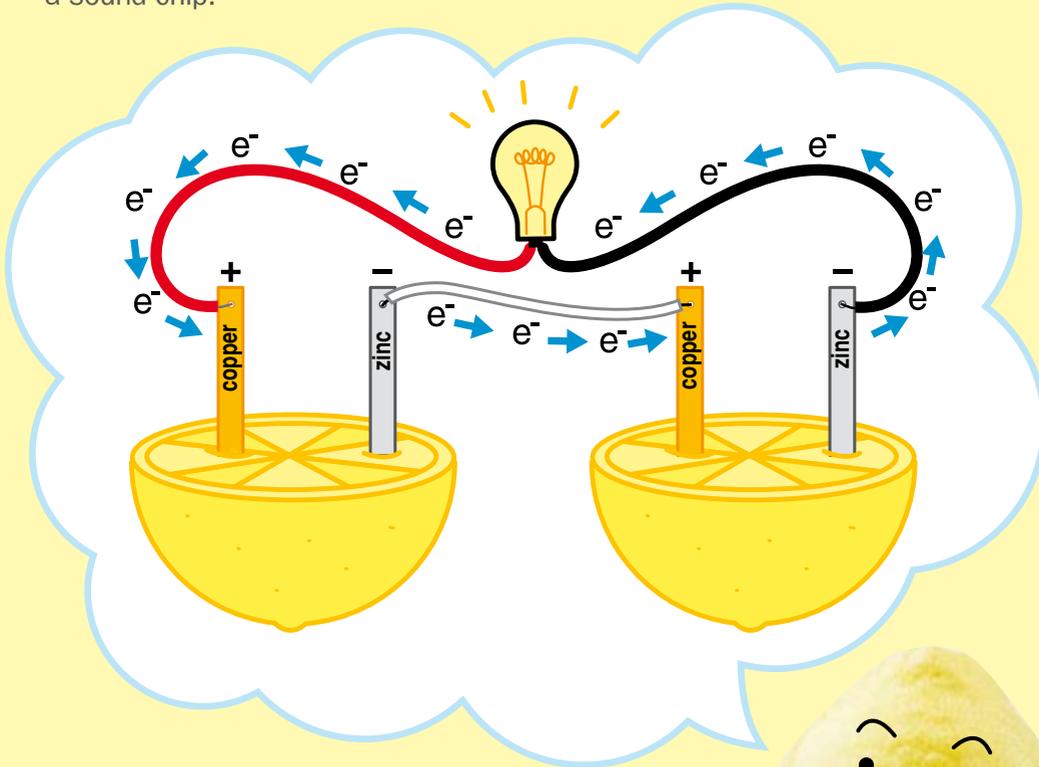


C. HOW DOES YOUR ENVIRO BATTERY WORK?

Your enviro battery works by immersing a pair (or pairs) of connected zinc and copper plates into an aqueous medium such as a potato, mud, water, or a piece of fruit. The zinc plate is the negative electrode; the copper plate is the positive electrode. When the metals are immersed into the electrolyte, a chemical reaction takes place. The acid in the electrolyte breaks down the atomic structure of the copper and zinc, causing individual electrons to be released. Zinc is a more reactive metal than copper in this chemical process. It generates electrons faster than copper in this chemical process. The excess electrons flow from the zinc plate to the copper plate. This flow of the electrons from a reactive metal to a less reactive metal forms a small current which is strong enough to power a small light bulb, a small watch or a sound chip.



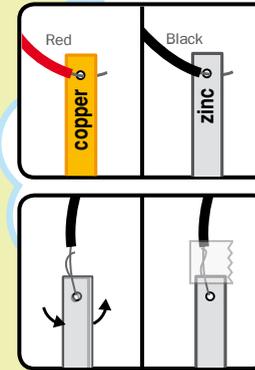
So, now that you know the basics, let the experiments begin!

D. POTATO POWER: MAKE A POTATO-POWERED CLOCK

YOU'LL NEED

From the kit: The LCD watch movement with its protective cover, 2 zinc plates, 2 copper plates, adhesive tape and a connecting wire.

