KITCHEN SCIENCE

STEAM POWERED KIDS™
Science. Technology. Engineering. Art. Maths

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

SAFETY MESSAGES

1. To Parents: Read all instruction before providing guidance to your children.
2. Adult supervision and assistance are recommended for all the experiments, especially when handling hot water, using scissors or desk lamp.
3. Intended for children aged over 8.
4. This kit and its finished products contain small parts which may cause choking if misused. Keep away from children under 3 years old.
5. Identify the contents of the kit before you start each activity. Kitchen materials are also required from home to perform the experiments. Adults' assistance is required in collecting these materials.
6. When performing the rocket experiment outdoors, launch the rocket in an open area. Do not point the rocket at a person or pet. Never watch the launching rocket from above to avoid any injury.
7. Children can choke on flat or broken balloons. Adult supervision is necessary when using balloons. Flat and broken balloons must be discarded immediately.
8. Always wash your hands after handling soil or compost.
9. Avoid contact between bubble mixture and your mouth or eyes. Always wash your hand after playing with bubbles.
10. Playing with bubble solution can be messy, so it is best to carry out all the experiments outdoors. If you have to work indoors, cover surfaces with newspapers before you start.

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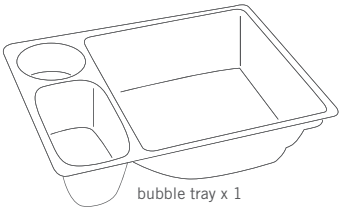
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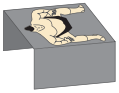
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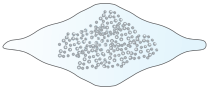
foam pieces


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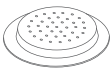
mountain base x 1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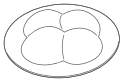
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connection wire x 1


round wand x 1


mouthpiece x 1


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metal washer x 3


adhesive tab x 1


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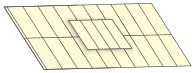
tiny plastic boat x 3


double-sided tape & adhesive tape x 1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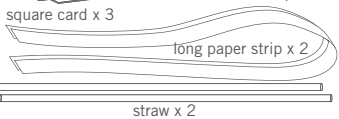
screw cap x 1


balloon x 1


square card x 3


small spoon x 1


long paper strip x 2


skewer x 2


coloured yarn


CD connector x 1


plastic bag x 1

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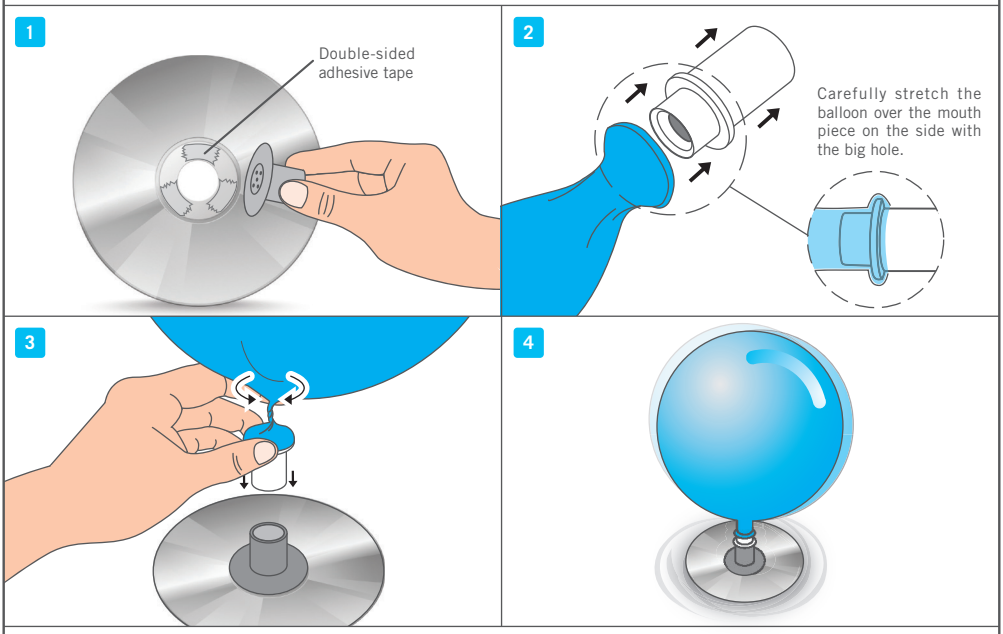
ACTIVITY 1: HOVER DISC

You'll need...
From the kit: 1 balloon, 1 CD connector, 1 mouthpiece, double-sided adhesive tape
From home: 1 old CD



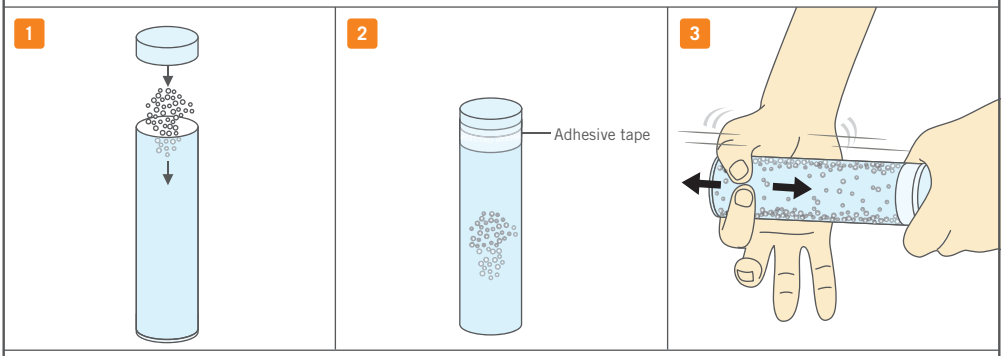
1. Stick some double-sided adhesive tape to the old CD as shown. Press the connector into the centre of the CD so that the tape holds it in place.
2. Push the neck of the balloon onto the mouth piece.
3. Place the CD on a smooth surface. Inflate the balloon (you might have to ask an adult to help you 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.
4. Place it on a smooth table surface and release the balloon. Give the CD a gentle push and watch it skim along.

How Does It Work?
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.

ACTIVITY 2: STATIC TUBE

You'll need...
From the kit: plastic tube with cover, foam pieces
From home: paper towel or wool cloth, adhesive tape



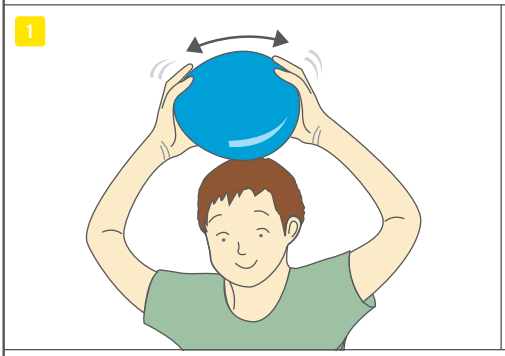
1. Drop the pieces of foam into the tube.
2. Fit the lid onto the tube and use the adhesive tap to keep the lid in place.
3. Rub the outside of the tube with a paper towel or a piece of wool cloth. The pieces of foam should stick to the inside of the tube. Touch the tube with your finger to make the pieces of foam fly about!

How Does It Work?
When you rub the tube, it gets a negative electric charge. The positive charges in the pieces of foam are attracted to this negative charge, so they stick to the tube. When you touch the tube, your finger drains the negative charge on that part of the tube, and the foam pieces are no longer attracted to it. They fly off to another part of the tube where there is still negative charge.

Fun Facts
- The negative charge is made up of millions upon millions of tiny particles called electrons.
- A positive charge is made up of millions upon millions of atoms that have one or more of their electrons missing. This means they have an overall positive charge.
- Static electricity can only exist on insulators — materials that don't conduct electricity. It flows away through conductors, such as metals.
- The tiny electric shocks you sometimes get when you touch metal objects indoors are made by static electricity jumping off your body. It is built up by the friction of your movements, such as your shoes rubbing on nylon carpets.
- Lightning can occur inside clouds, between clouds and from clouds to the ground. Around one quarter of lightning is from cloud to ground.
- When lightning strikes the ground, it seeks out the shortest route to something with a positive charge. This might be a tree, a tall building or a very unlucky person.

ACTIVITY 3: HAIR RAISING BALLOON

You'll need...
From the kit: balloon

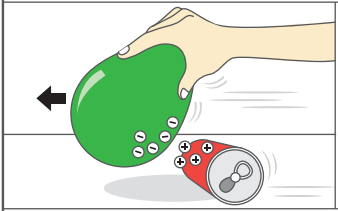


1. Inflate the balloon and tie a knot in its neck (you may need an adult to help you with this). Vigorously rub your hair a few times with the balloon.
2. Hold the balloon above your head – make sure it's not touching it. Watch in amazement as your hair stands on end. It's electric! Truly hair raising!

How Does It Work?
When you rub a balloon on your hair it creates static electricity. It stays on the surface of objects rather than flowing through them. You can easily produce static electricity by rubbing different materials together, such as the rubber balloon and your hair. When you do this, tiny particles called electrons jump from one material to the other. Electrons carry a negative electric charge, meaning that the material that gains the electrons gets a negative charge and the material that lost them is left with a positive charge. Two opposite charges – positive and negative – attract each other. When you hold the balloon over your hair, the negative charge on the balloon attracts the positive charge on your hair and makes your hair stick up. If two charges are the same they will repel each other. Who knew that electrons were so cool?

ACTIVITY 4: MAGIC ROLLING CAN

You'll need...
From the kit: balloon
From home: empty aluminium can

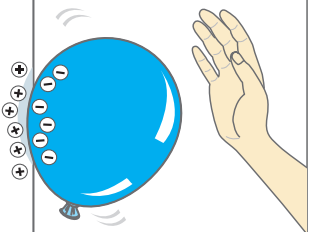


This is one of our favourite tricks and is really simple to perform. Place the can on a flat, smooth surface. Rub your hair with the balloon for as long as you can. Take the balloon and move it towards the can. If you've created enough electrons, it should start to roll towards the balloon. Now try to make it roll the other way. Can you keep the can rolling without it touching the balloon? This is wonderful wizardry at work – friends won't believe their eyes.

How Does It Work?
When you place the charged balloon close to the can, the negative charge on the balloon repels the electrons (which are negatively charged) in the can, leaving a positive charge on the surface. The negative charge on the balloon and positive charge on the can attract each other, following the balloon, causing it to roll. Hey presto – you have created a magic rolling can.

ACTIVITY 5: STICKY BALLOON

You'll need...
From the kit: balloon

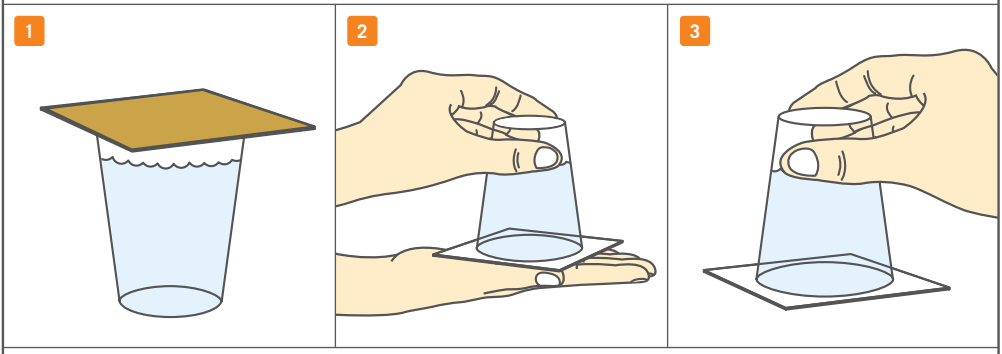


Rub your hair lots of times with the balloon. Carefully put the balloon on a wall. It will stick to the wall!

