THE EXPERIMENTALIST

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The “Cookit” stove

Dear young experimentalists,
These days, all you young people must have some knowledge of technology, because you are growing up in the modern world where such knowledge will bring great benefits and the lack of it will bring a poorer life.

Did you know you can cook with the heat of the sun? A "Solar Cooker" is easy and inexpensive to make, and can save many trips to fetch firewood. This magazine has plans to make one, and an explanation of how it works and how to use it.
When you young people of today become adults, more of Mozambique will have an electricity supply. It is therefore important that you should understand something about electricity. And, of course, you need a practical understanding of electricity in order to properly understand your physics classes at school. So read the second article on electricity in this journal.

Solar oven that can cook 200 loaves a day.

Many people today use cell phones. But do you know how they work? Read the article.

Finally, do you believe that we are being visited by beings from other planets arriving in flying saucers? For your enjoyment here is an article to say something about it. *The Editor*

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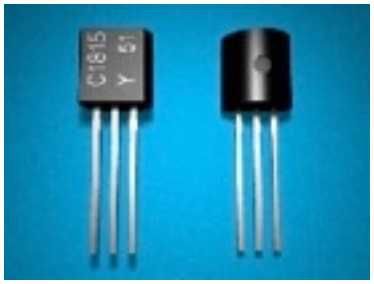
The Spark Group's website: www.experimentalista.org

Electricity Course - Part 2

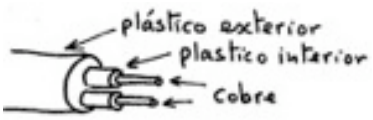
Good conductors
Substances that allow current to pass through are called 'conductors'. The best conductors are metals, in this order: Silver, Copper, Gold, Aluminum ...

Bad conductors
Other substances conduct, but not so well. For example:
Charcoal, graphite (pencil leads for example), Sulphuric Acid, Water (best when it has salt), the ground (earth), Rust (Iron Oxide), Copper Oxide) ...

Semiconductors
There are certain substances that conduct in certain conditions. They are used in transistors, integrated circuits, diodes, etc.. But we shall not speak here about these substances.
Obviously, the chemicals within a battery carry current. (Carbon, salt water (with the salt ammonium chloride) and zinc).



Insulators
A substance that does not conduct is an 'insulator'. It has no free electrons. Examples of insulators are: plastic, rubber, glass, tar, dry wood, varnish, paint, ceramic (earthenware) and air. In general, domestic electric wires are covered with plastic. Thin wires, for example in a transformer, are covered with varnish.



Fio de condutores sólidos

Wires, cables and domestic conductors
Cables for domestic electrical installations using solid conductors inside the plastic.
Flexible cables, for example to connect light bulbs, kettles, etc.. use conductors that consist of many thin wires of copper.

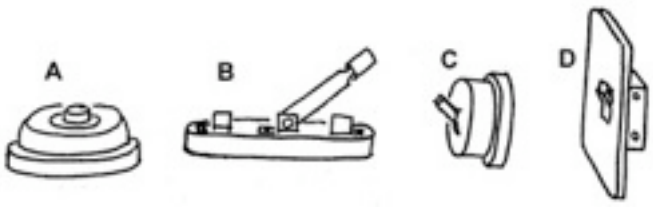
Fio flexível

Light bulbs
A current can do various things. For example, you can heat the wire through which it passes. If the wire is very thin, it will heat up until it is 'glowing' and emits light, as, for example, a light bulb.
Inside the lamp there is a very thin wire that glows and gives light when current is passed. It is the filament.
The metal filament is "tungsten". It does not melt, even when it has a temperature of 2,500 degrees Celsius and gives a white light.

Experience
You can make a holder for a bulb. Do it with galvanized wire or thick copper wire. Put it on a block of wood as seen in the picture. Note the direction of the wire spiral. The screw of the bulb and of the holder should go in the same direction to get the bulb to fit in properly.

Switch Types

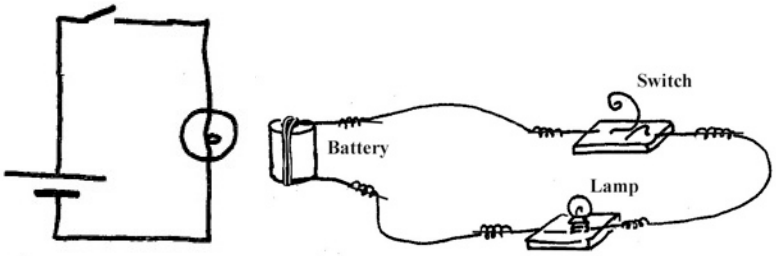
A: A button to operate an electric bell.
B: A "knife switch" - a low voltage switch. With voltages above 30 it is dangerous because it is open and can give an electric shock,.
C and D: Switches to light a light bulb at home (220 volts). The contacts are well insulated.