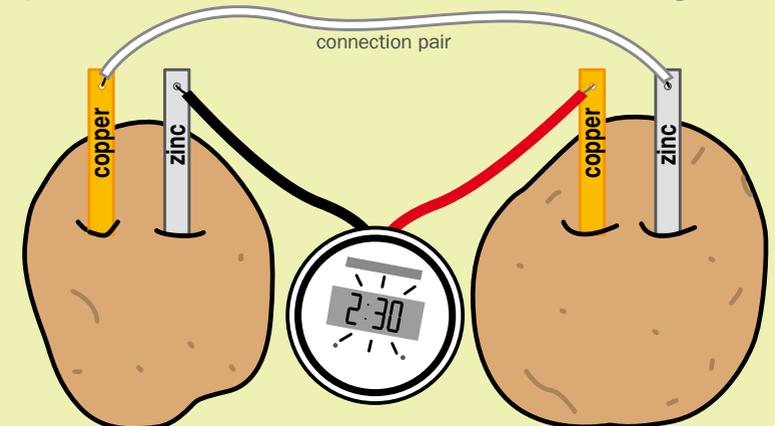
From home: 2 potatoes or any fruits e.g. lemons, apples.



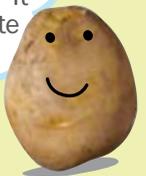
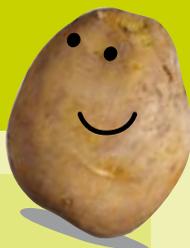
THINGS YOU NEED TO KNOW

There are universal standards for positive and negative terminals. The positive terminal is always the red coloured wire, whereas the negative terminal is always black. Always connect the negative terminal to a zinc plate (or a more reactive metal) and the positive terminal to the copper plate (or a less reactive metal). Note: It is important that the exposed wire and the plate touch. Use the transparent tape provided in the kit to further secure the connection.

1. Connect the black wire from the LCD watch (negative) to one of the zinc plates by carefully threading the wire's exposed metallic end through the hole on the plate. Gently twist the wire to secure it to the plate.
2. Connect the red wire from the watch (positive) to a piece of copper plate.
3. Assemble a "connection pair" by connecting the other pair of copper and zinc plates with a connection wire.
4. Now that all of the components are connected, insert the copper and zinc plates into the potatoes as shown in the diagram. Voila! You have created a battery to power the LCD clock! (See section M for setting the clock)



Note: After your experiments are complete, clean the zinc and copper plates to prevent rust and oxidization.



E. MUSICAL MUD: MAKE A SOUND - CHIP SING

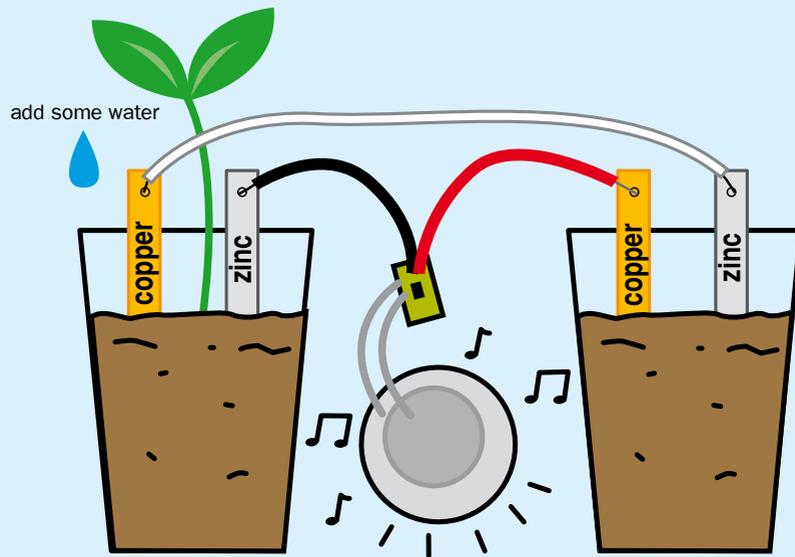


YOU'LL NEED

From the kit: The electronic sound chip, 2 pairs of copper and zinc plates, adhesive tape, a connecting wire and a paper cup.

