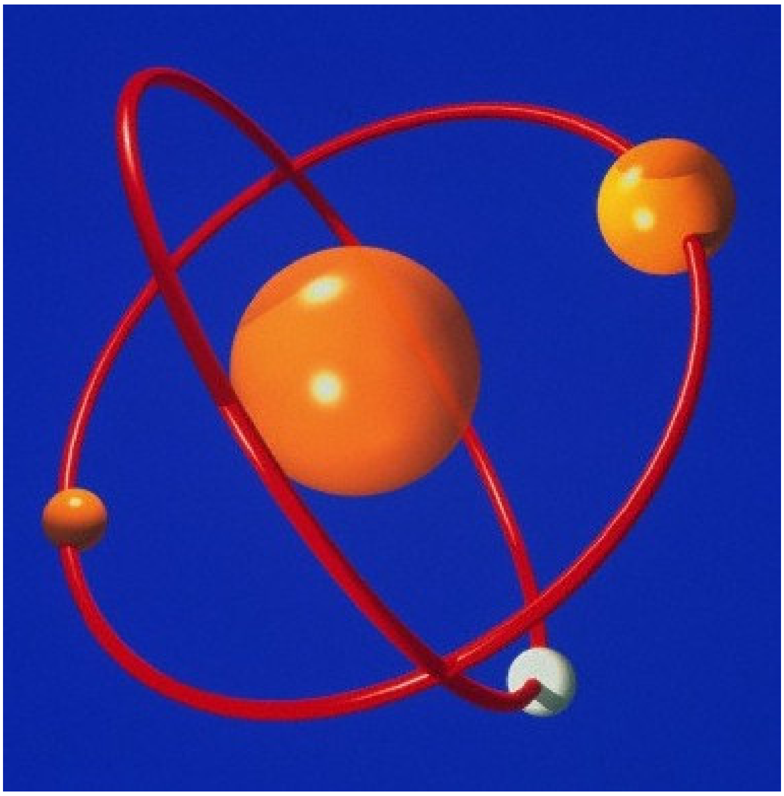
Energy projects



SOAPKIDZ

"BECAUSE it's pure magic when kids and nature meet"

Booklet compiled from www.energyquest.ca.gov

Table of Contents:

1. Hot, hotter, hottest

Some colours and materials are better at reflecting the heat of the sun than others

What do you need?

1. Four zip lock bags
2. Water
3. White, orange and black paper
4. Aluminium foil
5. Thermometer
6. Paper and pen

What to do?

1. Fill the four plastic bags with water and seal them tightly.
2. Place the bags outside in a sunny spot.
3. Wrap one bag in the white sheet, one in the orange sheet, one in the black sheet and one in the aluminium foil
4. Predict what effect the different wrappings will have on how the sun's energy heats the water in each bag. Which will be the warmest? Which will be the coolest?
5. Use a thermometer, measure the temperature of the water in each bag after an hour. Were your predictions correct?

What you'll discover!

When light hits a black object, all of the light is absorbed and none is reflected. When light hits a white object, all the light is reflected. This is why black objects get hotter in the sun than white objects

2. Heat Sheet

Conductors lead the heat in this activity

What do you need?

1. Paper
2. Scissors
3. Aluminium foil
4. Two Thermometer
5. Paper and pen

What to do?

1. Cut the strip of paper about 16 cm long and 5 cm wide.
2. Cut a strip of aluminium foil the same size.
3. Wrap about 2 cm of the paper around the bulb of a thermometer.
4. Wrap about 2 cm of the aluminium foil around the bulb of another thermometer.
5. Find a windowsill that has an area in the shade and an area in the sun. Put the two thermometers on the windowsill so that the thermometers are completely in the shade but the ends of the paper and aluminium foil are in the sun.
6. Record the starting temperatures for both thermometers. Then record the temperatures every few minutes.

What you'll discover!

The thermometer with the foil heated to a higher temperature because the aluminium is a good conductor of heat. Energy from the sunlight heated the aluminium foil and paper. Aluminium is a good conductor of heat, so it transferred much of the heat to the thermometer. Paper is a poor conductor of heat, so it transferred little of the heat to the thermometer

3. Peanut Power

Use the energy in a peanut to heat water!
Just about everything has potential energy stored in it. The problem is releasing that energy to be able to do some work.

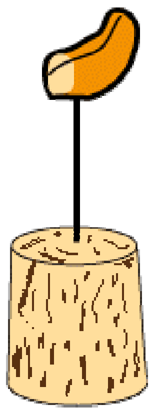
A tiny peanut contains stored chemical energy. When we eat them, the stored energy is converted by our bodies so we can do work. We can also use the energy in a peanut to heat a container of water.

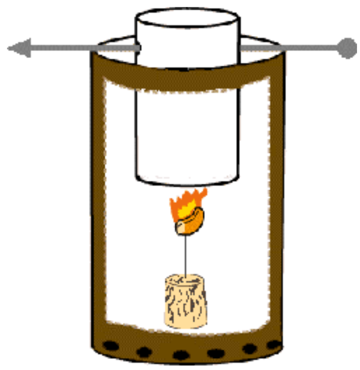
What do you need?

1. A small bag/can of unsalted, shelled peanuts
2. A cork
3. A needle
4. A large metal juice or coffee can
5. A small metal can (like a soup can) with paper label removed
6. A can opener
7. A hammer
8. A large nail
9. A metal BBQ skewer (like the kind for kebobs)
10. About a cup of water
11. A thermometer
12. Some matches or a lighter **(ask an adult for help here)**
13. A piece of paper and pencil to record your observations

What to do?

1. Carefully push the eye of the needle into the smaller end of the cork.
2. Then gently push the pointed end of the needle into a peanut. If you push too hard the peanut will break. If it does, use another peanut. It's also better to have the peanut at a slight angle.
3. Remove the two ends of the large juice can with the can opener. Be careful as the top's and bottom's edge can be sharp!
4. Using the hammer and nail, have an adult punch holes around the bottom of the large can. These are air holes that will make the can act like a chimney and will contain the heat energy focussing it on the smaller can.





5. Remove the top end of the small can (if it is not already removed). Using the hammer and nail, punch two holes near the top of the small can exactly opposite each other.
6. Slide the BBQ skewer through the holes of the small can.
7. Pour 1/2 cup of water into the small can and let it sit for an hour. This will allow the water to be heated or cooled to room temperature. (Munch on some peanuts while you're waiting.) Put the thermometer into the water and record the temperature on your paper
8. Place the cork and peanut on a nonflammable surface. Light the peanut with a match or lighter. **Have an adult help you!** Sometimes the peanut can be difficult to light, so the lighter may be easier to use.

What you'll discover!

The chemical energy stored in the peanut was released and converted into heat energy. The heat energy raised the temperature of the water in the small can.

Try a couple of other experiments using different kinds of peanuts or other kinds of nuts. Try:

- Raw peanuts
- Dry roasted peanuts
- Vacuum-packed peanuts
- Freeze-dried peanuts
- Try cashew nuts, Brazil nuts, pecans, walnuts or other kinds of nuts. (Do they contain more energy than the peanut? Why or why not?)

You might want to try more than one peanut. You'll need extra needles. Use four or five peanuts to heat the water. Is the temperature four or five times higher?

Energy is measured in a unit called the Btu, which stands for British thermal unit. A Btu is the amount of heat required to raise the temperature of one pound of water by one degree Fahrenheit. Using math, you can figure out how many Btu are in the one peanut. (The plural or Btu is still Btu, not Btus.)

First you'll need to find out how heavy 1/2 cup of water is. Use a small scale and weigh the small can with nothing in it. Then weigh the can with 1/2 cup of water in it. That will tell you how much the water weighs.

Then, knowing how hot the water was, how many degrees its temperature was raised, you can figure out roughly how many Btu are in the peanut.

(**PLEASE NOTE**: This will be an *approximate* figure because the entire peanut will not be completely burned...there is still some chemical energy left inside the partially burned peanut. In order to measure the heat energy exactly, you would need to use a sophisticated piece of machinery called a "calorimeter".)

For example: If the water weighed four ounces (1/4 of a pound), one Btu would raise the water temperature 4 degrees Fahrenheit. So, **if** your water temperature increased by 10 degrees (70 degrees at room temperature to 80 degrees), 10 divided by 4 would mean the peanut contained approximately 2.5 Btu. *This is only an example of the math and will not be the same as your calculations.*

One Btu equals approximately:

- One blue-tip kitchen match
- 0.252 kilogram Calories (food calories)

1000 Btu equal approximately:

- One average candy bar (252 kilogram Calories)
- One hour of bicycling
- 4/5 of a peanut butter and jelly sandwich

NOTE: You may see Btu defined as 252 calories. These are *International Table* calories which are equal to 1000 of the "Calories" or "kilocalories" we use for measuring food energy.

4. Battery Life – A Science Experiment

Which battery lasts the longest out of four different brands, Duracell, Energizer, Eveready and Rayovac?

What do you need?

1. Four of the same type, size and brand flashlights.
2. Two D-size batteries from each of the following brands:
   - Duracell
   - Energizer
   - Eveready
   - Rayovac
3. Two other D-size batteries to test each flashlight and bulb before starting tests.

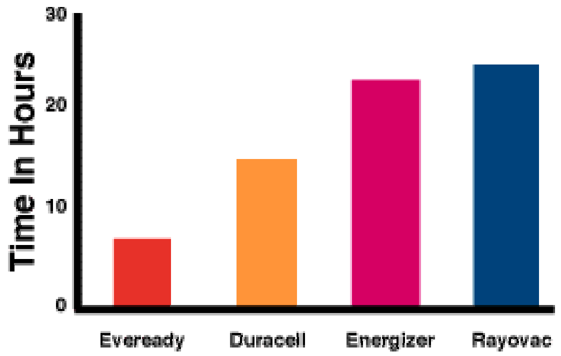
What to do?