How Does It Work?
When you put the charged balloon in a wall, the negative charge on the balloon repels the electrons (which are negatively charged) in the wall, leaving a positive charge in the surface. Then the negative charge on the balloon and the positive charge on the wall attract each other, so the balloon sticks on the wall.

ACTIVITY 6: SPACE WATER

You'll need...
From the kit: plastic cup, square card
From home: water

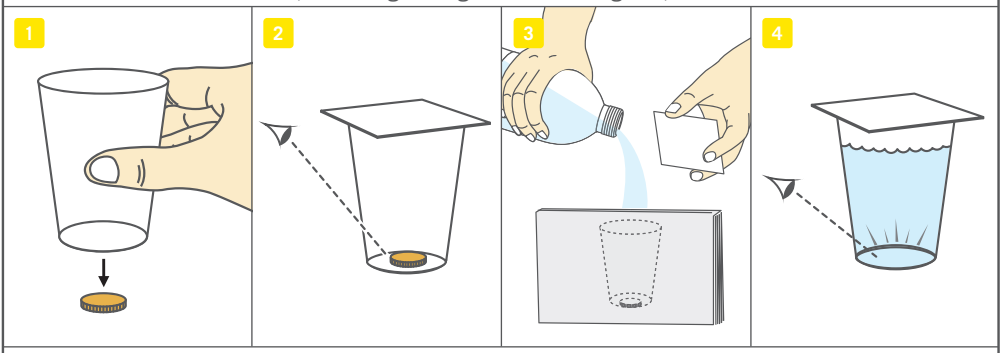


1. Present your audience with a cup of water that's almost full. It is your mission to make them believe that the water has come from outer space and has the power to defy the force of gravity. Can you succeed in your mission? Now cover the mouth of the cup with the square card. The white side of the card should be placed touching the cup.
2. Holding the card over the cup with one hand, slowly turn it over with the other hand so it's upside down.
3. The water will stay in the glass without escaping and you will be crowned master magician! You are fast becoming an illustrious illusionist. Are you ready for your next challenge? Defy the force of gravity.

How Does It Work?
The water doesn't escape because the water pressure inside the cup is less than the air pressure outside the cup. The card is forced against the mouth of the cup by the air pressure outside and surface tension is created in between the water and the cup's edge. This stops the outside air from getting into the cup, meaning the water won't escape. Try more experiments by squeezing the cup – what happens? Or add less water to the cup – does the water hold for longer?

ACTIVITY 7: MISSING COIN

You'll need...
From the kit: plastic cup, square card
From home: bottle of water, book big enough to hide the glass, small coin

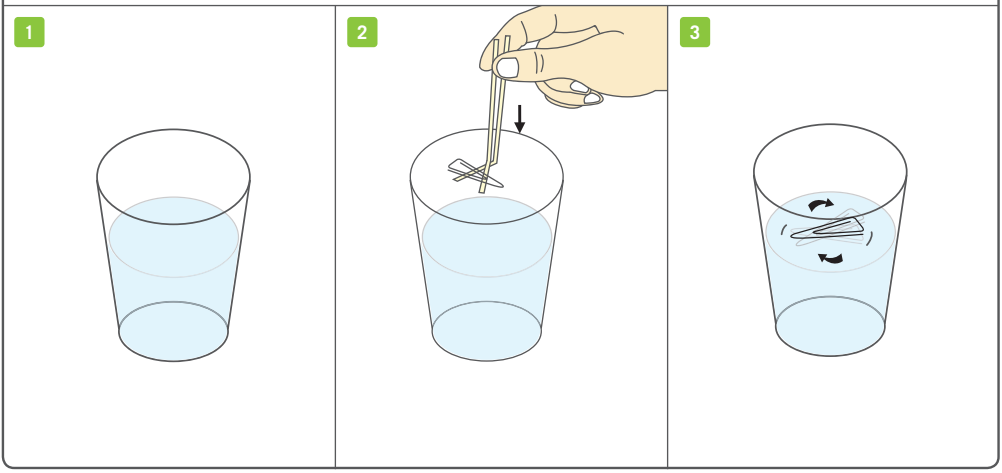


1. Place the coin on the table and put the cup on top of it.
2. Cover the cup with the square piece of card. Now it's time to get into character – make your audience believe you have magic water that can make the coin disappear.
3. Now place a book in front of the cup so your audience can't see what's going on behind it. Not only will this help with the illusion, it will also distract them! Cunning, hey? Show them your hands so they know you're not touching anything. Now take away the piece of card with one hand and pour water into the cup with the other.
4. When the cup is full, put the card back on top of it. Remove the book and ask someone from the audience to look through the cup to check if the coin is still there. They won't believe it when they see the coin is gone. You truly are a crafty conjurer.

How Does It Work?
The coin is still underneath the cup, but when water is added, the light ray is reflected and causes the coin to disappear from sight. However, the coin still can be seen from the top, which is why you need to make sure you cover the cup with the card. Isn't magic marvellous?

ACTIVITY 8: FLOATING METAL

You'll need...
From the kit: plastic cup
From home: water, 2 toothpicks, paper clips

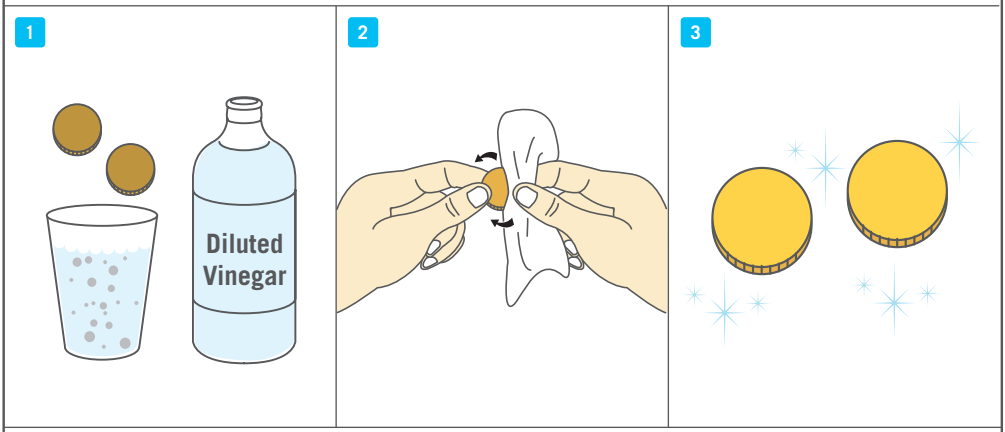


1. You are now well on your way to becoming an illustrious illusionist! Explain to your audience that metal normally sinks in water due to its higher density. Demonstrate this by dropping a paper clip into a cup of water – it will sink immediately. Now tell them you have some special paper clips made of space metal and they can float on water. They won't believe it. Now fill the plastic cup with water.
2. Break and bend two toothpicks as shown. Place a paper clip onto the bended arms. Hold the toothpicks as shown and slowly submerge them in the water.
3. When the paper clip reaches the surface of the water, slowly and carefully remove the toothpicks. If done correctly, the paper clip should float on the surface of the water.

How Does It Work?
Metal has a higher density than water, which means it should sink. However, there is water tension on the surface of the water. This tension can hold heavier substances if they are small enough and if they are placed very gently onto the surface without breaking the tension. Hint: if you have difficulty floating the clip on the water, try applying some wax on the clips before the show, but don't let anyone see you.

ACTIVITY 9: COIN SODA BATH

You'll need...
From the kit: plastic cup
From home: dirty coin, fizzy soda drink or vinegar, piece of cloth

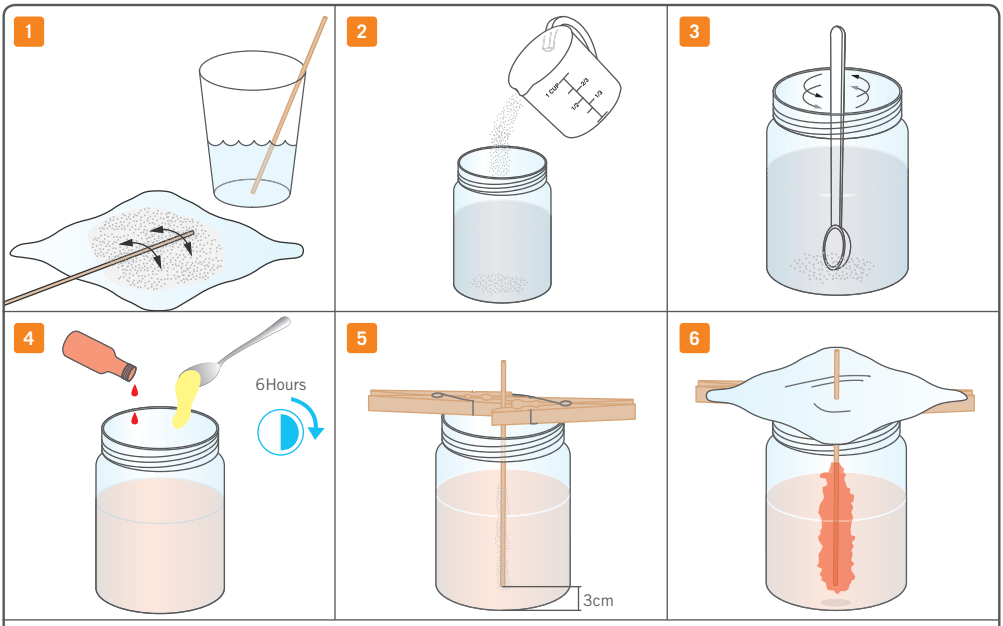


1. Prepare a cup of fizzy drink or vinegar solution. Ask your audience to donate some dull coloured coins. Explain that their coins are very dirty and need a good old clean – only you have the super powers to restore their shiny appearance! Place them into the cup.
2. Leave them in the cup for a few minutes, then take them out and give them a good rub with a piece of cloth.
3. Hey presto – they are super shiny once more.

How Does It Work?
Coins are made out of metal; when they are first made they are very shiny. After being exposed to air, they start to tarnish due to oxidisation. The oxidised surface is what makes the metal look dull. The fizzy soda in this trick is acidic. When metal is submerged in an acidic liquid, the oxidised surface starts to react with the acid and dissolve. This results in a good-as-new, sparkly coin. Kerching!

