

## TRICK 1: HOVER DISC

### YOU'LL NEED

**From the kit:** 1 balloon, 1 CD connector, 1 mouth piece, double-sided adhesive tape  
**Recycle:** 1 old CD

### Assembly

1. Stick a piece of double-sided tape to the bottom of the CD connector. Press the connector into the centre of the CD so that the tape holds it in place.
2. Push the neck of the balloon onto the mouth piece.

### Operation

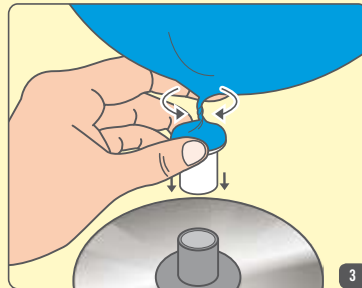
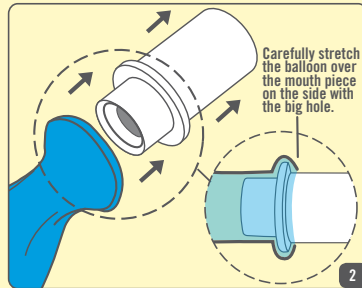
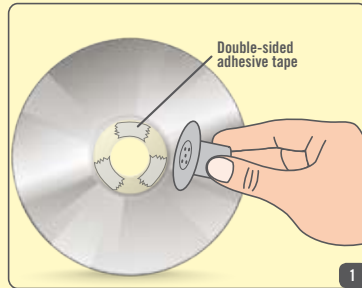
Place the CD on a smooth surface. Inflate the balloon (you might have to ask an adult to help you the first time to do this) and then twist the neck of the balloon to stop the air escaping. Insert the mouth piece into the CD connector, place it on a smooth table surface and release the balloon. Give the CD a gentle push and watch it skim along.

### How it works

If you give the CD a push when the balloon is deflated, it will only move a short way before stopping. The force that stops it moving is friction, caused by the CD and the surface touching. When the balloon is inflated, it forces air between the CD and the surface. The thin film of air gets rid of nearly all the friction, allowing the CD to move easily.

### Fun facts

- The Hover Disc works like a hovercraft - a vehicle that skims along on a cushion of air. Hovercraft can travel over water or land.
- A hovercraft has a large fan that blows air downwards to make an air cushion. The air is held in by a rubber skirt.
- Hover lawn mowers blow air downwards, making them easy to push across the grass as they cut it.



## TRICK 2 : TORNADO TUBE

### YOU'LL NEED

**From the kit:** 1 cap connector, 2 bottle caps  
**Recycle:** 2 plastic bottles (about 1 liter)  
**From home:** Water

### Assembly

1. Screw a cap onto each bottle. Half fill one bottle with water (but leave the other empty).
2. Put the connector onto the cap attached to the bottle with water in. Put the cap of the other bottle onto it. Now the two bottles are connected.

### Operation

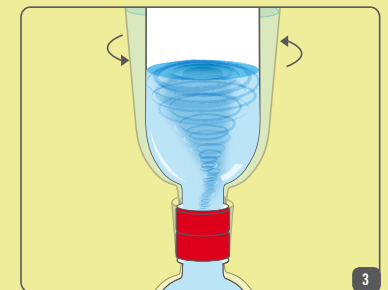
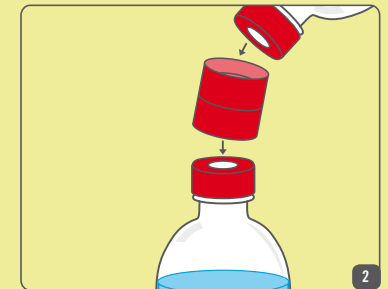
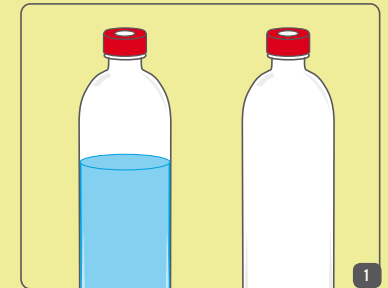
Tip the tube so that the bottle with water on top. Move the tube in small circles a few times to make the water swirl around, and stand the tube on a surface. You will see a funnel-shaped hole form in the centre of water as the water swirls down into the bottom bottle - it's like a water tornado! Repeat the experiment by turning the tube over.