We tested each of the flashlights by using the two test batteries. We then labelled each flashlight with the battery brand name and put the different batteries in each marked flashlight.

Before going to bed we will turn on all the flashlights at the same time and left them on overnight. We'll note down the time that the flashlights were turned on. When we wake up we will watch the flashlights until they go out and will record the time. If one goes out before we wake up, we will get two more of the same type of battery and watch it during the day.

What you'll discover!

Our experiment showed that Rayovac outlasted all of the other batteries we tested by at more than two hours. The Eveready battery, which is a regular, non-alkaline battery, lasted only 6 hours and 35 minutes. The Duracell lasted 15 hours. The Energizer lasted 22 hours and 15 minutes. The Rayovac lasted 24-1/2 hours.



The Eveready was the only non-alkaline battery. We observed that when it was going dead, it got very dim. The alkaline batteries just went out completely.

We came to the conclusion that even though batteries may be more expensive (like the Duracell was), you might not be paying for a better battery.

We do suggest that further testing be done, due to a few errors made during the experiment. Some flashlights were accidentally dropped, which could have caused differences in the results. Some batteries may not have been as "fresh" as the newer ones.

5. Electromagnet

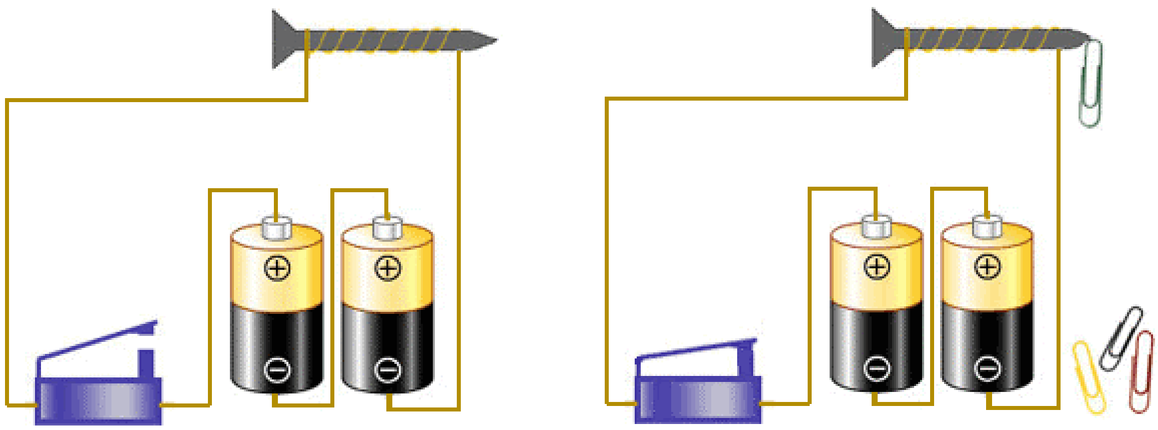
Here's an "attractive" project; create a magnet using electricity!

What do you need?

1. Thin wire
2. A long nail = 10p is a good size (10P = 10-penny - 3-inches, the size of the nail *)
3. Two 1.5 volt D-cell batteries, **AND/OR** a 12-volt lantern battery
4. Wire cutter
5. Masking tape
6. A "knife" switch – you should be able to find this in a hobby shop, electronic supply or a hardware store. Get a DC (direct current) switch **
7. Electrical tape
8. Some paper clips

What to do?

1. Wrap the wire that has been stripped bare very tightly around the nail - at least 50 times. Cut the wire leaving a few inches of wire at each end.
2. Tape down the end of the wire from the top of the nail to the negative pole of the battery. Make sure the wire is touching the battery end.
3. Open the knife switch and connect the wire from the bottom end of the nail to the terminal on the knife switch.



4. Cut another short piece of wire and tape the wire to the positive pole of the battery.
5. connect the wire from the battery to other terminals on the knife switch.
6. Close the circuit by closing the knife switch. When you do that, you create a circuit of electricity that passes through the wire round around the nail.
7. Touch the point of the nail to a couple of paper clips and watch what happens.

What you'll discover!

When the electric current passes through the wire round around the nail, it creates a magnetic field that reaches out in expanding circles. When a wire carrying electricity is twisted into a coil, it is called a solenoid. The magnetic field twists with the coiled wire, causing the magnetic field lines to concentrate inside the coil. This creates a powerful magnetic effect inside the coil called an electromagnet.

The magnetic field inside the coil causes the tiny magnetic fields in the metal of the nail to be aligned in one direction (all the north poles point the same way). These little fields all pointing in the same direction add to the coil and make the magnet strong enough to pick up some objects.

How many paper clips can you pick up by the electromagnet? What would happen if you used two batteries and connected them together (make sure you connect the positive to the negative poles if you're using the two batteries)? Try to see how many paper clips you can pick up. Now, try using the nine-volt battery. (Connect the positive and negative terminals like on the regular batteries.) How many paper clips can you pick up? Is there any relationship between the voltage of the batteries and the number of clips you can pick up?

6. Lemon Power

What to do with a lemon besides making lemonade?
Project to Make a Battery From a Lemon

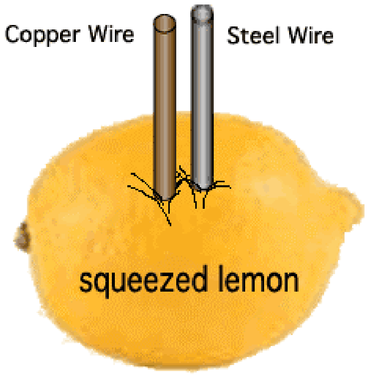
What do you need?

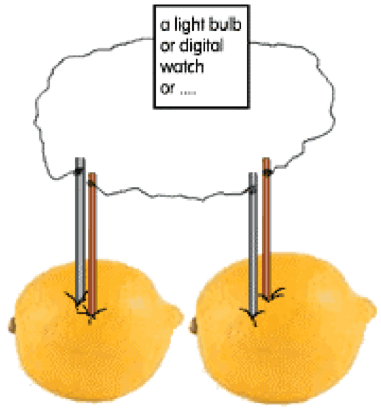
1. 18-gauge copper wire (smaller gauge will work too, but 18-gauge is stiffer)
2. Wire clippers
3. Steel paper clip (Some people find that a 2-inch strip of zinc works better)
4. Sheet of coarse sandpaper
5. Lemon
6. Help from an older friend or an adult

What to do?

1. Have your older friend or an adult strip 2 inches of insulation off the copper wire. Clip the 2 inches of bare wire with the clippers.
2. Straighten out the paper clip and cut about 2 inches of the straightened steel wire, or use a 2-inch piece or strip of zinc.
3. Use sandpaper to smooth any rough spots on the ends of the wire and paper clip or piece of zinc.
4. Squeeze the lemon gently with your hands. But don't rupture the lemon's skin. Rolling it on a table with a little pressure works great.
5. Push the pieces of the paper clip and the wire into the lemon so they are as close together as you can get them without touching.
6. Moisten your tongue with saliva. Touch the tip of your wet tongue to the free ends of the two wires.

You should be able to feel a slight tingle on the tip of your tongue and taste something metallic.





What you'll discover!

The lemon battery is called a **voltaic battery**, which changes chemical energy into electrical energy.

The battery is made up of two different metals (the steel paper clip and the copper wire). These are called **electrodes**, which are the parts of a battery where electric current enters or leaves the battery. The electrodes are placed in a liquid containing an **electrolyte**, which is a solution that can conduct electricity.

In a solution of water and an electrolyte, like the acid in the lemon, an excess of electrons collects on one end of the electrodes. At the same time, electrons are lost from the other electrode.

Touching the electrodes to your tongue closes the circuit and allows an small electric current to flow. A single lemon produces about 7/10 of a volt of electricity. If you connected two lemons together, you can power an inexpensive digital watch (uses about 1.5 volts). (Use a length of thin, flexible wire to connect the silver wire of one lemon to the copper wire of the other lemon. Then attach thin wires from the other two wires in the lemons to where a battery's positive and negative poles connect to power the watch.)

The tingle felt in your tongue and the metallic taste is due to the movement of electrons through the saliva on your tongue.

Note About Lemon Energy

We've had some students do this project and then try to use the lemon "battery" to light a small flashlight's light bulb. The lemons did not work. Why? The reason is that the lemons produce only a very small current (about one milliamp). This is not enough electric current to light the bulb. Even with multiple lemons, the amount of current flowing through the wire is not enough. Though the voltage is high enough (1.5 volts with two lemons), the current is too weak. But it was a great experiment! Even if an experiment doesn't work, it helps us to understand how things work. Good work!!!

7. Light by Friction

Excite the electrons…Create static electricity!

What do you need?

1. A piece of Saran Wrap or clear plastic wrap
2. A piece of fake fur (we don't use real fur)
3. A piece of wool
4. A piece of cotton
5. A piece of other types of cloth
6. A fluorescent lighting tube (an old one will do)

What to do?

1. In a dark room, hold the tube carefully in one hand and hold the piece of material in the other. Rub the fluorescent tube up and down vigorously with the saran wrap. Watch what happens.
2. Try this again and again with the other pieces of fur and cloth. Watch what happens.

What you'll discover!

A fluorescent tube will glow when there is an electric field inside the glass. Normally this occurs when a current of electricity is passed through the tube when a wall switch is turn on. The electric field causes some electrons to separate from the nuclei of the gas. When the electrons fall back into their regular places, they cause the tube to glow. This is called a "ground state."

When you rub up and down with each of the pieces or cloth, fur or plastic, you create static electricity. This static electrical field excites the electrons.

Does the tube glow brighter when a different material? Why do you think this is? Warning: the electricity being generated is not dangerous. But be VERY careful with the fluorescent tube. If dropped, you could get cut with broken glass. Also, fluorescent lights contain small amounts of mercury, so if it does break, put on a pair of disposable gloves, clean up the pieces with a damp paper towel, and seal everything in a plastic bag or in a container, such as an old margarine tub. The bagged pieces should be brought to a hazardous waste site or bulb collection site.