ACTIVITY 10: ROCK CANDY FACTORY

You'll need...
From the kit: 2 skewers
From home: sugar, steaming hot water, a glass container (glass or empty jam jar) which is a similar height to the skewers, 2 clothes pegs, paper towel, teaspoon, measuring cup
Optional: food colouring and flavouring oil



1. First prepare the skewer. Ask an adult to help you with the following steps as hot water is involved. Wet the skewer with hot water and roll it in some sugar to coat the surface. Leave the skewer to dry for at least 6 hours. This sugar layer provides a surface for sugar crystals to grow in the later steps.
2. In the kitchen, use the measuring cup to prepare a cup of steaming hot water. Pour it into the glass container. Mix it with 2 cups of sugar. Remarks: the combination of water to sugar is always 1 to 2. Adjust the contents in accordance to the size of the glass container. Do not fill the container to the top with hot water as when the sugar is added the volume will increase and cause an overflow. Two thirds of the container's height will be ideal.
3. Stir the mixture until all the sugar has dissolved.
4. Add half a spoon of flavouring oil and 2-3 drops of food colouring to the hot sugar solution (this is optional). Allow the sugar solution to cool for about 6 hours.
5. Place the prepared skewer (already coated with sugar) into the glass container and hold it in place using 2 clothes pegs as in Diagram 5. Rest the clothes pegs across the top of the glass container allowing the skewer to hang down. Adjust its position so that it is about 3cm from the bottom of the container. Avoid touching the bottom of the container as the candy will stick to the bottom.
6. Leave the glass container in a cool place, away from strong light. Place a paper towel over the top to prevent dust from falling into the container. You should see sugar crystals forming on the skewer after about 1 day. The longer you wait, the bigger the crystals will be. Allow the rock candy to grow to the size you want. Remove it from the sugar solution and let it dry for a few minutes. It is ready for you to enjoy! Or you can wrap it in plastic wrap and savour it later.

How Does It Work?

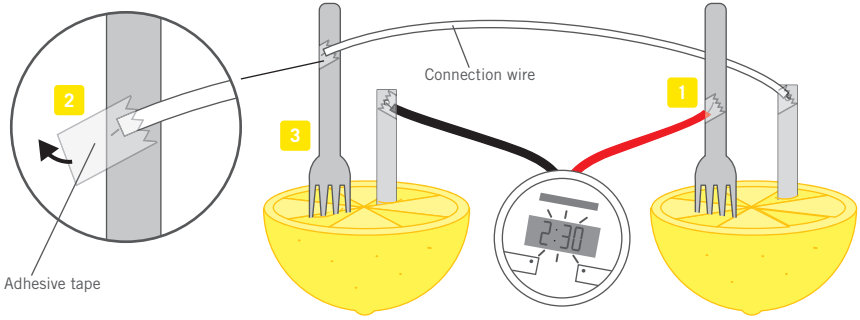
The sugar solution you made is called a supersaturated solution. This means that it contains more dissolved sugar than possible under normal conditions. This is achieved by mixing the sugar with very hot water. A supersaturated solution is very unstable and will crystallise easily. As time passes, the water will slowly evaporate, allowing more sugar crystals to collect on the skewer. By first coating the skewer with a layer of sugar, you provide a "seeded" surface for sugar crystals to grow more easily.

Fun Facts

Many crystals can be found on Earth. They are minerals that have had the chance to grow into their natural shapes which are determined by the chemicals they are composed of. Most of the Earth's crystals were formed millions of years ago when the hot liquid rock (lava) inside the Earth has cooled and hardened. Most of these crystals took thousands of years to 'grow'.

ACTIVITY 11: FRUIT BATTERY

You'll need...
From the kit: 2 zinc plates, LCD watch movement, connection wire, adhesive tape
From home: 2 forks, 1 lemon - halved (or other fruits, e.g. apple, tomato, orange)



1. Connect the red wire on the LCD watch to a fork and the black wire to a zinc plate. Secure the wires in place with adhesive tape.
2. Get another fork and zinc plate and connect them with the connection wire using adhesive tape.
3. Insert the forks and zinc plates into the lemon halves to activate the LCD watch movement as shown in the diagram. You will see your watch start blinking.

How Does It Work?

The forks act like the positive electrodes of a battery. They are plated with a metal which is less reactive than zinc. When the forks and zinc plates are inserted into the lemon, a chemical reaction takes place. Electrons (extremely small particles with negative charge) move from the zinc plates to the forks to form a current, thus activating the LCD watch. The lemon juice helps to conduct electricity. You can replace the lemon with a potato, a grapefruit or use soft drinks and see what effect this has.

Fun Facts

The development of the battery started in 1775 when a scientist called Alessandro Volta invented a machine that produced and stored static electricity by rubbing cat fur across a metal plate. A few years later, a doctor called Luigi Galvani noticed that dissected frogs' legs twitched when they were in contact with two different metals. Volta realised that the electricity came from the metals and began doing experiments with different types of metal. In 1800, he made the first ever battery which consisted of copper and zinc strips separated by a piece of paper soaked in salt water and dipped in diluted acid.

Setting The Watch

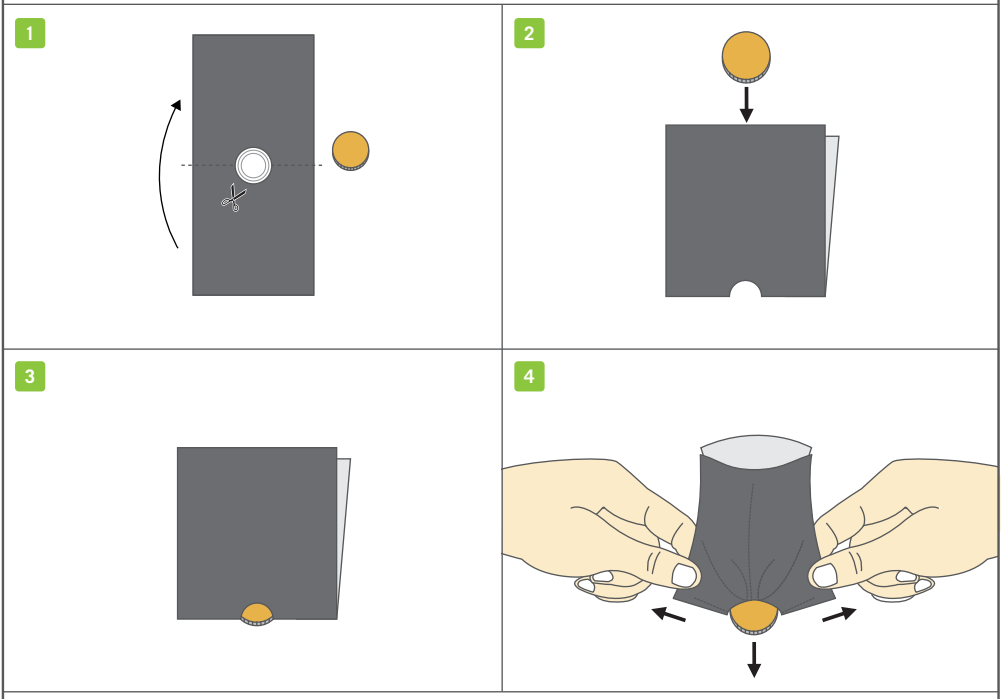
Press A twice and the display will show the set month mode, then press B to adjust to the right month. After the month is set, press A to confirm, and the set day mode will be displayed, press B to adjust to the the right day. After the day is set, press A to confirm and the set hour mode will be displayed, 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 on the display between the hours and minutes. The LCD watch may temporary lose its function in an electrostatic discharge environment, but normal function can be resumed by resetting the device.

Viewing The Time

By default, the clock display shows the current time. To view the Date, press B once. It will resume showing the current time after 2 second. To view the Seconds, press B 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.

ACTIVITY 12: THE GREAT COIN ESCAPE

You'll need...
From the kit: strip of paper with circles printed on it
From home: coin, scissors

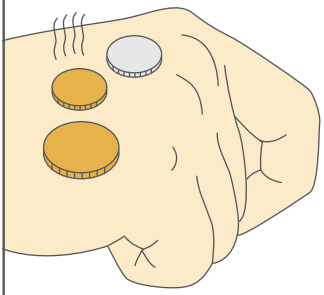


1. For this trick you'll need a small coin. On the strip of paper, choose a printed circle on the paper that is about 20% smaller than your coin. Fold the paper in half. Cut a circular hole around the chosen line. Test it first (away from prying eyes!) to make sure the coin can't fit through the hole.
2. In true magician style, show your audience the coin and paper and point out that the hole is much smaller than the coin. Ask a volunteer to push the coin through the hole without tearing the paper – this is physically impossible, right? Cue drumroll... now is your time to shine.
3. Carefully fold the paper in half and drop the coin inside so it sits snuggly in the half circle hole.
4. Now, holding each side of the folded piece of paper, bend and jiggle it for a while for maximum effect. The coin will slowly emerge through the hole to the amazement of your audience. You're getting good at this magic malarkey!

How Does It Work?
If you try to push the coin through the hole whilst holding the paper flat, the maximum width of the hole is its diameter, which is much smaller than that of the coin. There's no way you can get the coin through without tearing the paper. However, by folding and bending the paper, you are making use of the circumference of the hole, making the width larger. Circumference = Diameter x 3.14, so even when it's folded and reduced in half, it is still close to 1.5 times bigger than the hole's diameter. Now that's magic.

ACTIVITY 13: SEE THROUGH MAGIC

You'll need...
From the kit: plastic cup
From home: 3 coins of different shapes and sizes

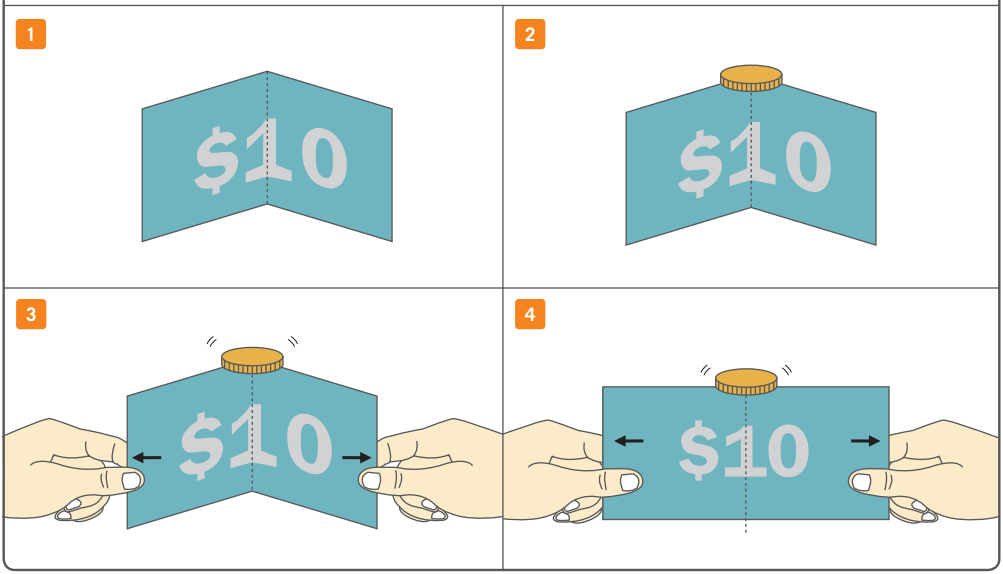


1. Practice makes perfect with this trick, so preparation and showmanship is key. To make the trick more interactive, pass around a cup and ask three willing friends to donate a coin – reassure them you'll give it back to them at the end! Each coin should be different.
2. Pass the cup with the coins in to one person and ask them to pick one out and show it to the rest of the audience without letting you see it. Tell them to grip the coin as tightly as possible, so you can't see what they've chosen.
3. Ask them to raise the hand that's holding the coin. At this point you should reveal that you have X-ray vision and the power to see through human hands! Pretend you're examining their fist with your super powers and ask them to concentrate as hard as they can.
4. After about a minute, get them to place the coin back in the cup without showing you. Quickly place all the coins on the back of your hand, one at a time. Check the temperature of all the coins – the one that feels the warmest is the one your friend chose. Get them to verify this with the rest of the audience.