### How it works

The swirling mass of water that forms in the tube is known as a vortex. Once you have started the water moving round, the energy comes from the water flowing downwards. The vortex has a hole in the centre. As the water flows down, air from the bottom bottle flows up to replace it. If you didn't spin the bottle, the water would plug downwards as the water and air changed places.

### Fun facts

- A tornado is a vortex of air. Tornadoes start when strong currents of air are created inside giant thunderstorms.
- You can see water vortices when you let water out of the bath and it spins down the plug hole.
- Strong currents in rivers and at sea sometimes create whirlpools, where water swirls downwards in a vortex.



## TRICK 3 : CD RACER

### YOU'LL NEED

**From the kit:** 1 tube end with centre hook, 1 plain tube end, 2 rubber bands, double-sided adhesive tape

**Recycle:** 2 CDs, 1 toilet-roll tube

**From home:** 1 pencil

### Assembly

1. Put some double-sided adhesive tape on either side of the hole on both CDs. Peel off the backing paper. Press the CDs onto the tube ends so that the double-sided tape keeps them in place.
2. Find the tube with the hook at the centre. Hook 2 rubber bands onto the hook. Insert it to the cardboard tube.
3. Feed the band through the cardboard tube and then through the plain tube end. Make sure the tube ends fit neatly onto the tube. Push a pencil through the loop in the rubber band. One end should protrude about 5 cm outside the edge of the CD.

### Operation

Hold the cardboard tube and wind the pencil round and round until the elastic band is tight. Place the CD Racer on the floor and let go.

### How it works

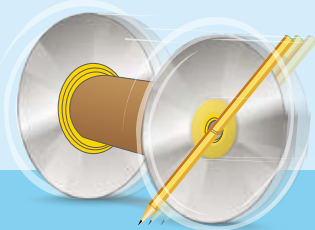
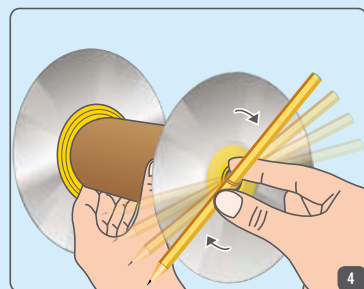
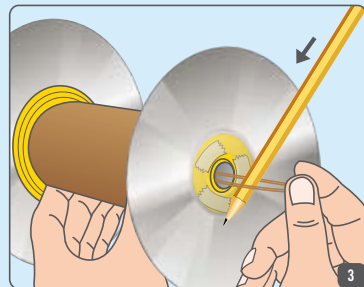
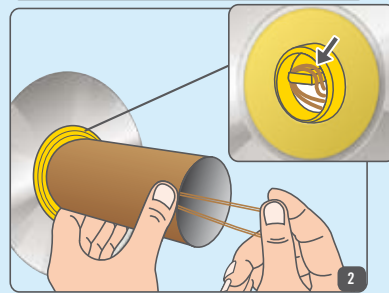
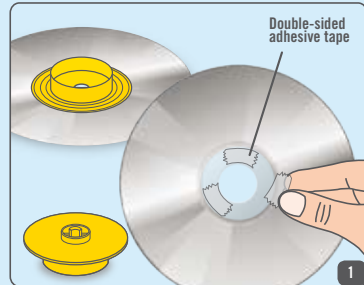
The wound-up rubber band tries to make the tube and the pencil spin in opposite directions. The pencil can't spin as it presses on the ground, so the tube spins, which makes CD Racer move along. The wound-up band stores energy, and this energy is converted to movement energy in the CD Racer.

### Trouble shooting:

If the plastic tube ends are not securely fixed to the paper tube, this will affect the performance of the racer. You may apply some double adhesive to fix them in place

### Fun facts

- Wind-up models such as planes and cars use wound-up elastic bands to provide energy to move their parts. Winding the band stretches it to several times its own length.
- A catapult uses the energy stretched elastic to fire an object.
- Most old clocks are powered by a coiled metal spring. As the spring unwinds, it moves the cogs that move the clock's hands.