8. Make your own Lightning!

Getting a Charge out of the "Sky"!

In a storm cloud, the moving air makes tiny water droplets and ice rub together so they become charged with static electricity. The positive electrical charges float up near the top of the cloud and the larger ones, with negative charges, stay near the bottom. This separation of electrical charges is very unstable and lightning is the way the charges are equalized or become balanced.

What do you need?

Method 1

1. A large iron or steel pot (not aluminum) with a plastic handle.
2. Rubber gloves.
3. An iron or steel fork.
4. A plastic sheet (a dry-cleaner garment bag is good source).

Method 2

1. Inflated balloons.
2. Wool clothing - like a wool sweater - or a piece of real fur **(No, don't use your pet!)**.
3. A metal surface like a filing cabinet or a metal door knob.

What to do?

Method 1

1. Tape the plastic sheet to a table top.
2. Put on the rubber gloves.
3. Darken the room as much as possible.
4. Hold the large iron pot or pan by its insulating handle and rub the pan vigorously to and fro on the plastic sheet.
5. Holding the fork firmly in the other hand, bring its prongs slowly near the rim. When the gap between pot and fork is small, a tiny spark should jump across (A darker room will help you see the spark more clearly).

Method 2

1. Inflate balloons.
2. Darken the room as much as possible.
3. Rub the balloon(s) rapidly against a wool sweater or a piece or real fur about ten times or more.
4. Move the balloon close to something metal like a filing cabinet or a door knob.

What you'll discover!

Method 1

It is as though the pan is the **thundercloud,** the fork is the **lighting rod** and you are the **Earth's surface.**

Method 2

The balloon is being used to create static electricity. The flash or spark that jumps from the balloon to the metal object is like lighting, though much, much smaller in scale.
Please note: The humidity in the air can affect static electricity. If the air is damp, such as during the winter, then this experiment may not work.

9. Electricity: Open and Short Circuits

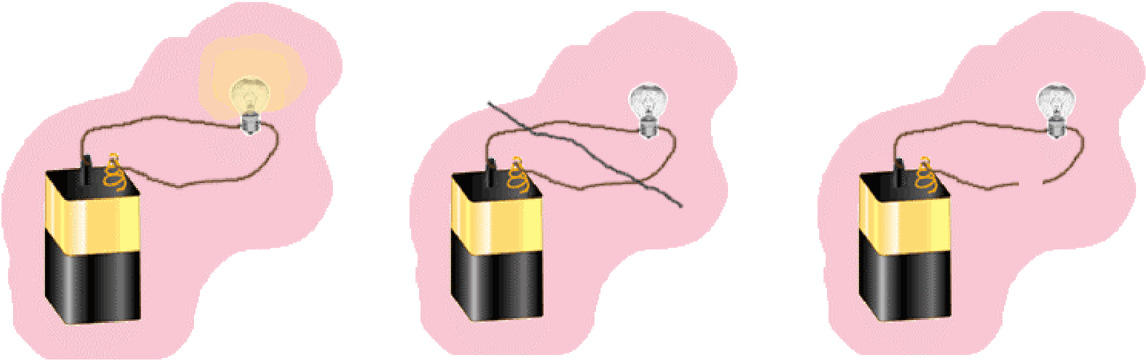
Does the "short circuit" mean the electricity takes a shorter course?

What do you need?

1. Lantern battery - DO NOT USE ANYTHING HIGHER THAN A NINE-VOLT BATTERY
2. Small light bulb/lamp or small motor
3. Wire to connect battery and lamp terminal (bare wire, not plastics or rubber covered)
4. Wire clippers

What to do?

1. Cut three pieces of wire.
2. Connect the wires from the battery terminals to the lamp terminals - lamp or motor will light up or run.



3. Take third piece of bare wire and drop across the two bare wires leading between the terminals - notice what happens. The lamp or motor should go out or stop.
4. Take the third wire that was laying across the other two wires. Take the wire clippers and cut one of the wires leading from the battery to one of the lamp terminals. The lamp or motor should also go out or stop.

What you'll discover!

When the third piece of wire was dropped across the two wires leading to and from the lamp, the wire created a "short circuit." This doesn't mean the electricity took a shorter course, it just took an easier path.
When you cut the wire with the clippers, you created an "open" circuit. If you placed a switch on this wire... you would create the same type of circuit you have with any electric light.

10. Making a Rheostat!

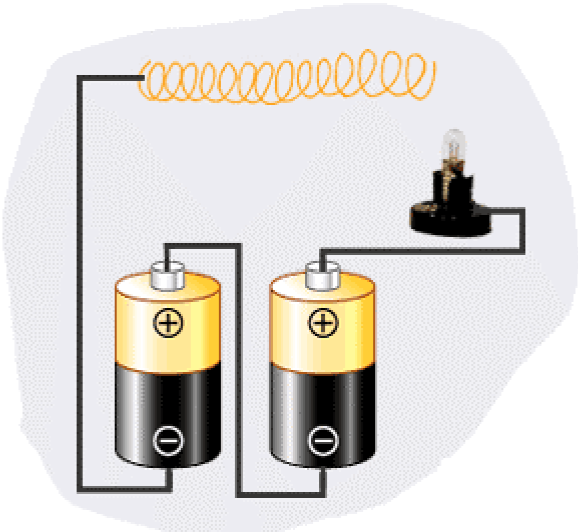
A small device that controls the voltage flow by dial or knob.

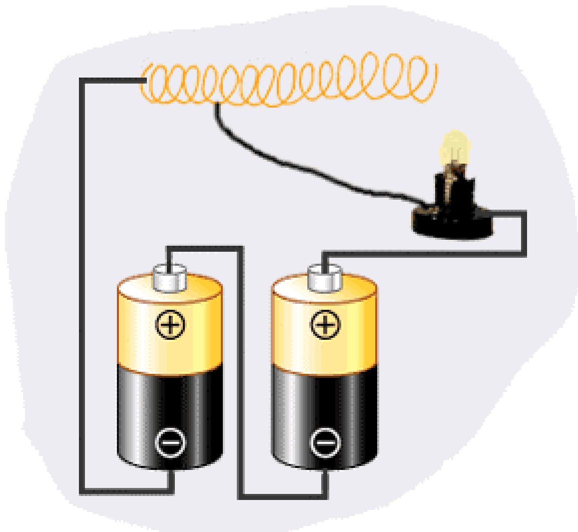
What do you need?

1. A flashlight bulb and socket
2. Two "D" cell batteries or a dry cell lantern battery
3. About 16 inches of wire
4. A piece of wire about 2 inches long
5. A long, long spring -- the spring from a inside w roll up window will work great. You'll need to break open the wooden section that the shade rolls up on to get to the spring. Ask an adult to help you get this spring out.
6. Pair of wire clippers

What to do?

1. Connect the two batteries so the positive pole connects to the negative pole of the other battery.
2. Cut the 16 inch wire in half and attach each piece to the open end of the joined batteries.
3. Connect the free end of one wire to one terminal of the light socket.
4. Connect the other free wire to one end of the spring.





5. Connect the two-inch long wire to the other terminal of the light socket.
6. Connect the wire coming off the terminal to the end of the end where the other wire is. Watch how brightly the bulb glows.
7. Now slowly move the short wire down the length of the spring. What happens?

What you'll discover!

As you go further away from the end where the wire is attached to the spring, the light will get dimmer and dimmer. The steel wire in the spring is not a very good conductor of electricity. The more wire the electricity has to pass through the more resistance there is and the less electricity. What you've made is called a rheostat. This is a device to vary the amount of a current passing through it to complete a circuit.

11. Geothermal Power Plant Model

Make a model of a power plant that uses steam!

WARNING: DO NOT THIS ATTEMPT ALONE!
YOU'LL NEED AN ADULT TO ASSIST YOU IN THIS PROJECT!

What do you need?

1. Child's pinwheel
2. Aluminium foil
3. Empty soup can or similar sized tin can with one end cut off
4. A wooden ruler
5. Small cooking pot
6. Hot plate
7. Hammer
8. 10p nail
9. Tape or rubber bands
10. Mitten type of pot holder

What to do?

1. Take hammer and nail and carefully punch a hole in the end of the tin can near the edge. Punch another whole directly across the top from it. The two holes should not be bigger than 1/8 inch across.
2. Tape or attach the ruler to can with rubber bands.
3. Put water into the pot and cover the top of the pot with two layers of tin foil. Tightly crimp the tin foil around the edges so it seals the top tightly.
4. Using the nail, punch a hole in the top of the tin foil cover in the very center about 1/16 inch across. Put covered pot to side.
5. Put the pot onto the hot plate and bring to a boil.
6. Put on the mitten pot holder, and when steam starts coming out of the top, carefully hold the pinwheel over the one hole. Notice how fast the wheel spins.
7. Take the can on the ruler and place it on the top of the pot so that the hole is in the center of the open end of the can. Steam should now be coming out of the top of the can through the two holes.
8. Carefully hold the pinwheel. Turn the pinwheel so that the holes are on opposite sides of the pinwheel. Notice how fast the pinwheel turns.
9. Take pot off the hot plate and let cool. Carefully take off the tin foil, add more water to the pot and put tin foil top back on. Take the nail and poke lots of holes all over the tin foil. Punch 5 holes close to the edge away from the center hole, repeat the experiment with ten holes around the edge, 20 holes around the edge.
10. Bring the pot back up to boiling. Hold the pinwheel over only the one center hole. How much steam do you see? How fast is the pinwheel turning?

What you'll discover!

With one hole the pinwheel, how fast did the pinwheel turn? With the can making the steam hit the wheel equally on either side, what happened? When you punched more holes in the tin foil what happened?