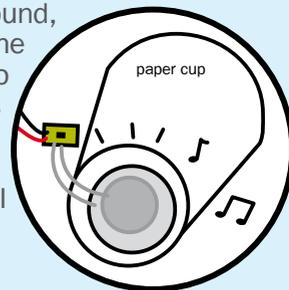
From home: 2 small potted plants or 2 cups of garden dirt.

1. Make sure the pots or cups of soil are reasonably moist.
2. Connect the sound chip to a pair of copper and zinc plates using the same technique as in the mini clock (i.e. red wire to copper plate, black wire to zinc plate).
3. Make a connection pair with the other zinc and copper plate as in D3.
4. Insert the zinc and copper plates into to the soil as shown in the diagram.



Did the chip sing?

If the experiment worked, you should hear a faint noise coming from the round metal plate of the sound chip. To amplify the sound, tape the base of the sound chip to the paper cup. The sound should now be louder. You should be able to hear a bird singing. Why? The paper cup resonates with the sound wave generated by the sound chip making it louder. Experiment using different “amplifiers” e.g. a water glass, a soda can etc. You’ll be amazed with the different sound effects they produce!

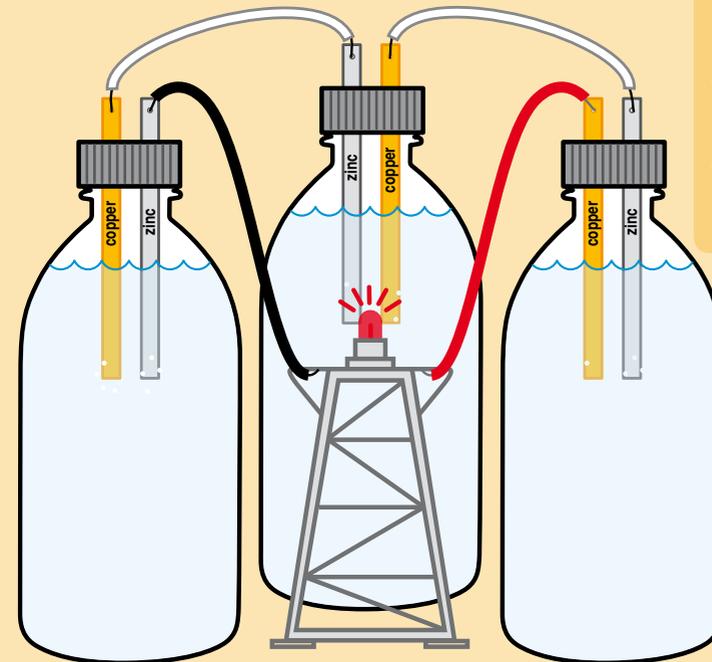


F. WATER WONDER: MAKE A BATTERY WITH WATER

YOU'LL NEED

From the kit: The light tower with LED lamp installed, 3 specially designed screw caps, 3 zinc plates, 3 copper plates and connecting wires. **From home:** Three small plastic water bottles (or you could simply use the cups provided, in this case, the specially designed screw cap is not needed).

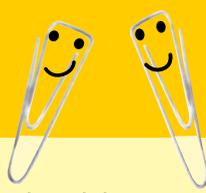
1. Fill three bottles with water.
2. Connect the LED light on the light tower to a pair of zinc and copper plates as done in the previous experiments.
3. Make 2 connection pair with the other zinc and copper plates.
4. Insert the zinc and copper plates into the water containers as shown in the diagram. Make sure the plates do not touch each other as this will cause a short circuit and the LED lamp will not light up.



Remark: If the bottles used in this experiment are too tall, you may need to stand the light tower on the screw cap due to the connection wire's length limit. On the other hand, you may choose to change to other display devices like the sound chip or LCD clock so that it could dangle naturally after the circuit is set.