## TRICK 4 : SPACE SOUND WALKIE TALKIE

### YOU'LL NEED

**From the kit:** 1 elastic silver string

**Recycle:** 2 paper cups

### Assembly

1. Using a sharp pencil, pierce a small hole in the base of each paper cup. Ask an adult to help you with this.
2. Feed the ends of the elastic string up through the holes in the bases of the cups, pull some string through and then tie a few knots in each end. The knots will stop the string slipping back through the holes.

### Operation

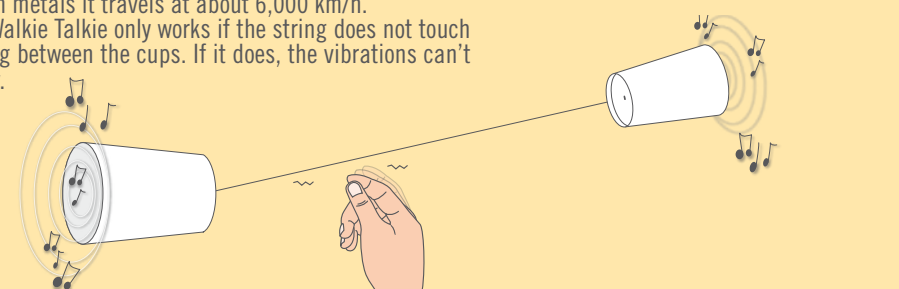
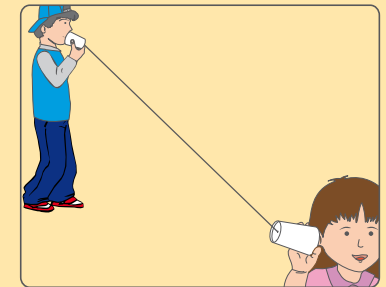
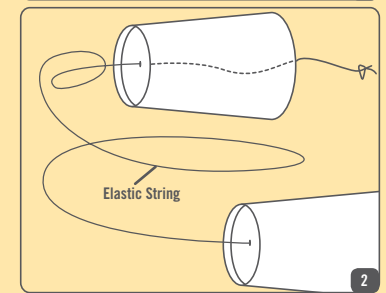
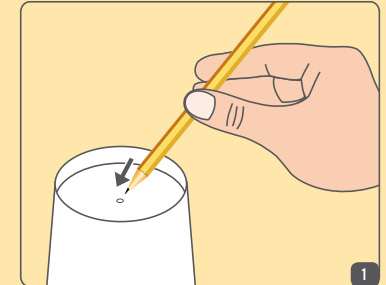
You need two people to work the Walkie Talkie. Each person holds a cup. Walk apart until the elastic silver string is stretched but not too tight. One person talks into a cup while the other listens (when you finish what you want to say, say 'over' to tell the other person it's his or her turn to speak). Or gently touch the elastic string, you should be able to hear some special space sound effects when the elastic vibrates.

### How it works

Sound is made up of vibrations. When you speak, you make the air around you vibrate, and the vibrations spread through the air. Your ears detect the vibrations so that you can hear the sounds. When you speak into the Walkie Talkie cup, the vibrations in the air make the base of the cup vibrate up and down. The vibrations pass along the string and make the base of the other cup vibrate too. This makes the air in the other cup vibrate, and the other person hears the sound.

### Fun facts

- Sound travels very fast. In the air it travels at about 1,200 km/h (that's a kilometer in just three seconds).
- Sound travels much faster in liquids and solids than it does in air. In water, sound travels at more than 5,000 km/h. In metals it travels at about 6,000 km/h.
- The Walkie Talkie only works if the string does not touch anything between the cups. If it does, the vibrations can't pass by.



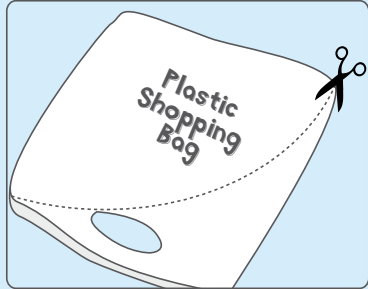
## TRICK 5 : SHOPPING BAG PARACHUTE

### YOU'LL NEED

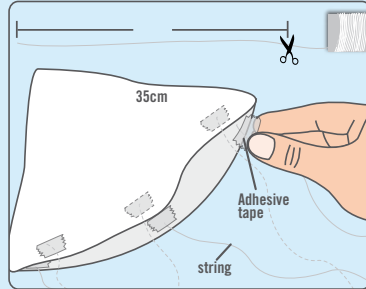
**From the kit:** 1 string, 1 pipe cleaner, 1 wooden bead, nuts  
**Recycle:** 1 plastic bag  
**From home:** Adhesive tape