In a geothermal power plant, steam is used to turn a turbine. The turbine is attached to a generator to make electricity. There are two places in the world where natural steam is found under ground and is used to make electricity. One is in Italy. The other is north of San Francisco in an area called The Geysers. The Geysers produces enough energy to power a city of about one million people. But in recent years, the amount of steam produced by the area has decreased. Some people think that it's because there are too many "holes" in the ground like the pot cover with 20 holes. It's like having a soda with 20 straws in it and all of your friends and you sipping at the same time. The soda glass will be drained VERY fast. That's what some people think is happening to the Geysers…that it's running out of steam.

12. Hydro Power I

The force of water!

What do you need?

1. Half gallon paper milk carton (empty and washed out)
2. Gallon of water
3. Awl or 10p nail
4. Masking tape
5. Ruler
6. Magic marker
7. Pair of scissors
8. Pad of paper and pencil to make notes

Do this experiment over a sink.

What to do?

1. Cut off the top of the milk carton.
2. From the bottom of the milk carton, measure up 1/2 inch and using the awl or 10p nail punch a single hole in the center of the side of the carton
3. Measure up one inch from the bottom and punch another hole in the center.
4. Measure up two inches from the bottom and punch a third hole directly above the other two holes.
5. Measure up four inches from the bottom and punch a final hole in the center of the side.
   NOTE: All holes should be the same size.
6. Take a long piece of tape and tape up all four of the holes.
7. Put the carton on the edge of the sink with the side with the holes pointing toward the sink.
8. Mark a line on the carton near the top. Always fill or refill the milk carton with water to that line.

9. Quickly remove the tape that's covering all the four holes. Watch what happens. Measure how far away each of the steams hits the sink.
10. Let all the water empty out. Watch what happens as the water level drops. What happens to the steams of water?
11. Now tape up all holes. Put the carton back on the sink edge. Refill the carton and remove the bottom tape. Measure how far out the stream goes. Retape the hole, and untape the next hole up; measure how far away the stream goes. Refill the carton with water. Retape the second hole and untape the third hole; measure how far away the stream goes. Refill the carton with water to the same level as before. Retape the third hole and untape the fourth hole; measure how far away the stream goes.

What you'll discover!

How far away did the streams of water fall from the carton. Was there a difference between the stream from the water from hole the bottom than at the top?

Here's why? Water has weight. The closer to the bottom of the carton, the more water is above and the more weight is pressing down from above. The more weight, the more water pressure. And the more water pressure, the further away the stream will go and the faster it will go.

Hydroelectric facilities are built at the base of dams to take advantage of the high pressure of the water at the bottom of a reservoir. The water pressure is funneled through a tunnel through the dam called a penstock. The water then is focussed on the blades of a turbine. Water pressure of the water turns the turbine, and the turbine turns a generator making electricity.

13. H_2O Electrolysis

Splitting water!

Electricity is "created" when certain chemicals react together. We use chemically-made electricity to power many machines from flashlights to a watch or sometimes a car. Yes, there are cars that run on electricity! The devices that store electricity are called batteries. Electricity can also be used to produce chemical changes.

Water is a simple chemical made from two gases -- hydrogen and oxygen. Every molecule of water has two atoms of hydrogen for every atom of oxygen. **H_2O** is the chemical formula for a molecule of water.

If an electrical current is passed through water between electrodes (the positive and minus poles of a battery), the water is split into its two parts: oxygen and hydrogen. This process is called electrolysis and is used in industry in many ways, such as making metals like aluminium. If one of the electrodes is a metal, it will become covered or **plated** with any metal in the solution. This is how objects are **silver plated.**

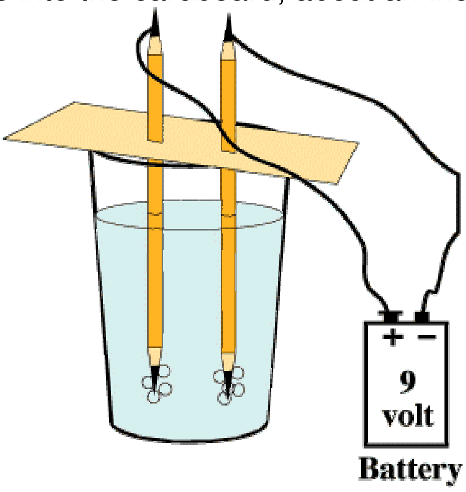
You can use electricity to split hydrogen gas out of the water similar to the process called electrolysis.
Try This!

What do you need?

1. A 9 volt battery
2. Two regular number 2 pencils (remove eraser and metal part on the ends)
3. Salt
4. Thin cardboard
5. Electrical wire
6. Small glass
7. Water

What to do?

1. Sharpen each pencil at both ends.
2. Cut the cardboard to fit over glass.
3. Push the two pencils into the cardboard, about an inch apart.



4. Dissolve about a teaspoon of salt into the warm water and let sit for a while. The salt helps conduct the electricity better in the water.
5. Using one piece of the electrical wire, connect one end on the positive side of the battery and the other to the black graphite (the "lead" of the pencil) at the top of the sharpened pencil. Do the same for the negative side connecting it to the second pencil top.
6. Place the other two ends of the pencil into the salted water.

What you'll discover!

As the electricity from the battery passes through and between the electrodes (the pencils), the water splits into hydrogen and **chlorine** gas, which collect as **very** tiny bubbles around each pencil tip.

Hydrogen collects around the cathode and the chlorine gas collects around the anode.

How can you get chlorine from H2O? Good question! Sometimes in experiments, a secondary reaction takes place. This is what happens in this experiment.

Oxygen is not given off in this experiment. That's because the oxygen atoms from the water combine in the liquid with the salt to form hydroxyl ions. Salt's chemical formula is NaCl - sodium chloride. The chlorine gas is from the chloride in the salt. The oxygen in the hydroxl ions stay in the solution. So, what is released in this reaction is not oxygen but is chlorine gas that collects around the pencil tip. Around the other pencil is hydrogen gas.

In real electrolysis systems, a different solution is used, and higher levels of electricity help to split the water molecules into hydrogen and oxygen without this secondary reaction.

14. Steamboat Power

Making a Steam-Powered "Rocket Boat"

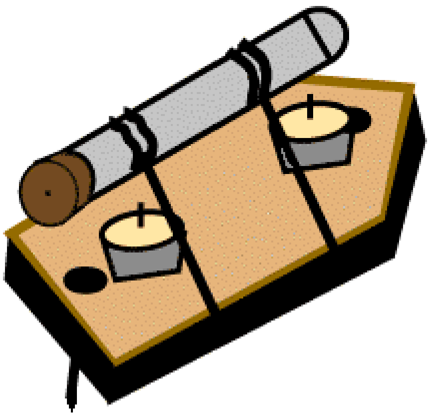
What do you need?

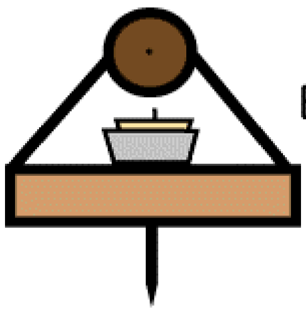
1. Metal tube (a cigar tube works great -- ask an adult to get you one)
2. Two pieces of strong, stiff wire (like clothes hanger wire) about 18-inches long
3. Cork that fits snuggly into the end of the tube
4. Two food warmer candles (in metal cups)
5. Balsa wood (4 inch by 8 inch, 1/2-inch thick)
6. Masking tape
7. Hammer and three nails
8. Matches

You'll need an adult's help with the matches and the hammer and nails!

What to do?

1. Put the cork into the end of the metal tube making sure its very tight. Carefully poke a hole through the cork with a nail.
2. Take the two 18-inch lengths of wire. Wrap the wire around metal tube about one-inch from each end of the tube, and twist the wire tightly with the pliers so the tube is firmly held by the wire and won't slide.
3. Cut a boat shape out of the balsa wood, making a triangle bow at one end. Hammer two large nails in each end about one inch in from each end. The nails will help to stabilize.





4. Mount the two candles about 1-1/2 inches from each end of the wood. Use loops of masking tape to stick the metal cups to the wood.

5. Take the tube with the wire and mount the tube so the wire will hold the tube just above the candles. Wrap the ends of the wire around and under the board and twist the ends neatly on the underside. (See picture.)
6. Carefully remove the cork from the tube and fill the tube about three-quarters full with very hot water. Tightly replace the cork. Make sure water will drip out the hole in the tube.
7. Fill up a bathtub or a large sink with water.
8. Put your boat in the water and ask an adult to carefully light the candles.

What you'll discover!

The heat of the candle will cause the water in the tube to boil. The water will change to steam and the steam will escape out the hole in the cork pushing the boat forward in the water.

Here are some questions to think about:
1. Why use hot water in the tube?
2. What would happen if you used cold water?
3. What would happen if you didn't put a hole in the cork (**DON'T TRY THIS!**)?
4. What would happen if the hole in the cork were larger?

What's Happening?

There are two different things to learn here.

A rocket works the same way. Hot gases and fire come out of the motor of a rocket. The gases coming out the nozzle at the bottom of the rocket come out in one direction. These escaping gases push the rocket in the opposite direction.

Second, energy from the candles changes the water into a gas (water vapor or steam). The steam can escape. Steam is used in a lot of energy power plants.

15. Make a Turbine

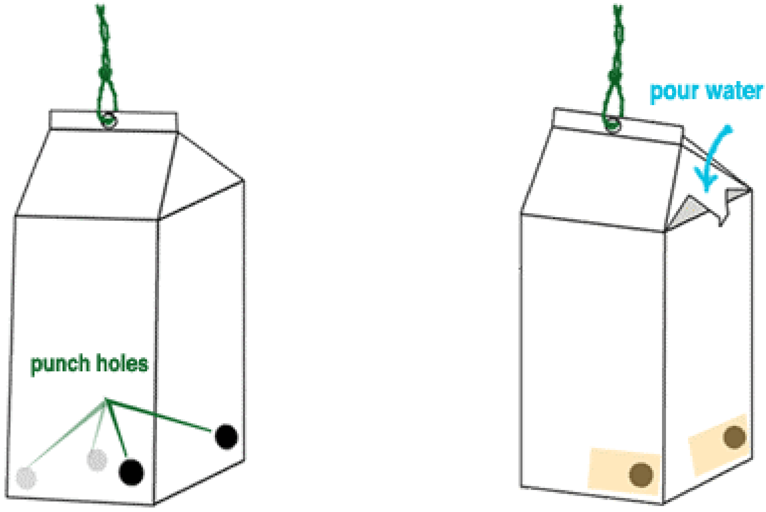
For every action there is an equal and opposite reaction!