A Circuit

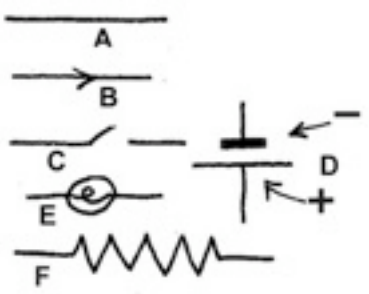
This is a 'circuit' - an arrangement of wires, light bulb, switch, etc..

Make a circuit to learn how it works in practice:



Symbols

A - Wire, wire, conductor
B - The arrow represents the current
C - Switch
D - Battery
E - Lightbulb
F - Resistor



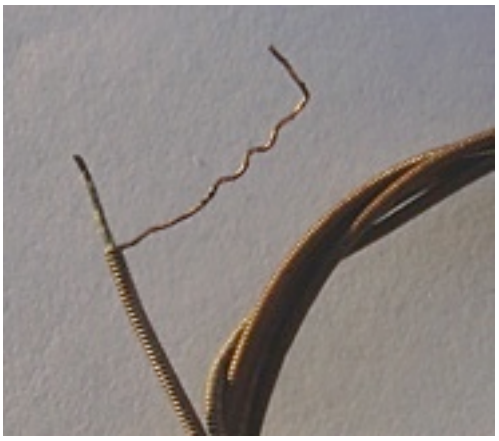
A short circuit

Be careful not to connect a wire directly from one contact of a battery to the other contact. This is a 'short circuit'. A large current passes and quickly uses up the chemicals in the battery.

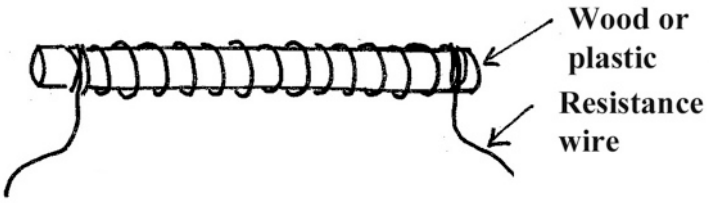
Do you know what a drawing with a red diagonal line indicates? It says, “Do not do it! "

Resistance

Resistance is the property of decreasing the current. To do this, it is necessary that the circuit includes a long thin wire. (Or a commercial resistor.)
The thinner the wire is, the more the current decreases. If we use a wire made of a resistance metal (resistance wire), the more the current decreases.

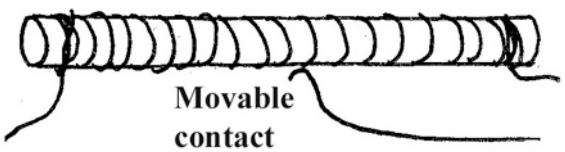


One type of resistance wire that is used in science labs is called "nichrome". Another type is 'nickel'. Nichrome wire is difficult to obtain, but you can get a thin nickel wire from a broken guitar string. One of the strings has a nylon interior, wrapped with a thin nickel wire.



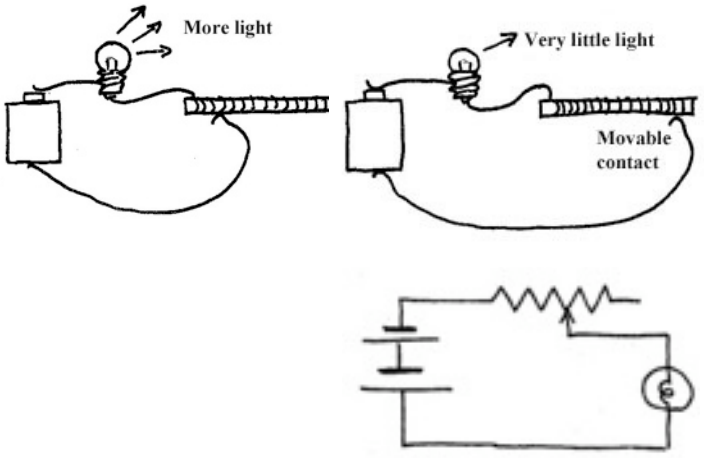
How to make a resistance wire.

Wind resistance wire around a pen or pencil. The drawings show a fixed resistance and a variable resistance.