### Assembly

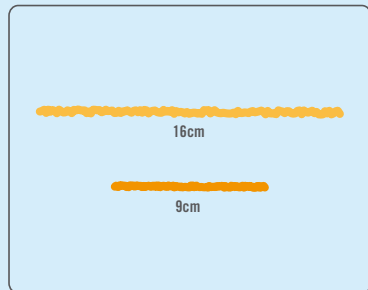
Use of scissors required, adult supervision required when using scissors.



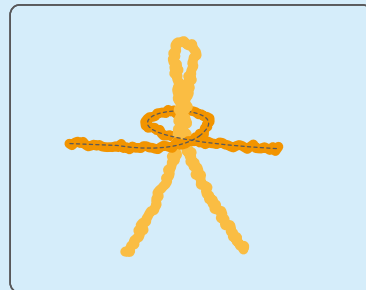
1. Lay a plastic bag flat (a lightweight supermarket bag is best). Draw a semicircle on the top side of the bag with a radius of about 15 cm (see diagram). Cut out the semicircle, cutting through both sides of the bag. You should finish with a disc of plastic that will be the parachute.



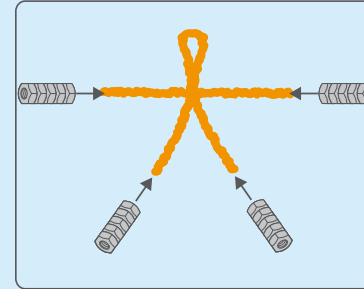
2. Cut 6 lengths of string, each about 35 cm long. Attach the ends of the strings, evenly spaced, around the edge of the plastic disc by the adhesive tape.



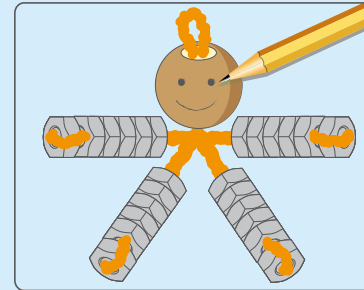
3. Now make a spaceman (weight) for the parachute. Cut 2 lengths of pipe cleaner about 9 cm long and 16 cm long.



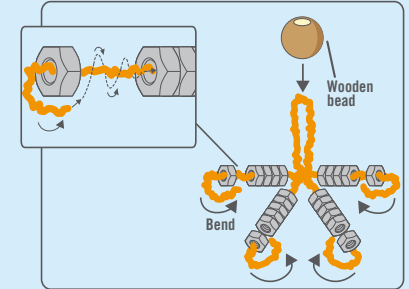
4. Bend the 16-cm long pipe cleaner in the middle. Wind the 9-cm pipe cleaner around it as shown.



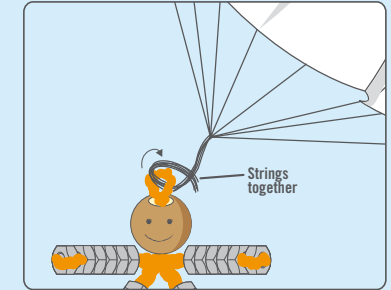
5. Push 5 nuts onto each arm and each leg.



7. Draw a face on the bead.



6. Fold over the ends of each pipe cleaner between the first and second nuts. This will hide the sharp points. (Adult assistance required.) Slide the bead over the body to make a head.



8. Fasten the strings with a knot then thread them through the loop above the spaceman's head. Tie the bundle with another knot. Your parachute is complete. Get ready to fly!

### Operation

Fold the parachute together, keeping the strings free underneath it. Hold the folded parachute and the spaceman together in one hand and throw them upwards as hard as you can. As the parachute begins to fall, it should open and float back to the ground. Adjust the number of nuts on the spaceman's arms and legs until the parachute floats down gently without swinging from side to side.

### How it works

Air resistance is a force that the air makes on objects that are moving through it. The size of the air resistance on an object depends on its size and shape. The domed shape of a parachute catches plenty of air as the parachute falls down through the air.