What do you need?
1. A quart or half gallon milk carton
2. String
3. A nail
4. Water in another larger container
5. Masking tape

What to do?

1. Using the nail, punch a hole in the bottom right corner of each side of the milk carton.
2. Punch another hole exactly in the middle of the top section of the carton

3. Push the string through the top hole of the carton and tie securely so the carton will hang from the string.
4. Tape up each hole with masking tape.



5. Go outside and hang the carton from a low tree branch or another place when the carton can hang freely and you won't mind if the ground gets wet underneath.
6. Fill the carton with water.
7. Pull off the tape on one corner. Watch what happens.
8. Pull off the tape on two corners opposite each other. Watch what happens.
9. Pull off the tape on all corners and watch what happens.

What you'll discover!

Sir Isaac Newton discovered the principle that for every action there is an equal and opposite reaction. This is called his Third Law The water pours our of the small hole and its force pushes the carton in the opposite direction. This is what makes it turn. The more holes there are, the faster the carton turns.

This is similar to some turbines. Some turbines use water or steam that is forced a high speed through many small holes to turn a turbine around. The turbine is connected by a shaft to an electrical generator, which makes electricity when it is turned.

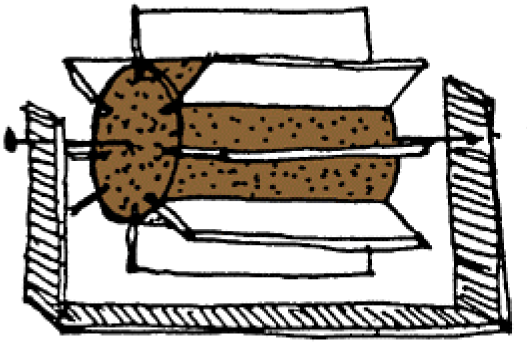
16. Hydro power II

Experiment with Water to Produce Energy

Water is a renewable resource that is an important source of electricity in California and the Northwest. The potential energy of water is harnessed to produce mechanical energy which can be used directly, or used to generate electricity.

Moving Water -- Moving Blades

You can make a small water turbine model by taping cardboard strips on a cork. Put pins in the ends for axles and make a U-shaped holder for it. You can also slip metal or plastic fins into the slits made in the cork. This will turn as fast as the water stream is moving, so generally turbines have high speed jets directed toward them.



An Overshot Waterwheel

This model is like the old waterwheels used for grinding grain or running machines. Great power and slow speed were needed to turn the heavy grinding stones at an even speed.

This device could use a relatively small stream. It is the weight of the water in the buckets that causes the wheel to overbalance and turn. You can equip your wheel with a string and bucket and find out how much weight the mechanism can lift.

17. Nuclear Chain Reaction!

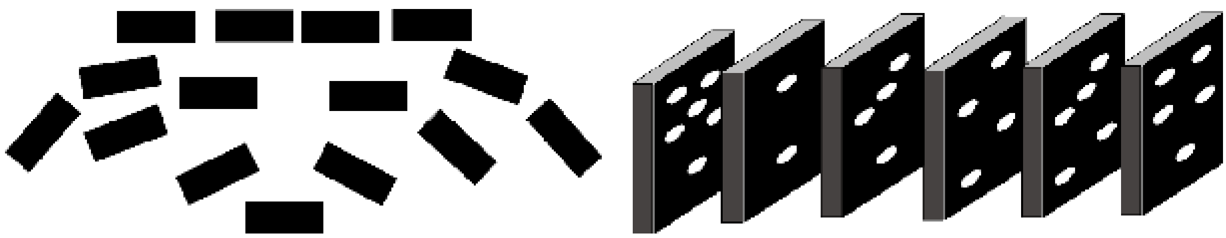
Demonstrate chain reaction!

What do you need?

1. Bunch of dominos
2. Ruler
3. Flat table that doesn't shake

What to do?

1. Arrange the dominos in the pattern shown.
2. On another section of the table, arrange two straight lines of dominos.
3. Knock over the single domino in front on the first pattern. Watch what happens.



4. Now, knock over the first domino in one of the two straight lines.
5. Take the ruler and hold it anywhere between the dominos lined up in the second straight line. Knock over the first domino and watch what happens. Not all the dominos fell over.

What you'll discover!

In a nuclear fission reaction in a nuclear power plant, the radioactive element Uranium-235 is used in a chain reaction.

The fission of U-235 splits off two neutrons, which in turn strike two U-235 atoms.

Two neutrons are split from each of the two U-235 atoms. Each of these neutrons then go on to strike another U-235 atom. Each of those atoms are split releasing two neutrons, which go on and hit more Uranium atoms.

The chain reaction continues on and on, getting bigger and bigger with each split.

The things that slow down a chain reaction are the control rods. A control rod is made up of cadmium or boron, which absorb neutrons. If you insert the control rod between the uranium atoms, the amount of neutrons available to cause more splits is reduced.

In the second line up of dominos, the ruler served as a control rod. Putting it between two dominos breaks the chain reaction similar to what happens in a nuclear reactor.

18. Plants help keep a House Cool!

Using shade trees to keep your home cool.

What do you need?

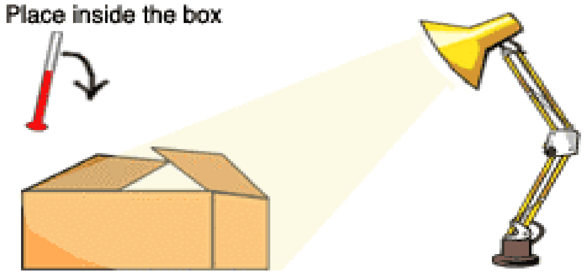
1. Two shoe boxes or small cardboard boxes
2. A reflector lamp with a one-hundred watt incandescent light bulb in it (you can also use the sun instead of a lamp)
3. Various types of plants in pots — small bonsai trees would work OK if you have one -- ask your folks first before using any of their plants.
4. Two good thermometers to measure air temperature. If you have a digital thermometer that measures inside temperature with an external sensor to measure outside temperature, that would work great!
5. Small can of black or dark-colour paint and small can of white paint

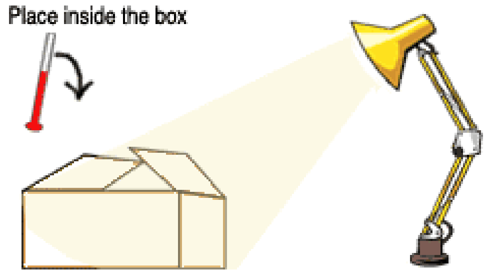
What to do?

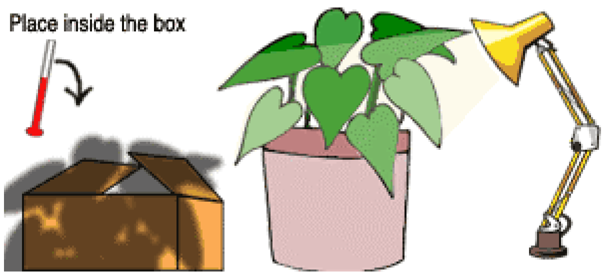
This experiment is done in three steps. First you'll want to see if shading your "house" will keep it cooler. Then you'll want to see if painting the "house" different colors outside affects the temperature inside. Third you can combine the colored houses with or without shading.

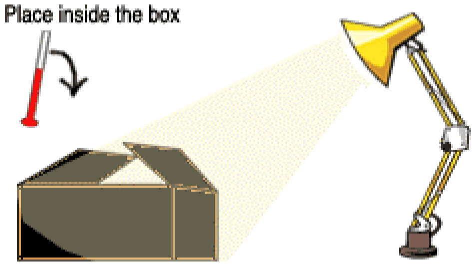
Step 1

1. Take both boxes and place them an equal distance from the lamp so that both of them get the same amount of light hitting them.
2. Put the thermometers inside the boxes.
3. Place plants between the lamp and one of the boxes so that the shadows cast by the plants cover most of the entire "house."
4. Turn on the lamp.
5. Measure the air temperature in each over a period of time. Which box has a higher temperature? Does the temperature change? Subtract or add plants…do the number of plants change the temperature of the shaded "house?"







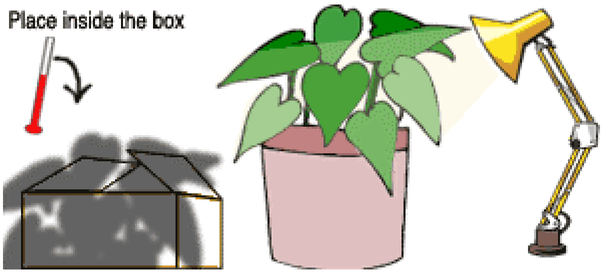


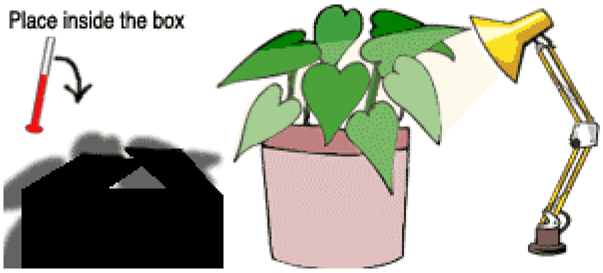
Step 2

1. Paint one of the boxes white and the other box black
2. Put both boxes and place them an equal distance from the lamp so that both of them get the same amount of light hitting them.
3. Put the thermometers inside the boxes.
4. Turn on the lamp.
5. Measure the air temperature in each over a period of time. Which box has a higher temperature? Does the temperature change?