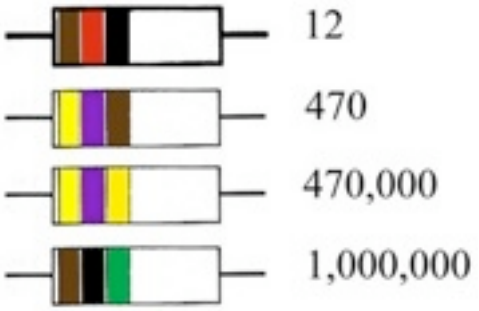
Measurement of resistance

The unit of resistance is an 'Ohm'. For example, 1 meter length of Nichrome wire, 0.5 mm diameter, has a resistance of 133 Ohms. Three feet of copper wire of the same diameter has a resistance of 2.1 Ohm.



The symbol for ohm is the Greek alphabet Ω (Omega).

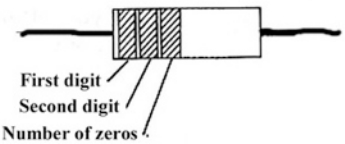
Resistors for electronic circuits (eg for radios) are in general made of carbon and have resistances between 1 Ohm and 10 megohms. ('Meg' means one million.)



Codes for resistance
Electronic resistors are painted with bands of colors to indicate resistance.

First band = the first number.
Second = second band number.
Third band = number of zeros
Examples:

0	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Violet
8	Grey
9	White



Resistor code

Symbol of a resistor of 4,700 Ω.

"K" = 1,000

Magnets and Electromagnets

Magnets

Once upon a time, a magician came to the village of Macondo in South America. His name was Melquiades. He had a wild beard and small hands. He went from house to house dragging two metal ingots and everybody was amazed to see pots, pans, stoves and iron swords jump out of the houses. Objects that had been lost for a long time appeared and went dragging along with the turbulent confusion behind Melquiades irons.
The villagers had never seen such a thing. (This was long ago, when most people did not know what a magnet was.)

(from Brazilian Jorge Amado's novel)

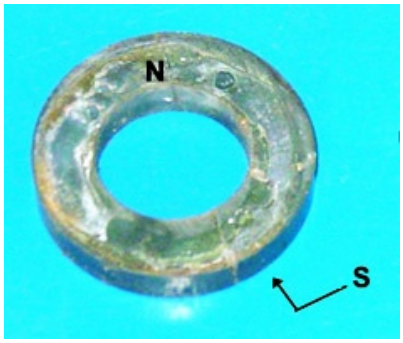
Even today, many people still have never seen a magnet, and do not know that are easy to make. But not such powerful magnets that can pull the pots out of the houses. (And our pots and pans today are made of aluminum or clay, which are not attracted by a magnet.)

Have you ever seen a magnet from the speaker of a broken radio? Here in Mozambique, people call it a “Shock” because they do not know its real name, which is a 'permanent magnet'. The magnets in the photo are circular but they can be of many shapes

Magnets are interesting things because they attract things made of iron, such as nails. If you can get an old loud speaker, take the magnet out. It is difficult to do this because it is very strongly glued. Use a knife and a hammer, as shown in photo.

The magnet is made of 'ceramic', a bit like a clay pot, and so it is fragile. But if you break the magnet, even small pieces of magnets are magnets. Breaking a magnet does not destroy its magnetism.

The photo shows another type of permanent magnet. It attract iron at its ends (the 'poles'). In the photo, it has picked up some nails.



The poles of a speaker magnet are the opposite faces.

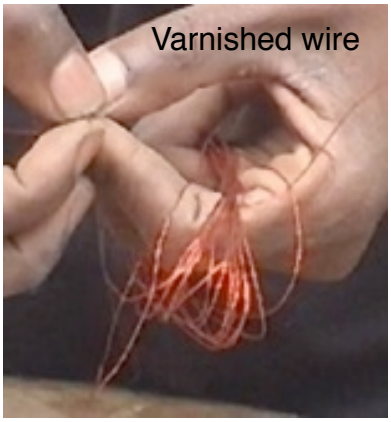
The photo below is of a magnet lifting Meticais coins. The magnetic effect passes through one to the other. The coins contain Nickel, which is magnetic.

The magnet is able to lift an empty can – the part that is made of iron, not the part that is made of aluminum.

Electromagnets

You can make a magnet using only things you can find a village or in the rubbish heap of a town.
You need: a nail, a battery and a metre of electric wire – insulated wire, as thin as possible. Thin wire is best because thick wire takes more current and the battery wears out fast.

Often one can find an old transformer with varnished wire, or an old electric motor. The picture shows this type of wire. This is the best. It is covered with strong paint (enamel) to prevent it touching the nail or the other turns of wire.The insulation is very thin, but good.