How Does It Work?
Coins are made out of metal, which is a heat conductor. When someone holds a coin tightly, the body transfers some of its heat to it, making it warmer than those that weren't chosen. But remember, it's vital to check the temperature quickly before the coin starts to cool down. So why do you place it on the back of your hand? The layer of skin on the back of your hand is thinner and more sensitive to outside stimulus, such as changes in temperature. This means you'll be able to spot the different temperature much more easily.

ACTIVITY 14: COIN ON THE EDGE

You'll need...
From home: small coin, relatively new bank note or piece of paper the same size as a note



You don't need much preparation for this trick, meaning you can perform it anywhere. First, challenge your friends to balance a coin on a straightened bank note. But we know that's impossible... Now for the good bit.

1. Fold the note in half and make it stand on a table at a right angle.
2. Place the coin on top of the fold line so it stands steadily on the note.
3. Hold the note on both sides. Very slowly pull it open until it's completely straight.
4. Easy-to-master trick.

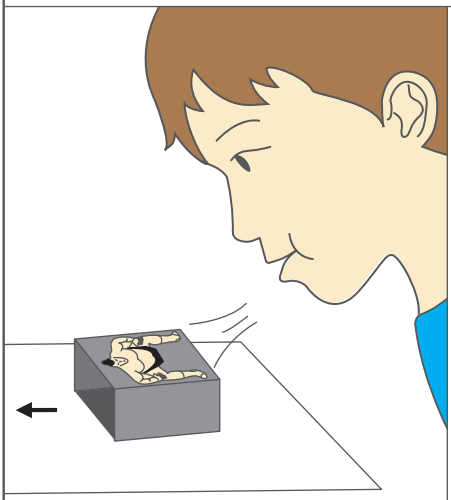
How Does It Work?

When you pull the note open, the coin on top of it moves as well. Since there is a frictional force going on between the note and the coin, the centre of gravity of the coin is moved and maintained at a balanced status. When the note is pulled straight, the coin's centre of gravity aligns with the straight line and it stands firm. This is one of our favourite illusions.

ACTIVITY 15: THE HEAVIEST SUMO

You'll need...

From the kit: paper strip with a sumo wrestler on it



Start with some facts: tell your captive audience that sumo wrestling is the national sport of Japan and sumo wrestlers are extremely heavy. Now tell them you have invited a wrestler to take part in your next trick. They'll all be expecting a giant to appear – instead, produce the super-light paper strip. Insist that he's really heavy and that no matter how hard they try, they won't succeed in blowing him over.

This is where your acting skills come in – pretend to talk to the sumo. Convince your audience that he's asked for a volunteer to step up and try to blow him over. The only rule is they have to blow from the front. Whoever succeeds is the mighty victor!

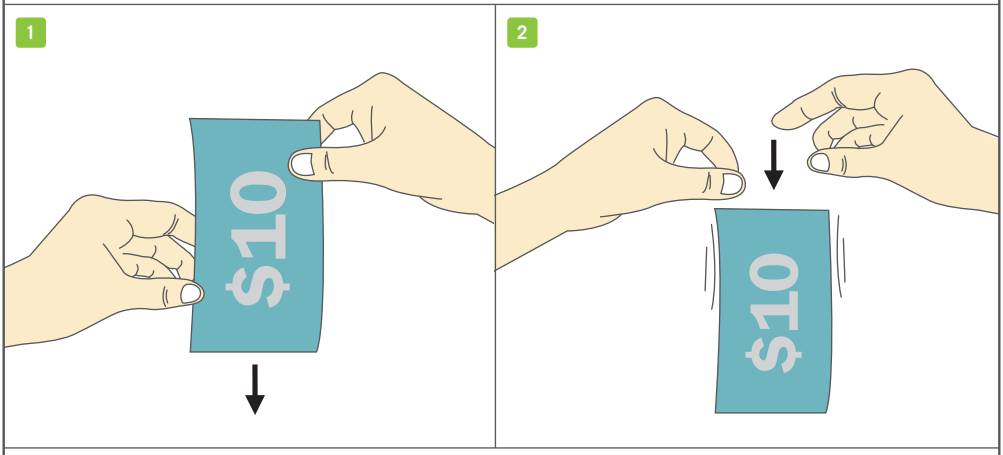
Now fold the paper like a bench and place the sumo on the table; get the volunteer to blow as hard as they can. No amount of huff or puff will make the paper move – cue a stunned silence from your audience. This guy is truly a super sumo. Congratulations, you're getting good at this.

How Does It Work?

When air is blown towards the front of the paper, the current is divided by the folded paper, making it stream above and beneath it. The lower stream flows faster because of the way it has been folded. Faster air has a lower air pressure. The upper stream flows slower and has a higher pressure, which presses on the paper. It might seem hard to believe, but no matter how hard you blow, the sumo can't be blown over as there is always a higher pressure pressing down on it. You may even see that the paper clings more firmly the harder you blow. Daniel Bernoulli, a Swiss scientist in the 1800s, first demonstrated this principle. The same principle applies to aerodynamics and explains how aeroplanes lift. In the case of a plane, lower pressure is created on top of the wing, creating an upward lifting force.

ACTIVITY 16: FLYING BANK NOTE

You'll need...
From home: bank note

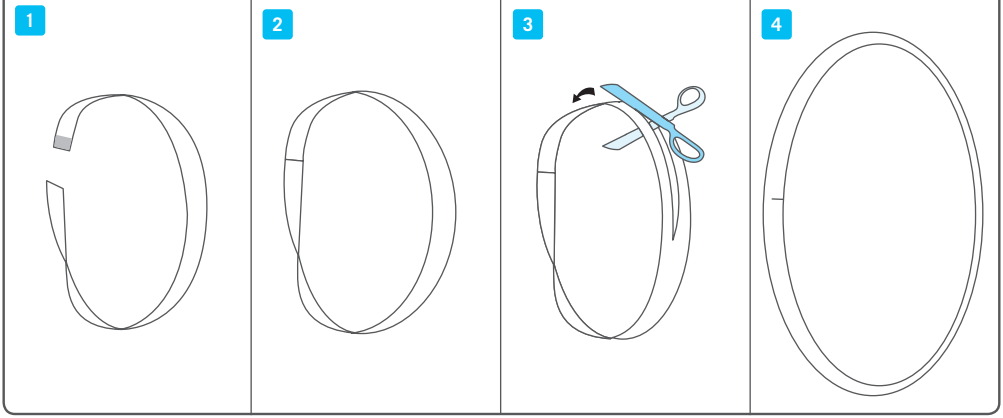


1. There is absolutely no preparation needed for this trick. Start by holding a note in the top right hand corner so it's in a vertical position. Ask a friend for some help: get them to place their thumb and index finger at around the middle of the note without touching it.
2. Tell them you're going to release the note and if they can catch it, they can keep it. It sounds easy, but it's not.

How Does It Work?
Your brain is a mighty muscle and controls your hand's catching action. It takes around 0.2-0.3 seconds for your brain to send the signal from your eye to your hand and catch the falling note. An average bank note is approximately 15cm long, so when the volunteer's finger is placed half way down it, the falling distance is shortened to 7.5cm. It takes less than 0.2 seconds for the bank note to fall that distance, meaning the brain won't be able to react in time as the note falls faster. There is always a delay in brain to hand reactions, unless, of course, your friend has supersonic, super-fast reactions.

ACTIVITY 17: PAPER RING MAGIC 1

You'll need...
From the kit: long paper strip (you could also use newspaper to make more paper strips for future shows)
From home: scissors, glue



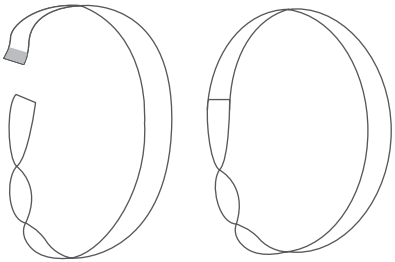
1. Twist the paper strip once.
2. Stick both ends together with glue. Show your audience the paper ring you have prepared, making sure you hold the ring where it twists so your audience won't spot it.
3. Ask your audience to guess what might happen if you cut the paper ring lengthwise. Most will probably say you'll end up with two individual rings. Declare that you have some special magic scissors that will create something completely different. Let the snipping commence!
4. To build the suspense you may want to accentuate your actions and put on a bit of a show. They won't believe their eyes as you present a continuous ring of paper, twice the size of the original.

How Does It Work?
By twisting the strip before connecting the ends you actually make the ring's two surfaces become one. This is known as a Mobius strip and was co-discovered independently by German mathematicians August Ferdinand Möbius and Johann Benedict Listing in 1858. The cut is like a continuous cut on one plane surface. Instead of using scissors, draw a line down the middle of the ring with a pen. You will end up drawing one complete circle over the two planes.