Did the LED light up? Was it bright? Try adding some vinegar into the solution. Does this make the LED brighter? Can you explain why adding vinegar to the water would make a difference? Because water is neutral and metals are more reactive in acidic solutions, the current produced is stronger when vinegar, or other acidic solution, is added to the water. Now try using a salt solution, water and fruit juice. Record your findings on the experiment sheet. Which solution produces the best results and causes the LED to shine brightest?

G. PAPER CLIP PARTY: MAKE A PAPER CLIP BATTERY

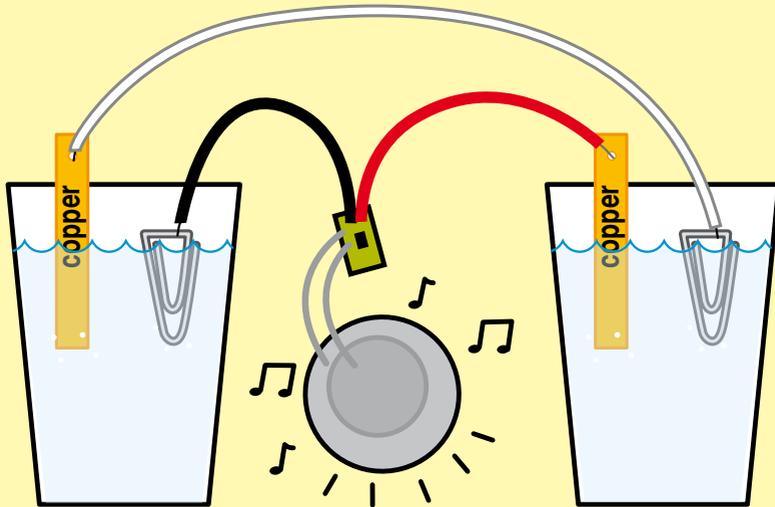


Now that you have tried using different electrolytes for creating electricity, try different metals (electrodes) too. You'll be amazed how common household metals generate current like magic. (Household items are required for conducting the following experiments, they are not supplied. Please ask an adult to get them for you.)

YOU'LL NEED

From the kit: 2 copper plates, 2 plastic cups, the electronic sound chip, adhesive tape and connection wire. *From home:* 2 big paper clips.

1. Connect one end of the black wire to one of the paper clips.
2. Connect one end of the red wire to one of the copper plates.
3. Connect the second copper plate to the paper clip to make a connecting pair.
4. Insert the metals into to plastic cup filled with vinegar water and viola, the sound chip is activated.



How does it work?

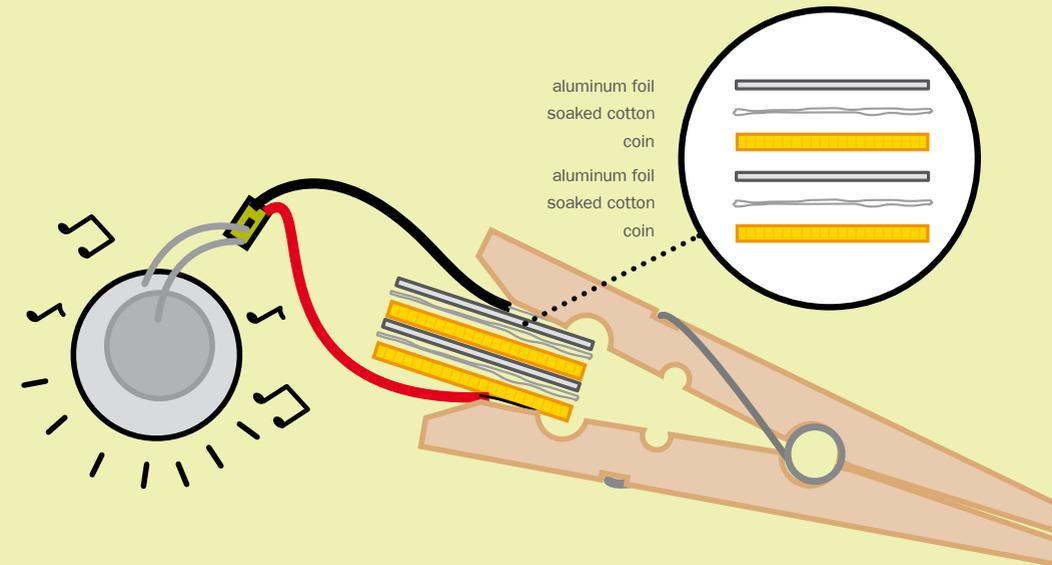
Most metal paper clips are plated with a layer of zinc. When the metals are inserted in the acid water, a reaction takes place and a current is formed.