We wound one metre of wire on a nail. (But any small piece of iron will do.) The first photo shows it when wound with plastic covered wire. The second shows it when using varnished wire. Connect it to a battery and it can lift small nails.

We made an electromagnet that works with electricity, using a battery. We got some thin electrical wire - an old piece of telephone cable - the type of wire covered with coloured plastic that children use to make models of bicycles.

Beware, the battery wears out quickly. Connect it for only a few seconds. Use it to pick up some small nails. Nails are made of iron. Magnets attract iron. The type of magnet that works with electricity is called an 'electromagnet'.

Of course, when you disconnect the battery, the magnet returns to normal and does not attract anything. (But if a nail is steel, it remains a (weak) magnet.)

Making small permanent magnets

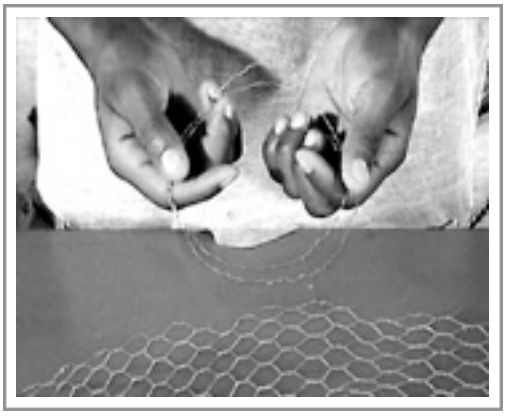
Some nails may become permanent magnets. It depends on the type of nail you use. Some contain a proportion of steel. If you make an electromagnet with one of these nails, the steel keeps a bit of magnetism when you turn off the battery. The steel makes permanent magnets. Try various types of nails to see if you can find one that can make a permanent magnet.
The photo shows steel nails.
If possible, use a steel nail that is specially made to go into concrete. If there is a nail in a wall in your home, it is likely to be made of steel.

Try things that the magnet attracts. Plastic? A bronze key? A piece of tin roof? (It is not made of zinc, iron is coated with zinc to prevent it rusting). You will see that in general, only things made of iron or steel will be attracted by the magnet. No aluminum. Not wood. These materials are not magnetic.
But our coins here in Mozambique are steel coated with nickel. Nickel is magnetic.

Magnetism goes through things like paper and plastic.
If your magnet is too weak to do it, or if(if the nails are too heavy) try pins. (Pins are steel.)

A magnet attracts rust (iron oxide). It also attracts a VHS tape, which is covered on one side with iron oxide. Try to see if the magnet is able to raise small nails through a piece of paper or thin plastic.

Using chicken wire



If you can not get better wire, use a piece of wire taken from old chicken wire-netting (which is used for chicken runs). Unwind it until you have a meter. It takes a long time, but it is not difficult.
It doesn't matter if the wire is rusty.

Of course, the wire has many bends. Pull it tightly to straighten it. Wrap a strip of paper around the nail. (This is called 'insulation'. The paper prevents the electricity that comes from the battery from going into the nail. But if you are using plastic-covered wire you do not need paper.

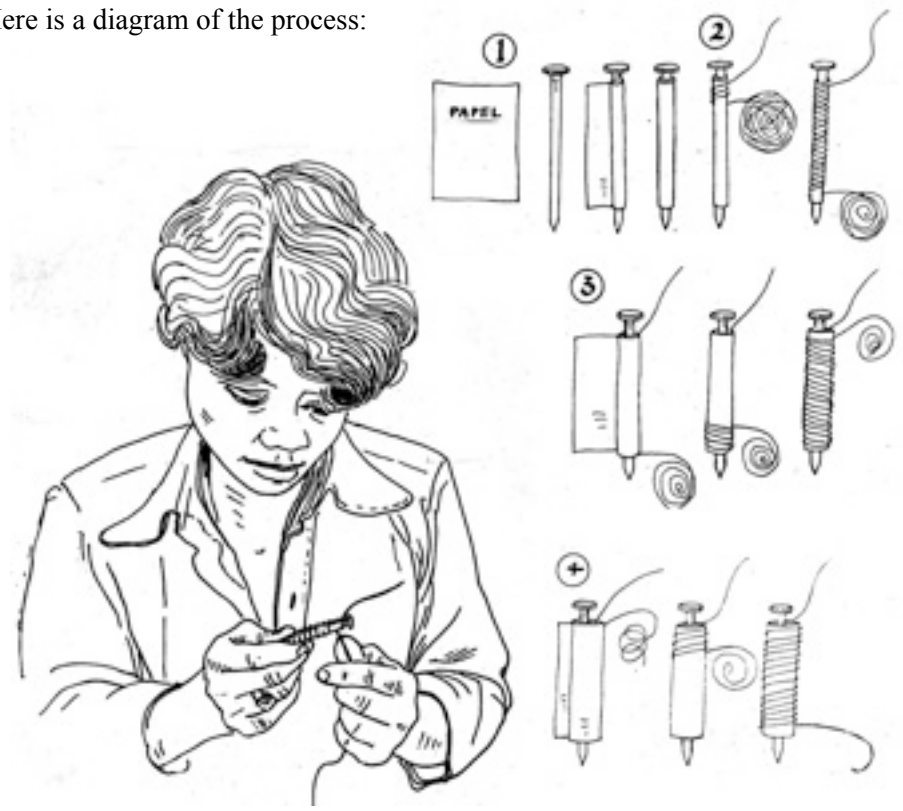
Then wrap the wire around the nail. If you are using wire without insulation, the turns of the wire should not touch. If they touch, the electricity will go directly from one loop of wire to the other without going around the nail.