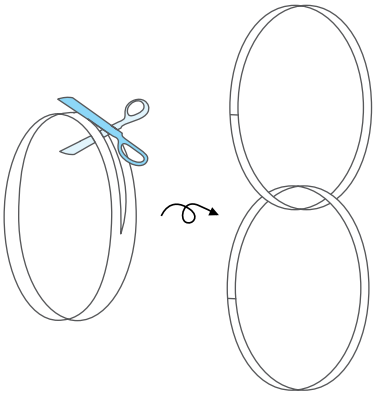
ACTIVITY 18: PAPER RING MAGIC 2

You'll need...
From the kit: long paper strip (you could also use newspaper to make more paper strips for future shows)
From home: scissors, glue

1



2

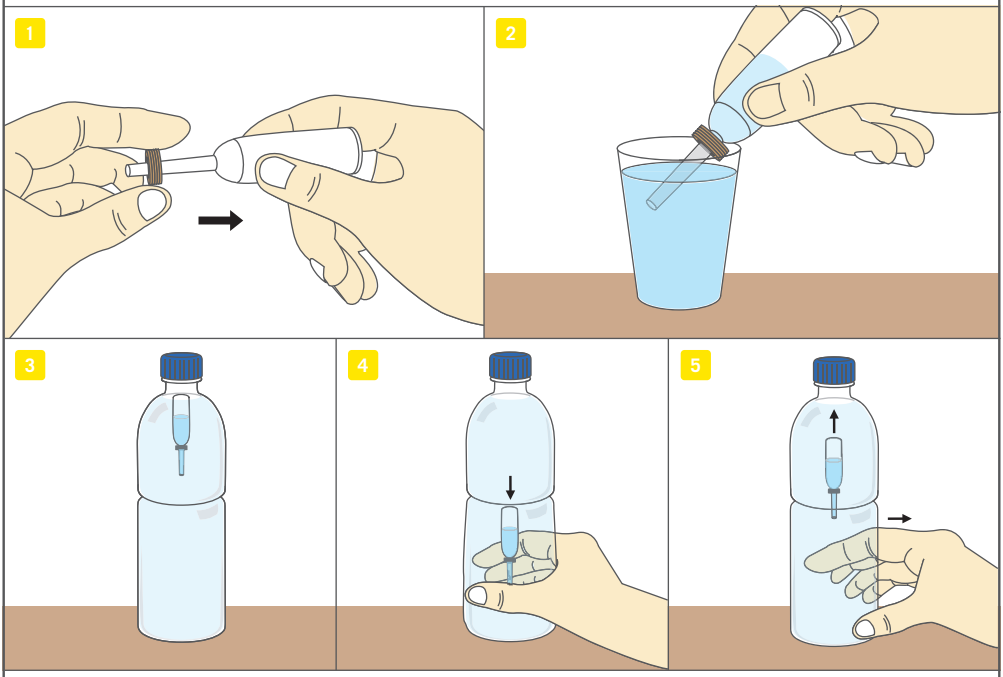


1. You should perform this trick straight after Paper Ring Magic 1, for best effect. This time, make TWO twists in the middle of the paper strip. Stick both ends together with glue. Remember – don't let anyone see the twists in the paper.
2. Ask your adoring audience again what they think will happen if you start cutting like last time. They might think they know, but chances are they'll be well and truly flummoxed. Get into full-on magician mode and work the crowd whilst you start snipping the paper. Drumroll... you have expertly created two interlocking rings and are truly are a cunning conjurer.

How Does It Work?
This is another mind-boggling demonstration of the Mobius strip, just like in the Paper Ring Magic 1 trick. By adding an extra twist to the paper strip before connecting the ends, it produces different results after it is cut. Why not try three twists? This will produce a strip tied in a "trefoil knot", much to the bemusement of friends and family. It's amazing what you can achieve with a piece of paper and some twists and turns.

ACTIVITY 19: MAGIC DIVER

You'll need...
From the kit: suction tube, 3 metal washers
From home: plastic water bottle



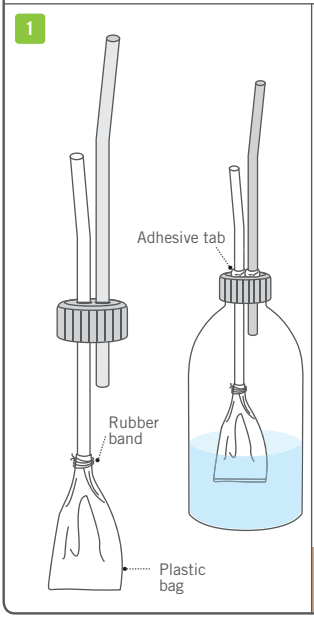
1. Start by placing the three metal washers onto the suction tube.
2. Immerse the tube in a cup full of water. Gently squeeze the tube so it starts to fill up. As you squeeze it, water will be sucked in: it should be two thirds full. Now you're ready for the next stage of the experiment.
3. Fill the plastic bottle with water and place the tube inside the bottle. Make sure it stays afloat at the water level. If it starts to sink, remove the tube and squeeze out some of the water so it floats at the top of the bottle. Now tightly fasten the cap.
4. This is where your acting skills come in! Present your audience with the bottle with the tube inside. Make them believe that you have the magic powers needed to move the tube up and down the bottle without touching it. Now say, "Down", whilst gently squeezing the bottle – the tube will start to submerge.
5. Next say, "Up", whilst releasing your grip, and the tube will start to travel up the bottle like a magic diver. Repeat this process as many times as you can to the amazement of your cooing crowd.

NB: To stop your audience noticing your hand movements, we recommended you squeeze the bottle before starting the trick while they're not looking so the tube is already slightly submerged.

How Does It Work?
The up and down movement of the tube is controlled by the air bubble trapped inside. When you squeeze the bottle, pressure inside increases, causing the air bubble to contract. This decreases its buoyancy and sends the tube to the bottom. When you release your grip, the air bubble expands and its buoyancy increases, making the tube move to the surface. If your tube won't submerge, there is probably too much air inside and the buoyancy is too high. Suck in more water to solve the problem.

ACTIVITY 20: SELF-INFLATING BAG

You'll need...
From the kit: screw cap, 2 straws, plastic bag, adhesive tab, rubber band
From home: plastic water bottle, a water container e.g. water tray

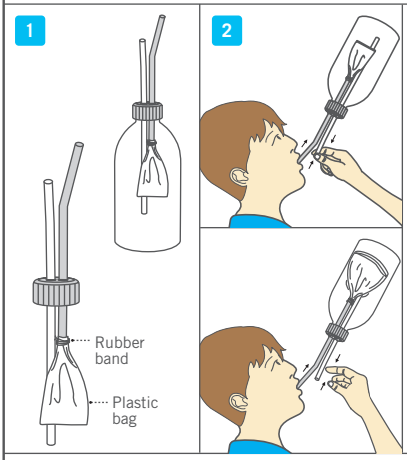


1. Set the props up as shown. Use a rubber band to tie the plastic bag to one straw. Insert the straws and plastic bag into the plastic water bottle. Tighten the screw cap. Apply adhesive tab to all connecting gaps to make the whole system air tight.
2. Tell your audience that you have a magic plastic bag which will inflate by itself. Show them the system you prepared. Now invert the bottle to let the water flow out to the water container. Bravo, the bag starts to inflate magically by itself.

How Does It Work?
The outside air is forced to go through the straw due to the pressure difference when the bottle is inverted and the water begins to drain. The difference in air pressure causes the bag to inflate.

ACTIVITY 21: STUBBORN BAG

You'll need...
From the kit: screw cap, 2 straws, plastic bag, adhesive tab, rubber band
From home: plastic water bottle

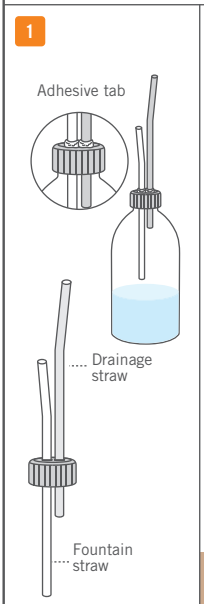


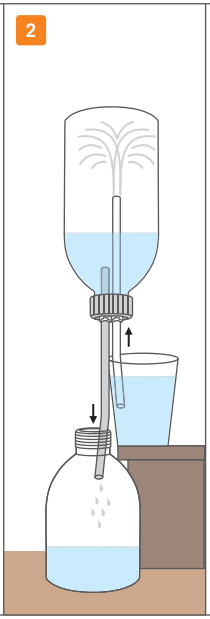
1. Set up the props as shown. Use a rubber band to tie the plastic bag to one straw. Insert the straws and plastic bag into the plastic water bottle. Tighten the screw cap. Apply adhesive tab to all connecting gaps to make the whole system as air tight as possible.
2. This trick could be a continuation of the Self-inflating Bag done previously. You have shown your magic bag inflated by itself. Now tell your audience that only you can inflate the bag! They won't believe you, so ask a volunteer to try. In the meantime, pretend that you are helping your volunteer to hold the bottle. Without being seen by the audience, block the opening of the other straw with your finger. No matter how hard your volunteer tries, the bag will not inflate. Now it's your turn. Clean the straw. Release the finger that has been blocking the other straw's opening. Blow gently and the bag inflates. Bravo!

How Does It Work?
When you blow into the straw, air tries to go inside the bottle. However, since the only air passage is blocked by your finger, the air inside the bottle can not escape. This airtight pressure stops the air you blow from going in and the plastic bag cannot be inflated. When you release your finger, the inside air pressure no longer exists, and the plastic bag can then be inflated.

ACTIVITY 22: MAGIC FOUNTAIN

You'll need...
From the kit: screw cap, 2 straws, adhesive tab
From home: plastic water bottle, 2 water containers, e.g. water tray, bottles etc.



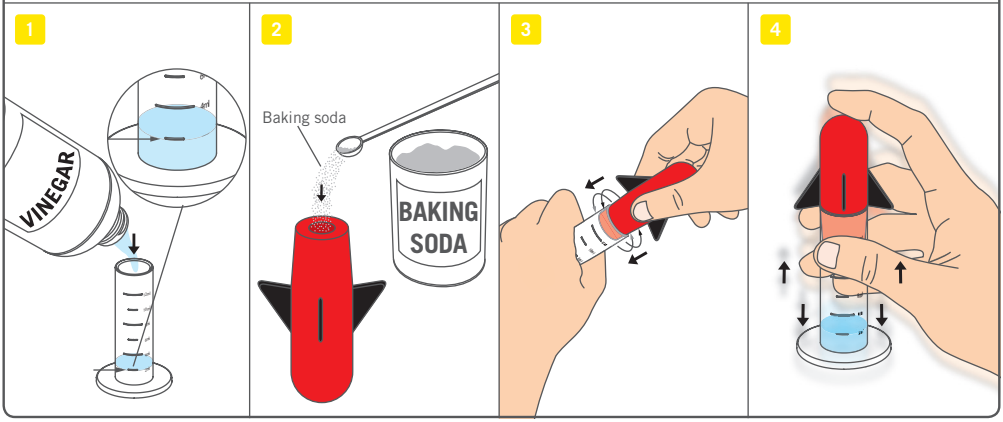


1. Set up the screw cap and straws as shown. Fill the bottle to 1/3 full of water. Insert the straws into the plastic water bottle, and tighten the screw cap. Use adhesive tab to make the whole system as air tight as possible. Prepare another two bottles/containers, one empty and one filled with water. To make the fountain more spectacular, add some food colouring (or condensed drink syrup) to the water inside the supply container.
2. Start by asking your audience how a fountain works. Now tell them you could make a mini fountain inside a bottle, which is powered by a magic, invisible force. Now slowly invert the bottle and insert the "fountain straw" into the container with water and the "drainage straw" to the empty container. Make sure the other end of the "fountain straw" is dipped inside the water. What happens? While the water flows out to the empty container from the "drainage straw", you will see water blowing out from the "fountain straw," creating an interesting fountain. You may also try lifting the fountain bottle a bit so that the "fountain straw" is above the water level of the water container. Instead of flowing out, the water will "shoot" out.

How Does It Work?
When water flows out from the "drainage straw", air pressure decreases inside the bottle. The air pressure outside is stronger and forces the water in the supply container to go up and flow out from the "fountain straw", thereby creating a fountain scene. When the fountain bottle is lifted, there is water half way inside the straw. With the straw above the water surface, air, instead of water, flows inside the straw. The pressure of flowing air causes the water to shoot up.

