw (mitre box) at 45 degrees.

7.On the rear end of the box a strip 5 x 15 x 100mm (6) is cut off to 90mm and glued between the the edge strips on the sides. This should also protrude 5mm into the box. If you have chosen the 45 degree angle design this strip must be 120mm long.

8. The metal angle (contact) strips (8) are screwed to the base in the box. Fix each strip with two screws (3,9 x 9,9mm) space the strips apart approx 62mm (width of the 4.5 volt battery)

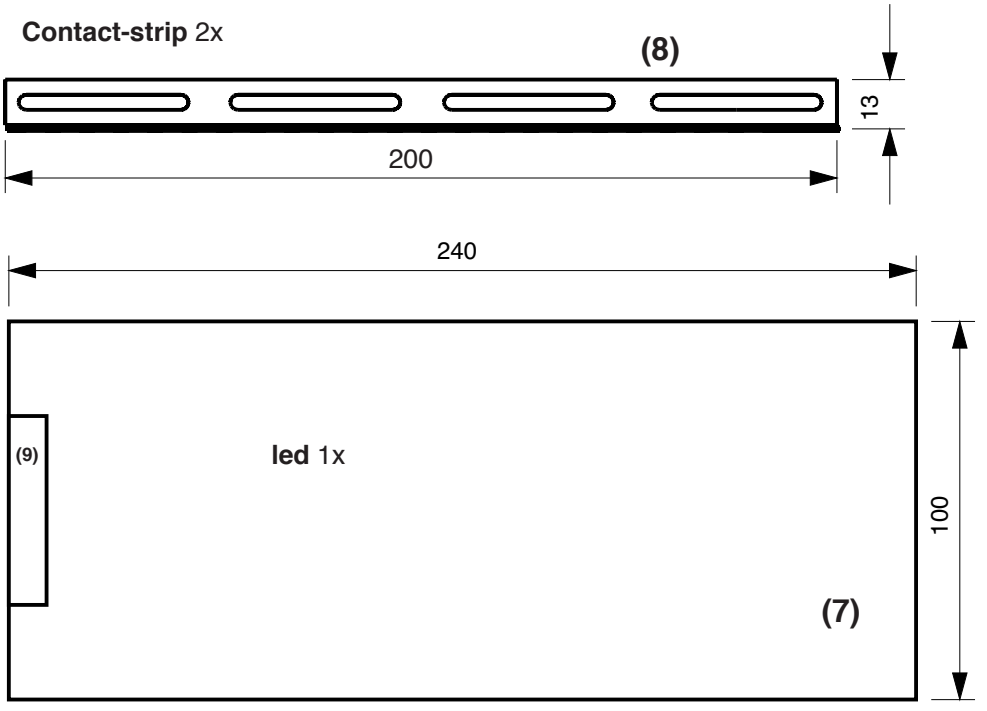
9.The lid (7) is 240mm long cut from the 3 x 100 x 250mm plywood and is then ready to slot into the groove formed by the two strips 5 x 5 x 190mm and 5 x 15 x 250mm.

10. Use the remainder cut off from the lid and shape it to act as a thumb grip, so that the lid can be slid open easily. (glue the grip in position)

11. We recommend sealing the finished box with a clear varnish (eg Marabu Aqua Clear varnish Order No 96830)

12. Glue the 2 plywood strips 6 x 75 x 100mm on top of each other, to form a base 12mm thick. This thicker board will be used to mount the switch on.