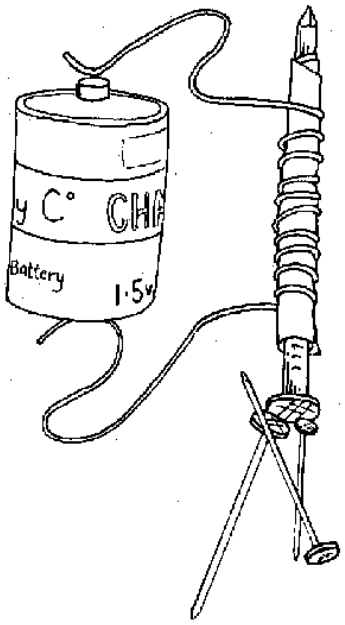
Leave the end of the wire sticking out out ten or more centimetres, because you will connect it a battery.

To make the magnet stronger, put another layer of paper on the first coil and continue winding another layer of wire. Wind the wire in the same direction and make sure that the paper is wide enough to prevent the second layer of wire from touching the first layer.

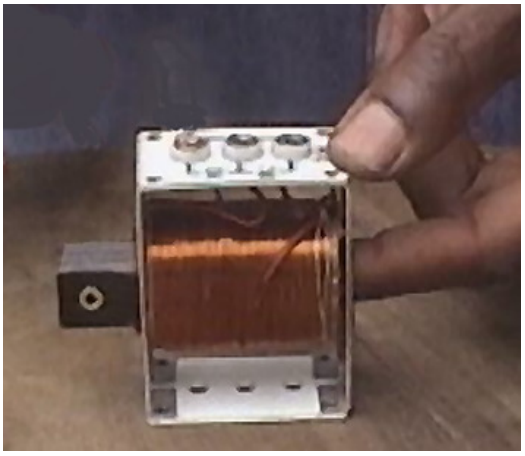
If you still have enough wire, put on a third layer of paper and wind coils on top of the second layer.

Here is a diagram of the process:





Stronger Electromagnets



The picture shows an industrial electromagnet as is used in schools to show to students. It has 600 turns of enamelled wire, and instead of a nail, has a rectangular block of iron. It works best with 12 volts, so for this we use a car battery. It can raise a dozen large nails.

A small batterery has only 1.5 Volts and makes only weak magnets

So we made a very strong electromagnet in the form of a 'U'.

Fold a piece of iron that masons use to reinforce concrete. (It is very difficult to bend.) We made this one into a 'U' and then wound it with thick

electrical cable.(The type of wire that is used to connect electric lights at home.) We connected it to a car battery. This is a very strong magnet and can lift ten pounds.

The picture shows children using the magnet.

The idea of doing it in the form of a 'U' is to bring together the two poles, so that it has dual power.

Some permanent magnets are bent to bring their poles N and S together for the same reason. Sometimes this type of magnet is used as an icon to represent a magnet.

For example, you can see this on the packet of a VHS tape, which means 'No magnets!' because magnetism is able to destroy the images on magnetic tape.