### Fun facts

- Modern parachutes don't float down to the ground vertically. They are blow-up wings that glide along as they drift downwards.
- In 1960 Colonel Joe Kittenger of the US Air Force made the highest parachute jump ever, from 31,333 metres above the Earth
- Parachutes are used to slow down fast-moving vehicles, including dragsters and fighter jets.

## TRICK 6 : CARTESIAN DIVER

### YOU'LL NEED

**From the kit:** 1 dropper, 3 copper washers, 1 plastic hook, 6 plastic weights, score labels  
**Recycle:** 1 plastic bottle (about 1 liter)  
**From Home:** Water

### Assembly

1. Stick score labels onto the different weights (there are two labels for each weight).
2. Push the three copper washers onto the neck of the dropper, and then push the hook onto the end of the neck. This will make the diver.
3. Squeeze the dropper gently, hold the opening under water and suck up water so that the dropper is about two-thirds full.

### Operation

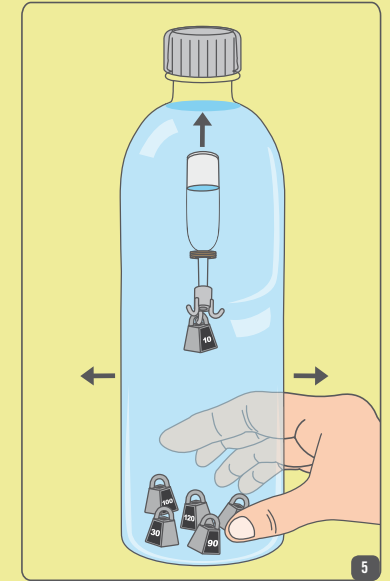
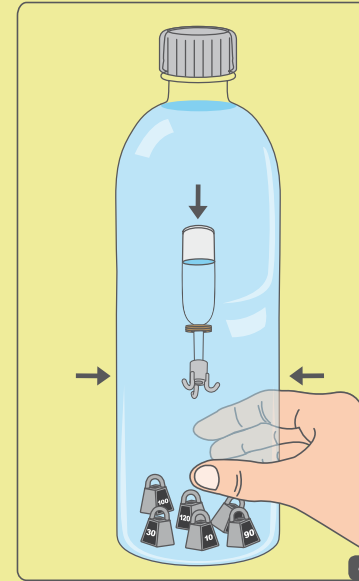
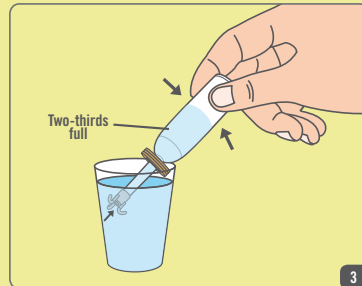
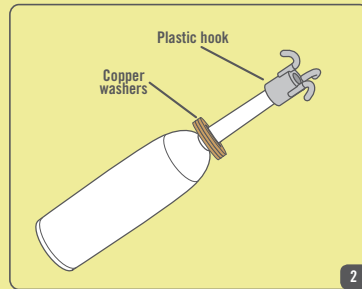
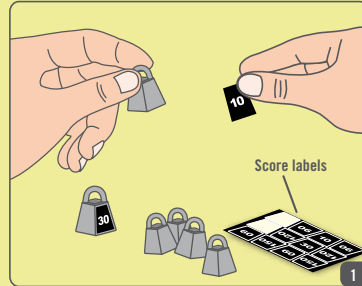
Fill the plastic bottle with water, leaving a small air space at the top. Drop in the weights, then the diver and then screw on the bottle lid. If your diver sinks, it is too heavy. You need to squeeze the tube to get rid of a little water. Keep going until the diver just floats under the water level. Gently squeeze the bottle. The diver should sink to the bottom. If it does not, it is too light and you need to suck some more water into it. Stop squeezing the bottle and the diver should surface again. Can you diver hook a weight and bring it to the surface? What score did you get? Challenge your friends or family to see who will get the highest score.

### Trouble shooting

If your diver does not sink when you squeeze the bottle, it is too light, you need to suck in some more water into the diver tube. If your diver does not resurface when you release the bottle, it is too heavy. You need to squeeze the diver tube to get rid of a little water.