scale 1:2



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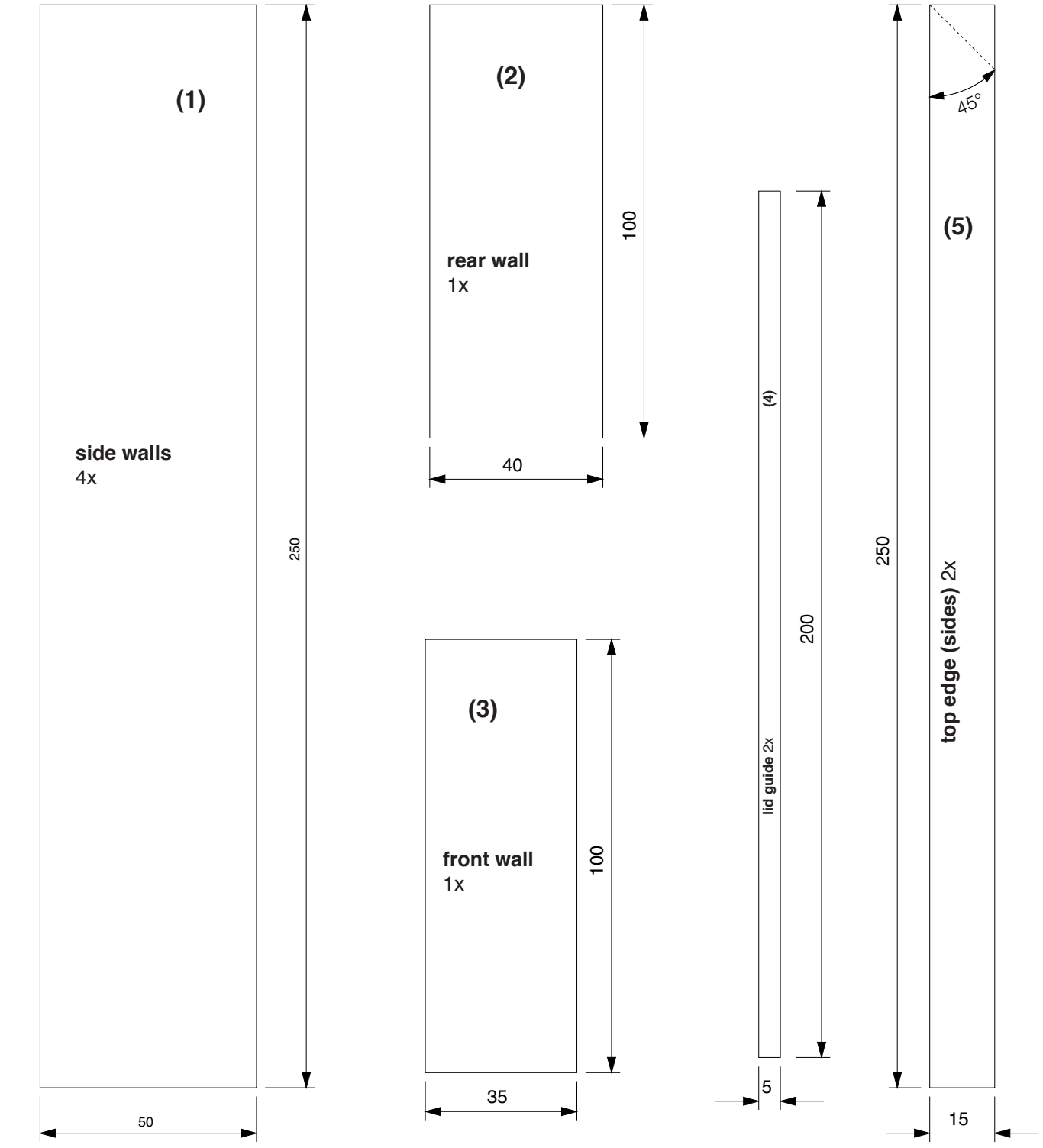
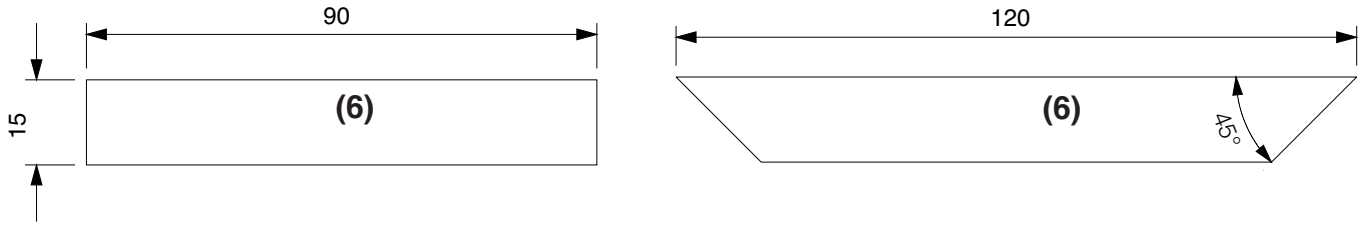
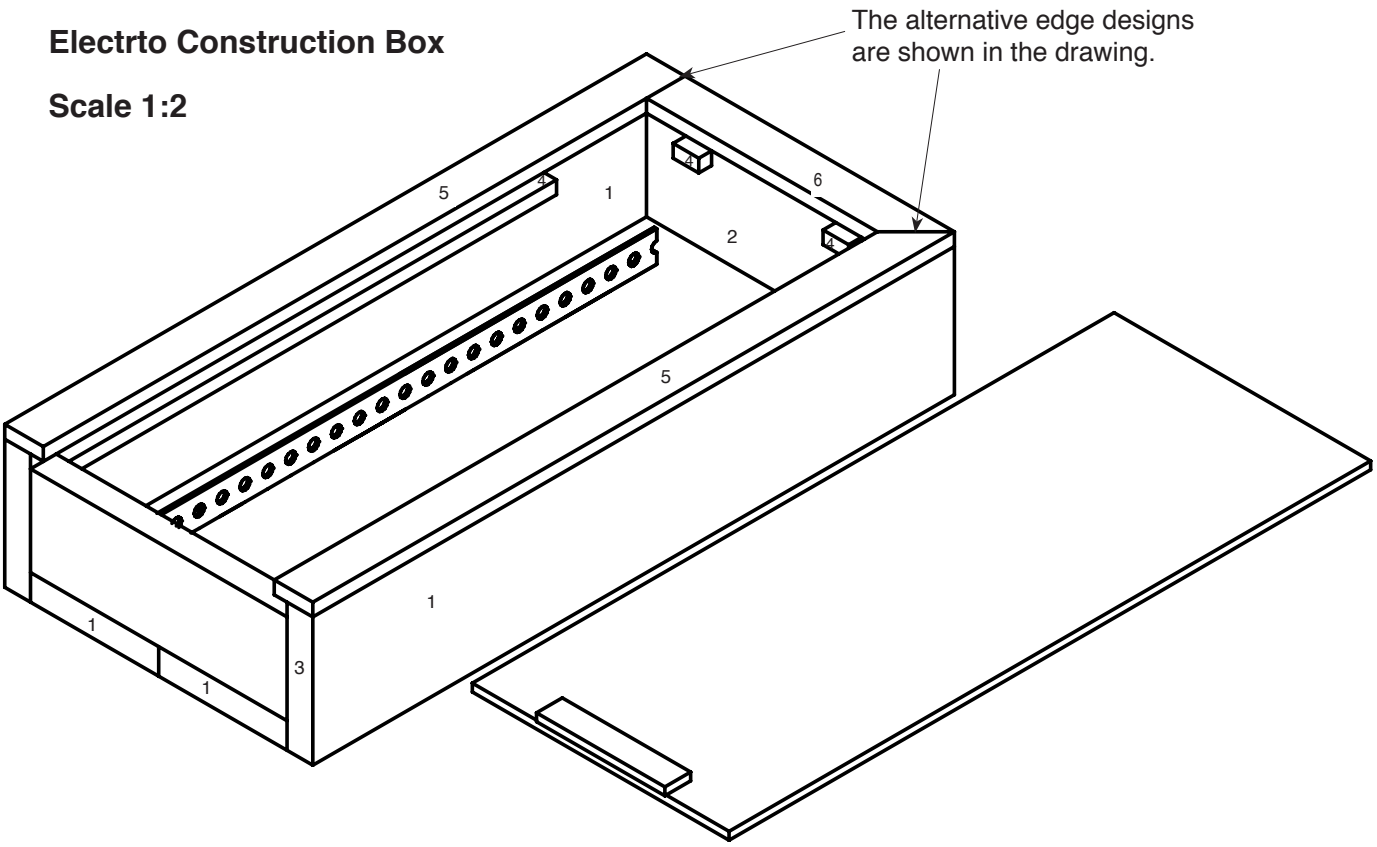