H. CRAZY COIN: MAKE A COIN BATTERY THAT SINGS

YOU'LL NEED

From the kit: The sound chip. *From home:* Vinegar, a clothes peg, aluminum foil, 2 cotton pads, and 2 copper or copper alloyed coins.

1. Cut the aluminum and cotton the same size as the coin.
2. Soak the cotton pads with vinegar and set them aside (they should be wet, but not dripping as this may cause a short circuit).
3. Built a six layer sandwich using this sequence: aluminum foil > soaked cotton > coin > aluminum foil > soaked cotton > coin.
4. Place the red wire from the sound chip on the coin side of the sandwich.
5. Clip the clothes peg to the wires, top and bottom, as shown in the diagram. Make sure it's clamped firmly. And you have it, the ONLY singing coin in town!



How does it work?

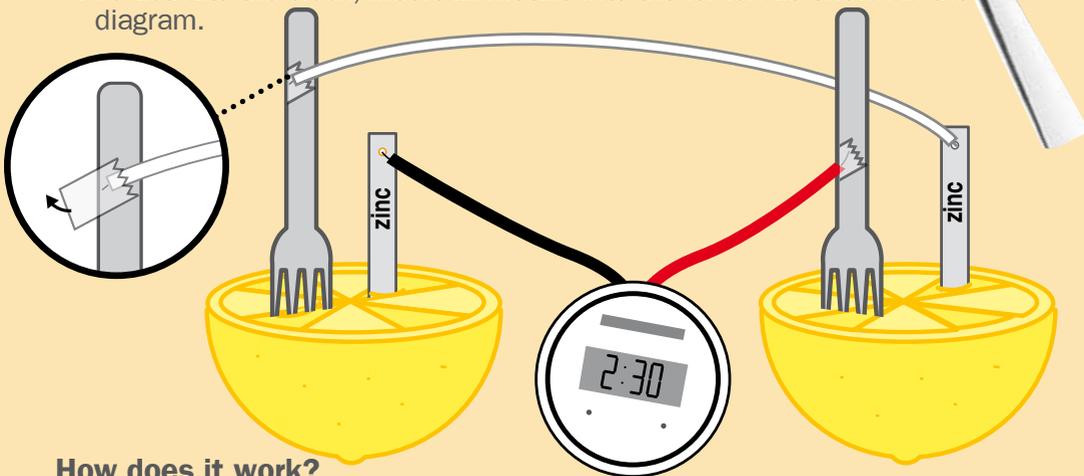
Most brown coloured coins are made from copper or a copper alloy. The coins act as a substitute for the copper plates in the previous experiments. So when a connection with more reactive metal (aluminum in this experiment) is mixed with an acidic solution like vinegar, a reaction takes place. It creates enough current to generate sound or even light! Try it with the LED lamp and see if it works!

I. FREAKY FORK: MAKE A FORK BATTERY

YOU'LL NEED

From the kit: 2 zinc plates, LCD clock, adhesive tape and connection wire. *From home:* 2 forks, 1 lemon - halved.

1. Connect one end of the red wire to the fork. Use a clothes peg or adhesive tape to secure the connection.
2. Connect the black wire to the zinc plate.
3. Now get another fork and zinc plate, connect them with a wire to make a "connection pair".
4. To activate the clock, insert all metals into the lemon as shown in the diagram.



How does it work?

The fork acts like the positive electrode of the battery, like the copper plates in previous experiments. Most tableware utensils are plated with a metal which is less reactive than zinc. When both the utensils and zinc plates are inserted in the lemon, a reaction takes place. Electrons move from the zinc plates to the fork forming a current.