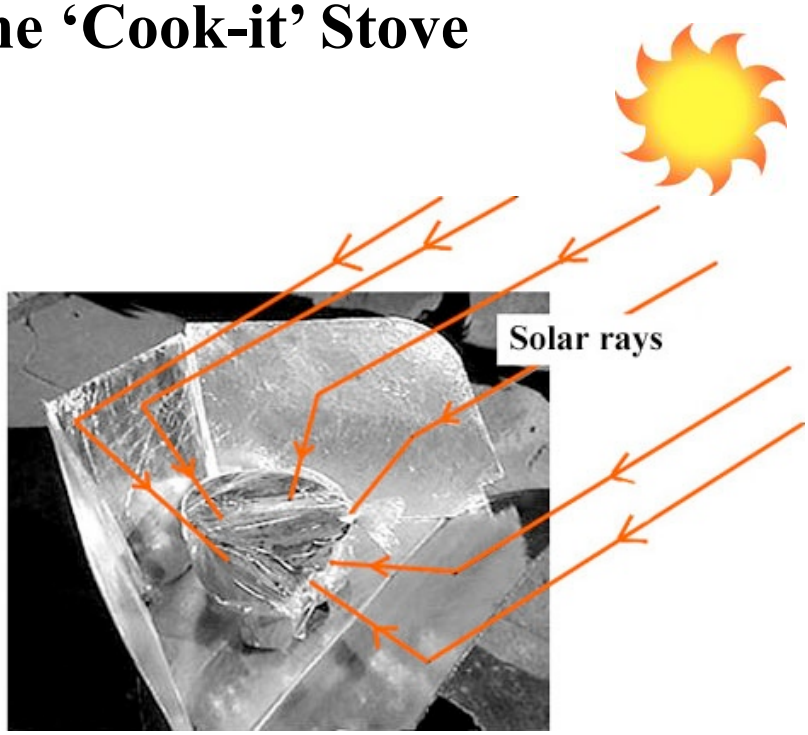
Technical terms:

The turns of wire of an electromagnet are called the 'coil'. The iron in the middle is called the 'core'. The magnetic influence is called 'magnetism' and the area where there is magnetism is the 'magnetic field'. The paint (or plastic) on the wire is 'insulation'.

The Solar Cooker - The ‘Cook-it’ Stove

In the following sections, we explain what a solar cooker is, how it works, how such stoves are made and how our little Spark group made and demonstrated one. We also explain the advantages of using solar cookers for families and the benefits for the country, and how the use of solar cookers should be spread throughout the country.

The sun emits rays of light and heat. By means of mirrors (reflectors) we can concentrate these rays onto a saucepan.



A 'Cookit' is a stove in the form of a box that uses the sun to cook. Many use mirrors to direct sunlight onto a black pot.
They are not mirrors of glass. They consist of aluminum foil glued to cardboard. Of course, the Cookit must face the sun and should be reoriented to the sun every half hour as the sun moves.
It is advisable to put the saucepan in a transparent plastic bag. The plastic does not impede the sun's rays but keeps the heat in and the wind does not chill it.
After being used, the Cookit can be disassembled (folded) to take up less room, and stored at home.

The Cookit that the pictures show takes two or three hours to cook the curry in a pot about half full.
Many countries in Africa use solar cookers, but they are not well known in Mozambique.
The Cookit is more efficient in the provinces where there is more sun, such as Tete and Pemba. But it works well in other provinces such as Maputo, when the sun is shining brightly. It does not work well on cloudy days. In the days when the sun does not shine, you must go back to using firewood.

The photo shows Cookit stoves in Ethiopia, built by women.

When the sun is shining brightly, the Cookit can be used so as not to spend money on firewood, charcoal, oil, electricity, etc..

The Cookit cooks slowly. To cook a fish curry (a pot half full) takes three hours. Starting at 10.00 am, the curry will be ready at approximately 13:00 hours, depending on the intensity of the sun.
Cooking rice takes two hours. Of course, to cook two saucepans at the same time, you need two Cookits. They are cheap to make.

The best pans are aluminum since they conduct heat better. They must be black outside (including lids). Typically, the pans used on the ordinary wood or coal stove become black because of the smoke.

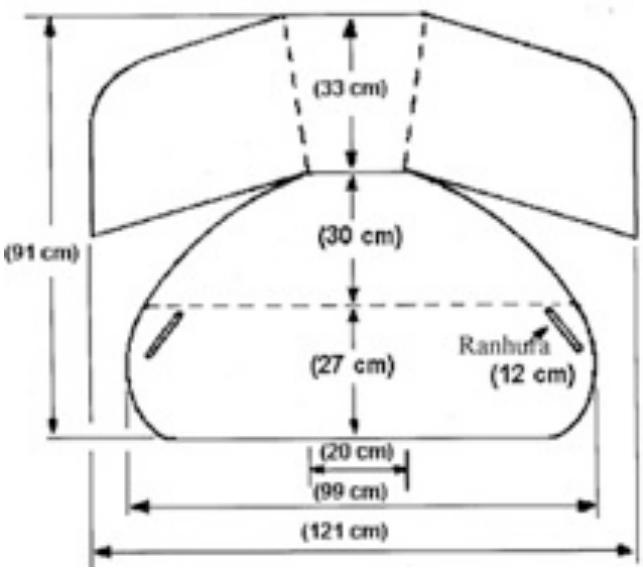
The overall simplicity of the solar cooker, its powerful cooking power and its low cost means that solar cooking can be brought to a huge amount of people.
It is suitable for cooking many types of food, and for teaching the basics of solar energy.