top edge (rear) 1x



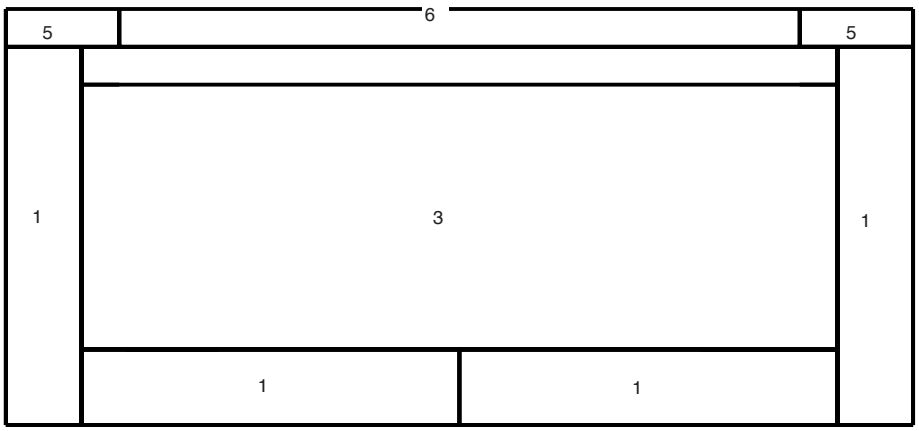
Electrto Construction Box

Scale 1:2



Front view

Scale 1:1



SIMPLE ELECTRONIC EXPERIMENTS

OPITEA and **OPITEO** discover with you the secrets of electricity!

You will find in everyday life many things that use electricity to function.
(in school, home, shops and building sites)

How many of these things do you raelly understand?
Where does the electricity come from?

The simple answer is:

Electricity is produced in power stations by large turbines.
Although electricity produced by wind, water or the sun (solar cells) is much better for our environment!
A dynamo fitted to the wheel of a bicycle is a ”mini power station” and will produce electricity as you ride, lighting up the front and rear lights.
Of course you can also use a battery as a source of electricity.
All products which use or make electricity are marked with a number and the word VOLTS (V). From these markings we know how much electricity is being made or is necessary - this called the voltage.

ATTENTION! You should be aware that voltages over 42 Volts (V)L are LIFE THREATENING and should not be used for experiments.

The voltage from household sockets is normally 240 volts!

For our experiments we will use a 4,5 volt (V) battery.

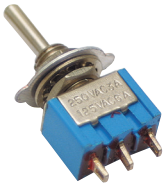
The flat shaped battery will fit into our box and will make a convenient power source for our experiments. How the battery fits is shown in the plans for the box.

For our experiments with electicity we shall use a range of common electronic components each of which can be identified by its symbol.

Battery

Power source

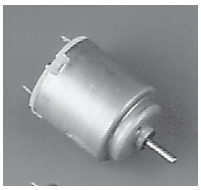
Lamp



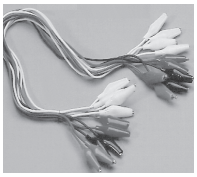
Switch

Push switch

Mini buzzer



Electric motor



Connecting wire

Working on a bench top you can join the components together with wire to make the circuits. Better and easier to see is, when the components are assembled on a small board.