J. ADDITIONAL EXPERIMENTS

You can do more experiments by combining those provided in the kit with materials from home. Here are some of the materials you could try:
 Electrolyte: Soda drink, salt water, fruit juice, different fruit etc.
 Positive Electrode: any kind of copper, copper plated metal and alloy, copper screw/nuts, copper key, copper foil, different kinds of brownish coins, copper wire, spoon.
 Negative Electrode: iron, aluminum, any kind of zinc plated metal, common screw/nuts/washer/nail, iron wire.
 Mix and match the different metals, the electrolytes and display devices. Record each of your findings on the record sheet and compare the results. It's fun to analyze your results and develop hypothesis for additional experiments.

K. EXPERIMENT RECORD SHEET

*1 - 6 are experiments from section D - J.

	Positive Electrode	Negative Electrode	Electrolyte	Display Media	Number of connections	Comment
1*	Copper Plate	Zinc Plate	Potato	LCD Clock	2	
2*	Copper Plate	Zinc Plate	Mud	Sound Chip	2	
3*	Copper Plate	Zinc Plate	Water (Vinegar)	LED Lamp	2	
4*	Copper Plate	Paper Clip	Soda drink	Sound Chip	2	
5*	Coin	Aluminum Foil	Vinegar	Sound Chip	2	
6*	Fork	Zinc Plate	Lemon	LCD Clock	2	
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						

L. FUN FACTS



“Voltaic Pile” - Did you know that one of the first batteries was actually a stack of metal discs separated by cotton that was soaked in salt water? The coin experiment outlined in this kit is very similar. Although you used vinegar (it's more acidic) instead of saltwater, the principle is exactly the same!

Gaston Plante invented the first lead-acid battery in 1859, and Thomas Edison invented the first alkaline cell in 1914, less than 100 years ago! Can you imagine life without batteries? No flashlights, no CD or MP3 players, no handheld games, or digital watches! But that's only the tip of the iceberg, there would be no hearing aids or digital thermometers, no remote toys, no cell phones, most calculators wouldn't work, and there would be a hand-crank on your parent's car! What other items can you think of that require batteries?

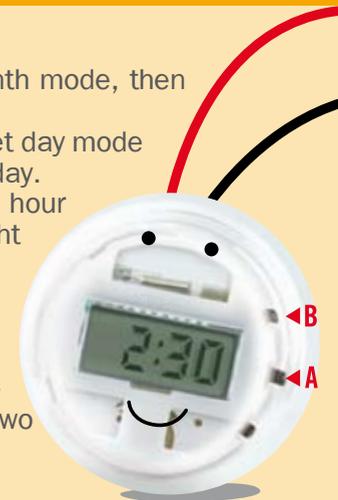
How are batteries recharged? Recharging a battery simply requires that you reverse the flow of electrons using a separate energy source such as electricity or solar panels. When the process is complete, the positive and negative elements of the battery are restored to their original state and can be used again. The problem with recharging; however, is that the battery starts to lose its charge a little faster each time it is recharged. Scientists are looking for new types of batteries that don't harm the environment and that can be replenished without using electricity.

Why are store-bought batteries hazardous to the environment? Stop and think about it. Do you have any ideas? Well if you guessed that they are pollutants, you're absolutely correct! The chemicals used in batteries eventually corrode through the battery casing and leak into the soil, eventually making its way into our water sources. Some of these chemicals, such as mercury, were considered so dangerous to the environment that they have been outlawed in certain countries! One of the most popular components in today's batteries is lead. **Billions** of wet-cell lead-acid batteries are manufactured **each year** for use in automobiles, motorcycles and boats! That's a lot of batteries, and a lot of pollutants! So until there is a better, environmentally friendly battery source, make sure you recycle and tell your friends to recycle too! Most city's have drop-off centers for batteries. If you don't know where to go, have a parent call the city offices to get the information you need. Remember to think GREEN SCIENCE!