Construction:

Start with a large piece of cardboard, measuring 1m x 1.33m. Cut and fold it as shown in the diagram.

The angles and folds are indicated, but small variations can be made.
To make straight folds in cardboard, first make a crease along the fold line with a blunt object such as a spoon handle. Then fold against a firm straight surface.

Make the slots a bit smaller and narrower than the tabs to be fitted so that they are securely fastened to the front panel.



Glue aluminum foil on the areas that form the inside surfaces when the stove is ready to cook.
To install, lay it down with the shiny side up. Fold up the front and rear ends and fit the corners in the slots at the front.
And you're ready to cook!
Put your food in a black pot. Then place the pot inside a plastic bag.

This 'cooking bag' will help to keep the heat in). Then close the the bag

and place it in the center of your stove on three stones.
The stove must always be oriented towards the sun.


The food is ready!

<The image shows eight stoves used by a family in Kenya.

The food's ready! >>

To see more examples of solar stoves, go to:

http://solarcooking.org/

on the Internet.

Introduction to the Mobile Telephone

Millions of people worldwide use mobile phones.

The penetration of mobile telephony in Mozambique is still considered a little weak. It is estimated that there are 3.3 million users in the country that have access to a cellphone.

Mobile phones provide an incredible array of functions and new handsets are released at an accelerated rate. Depending on your phone model, you can:

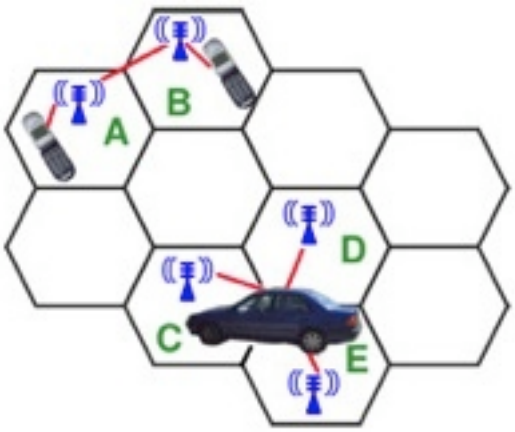
store contact information;
make lists of tasks;
schedule appointments and set reminders;
use the built-in calculator for simple calculations;
send or receive e-mail;
Obtain information (news, entertainment, stock quotes) from the Internet;
play games;
send text messages;
Integrate other devices such as PDAs, MP3 players and GPS receivers.

The Operation of a Mobile

One of the most interesting things about the cell phone is that it is actually a radio - an extremely sophisticated radio.

In the times"before cell phones, people who really needed mobile communication, installed radio telephones in their cars. In the radio-telephone system, there was a central antenna per city, and perhaps 25 channels available on that tower. This central antenna meant that the phone in your car needed a powerful transmitter - big enough to transmit for about 70 km. It also meant that few people could use radio telephones - there were not enough channels.

The genius of the cellular system is the division of a city into small cells. This allows extensive frequency re-use across a city, so that millions of people can use cell phones simultaneously.



In a typical cell phone, your service provider receives about 800 frequencies to use across the city. The carrier chops up the city into cells. Each cell is typically divided into about 26 square kilometers. The cells are usually seen as hexagons on a big hexagonal grid like this:

Because mobile phones and base stations use the same low power transmitter, the same frequencies can be used in non-adjacent cells. The two purple cells can reuse the same frequency.

Each cell has a base station that consists of a tower and a small building containing radio equipment. When you make a call with your cell phone, it emits radio waves (also known as radiofrequency energy or "RF"). These radio waves are received by the antenna of a base station nearby.

The base station consists of one or more radio transmitters and radio receivers and radio antennae that communicate with individual cellular phones in the area. When the base station receives radio waves from mobile phones, it transmits them to another point (called a "switch", which routes the call to another base station or the fixed line network, depending on the type of call made.

The base stations are located in strategic areas, known as "cells." If they are well placed, the base stations allow reuse of the available radio frequency in other cells, thus allowing the network to process more calls. This also means that the base station must operate at low power levels so there is no interference with other base stations in the area.

The infrastructure for a base station is often located on towers, roofs of buildings, or existing structures. The first photo shows one of the base stations which are seen on the streets. The other is a hidden antenna.

Sometimes the towers are camouflaged as trees.

The interior of a cell phone

Cell phones are some of the most complex devices that people use day-to-day. Modern digital cell phones can process millions of calculations per second to compress and decompress your voice.