Take note of the tips at the end of these instructions- expecially for the mini buzzer.

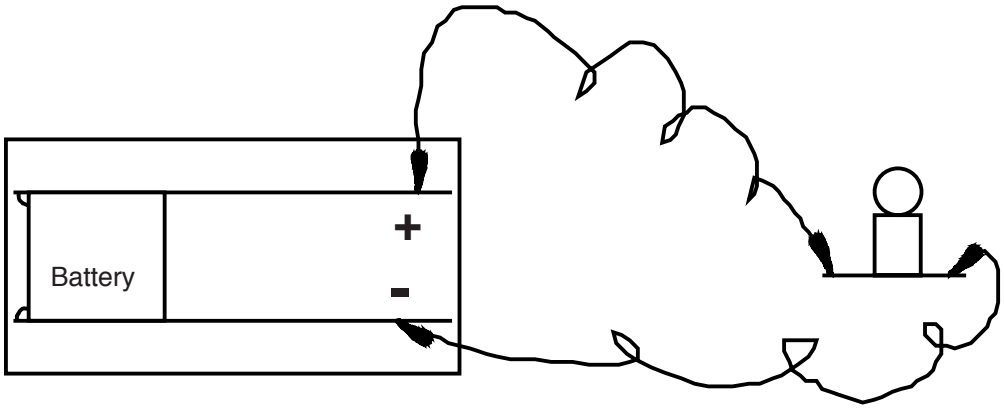
EXPERIMENT 1:

Join the minus pole of the battery (Symbol -) with length of connecting wire to one side of a lamp holder (with lamp). Then add a wire from the other side of the lamp holder back to the battery and connect it to the plus pole (symbol +).

What do you see?

The lamp lights because the electricity can flow in a closed circle- a circuit.

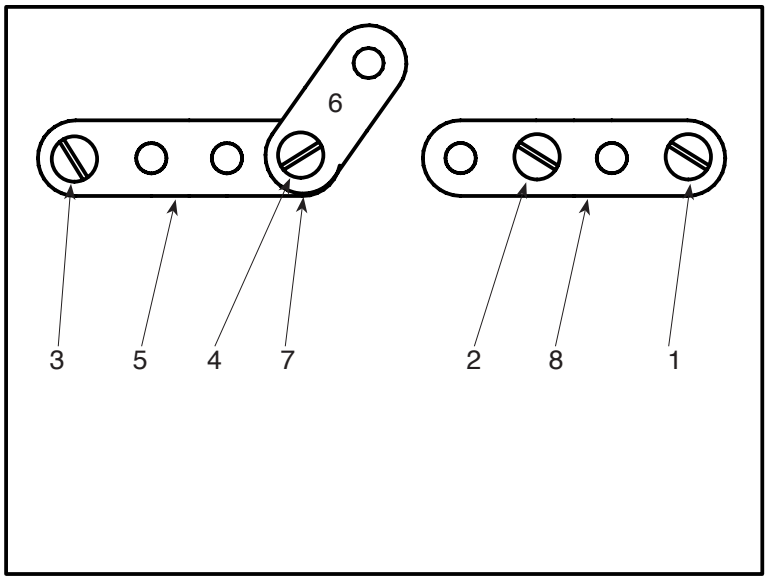
Think, how you can break the closed circuit and allow the lamp to be turned on and off.



The easiest solution is to open and close the circuit with a switch.

A simple switch can be made using the metal strips scewed in an arrangement as shown. Use a small board to mount the parts.

Note: Use a bradawl to make a small hole before inserting the screws.



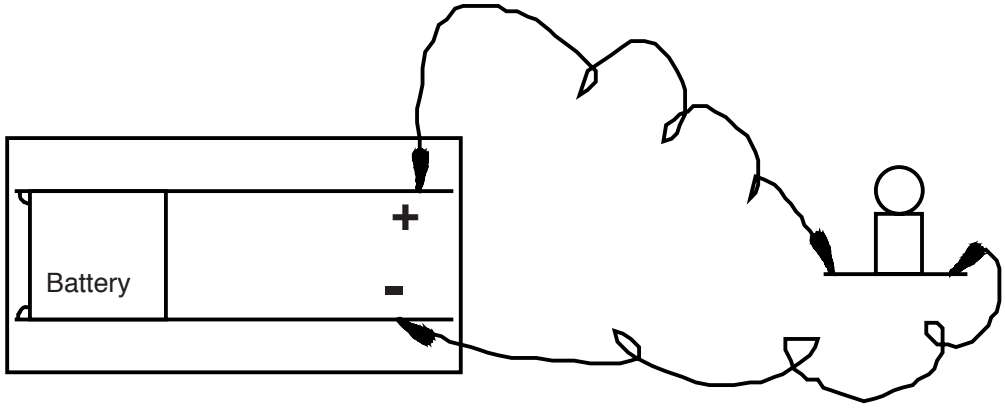
- Wood screws (1,2,3) screw these a little tighter.
- The lever is made up of the machine screw (8) nut (7) and 3 holed strip (6) as shown in the photo
- A wood screw (4) joins the lever with the 4 hole flat strip (5)

In between is the washer (7)

Now connect the plus pole of of the battery to screw 1 of the switch.
Then join a wire from screw 3 to one side of a lamp holder (with lamp) and from the other side of the holder back to the minus pole (symbole -) of the battery.