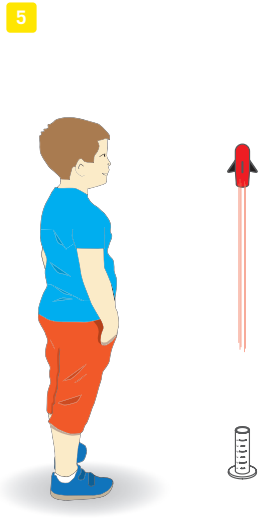
ACTIVITY 23: VINEGAR ROCKET

You'll need...
From the kit: foam rocket, launcher pad, small spoon
From home: baking soda, vinegar



Safety Messages
Find an outdoor open space with a level surface, preferably with a concrete floor, e.g. a garden yard. Cover the area with old newspaper as the launching could be messy.
Warning! Do not point the rocket at a person or pet. Never watch the launching rocket from above. Do not aim at eyes or face.

1. Put 2ml of vinegar into the launch pad and place it on the floor.
2. Using the small spoon provided, put a spoonful of baking soda into the hole at the bottom of the rocket. Remove excess baking soda from the edge of the rocket so that the baking soda just fills up the bottom cavity.
3. Insert the rocket into the launch pad.
4. Hold the launch pad and rocket as shown and shake gently three times.
5. Quickly place the rocket and the launch pad on the floor vertically and move away. Keep your distance. Watch how your rocket shoots up into the sky! 3, 2, 1 ... Blast off!

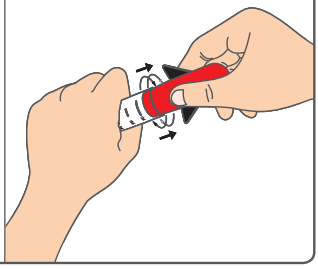


Remarks
Rinse the launcher pad and rocket with water after each use. The vinegar residual will erode the plastic of the foam rocket and the launcher pad.

How Does It Work?
A chemical reaction takes place when the vinegar is mixed with the baking soda. The acidic vinegar reacts with the alkaline baking soda to produce carbon dioxide. There is no place for the carbon dioxide to escape inside the launch pad. The pressure builds up and eventually it gets so great that the launch pad propels the rocket high up into the sky.

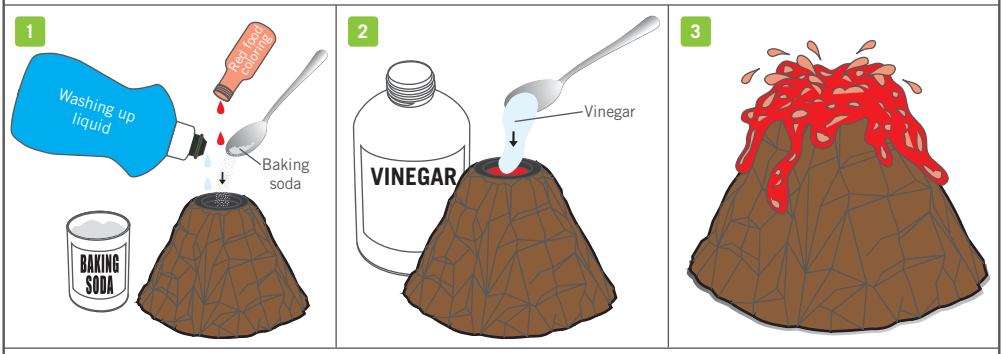
Fun Facts
In a real rocket, fuel is burned inside which causes hot gases to shoot out of the back of the rocket. This propels the rocket forward according to Newton's Third Law of Motion, which states that every action creates an equal and opposite reaction. The force that pushes the gases out of the back of the rocket is the action. The rocket moving forward in an upward direction is the counter-reaction. Since rockets are heavy, it takes a large force to make a rocket speed up to the point where it can escape the Earth's gravity (Newton's Second Law states that the force is proportional to the mass and acceleration). Once the rocket is in motion, it keeps moving in a straight line until another force makes it turn or stop. This is the result of Newton's First Law, which states that an object will remain at rest or in uniform motion in a straight line unless acted upon by an external force.

Troubleshooting
If your rocket does not blast off, the connection between the rocket and the launch pad is probably too loose meaning that the air leaks out, or it may be too tight so that friction prevents the rocket from shooting up.
Hold the rocket and the launch pad so that the rocket faces away from you and not pointing at anyone. Remove the rocket from the launch pad carefully. If you hear a big pop sound (which is produced by the escaping air) then the rocket and launch pad connection was probably too tight. If the pop sound is small, the connection is too loose and the air is leaking already. Repeat the launching steps and adjust the force used to insert the rocket accordingly.



ACTIVITY 24: TABLE TOP VOLCANO

You'll need...
From the kit: volcano
From home: tray, baking soda, vinegar, washing up liquid, red food colouring, teaspoon

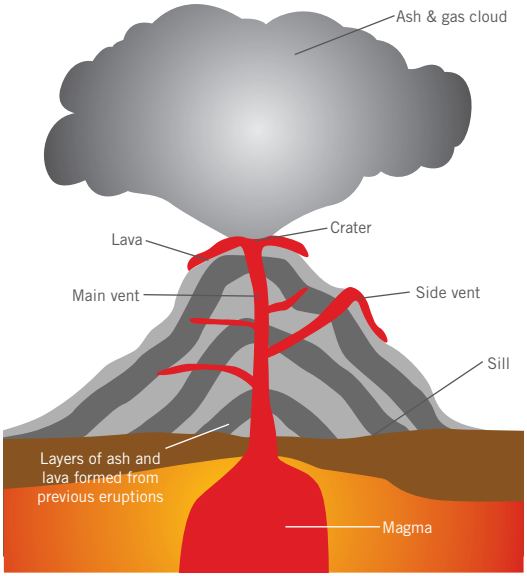


1. Place the volcano on a large flat tray to avoid making a mess. Cover the table with old newspaper. Put two teaspoonfuls of baking soda into the volcano. Add a few drops of washing up liquid and red food colouring. This will make the 'lava' effect look more dramatic. The washing up liquid slows down the eruption and makes the volcano foam.
2. Slowly pour a teaspoonful of vinegar into the volcano and watch it erupt with 'bubbly lava'.
3. You can continue to add more vinegar to cause more 'lava' to erupt out of the volcano. Eventually the eruptions will cease.

Remarks:
You could repeat the eruption process unlimited times. However, remember to rinse the volcano with water after each use to prevent the vinegar residual eroding the plastic.

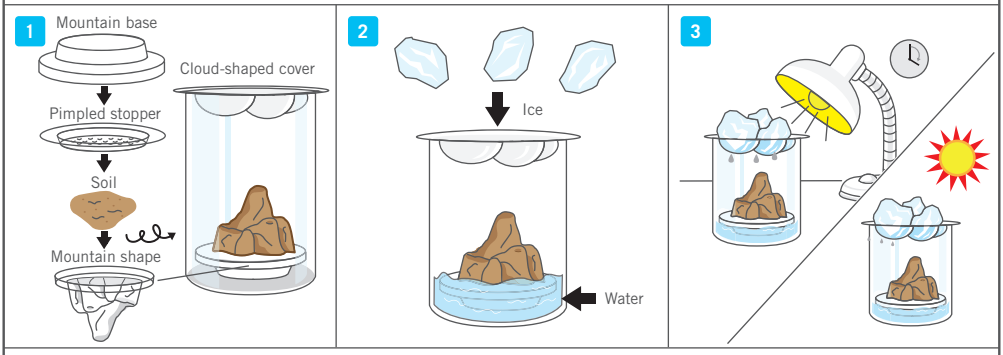
How Does It Work?
When the vinegar and the baking soda are mixed together, a chemical reaction takes place which produces carbon dioxide. The carbon dioxide escapes from the volcano in the form of bubbles. When all the carbon dioxide has escaped into the air, the solution becomes flat and the volcano stops 'erupting'. You can try using lemon juice instead of vinegar and see what effect this has on the eruption. Or add some starch or sand to the baking soda to see if you can get a better 'lava'.

Facts About Volcano
Volcanoes are openings in the Earth's surface. When they are active they can shoot out ash, gas and hot liquid rock known as magma. Once the magma comes out of the volcano, it is known as lava. Lava can flow at a rapid speed. The most lava ever recorded from a single volcanic eruption was the 1783 Laki eruption in Iceland. A quarter of the population of Iceland was killed by the poisonous gases and clouds of ash that resulted in severe destruction of crops and starvation.



ACTIVITY 25: MINI WATER-CYCLE MODEL

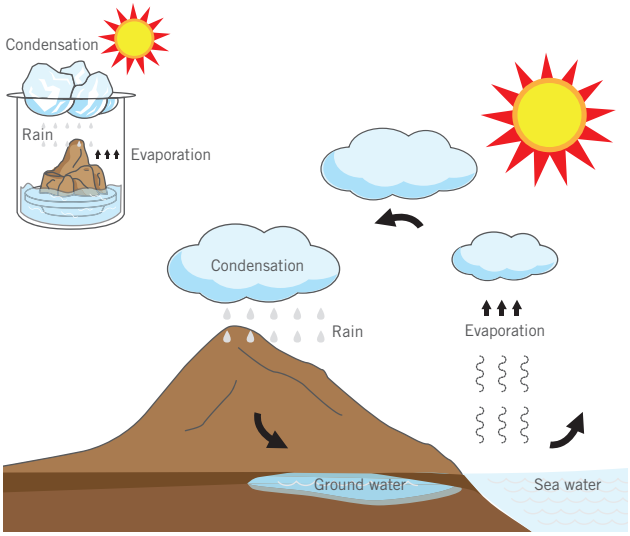
You'll need...
From the kit: mountain base, pimpled stopper, mountain shape, cloud-shaped cover
From home: drinking glass, ice, some potting soil, desk lamp



All the time, water is moving between the oceans, the atmosphere, the land, lakes and rivers and vegetation. Water evaporates from the oceans, condenses in the air to make clouds, water from clouds falls as rain, and runs down rivers into the ocean. This movement of water is called the water cycle. In this activity, you can make a mini model of the water cycle.

1. Find the mountain shape, then find the hole in the mountain side. Hold the shape upside down in one hand, keeping a finger over the hole. Pour the soil into the mountain shape. Add a few drops of water to dampen the soil. Put the pimpled stopper on top of the soil, then clip the mountain base into place. Put the mountain shape into a glass.
2. Pour water into the base of the glass until the water is about 1 cm (0.5 inch) deep so that it covers the base. Now put the cloud shaped cover on top of the glass. Put a few ice cubes in the top of the cloud cover.
3. Place the model outdoors under sunshine or alternatively put a desk lamp (a 60-watt incandescent light bulb) about 15 cm (6 inches) away from the glass and switch it on. Ask and adult to help you with the desk lamp, as it could get hot. Watch the cloud blister for a couple of 10 minutes. What happens? You will see drops of water condensed underneath of the cover. These are 'rain'.

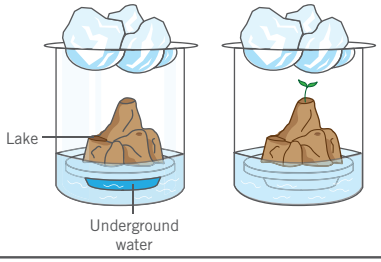
How Does It Work?
The heat from the desk lamp makes the water in the glass warm. This makes some water evaporate into the air in the glass. The warm air rises to the top of the glass, where the ice in the cloud-shaped blister cools it down. The water vapour in the air condenses, forming water droplets on the bottom of the cloud. When there's enough water, it drips down onto the mountain, then runs back into the water at the bottom of the glass. This is a mini model of the water cycle. The water in the glass represents the ocean, the cloud blister represents a cloud, and the dripping water represents rain.