Step 3

1. Place plants between the lamp and one of the boxes so that the shadows cast by the plants cover most of the entire "house."
2. Turn on the lamp.
3. Measure the air temperature in each over a period of time. Which box has a higher temperature? Does the temperature change? Subtract or add plants or change the house they are in front of. Which house stays the coolest?





What you'll discover!

Plants can act as a shades to block sunlight and help us keep our homes cooler. In the summer time a tree with leaves will shade the home, decreasing the amount of sunlight striking the house, keeping it cooler. In the winter, when a tree drops it's leaves, the sunlight is allowed to hit the home to assist in keeping it warm.

The color your home (and especially the roof) is painted can have an impact on heating and cooling it. Light colors will reflect the sunlight. Dark colors will absorb more sunlight. So, if you paint a house light colors or have a light-colored roof, the house will stay cooler in the summer.

19. Heat Produced from Light Bulbs

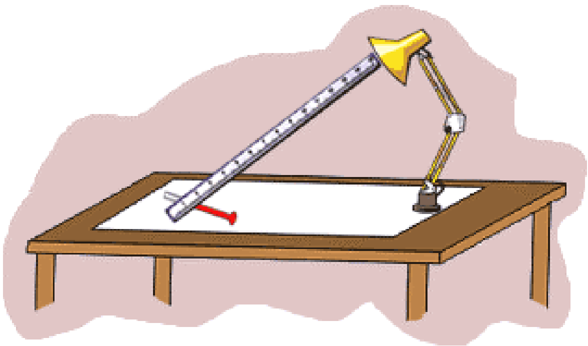
Increase the wattage, increase the heat.

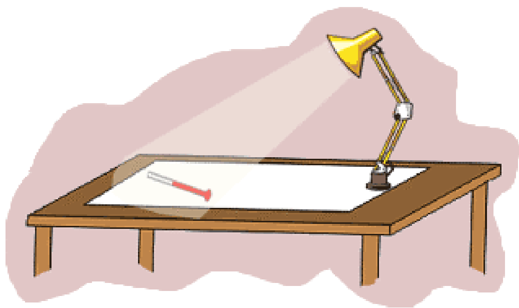
What do you need?

1. A goose-neck style lamp.
2. An extension cord.
3. Different wattage of incandescent light bulbs - 25 watt, 40 watt, 60 watt, 75 watt, 100 watt, 150 watt.
4. Compact Fluorescent light bulbs - 7 watt, 23 watt - They are expensive; so shop around for ones that don't cost so much.
5. Thermometer.
6. A ruler or yard stick to measure distance from the thermometer to the light bulb.
7. A white towel.
8. A watch or stop watch to measure the time.
9. A piece of paper and pencil to record your observations.

What to do?

1. Put the towel on a flat table. Put the goose neck lamp on the end of the towel on the table
2. Put the thermometer under the light of the lamp and measure the distance from the bulb.
3. Make sure the lamp is unplugged and screw in the smallest wattage light bulb





4. Measure the temperature and write down the start temperature
5. Angle lamp over thermometer and turn on lamp.
6. Leave lamp shining on the thermometer for at least five minutes
7. Start watch and at the end of five minutes read the temperature and mark down what the final temperature is.

Repeat the steps above with each different light bulb.

- Allow the lamp and desk to cool for half an hour between each bulb.
- Do not unscrew the light bulb right after turning off the lamp as the bulb may be hot and can burn you.
- Unplug the lamp before changing the bulb.
- Make sure the distance between the thermometer and the light bulb is the same for each different bulb. The thermometer should be in the same spot.
- The starting temperature for thermometer should be about the same for each light bulb.

What you'll discover!

Incandescent lights give off heat as well as light energy. The higher the wattage of the light bulb the higher the temperature. A compact fluorescent bulb gives off very little heat energy because they do not use resistance and cause a light to glow hot.

In a home or office, lots of incandescent lights means that the air conditioner would have to use more energy during the summer to remove the extra heat given off by lights. Also, some lights such as torchieres, can be very dangerous as the bulbs are rated at 300 watts or more and get VERY hot. They can catch drapes or other materials on fire if you're not careful.

20. Insulation

What materials make the best insulation?

What do you need?

1. Down jacket
2. Gloves/mittens
3. Cotton sock
4. Wool sock
5. Other types of cloth or clothing
6. Plastic foam
7. Dirt
8. Large piece of paper
9. Aluminum foil
10. Leaves
11. Fiberglass insulation material (ask your parents if there is any extra around! Use gloves to handle so the fiberglass doesn't irritate your skin.)
12. Baby food jars with lids -- one for each of the different materials you'll be checking.
13. Large board to place all your items on -- a large tray will work too!
14. A gallon jug of water or hot water (don't scald yourself) from a sink.
15. A good thermometer
16. A note book and pencil

Do this experiment over a sink.

What to do?

1. On a page in the notebook, list all of the different items you'll be testing.
2. Quickly fill all the baby jars with hot water from the jug.
3. Measure the temperature of the water in each jar then screw on the lid. Record the temperature of each jar. They should all be the same temperature.
4. Wrap or surround each of the jars in one of the materials. And place on the tray or board. Leave one jar uncovered as a "control."
5. Carry the board outside where it's colder.
6. After leaving the jars outside for a specific period of time, take off the materials, unscrew the lids and measure the temperature of the water in each jar. Write down the temperature in your notebook next to each item.
7. Compare the differences between the temperatures of each of the jars. Which one(s) kept the water same temperature as before?
8. Try the experiment again, but this time, leave the jars outside longer (one, two, three hours or more). What materials work better. Is there a point where none of the materials works to keep the jars hot?

What you'll discover!

You'll learn that some materials make good insulators. These are the types of materials that we should use to keep a house warm in the winter and cool in the summer. This experiment should also tell us what materials will keep our bodies warm in the winter -- for example would a jacket made of down be better than a jacket made from cotton? Should you switch in the summer because one type of material will help you stay cooler?

21. Meet the Sun

Use a sun puppet or sun mask (see below) for all of the following dialogue.

What do you need?

1. Sun mask / puppet (instructions below)
2. one celery stick,
3. tree branch,
4. toy dinosaur,
5. toy car.

What to do?

"Hello boys and girls. I'm the Sun. I don't want to brag, but I am a very important source of energy."

(Hold up celery)
"Plants don't eat like people do. Instead, they use sunlight for energy to grow and stay alive. If there were no plants, what would animals and people eat? You people certainly need me!"

(Hold up tree branch)
"As a tree grows it stores the sun's energy in its wood. When the wood is burned, it releases the sun's energy as heat and light."

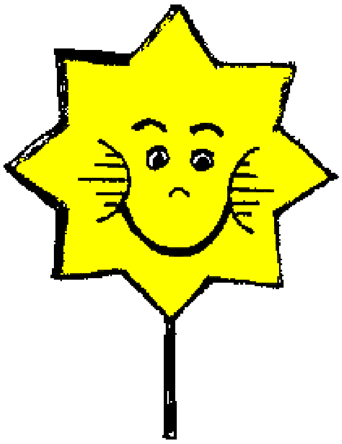
(Hold up dinosaur)
"Long ago, when the dinosaurs were still alive, plants and animals used the sun's energy. When they died, the sun's energy was stored in them. Today some of these old dead plants and animals with the stored sun's energy have changed into coal, oil and natural gas."

(Hold up toy car)
"When we use gasoline in a car we are using very old sun's energy to make the car go!"

"By myself, I can keep you warm and give you light. I can be used to heat your home and heat your water. You must agree that I'm really quite wonderful!"

Make a Sun Mask

1. Glue two pieces of orange construction paper together. (This provides flexibility and strength.)
2. Cut out a sun with a center hole just big enough to fit around your face.
3. This mask should stay around your face without holding it.



Make a Sun Puppet

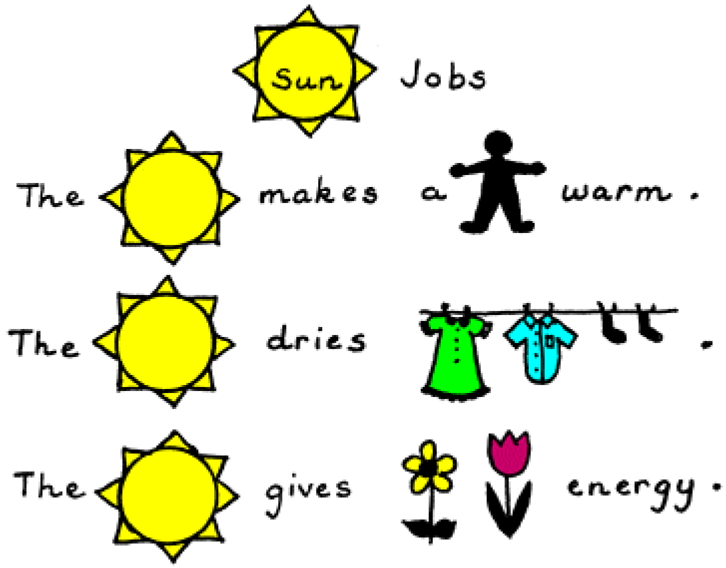
1. Cut two identical sun shapes out of yellow construction paper.
2. Glue the two suns together leaving an unglued sleeve at the bottom that is large enough to insert half the length of a chopstick.
3. Colour a sun face on one or both exposed sides. Store this puppet in a file folder and just insert a chopstick (pencil, ruler, etc.) when ready to use.

Sun Jobs

What jobs does the sun do?

Make a sun jobs chart or book with students.

Below is a sample of how the chart may look with three examples.



22. Solar Hot Dog Cooker

Use the heat off the sun to cook.

This project is for older students or for younger students with adult supervision.