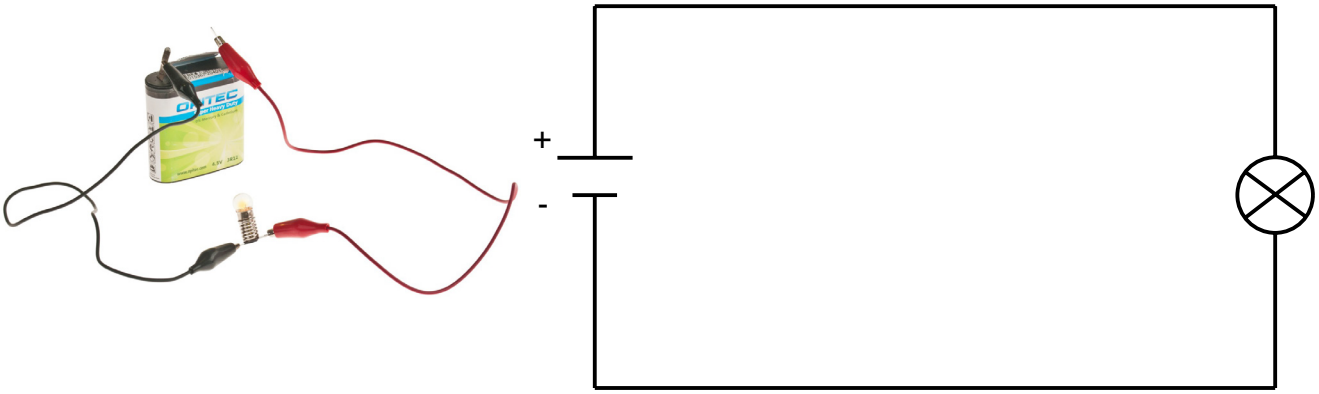
What happens now when open and close the lever switch (part 6)?

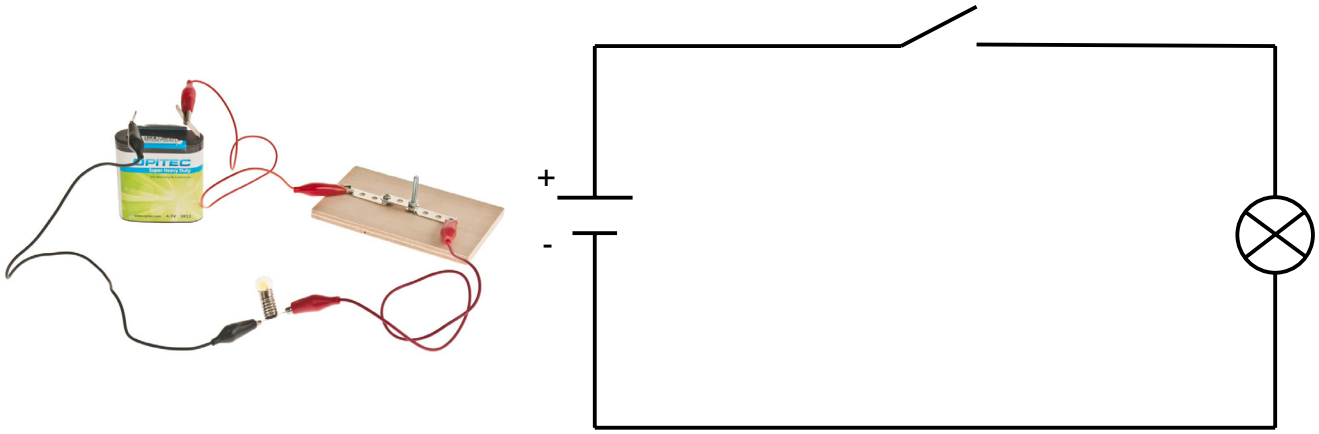
The lamp does not light when circuit is open!



These first two experiments can be drawn as a circuit diagram using symbols to show the components.

For the first circuits the diagrams will look like this:





EXPERIMENT 2

Use the same layout as before only with an open circuit - the switch lever 6 not having any contact with flat strip 8

To bridge the gap between the lever (part 6) and the flat strip (part 8) firstly use a pencil eraser then a nail, a piece of wool, a coin, a matchstick and finally a paper clip.

Which materials bridge the gap and light the lamp?

Why does the lamp light sometimes and not othertimes?

You can find out which materials let electricity pass through them (conductors) and which ones stop the flow user. Sort out your materials and make a list of conductors and insulators.

Insulating materials are used to protect cables that carry electricity, so that electric shocks are not felt by the user. Sort out your materials and make a list of conductors and insulators.