The parts of a cell phone
If you take a cell phone apart, you will discover that it contains only a few individual parts. A “circuit board” contains the "brain" of the phone. The circuit board is the heart of the system. This is a Nokia digital phone. >

It has a microphone, a speaker and a battery. It is amazing how the phone reproduces good quality sounds through speakers and microphones so tiny.

The “SIM card” is used to identify, manage and store data from cell phones. The name is an acronym SIM for "Subscriber Identity Module". < The picture shows the SIM removed from the phone

What is surprising is that all this functionality, only 30 years ago, would have occupied an entire floor of an office building and now fits into a package that fits comfortably in the palm of your hand!

(A part of this article was copied from the website:

http://electronics.howstuffworks.com/cell-phone.htm))

Consult the page to learn more.

The popular term "flying saucer" was created in the 1940's to define a flying object that looked like a saucer.

The shapes of such objects are reported to have diversified since then, but the term flying saucer is still used to refer to a flying object which is assumed to be non-terrestrial.

The existence of flying saucers is not officially recognized by most government officials from around the world, but many witnesses claim to have seen them.

The number of recorded sightings is certainly considerable. It is assumed that these flying objects may have extraterrestrial origin, mainly because of the extraordinary and impressive maneuverability of them is absolutely incomparable to the equipment currently produced by human beings, whether of military or civilian use.

UFO is an acronym for "Unidentified Flying Object '.


Uma das supostas evidências de OVNIS mais famosas, foto tirada em 31 de Julho de 1952, Nova Jérsei, Estados Unidos.

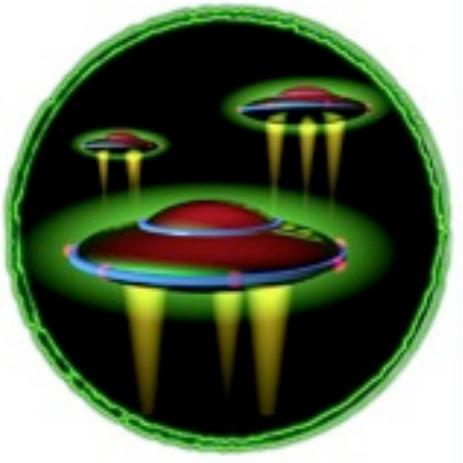
Examples of objects often mistaken for flying saucers are: emergency beacons, weather balloons, Chinese lanterns, meteorites entering the atmosphere, or disc-shaped clouds. etc

Due to difficulties in obtaining reliable data, research in "UFO-ology" is not a recognized science,. No scientific study done by qualified researchers has shown a result that does not have a mundane explanation.

To try to interpret the most diverse phenomena related to UFOs, a listing of more commonly accepted theories among ufologists were set up.

In them there are different schools of thought, from sceptical (believing the whole phenomenon is a misrepresentation or a fraud) to the mystical or spiritual in character.

Hypotheses involving the objective existence of UFOs.



These hypotheses speculate that the phenomenon is real and physical, rather than the mind of the beholder.

The extraterrestrial hypothesis (ETH) theorizes that some UFO sightings are alien spacecraft.

The hypothesis of advanced human aircraft

This is the theory that all or at least some UFO sightings are experimental aircraft, advanced or secret, of earthly origin.
There is a theory that secret groups developing these aircraft in the U.S. have encouraged the idea of "alien spacecraft" to divert attention from their activities.

The Outer Hypothesis has two meanings:
That some UFO sightings are alien spacecraft that came from a parallel dimension or something similar, or are human aircraft from the future.

One theory, related to the psychosocial hypothesis, is that angelic manifestations, and other demonic supernatural manifestations over the centuries were caused by aliens trying to control mankind, and that some UFOs are part of that process.

The natural explanation hypothesis. This is the theory that most UFO sightings are due to poorly perceived natural phenomena such as ball lightning or delusions.

Psychosocial Hypothesis. This is the theory that some UFO sightings are hallucinations, hypnotic suggestions or fantasies and are caused by the same mechanism as that of many occult experiences, paranormal, supernatural or religious (compare alleged sightings of the Virgin Mary).

The behavior of these fantasies can be influenced by the environment in which the alleged witness grew up: fairy tales and religion, science fiction etc: for example, an alleged witness may see fairies when another sees 'little green men' or “Greys”.

According to Ufology, 'Greys' are extraterrestrial beings that have as main feature a height generally small (something like 1.30 meters), usually have a skin color ranging from gray to almond, large, dark eyes, thin lips and minimal nostrils, body very disproportionate to the size of the head, as well as being stunted, skinny, delicate, arising from the alien spacecraft that they drive.

Fraud. Many of the alleged sightings of UFOs are actually scams.