You will also notice some rain water collects in the small dip in the mountain, which represents a lake. In real life, this would be fresh water because the minerals that make sea water salty are left behind in the sea when the water evaporates. Some water will seep through the soil, and collect in the base of the mountain. This represent underground water.
If you want, you can grow a bean on the mountain. Cut open the mountain top with a scissors. Germinate a broad bean. Put the germinating bean into the hole in mountain so it can continue growing. The plant will use water from the water cycle to stay alive. It will also release some water vapour into the atmosphere from its leaves (this is called transpiration).

Fun Facts

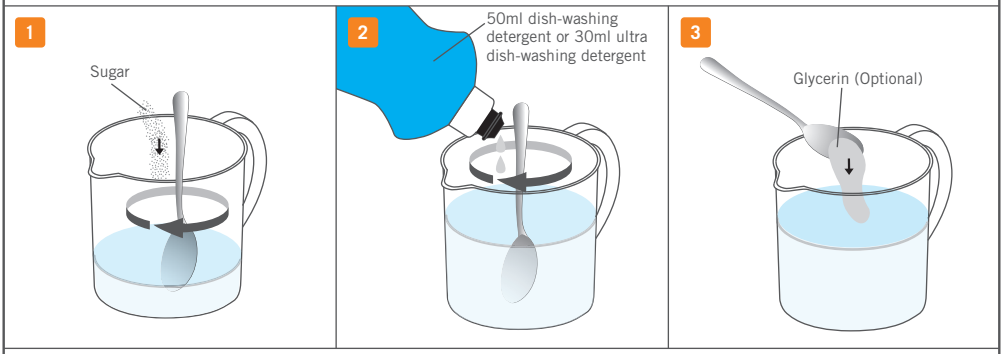
- The water in the oceans is salty, but rain is made of fresh water. That's because the minerals in the sea are left behind when the water evaporates.
- In a hundred years, an average particle of water spends 98 years in the ocean on its way round the water cycle.
- Only about one hundredth of a thousandth of all the water on Earth is in the atmosphere at one time.
- The water going round the water cycle today is the same water that was going round the water cycle when the dinosaurs were alive.



MIXING BUBBLE SOLUTION FOR ACTIVITIES 26 – 32

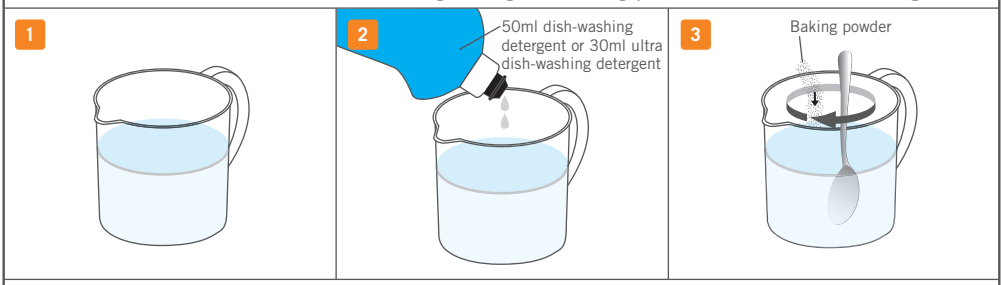
A bottle of bubble solution is included in the kit, yet it is not enough for playing all the activities. You need to mix bubble solution for some of the tricks below. As a quick start, you can simply dilute dish-washing detergent to make a basic solution. But if you want to make large bubbles and bubble films, you will need to mix a better bubble solution. Making your own bubble solution is fun. Here are two recipes which produce good-quality bubble solution. For both recipes you need a good-quality dish-washing detergent. These have different names in different countries (e.g. Joy, Fairy, Ivory, Morning Fresh and Fairy Dawn). They also often come in different strengths: standard and ultra. Tap water is okay for making bubble solution, but distilled water is better if you can get it. You will need a measuring jug and a spoon to prepare the mixture.

Recipe 1
You'll need...
From home: standard or ultra dish-washing detergent, sugar, container for mixing
Optional: glycerin (available from your local pharmacy)



1. Put 200 ml (6.7 fl oz) of warm water into a measuring jug. Stir in a tablespoon of sugar until the sugar has dissolved.
2. Add 50 ml (1.5 fl.oz) of standard dish-washing liquid or 30 ml (1 fl.oz) of ultra dish-washing detergent to the water. Add 300ml (10 fl.oz) of water into the mixture and stir well.
3. Stir in a tablespoon of glycerin, if you have some.

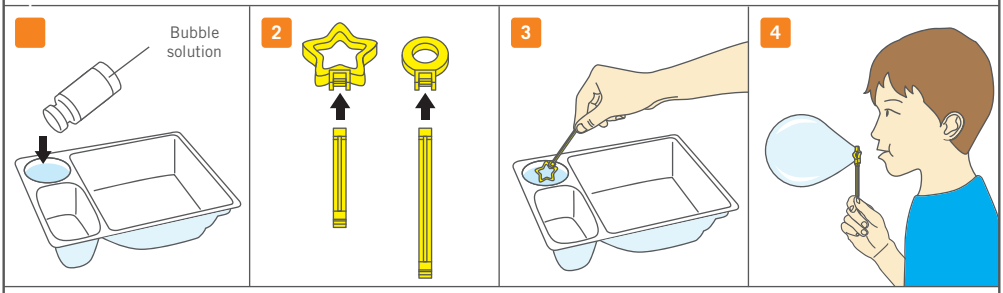
Recipe 2
You'll need...
From home: standard or ultra dish-washing detergent, baking powder, container for mixing



1. Put 500ml water into a container.
2. Add 50 ml of (1.5 fl.oz) standard dish-washing detergent or 30 ml (1 fl.oz) of ultra dish-washing detergent to the container.
3. Stir in a tablespoon of baking powder. If you keep this home-made bubble solution undisturbed for 24 hours, you will find it performs better.

ACTIVITY 26: BASIC BUBBLE FUN

You'll need...
From the kit: bubble tray, star wand, round wand, 2 clip-on wand handles, bubble solution



1. Pour some bubble solution into the small cavity of the bubble tray.
2. Clip wand handles onto the round and star wands.
3. Dip a wand into the bubble solution, then lift it out and shake off any excess solution.
4. Blow through the wand to make bubbles. Blow gently to make a larger bubble, and blow a bit harder to make a stream of smaller bubbles.

What Is A Bubble?
A bubble is film (a thin layer) of soapy water that contains air. The skin is stretchy, which is why you can blow up a bubble. As you blow, the skin stretches. It's similar to how the skin of a balloon stretches as you blow it up.

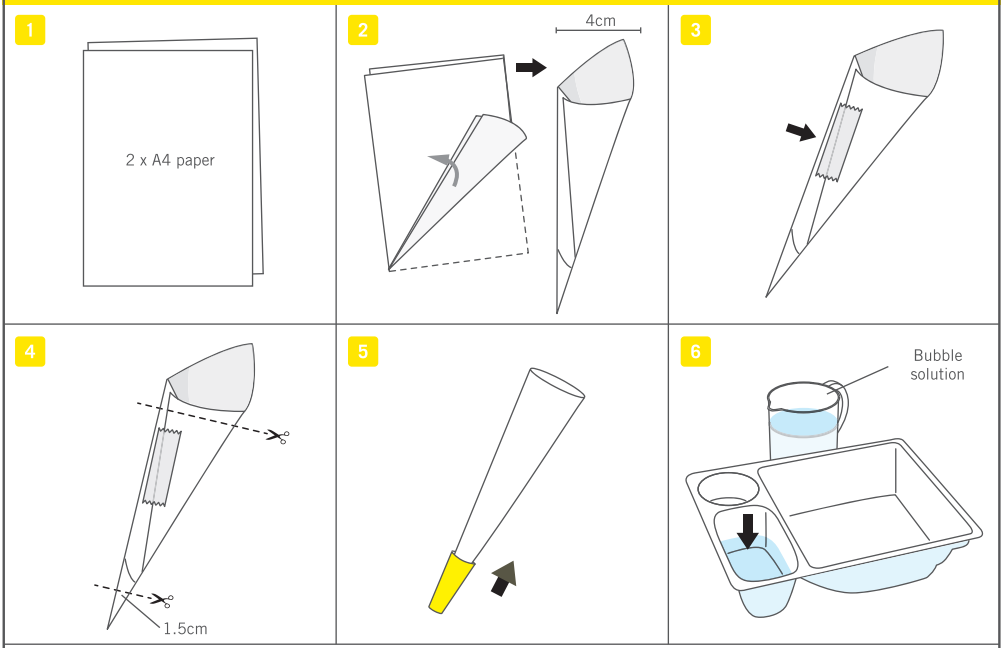
Why Are Bubbles Coloured?
You can often see bands and swirls of colour in a bubble. They happen because light rays bounce off the outside and inside walls of the bubble. The rays combine or cancel each other out to make rays of different colours. Scientists call this effect interference. The colours change as the bubble's skin gets thinner.

Why Are Bubbles Round?
Single bubbles are always a round shape (called a sphere). This is because the skin of a bubble always tries to shrink to the smallest surface area possible to contain the air inside it. When you blow a giant bubble, you can see that it slowly turns from a wobbly shape into a sphere. When two bubbles stick together, they keep making smallest surface area, which is why you see flat walls between the bubbles.

ACTIVITY 27: MAGIC PAPER WAND

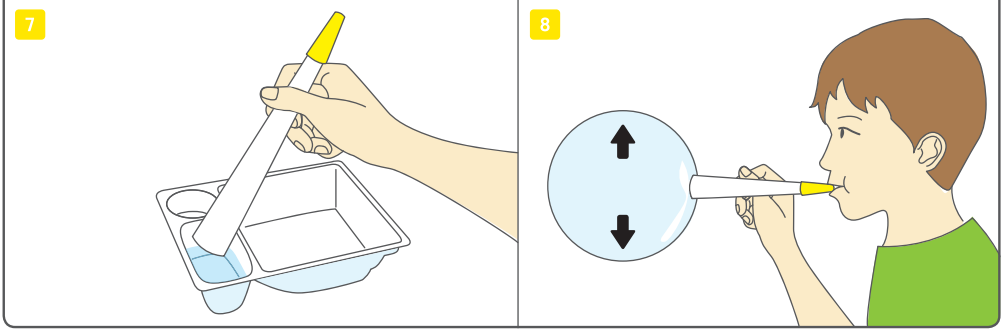
You'll need...
From the kit: bubble tray, mouthpiece
From home: bubble solution, 2 sheets of A4-sized paper (e.g. photocopier or printer paper), scissors, long straw, adhesive tape

MAKING A PAPER WAND



1. Place one paper sheet on top of the other and line up their edges.
2. Starting at one of the narrow sides of the paper, roll the paper into a narrow cone. Roll one edge of the paper very tightly and the other edge less tightly. You should end up with a cone with one pointed end and one end about 4 cm (1.6 inches) across.
3. To stop the cone unrolling, stick down the edge of the paper about halfway along the cone.
4. Carefully snip off the narrow end of the cone to leave an opening about 1.5 cm (0.6 inches) across. Carefully trim the wide end of the tube to leave a neat circle. Trim away any rough edges.
5. Push the plastic mouthpiece onto the narrow end of the tube, tightly enough that the tube stays in place when you hold up the mouthpiece. That's the paper wand complete.
6. Pour some bubble solution into medium cavity of the bubble tray. Now you're ready to blow some bubbles with the neat magic paper wand!