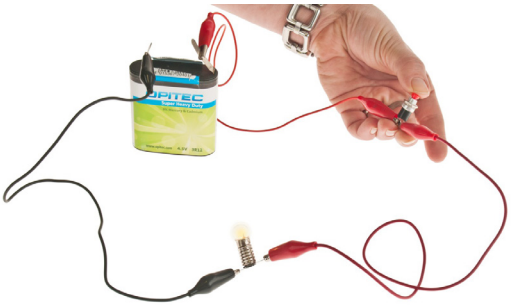
Which materials make a good conductors?

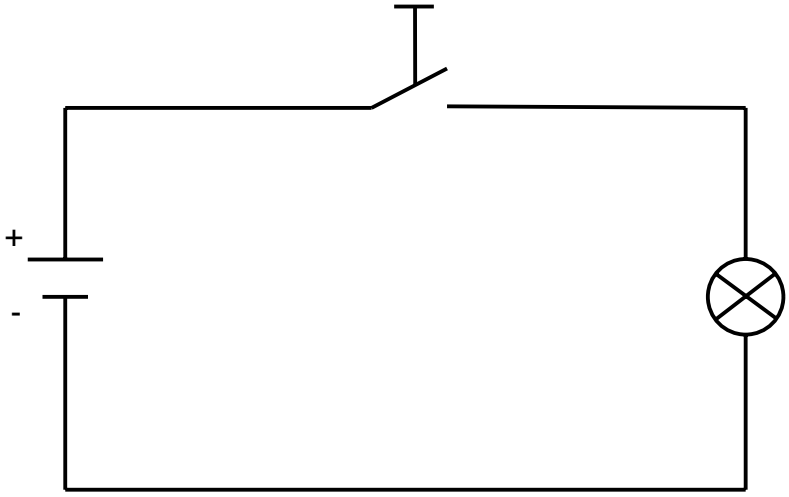
Look carefully at the lamp holder- can you identify the isulating material?

EXPERIMENTS 3, 4 AND 5

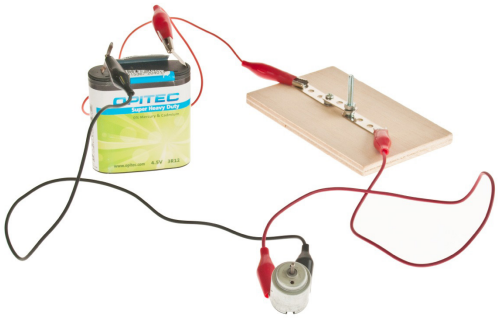
You should now have learnt something about electricity. See if you can make the next circuits as shown on your own:

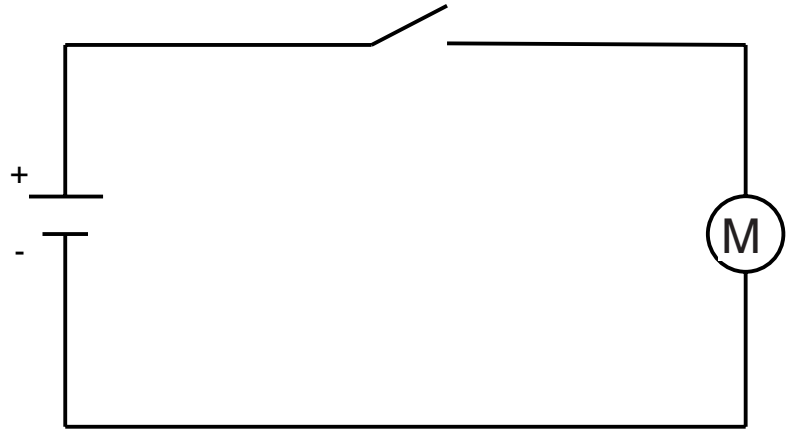
Experiment 3



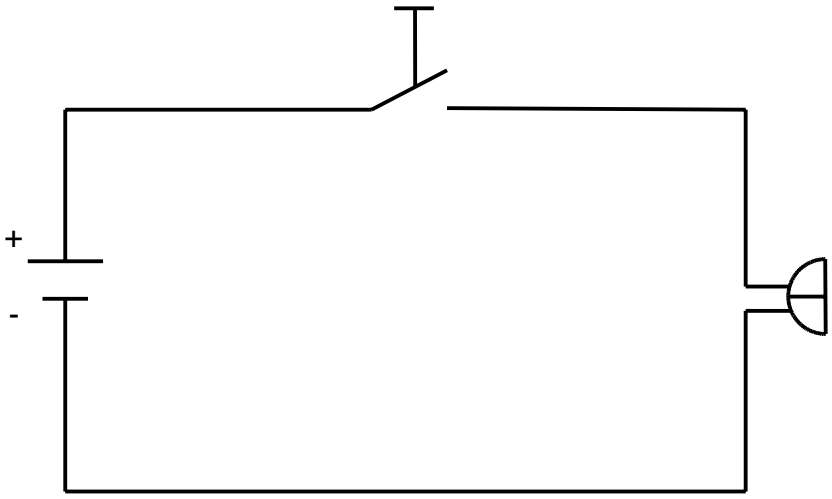


Experiment 4





Experiment 5



Experiment 6

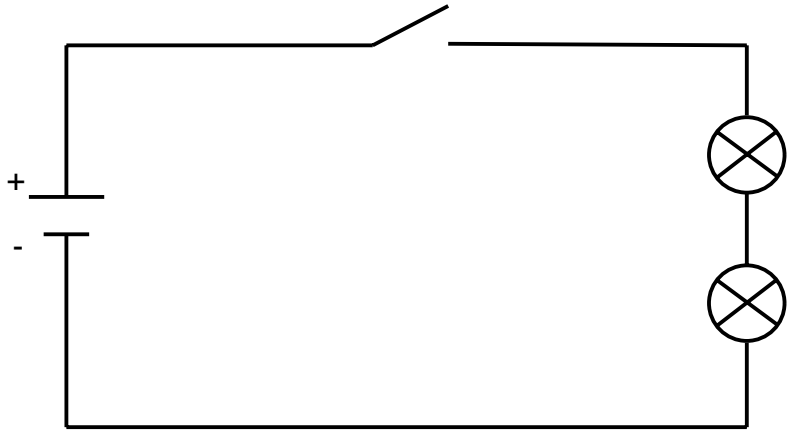
If you have ever looked carefully at a row of lights you will see that they are joined one after another by a cable.

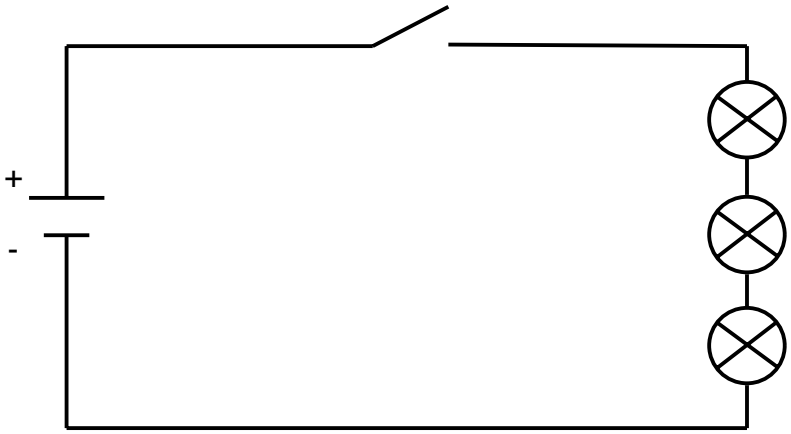
See if you can make a row of lights, firstly try with two lamps and then three. Then connect the battery.

What did you notice?

Unscrew one of the lamps whilst the battery is still connected- what happens?

Note: When you make a row (series) of lamps, they all light up a little bit dimmer. When you unscrew one of the lamps the circuit is broken and they all go out.





EXPERIMENT 7

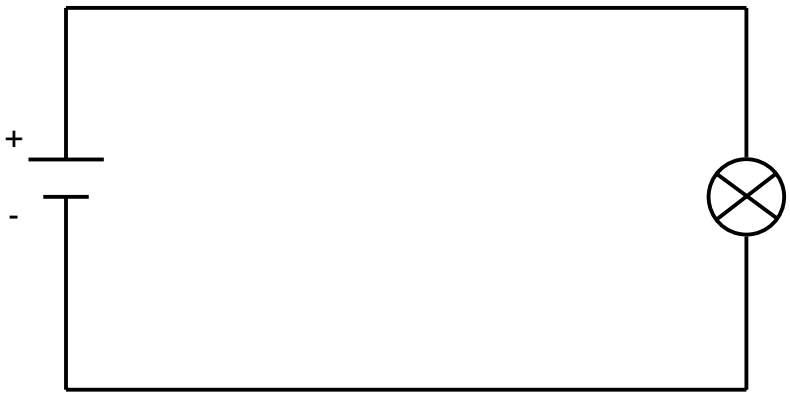
You have been asked to design and make a circuit for a dolls house so that you can switch on two diferent lights on at the same time. They must not however be in series.

Try to make this circuit using your electro-box.

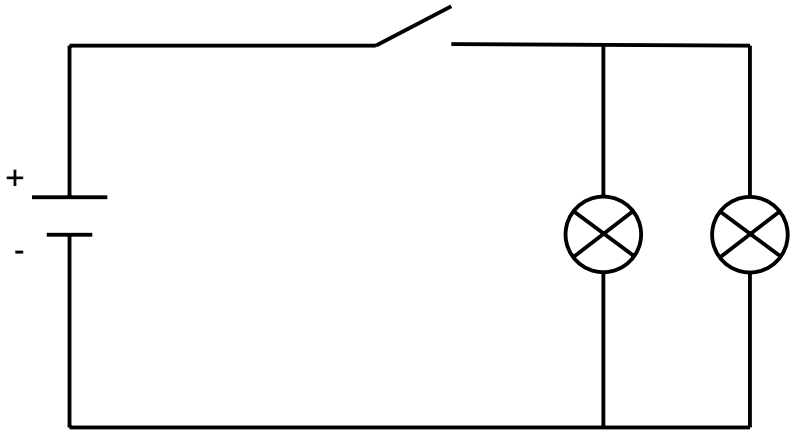
Think first how the circuit diagram will look.