M. SETTING THE WATCH

1. Setting the watch

- Press A twice and the display will show the set month mode, then Press B to adjust to the right month.
- After the month is set, Press A to confirm, and the set day mode will be displayed, Press B to adjust the to the right day.
- After the day is set, Press A to confirm and the set hour mode will be displayed, Press B to adjust to the right hour.
- After the hour is set, Press A to confirm and the set minute mode will be displayed, Press B to adjust to the right minute.
- After the minute is set, Press A to confirm and the normal time will be displayed. You should see the two dots flashing between the hour and minute display.



2. Viewing

- By default, the clock display shows the current time.
- To view the Date: Press B once. The clock display will resume showing the current time after 2 second.
- To view the Seconds, Press B for twice. To resume to normal time, Press B again.
- To view the Time and Date alternately, Press A once. To resume to normal time display, Press A 5 times to skip all set clock modes.

N. TROUBLE SHOOTING

If your experiment produces a weak sound or light signal, try one of the following:

1. Give it time, the signal is sometimes weak at the beginning of the experiment, but gets stronger after a short while.
2. You can try adding another connection to strengthen the current. For example in experiment 1, instead of using two potatoes, you could add another one. However, you will need to make another connection pair with an extra pair of zinc and copper plates. The whole circuit has to be connected in correct sequence. The display devices provided are of different voltage. The sound chip has the lowest voltage, whereas the clock is in the middle and the LED lamp is the highest. You will find the sound chip can easily be activated in most conditions. (You could even try using one connection for the sound chip by using a half lemon). However, the LED lamp, depending on the acidity of the solution and the metal used, may require as many as 3 or 4 connections to make it light up brightly.

N. TROUBLE SHOOTING (CONTINUED)

3. Examine the metal plates for rust (oxidization). Use sand paper to remove any rust.
4. Try putting the metal plates closer together (but not touching each other). Conduction will be better if the distance between the plates is shorter.
5. If there is no reaction whatsoever, check all the connection points. Make sure that the connection points are correctly and firmly placed. Also, check if the polarities are correct - negative (black wires) and positive (red wires) terminals are connected properly.
6. Check if the metal plates/wires are touching each other, this causes short circuits.

QUESTIONS & COMMENTS

We treasure you as a customer and your satisfaction with this product is important to us. In case you have any comments or questions, or you find any parts of this kit missing or defective, please do not hesitate to contact our distributor in your country, whose address is printed on the package. You are also welcome to contact our marketing support team at Email: infodesk@4M-IND.com, Fax (852) 25911566, Tel (852) 28936241, Web site: WWW.4M-IND.COM



Build a better tomorrow through education & awareness. You will like the other great Green Science kits:

00-03263 Dynamo Torch

Turn a simple toy motor into a generator that converts hand motion into electrical energy and powers a light bulb. No battery, no pollution, just amazement. The generator could be used as an awesome emergency torch. Caution: High Voltage Inspiration & Fun!



00-03266 Robugs

Millions of soda can are wasted everyday. Help save our environment. Recycle one of them and turn it into a cool robotic bug. Switch it on and watch it vibrate causing it to slide across the floor. It even emits a "buzz" as it moves along - just like a real bug. It's an awesome robotic science kit.

GREEN SCIENCE

ENVIRO BATTERY



WARNING:
CHOKING HAZARD - Small parts.
Not for Children under 3 years.

A. SAFETY MESSAGES

1. Please read all instructions before you begin.
2. Adult assistance and supervision is recommended.
3. The kit is intended for children age over 8.
4. This kit and its finished products contain small parts which may cause choking hazard. Keep away from children under 3 years old.
5. Please ask an adult for help when getting any material (i.e. potatoes, fruits, juice, etc) needed for the experiments.
6. Food or beverages used in these experiments are not edible. Please dispose of them immediately after use.
7. Do not connect any of the parts provided to any AC wall socket or any batteries. This may cause electric shock or a short circuit.

B. CONTENTS

4 zinc plates (silvery grey), 4 copper plates (brownish), 4 connection wires, 2 plastic cups, 1 paper cup, 2 specially designed bottle screw caps, 1 light tower with LED lamp, 1 sound chip, 1 LCD watch moment with protective cover, 1 set transparent adhesive tapes, 1 set experiment instruction guide with experiment record sheet and fun facts.