### How it works

When you squeeze the bottle, the pressure inside the bottle increases. This squeezes the air inside the dropper into a smaller space, allowing more water to enter the dropper. So the dropper becomes heavier, making it sink. When you release the bottle, the pressure drops again. The air in the dropper expands, pushing some water out. This makes the diver lighter, and it floats to the surface.



### Fun facts

- A submarine works in the same way as the Sinking Diver. To dive under the water, a submarine's ballast tanks are filled with water, which makes the submarine heavier. To surface again, the water is blown out of the tanks with air.
- The deeper you go in water, the higher the pressure becomes. The pressure means it is impossible for scuba divers to go down more than about 300 metres.
- Humans normally float, so divers have to wear weights to help them dive.

## TRICK 7 : GRAVITY ROBOT

### YOU'LL NEED

**From the kit:** Can holder, walking foot structure, string, screw nuts, double sided adhesive tape  
**Recycle:** An empty drink can

### Assembly

1. Slide the walking foot structure onto the slot of the can holder.
2. Peel off the backing paper from four double-sided adhesive tabs. Stick them to the can holder. Peel off the other side of the backing paper and stick the drinks can in place.
3. Tie a string to the hanging hole on the walking foot structure. Secure with a few knots.
4. At the other end of the string, tie 15 screw nuts. Secure the nuts in place with a few knots at the end of the string. Your Gravity Robot is now complete.

### Operation

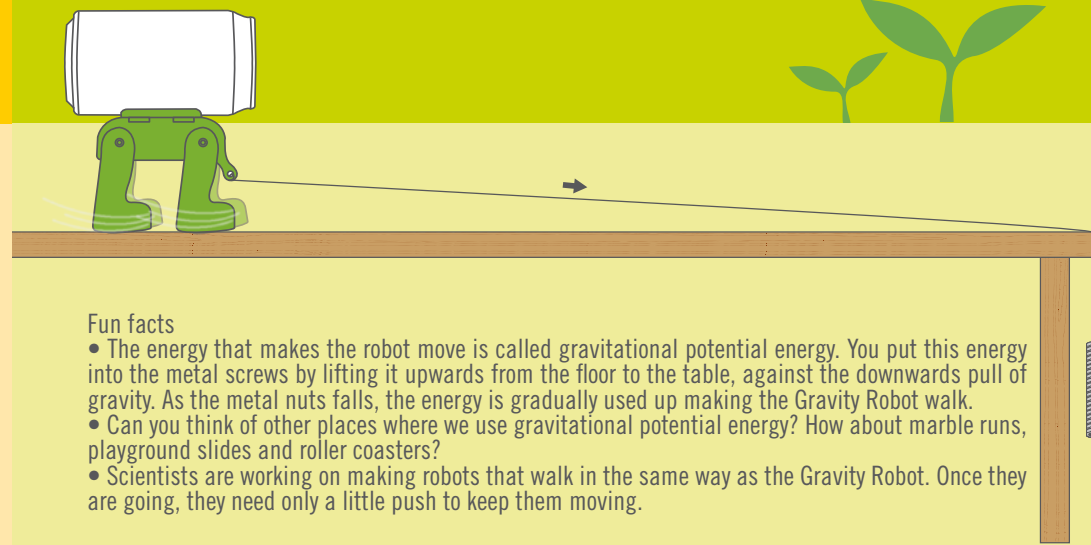
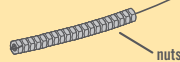
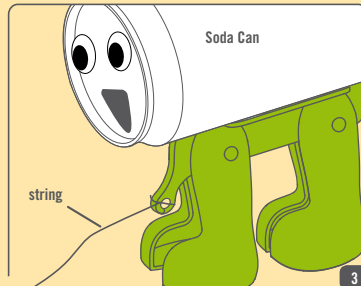
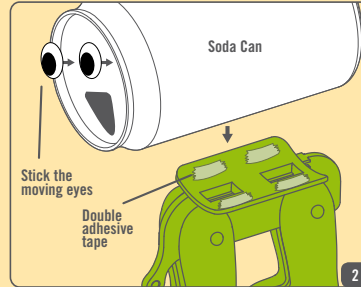
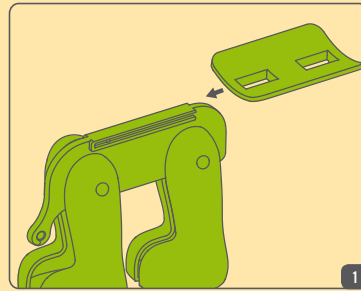
Stand your Gravity Robot on a table (preferably a wood table with a matt surface) with the screws hanging over the edge and the string taught. Let go of the screws and watch the Gravity Robot waddle across the table! If your robot does not move, give it a slight push on one side.