The following diagrams may help you - which do you think is the correct solution? Circuit diagram a) b) or c)

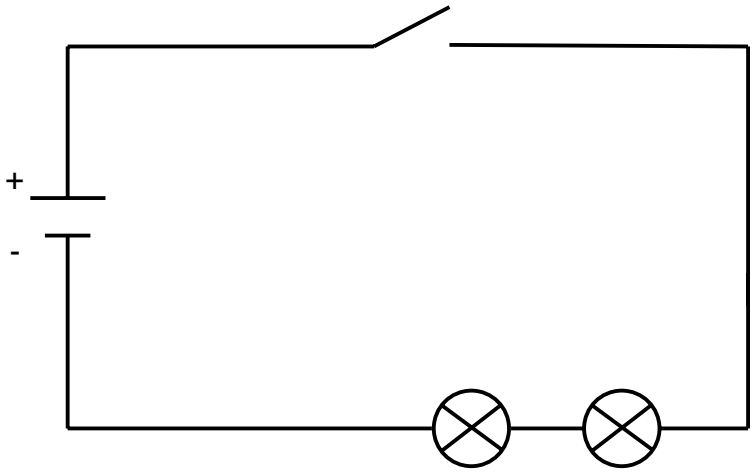
Circuit diagram a)



Circuit diagram b)



Circuit diagram c)

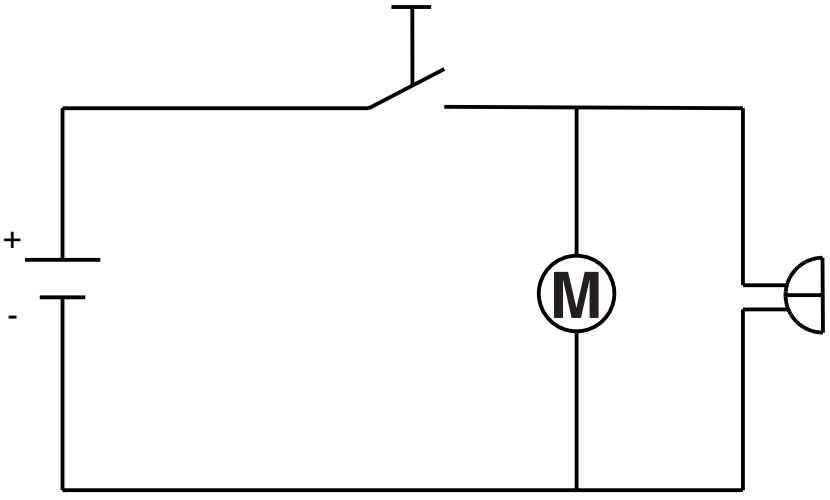


When you make a further connection with a lamp parallel to another in a simple circuit this is called a parallel circuit. You can also arange other different components in a lparallel circuit.
You will see that in a parallel circuit the lamps receive an equal amount of electricity and are the same brightness. Also when you unscrew one of them the other still lights.

EXPERIMENT 8

Can you describe the next circuit?

See if you can make this circuit!



Here are a few tips that you can use to change the design of the circuits shown.

- From Experiment 3 onwards instead of a self- made switch you can use a variety of different push or toggle switches.

- When experimenting with a buzzer you will need to make sure that the red cable is connected with the plus pole of the battery. (A buzzer will only work if the red wire is connected to the positive side of the battery and the black to the minus). Screw the connectors to the end of the buzzer cable so that you can build it into a circuit.

- Push the plastic reducer 4/2mm into the centre of the wooden pulley wheel and push them both on to the shaft of the electric motor. You can drive a card disc glued to another pulley on a separate shaft from this using a rubber band. Is this like the wheel of fortune you see in game shows on television?

- Assemble the propellor and mount this on the motor shaft. Finally mount the motor on the edge of your box- you have now made a fan- attention don't catch your nose in it whilst it is turning!

- You should now be able to try your own ideas, designing and making many different circuits of your own- we wish you fund and success in your experimenting.

OPITEA and OPI- TEO.

Please note! **To avoid a short circuit or the battery discharging, please remove the battery from the metal strips after completing your experiment.**

Contents

4x Lamp holders E10	
2x Lamps	3,5V/0,2A
2x Lamps, red	3,5V/0,2A
10x connecting cables with crocodile ends	
1x Toggle switches	
1x Push switch	
1x Buzzer	
2x Small connectors	
1x Motor R20	
1x Spring clamp (motor holder)	
1x Reducer 4/2 mm	
1x Pulley	ø 15mm
1x Propellor set	
1x Insulated cable	3m
2x Flat metal strip 4 holes	
1x Joiner metal strip 2 holes	
1x Board	80 x 80 mm
1x Washer	M4
5x Screws (for switches and motor holder)	3x10mm
6x Screws (for lamp holders) 2x10mm	
8x Screws (Press switch, toggle switch, buzzer)	3x12mm

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