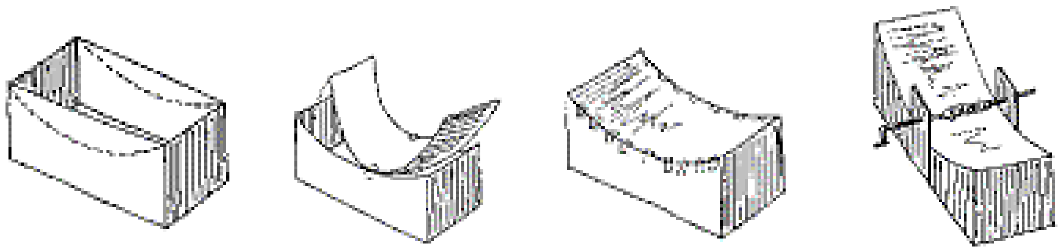
A reflective hot dog cooker can be built from a cardboard box, tin foil, and posterboard. Sunlight hits the reflective surface and focuses on the hot dog held in the center. Students can work in pairs or individually if there are enough materials.

What do you need?

1. A cardboard box
2. tin foil
3. poster board

What to do?

1. Select a long narrow box; the longer the box the more heat collection is possible. Choose a focal length between 5" and 10" and design a parabolic curve as seen in the picture. One template could be used for all the cookers. Trace the curve on the open end of the box so that it is centred and straight.
2. Cut out the curve with a utility knife. Stress the importance of being exact. Measure and cut a piece of poster board that will fix flush against the opening to the box. Attach this with tape beginning at the centre and working toward to edges.
3. Cover the curve with white glue and apply aluminium foil shiny side out. Start in the middle and smooth toward the edges. Try not to wrinkle or fold the foil; you want it as smooth as possible.
4. Use two scraps of cardboard taped to each side as supports. Using the sun or a projector light, test the focal point. There should be a bright spot where light is concentrated; mark this spot and punch a hole for the skewer. Use a section of a coat hanger from which the paint has been removed for a skewer.
5. Enjoy your hot dog!

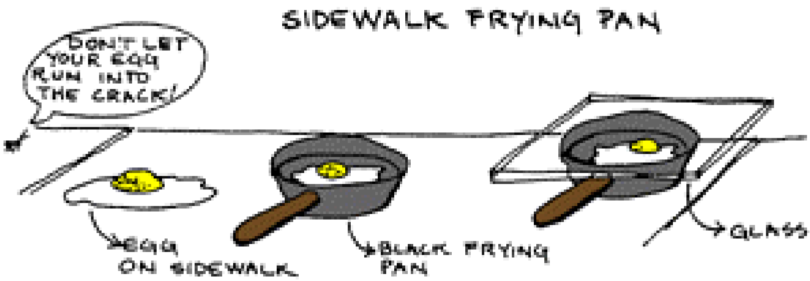


23. Hot enough to Fry an Egg?

You can also use the heat of the sun on a sidewalk or on black asphalt.

What to do?

1. Take three eggs, two black/cast iron frying pans, and one piece of thick glass to cover one of the frying pans.
2. Put one egg directly on the sidewalk, one in the pan without the glass cover, and one in the pan with the cover.
3. Which one do you think will fry the quickest. Make sure you clean up afterwards!



24. Air Power for Transportation

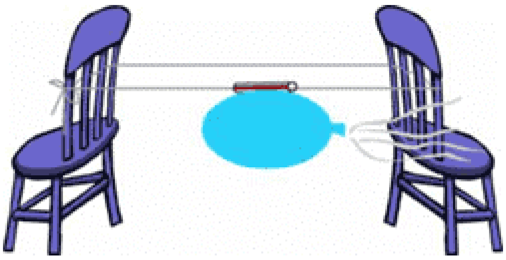
Use the force of the air to propel a vehicle!

What do you need?

1. Balloons of different sizes
2. Masking tape
3. 25 feet of thin fishing line (mono-filament line)
4. Plastic drinking straws (one for each balloon)
5. Some heavy books
6. A 25 foot tape measure
7. A pad of paper and pencil for writing measurements and observations

What to do?

1. Blow up each balloon, holding the end closed with your fingers so it stays full, and have someone else tape a straw to the middle of the balloons. Let the air back out of the balloons.
2. Take the piece of fishing line and stretch it tight between the back of two chairs spaced about 20 feet apart. Leave one end with a bow knot so that you can untie it easily.
3. Put some heavy books on the seats of the chairs to keep them from tipping over.



4. Untie the fishing line and push the line through one of the straws with the front of the balloon facing and bring the balloon and straw back to the other end (the starting line). Retie the string to the chair so the fishing line is tight.
5. Blow up the balloon as much as you can. Pinch off the end. Then let go of the balloon. Measure how far it went along the fishing line.
6. Try another balloon of different sizes, or try the same balloon blowing it 1/2 way full or 1/4 of the way full. Measure how far the balloon travels.
7. Write down each of the balloons type (round, long, small, large) and how much you blew it up (full, 1/2 way, 1/4 full, just a little) and how far each of the balloons traveled.

What you'll discover!

A law of physics says for every action, there is an equal and opposite reaction. The force of the air escaping from the balloon and pushing out the end forced the balloon to travel forward. This is the same principle used in rockets. Yet, instead of air...the rockets use rocket fuel.

The air you blew into the balloon became stored energy. When you released the balloon's end, the stored energy became mechanical energy moving the balloon.

Rather than flying all around the room, the straw and the fishing line kept the balloon traveling in a straight line. What balloons worked best: the long skinny ones or the round ones? What happened when you blew up the balloon only half way or 1/4 of the way?

Do you think air can be used for moving a car? What about moving an astronaut in space? Can you think of other things that compressed air can do?

25. Building a Wind Gauge

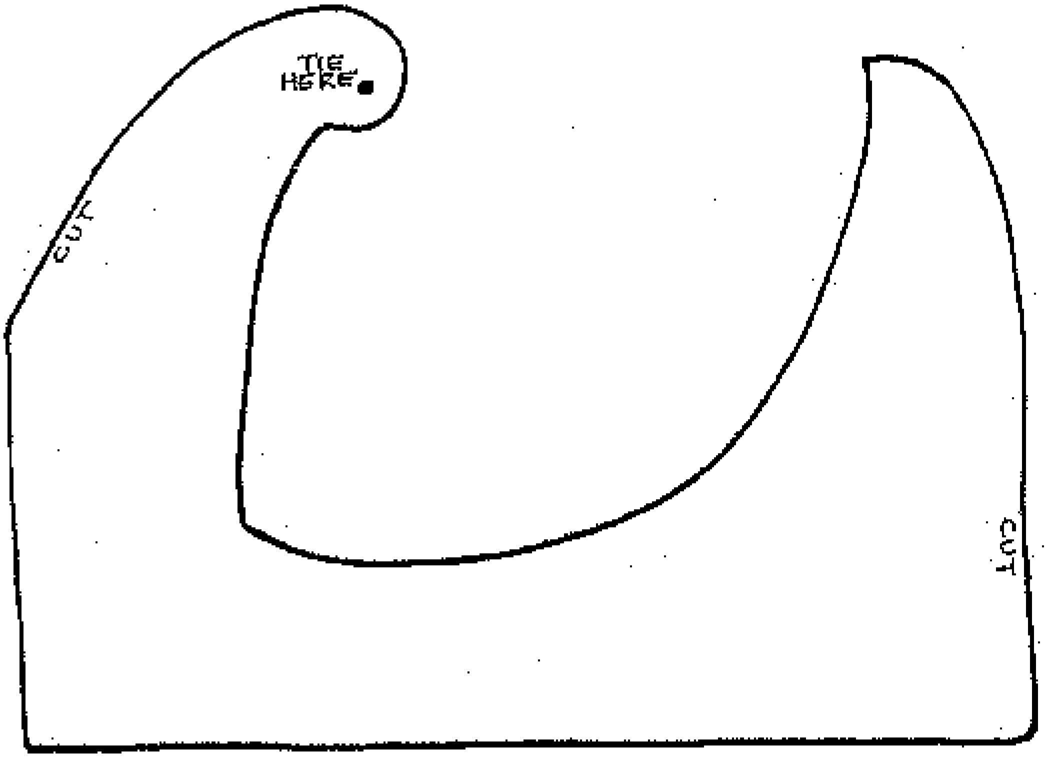
Measure how strong the wind blows.

Here is a simple wind gauge for use in breezes. It will indicate direction and relative speeds. Use the wind gauge to find out where the wind blows strongest. Compare gauge readings. Do obstacles affect wind speeds and direction?

What to do?

1. Print out the pattern using your Internet browser software.
2. Trace the pattern onto cardboard.
3. Cut out the light cardboard wind gauge.
4. Tie thread or string in hole.

5. Move gauge until thread is blowing the same way edge furthest from the string is pointing. This indicates wind direction. Keep pointing the gauge in that direction.
6. Where the thread points along arc indicates a relative velocity. Make marks with a pen along the arc to show how hard the wind is blowing.



Left side toward direction wind is blowing from.

Bottom parallel to ground.

26. Make an Anemometer!

Measure how fast the wind blows.

An anemometer is a device that tells you how fast the wind is blowing. The device you can build is a model of a wind speed indicator. A real one will be able to accurately measure how fast the wind is blowing. Yours will give you only approximation of how fast it's blowing. It can't give you an exact wind speed.

The energy in the moving wind can be used to generate electricity. But you have to know how fast the wind is blowing before you can harness wind power.

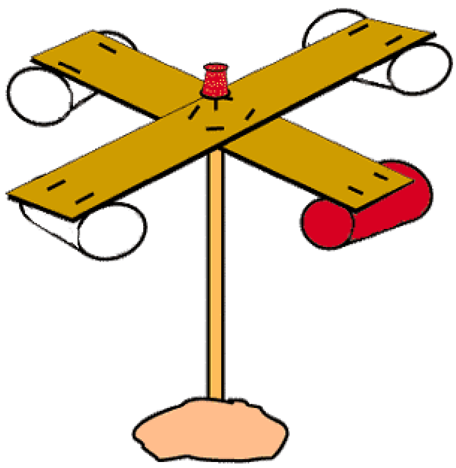
What do you need?