### Trouble shooting

If the desk surface is too smooth, the robot will move too fast and will not "waddle". You could cover the table surface with a piece of newspaper and let your Robot walk on it. Or you could stick a few lengths of sticky tapes to the table to make a 5 cm x 50 cm walking track for the robot.

### How it works

The Robot moves because the screw nuts pull on it. The force that pulls the screw nuts down is gravity, so the Robot moves because of gravity. As the body is pulled forwards, the legs on one side catches the ground. The body and the other legs swing forward. This sets up a natural rocking motion, which is kept going by the forwards motion. When one set of legs is on the ground, the other is free to swing forwards.



### Fun facts

- The energy that makes the robot move is called gravitational potential energy. You put this energy into the metal screws by lifting it upwards from the floor to the table, against the downwards pull of gravity. As the metal nuts falls, the energy is gradually used up making the Gravity Robot walk.
- Can you think of other places where we use gravitational potential energy? How about marble runs, playground slides and roller coasters?
- Scientists are working on making robots that walk in the same way as the Gravity Robot. Once they are going, they need only a little push to keep them moving.

## RECYCLING TIPS AND FACTS

- Lots of objects used in these toys are old objects that we are re-using instead of throwing them away. They include plastic bags, soda cans, plastic bottles, paper cups and CDs. Using objects again is good for our planet. It saves making new objects, which uses up precious materials, such as plastics, metals and paper, and takes energy. And it saves us from filling up rubbish tips with the old objects.
- Re-using objects is just one of the things we can do with materials to help the environment. The others are reducing (which means we should try to use less materials in the first place) and recycling (which means we should use the materials in old objects to make new objects).
- All sorts of materials can be recycled, including paper, metals, most types of plastics and glass.
- In the year 2000, approximately 4,000,000,000,000 plastic bags were made and used every year. That's 4 million, or 4 trillion. In many countries the number of bags used has dropped dramatically because of re-using and recycling, and making people pay for bags.
- In the USA, about half of all soda cans are recycled. But 1,500 soda cans are thrown away every second!
- Adventurers in the USA are building a 20-metre catamaran from plastic water bottles that will sail across the Pacific Ocean.
- Ingenious people have invented dozens of ways to re-use old CDs. Things made from CDs include table mats, paper weights, bicycle safety reflectors, door screens, bird scarers, flower holders, sun catchers, spinning tops, and even CD racks!



**00-03279 Weather Station**  
This ultra smart weather station has many functions. You can keep track of weather changes, learn facts about the weather and do experiments on the green house effect. When you have done exploring you can recycle the bottle and make your very own mini green house.



**00-03267 Windmill Generator**  
Build this amazing and wind generator and learn about renewable energy. Watch the LED glow as it is powered by free energy from the wind. No batteries required!



**00-03275 Potato Clock**  
What! No Batteries? Be a scientist as you discover how to power this digital clock using potatoes. Experiment to find out what other substances will power the clock - you'll be amazed! Caution: High Voltage Inspiration and Fun!



**00-03266 Soda Can Robug**  
Recycle a soda can 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.



**00-0281 Clean Water Science**  
Experience how water is filtered in a simple and pure away. This purifying system demonstrates the scientific way of extracting salt from sea water. All you need is a water glass and you're on your way to creating your own desalination plant.



**00-03278 Solar Science**  
Turn a foil cardboard into an amazing cooker, naturally fuelled by solar energy. Learn the superb skills for pasteurizing water and cooking by using the power of the sun. It is really simple to make a remarkable effect.

# GREEN SCIENCE

# ECO SCIENCE TOYS

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



**To Parents: Read all instructions before providing guidance to your children.**

## 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 needed for the projects.

## B. CONTENTS