1. Scissors
2. 4 small paper cups (like drinking cups)
3. A marking pen (any colour)
4. 2 strips of stiff, corrugated cardboard -- the same length
5. Ruler
6. Stapler

7. Push pin
8. Sharpened pencil with eraser on the end
9. Modelling clay
10. A watch that shows seconds

What to do?

1. Cut off the rolled edges of the paper cups to make them lighter.
2. Color the outside of one cup with the marking pen.
3. Cross the cardboard strips so they make a plus (+) sign. Staple them together.
4. Take the ruler and pencil and draw lines from the outside corners of where the cardboard strips come together to the opposite corners. Where the pencil lines cross will be the exact middle of the cross.



5. Staple the cups to the ends of the cardboard strips; make sure the cups all face the same direction.
6. Push the pin through the centre of the cardboard (where the pencil lines cross) and attach the cardboard cross with the cups on it to the eraser point of the pencil. Blow on the cups to make sure the cardboard spins around freely on the pin.
7. Place the modelling clay on a surface outside, such as a a porch railing, wooden fence rail, a wall or a rock. Stick the sharpened end of the pencil into the clay so it stands up straight.

What you'll discover!

Measuring Wind Speed

This anemometer cannot tell the wind speed in miles per hour, but it can give you an idea of how fast the wind is blowing.

Using your watch, count the number of times the coloured cup spins around in one minute. You are measuring the wind speed in revolutions (turns) per minute. Weather forecasters' anemometers convert the revolutions per minute into miles per hour (or kilometres per hour). Keep a record of the wind speeds you're measuring for the next few days.

Measure the wind speed at different times of the day. Is it the same in the morning; the afternoon; the evening? Move your anemometer to another location. Is it windier in other places? Do trees or buildings block the wind?

Wind speed is important for wind energy. Wind turbines -- which are the machines that change the movement of the wind into electricity -- need a constant, average wind speed of about 14 miles per hour before the wind turbines can generate electricity. That's why wind farms, where there are a lot of wind turbines grouped together, are located in windy spots. In California, these are in three main places -- the Altamont Pass east of San Francisco, Tehachapi south of Bakersfield, and in San Gorgonio near Palm Springs.

27. Greenhouse Effect

Recreating the Greenhouse effect

The Earth's climate has changed many times in the past. Subtropical forests have spread from the south into more temperate (or milder, cooler climates) areas. Millions of years later, ice sheets spread from the north covering much of the northern United States, Europe and Asia with great glaciers. Today, nearly all scientists believe human beings are changing the climate. How can that be?

Over the past few centuries, people have been burning more amounts of fuels such as wood, coal, oil, natural gas and gasoline. The gases formed by the burning, such as carbon dioxide, are building up in the atmosphere. They act like greenhouse glass. The result, experts believe, is that the Earth heating up and undergoing **global warming**. How can you show the **greenhouse effect?**

What do you need?

1. Two identical glass jars
2. 4 cups cold water
3. 10 ice cubes
4. One clear plastic bag
5. Thermometer

What to do?

1. Take two identical glass jars each containing 2 cups of cold water.
2. Add 5 ice cubes to each jar.
3. Wrap one in a plastic bag (this is the greenhouse glass).
4. Leave both jars in the sun for one hour.
5. Measure the temperature of the water in each jar.

What you'll discover!

In bright sunshine, the air inside a greenhouse becomes warm. The greenhouse glass lets in the sun's light energy and some of its heat energy. This heat builds up inside the greenhouse. You just showed a small **greenhouse effect**. What could happen if this **greenhouse effect** changed the Earth's climate?

Another version of a greenhouse is what happens inside an automobile parked in the sun. The sun's light and heat gets into the vehicle and is trapped inside, like the plastic bag around the jar. The temperature inside a car can get over 120 degrees Fahrenheit (49 degrees Celsius).

28. Make a Thermometer

Watch how a simple thermometer works.
A thermometer is an instrument that measures the temperature. Temperature is measured in a scale called Fahrenheit (by most people in the United States) and in Celsius or Centigrade (used by scientists and by people in many other countries). The point where water freezes is 32 degrees Fahrenheit (F for short) and 0 degrees Celsius (C). The point where water boils is 212 degrees F and 100 degrees C. If you want to know how to convert from F to C or from C to F, **see the end of this booklet**.

Some scientific thermometers use the Kelvin scale, where 0 Kelvin is called **absolute zero** - a place where there is no movement of any parts of matter, where substances have no thermal energy. It's about minus 273.15 degrees C (below 0° C) or 459.67 degrees below 0° F. Scientists have never been able to measure anything at absolute zero, though they have gotten very close.

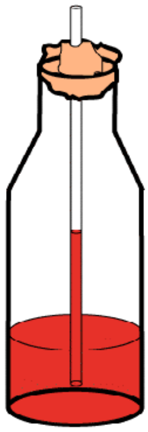
Thermometers help us know what the weather will be like. If it will be 90°F outside, we're not going to put on a winter coat. Or if it's below zero, we won't be wearing shorts. Here's a way to show how a simple thermometer works.

What do you need?

1. Tap water
2. Rubbing alcohol (**do not drink this**)
3. Clear, narrow-necked plastic bottle (11-ounce water bottles work well)
4. Food colouring
5. Clear plastic drinking straw
6. Modelling clay

What to do?

1. Pour equal parts of tap water and rubbing alcohol into the bottle, filling about 1/8 to a 1/4 of the bottle.
2. Add a couple of drops of food coloring and mix.
3. Put the straw in the bottle, but don't let the straw touch the bottom (**DO NOT DRINK THE MIXTURE**).
4. Use the modeling clay to seal the neck of the bottle, so the straw stays in place.
5. Now hold your hands on the bottle and watch what happens to the mixture in the bottle.



What you'll discover!

Congratulations!!! You just made a thermometer. Just like any thermometer, the mixture expanded when it was warmed. This made the liquid no longer fit in the bottom of the bottle. As the alcohol expanded the colored mixture moved up through the straw. If the bottle were to get very hot, the liquid would have come through the top of the straw.

You can watch your thermometer and see how the liquid changes throughout the day.

What happens if your thermometer is in shadow or in sunlight?
What happens when it gets colder?
How does wind affect the thermometer?

Of course, in order to accurately read the temperature, you will need to buy a real thermometer that is carefully calibrated for temperature changes. This one is to see how a thermometer works -- just for fun.

After you're done with your thermometer, dispose of the liquid properly and rinse the bottle well. Cut it in half, or have a parent cut it in half, so the bottle can't be reused. Then recycle the plastic. The used bottle could have some left over alcohol in it, and you don't want anyone to reuse the bottle for drinking water. So, it's best to recycle the bottle.

Changing Temperature Scales

The Fahrenheit scale was named after Gabriel D. Fahrenheit who lived from 1686 to 1736. He devised a way of measuring temperature. The Celsius scale was named after Anders Celsius, its inventor, who lived from 1701-1744. The Celsius scale is also called Centigrade. The **Centi** in centigrade means 1/100 (one one-hundredth) for the 100 equal divisions on the scale and is used by scientists. It is the temperature scale used by most of the world. The difference between the temperature where water freezes and boils is an even number of degrees...100. In the Fahrenheit scale, the difference between freezing (32° F) and boiling (212° F) is 180.

You can **change the temperature in Fahrenheit into Celsius** using math.
Take your number; subtract 32° from it; and divide the remainder by 1.8.

Example

Change 75 degrees Fahrenheit into Celsius.

75 - 32 = 43
43 / 1.8 = **23.88° C**

So, 75° F is equal to 23.88° C

To **change the temperature in Celsius to Fahrenheit** using math.
Multiply your number by 1.8 and add 32°

Example

Change 12 degrees Celsius into Fahrenheit.

12 x 1.8 = 21.6
21.6 + 32 = **53.6° F**

So, 12° C is equal to 53.6° F

29. Acknowledgement

SOAPKidz would like to take the opportunity to acknowledge and thank the various websites and people that have contributed ideas and content to this recycling initiative.

Sunrise On Africa's Peaks Kidz

- SUNRISE ON AFRICA'S PEAKS' KIDZ (SOAPKIDZ) IS A NON-PROFIT ORGANISATION AND HAS BEEN ACTIVE SINCE APRIL 2005.
- SOAPKIDZ CREATES ENVIRONMENTAL AWARENESS AND PROMOTES NATURE CONSERVATION AMONGST THE PRECIOUS CHILDREN IN AFRICA.
- SOAPKIDZ HAS REACHED 4623 PEOPLE SINCE APRIL 2005 AND HAS PICKED UP MORE THAN 1000 BAGS OF LITTER.
- SOAPKIDZ' MISSION IS TO EXPOSE THE CHILDREN OF AFRICA TO NATURAL ENVIRONMENTS, WHERE THE BREATH OF GOD ON THEIR SKIN, WILL FILL THEM WITH AWARENESS, PASSION, LAUGHTER, TRUST, COMPASSION, LOVE, ACCEPTANCE, FREEDOM AND COMPANIONSHIP.
- WITH THE HELP OF VARIOUS OUTDOOR ACTIVITY GROUPS AS WELL AS VOLUNTEERS, WE TEACH CHILDREN ABOUT: NATURE, THE PRESERVATION THEREOF, SELF PRESERVATION, LIFE, FRIENDSHIP, LOYALTY, TRUST, COURAGE, TEAMWORK ETC.
- EVERY ACTIVITY INCORPORATES ENVIRONMENTAL CLEAN UP PROJECTS WITH A PRIZE FOR THE TEAM WHO COLLECTS THE MOST LITTER.

"It is pure magic when kids and nature meet"

TOGETHER, WE DO MAKE A DIFFERENCE!

This booklet was compiled by SOAPKidz.