BIG BUBBLES



7. Dip the wide end of the paper wand into the bubble solution, to a depth of about 1 cm (0.4 inches), leave it there for a couple of seconds, and then lift it out.
8. Blow gently into the mouthpiece and watch a bubble grow. Keep blowing gently to make the bubble bigger.

What's The Biggest Bubble You Can Blow?
You will notice that you blow bigger bubbles with this paper wand. Why? The paper absorbs a large amount of bubble solution which allows the bubble to grow bigger than the plastic wands do.

BUBBLE CHAINS

9. Using the paper wand, blow a bubble about 10 cm (4 inches) across. Put you finger over the mouthpiece to stop the air escaping from the bubble.
10. Dip the end of the long straw into the bubble solution. Hold the end close to the bottom of the first bubble and blow gently to grow a new bubble that attaches to the first bubble and hangs below it.
11. Add more bubbles to the bottom of the chain. How many more bubbles can you add to the chain before your bubbles burst?

A BUNCH OF BUBBLES / BUBBLE IN A BUBBLE

A Bunch Of Bubbles
12. Start as for the bubble chain above, but keep adding bubbles with the straw around the bubble from the paper wand. How many bubbles can you add to the bunch before your bubbles burst?

Bubble In A Bubble
13. Using the paper wand, blow a bubble about 15 cm (6 inches) across. Put your finger over the mouthpiece to stop the air escaping from the bubble.
14. Dip the end of the long straw into the bubble solution. Slowly push the end of the straw through the skin of the bubble. Blow gently into the straw to make a new bubble inside the first bubble!
Remarks: Eventually your paper wand may become saturated and the paper may begin to fall apart. If this happens, simply make a new wand from two sheets of fresh paper.

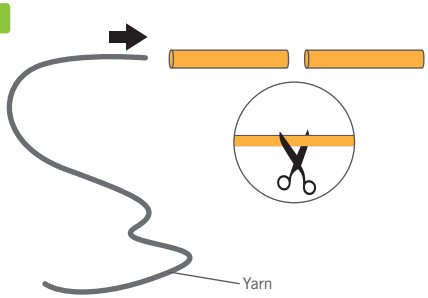
What Is The Skin Stretchy?
The stretchiness of water is caused by an effect called surface tension. It happens because the tiny particles (called molecules) that water is made from cling to each other. The pulls the molecules at the surface of water inwards, making the surface like a skin.

ACTIVITY 28: BUBBLE FILM

You'll need...
From the kit: bubble tray, yarn, round wand, wand handle
From home: bubble solution, long straw

MAKING A BIG BUBBLE

1



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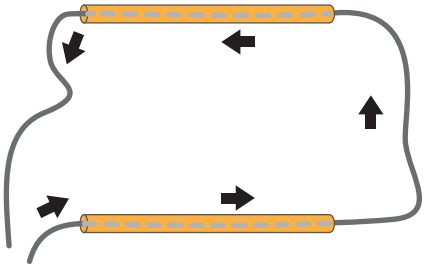

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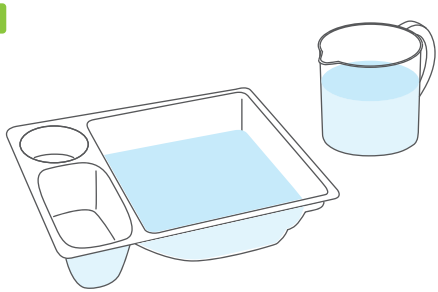

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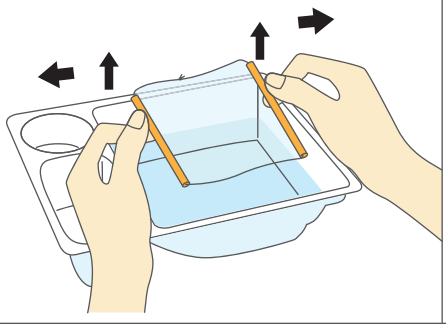

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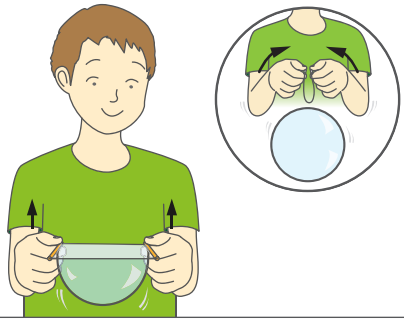
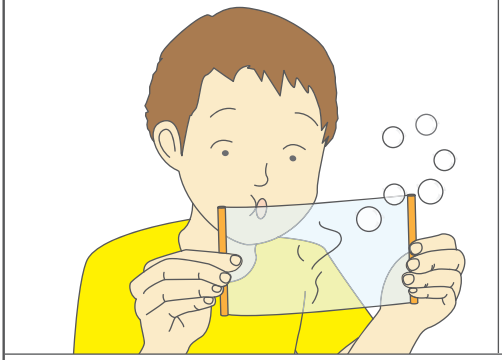


1. First you need to make a frame. Cut the long straw into two equal halves.
2. Thread one end of the yarn through the straw. Feed the yarn through the other straw in the same way.
3. You should now have the two straws on the yarn. Tie the two ends of the yarn together with an overhand knot. Cut off any spare ends of yarn.
4. Pour bubble solution into the large cavity of the bubble tray.
5. Hold the frame by the straws (one in each hand) and dip it into the bubble solution, make sure that the yarn gets soaked with solution. Gently and slowly lift the frame from the solution and pull the straws apart to straighten the yarn and make a rectangle shape. There should be a film of bubble solution in the frame.
6. To make a big bubble, slowly pull the frame through the air. The film should stretch and form a big bubble. When the bubble has grown, pull the frame quickly to release it into the air.

MAKING SMALL BUBBLES

7



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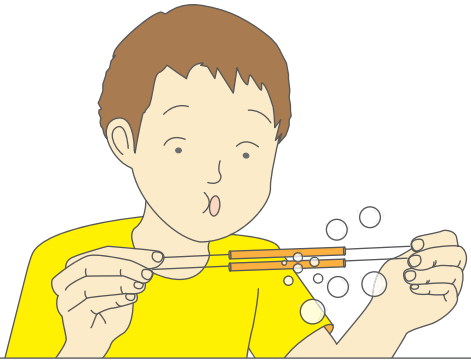

7. Make a bubble film as in step 5 above, then blow gently on the centre of the film. You should get as stream of small bubbles without the film breaking.
8. You can also make small bubbles by holding the straws a few millimetres apart, dipping them into the bubble solution and blowing gently between them.

BOUNCING BUBBLES

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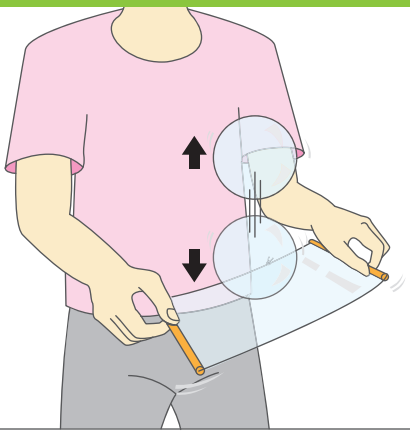


9. You will need a helper for this step. Make a bubble film as in step 5 above. Ask your helper to dip the round wand into the bubble solution, and then gently blow into wand to make a small bubble in the air.
10. Hold the bubble frame under the small bubble. Move the frame upwards as the bubble floats down towards it. You should see the bubble bounce off the film. It's like a bubble trampoline!

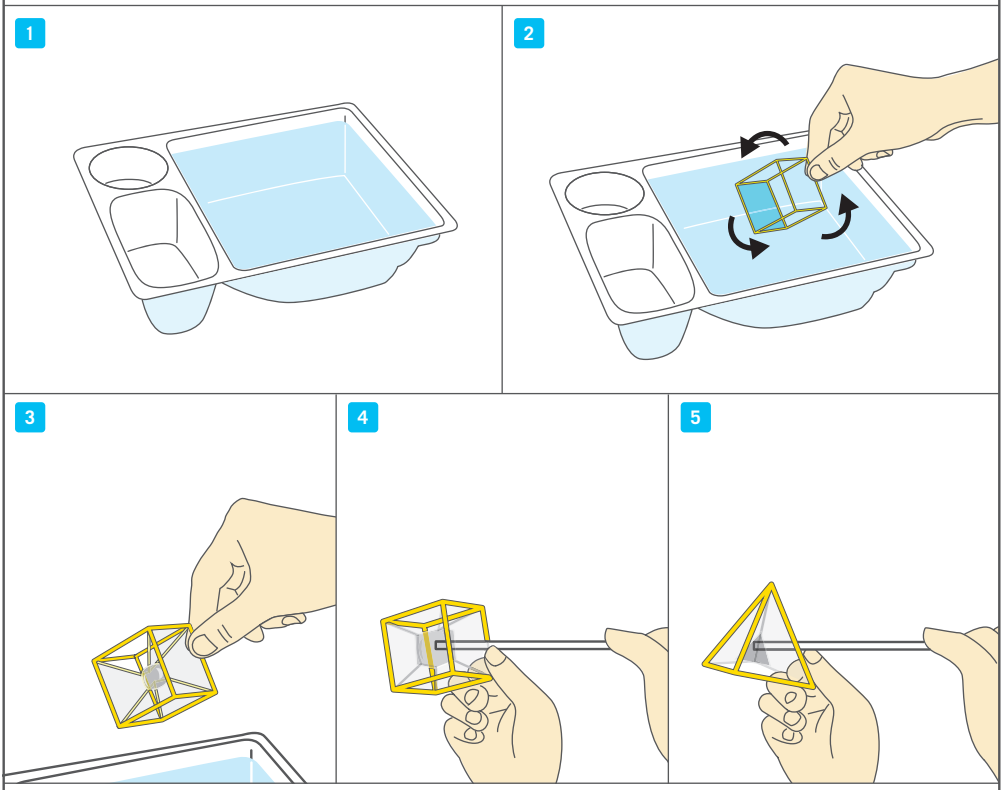
Troubleshooting

If your bubbles burst quickly, or you are having problems making a film of bubble solution in the various wands in the kit:

- Clean your wands thoroughly with soap water.
- The problem may be the weather. When it is very dry, the water in a bubble will evaporate very quickly, making the bubble burst. Wait until the weather is wetter.
- Bubble making will also be tricky on windy days. Try blowing your bubbles at somewhere sheltered from the wind e.g. a semi covered playground.
- If you are using your own bubble solution, check that you have made it according to the instructions.

ACTIVITY 29: BUBBLE GEOMETRY

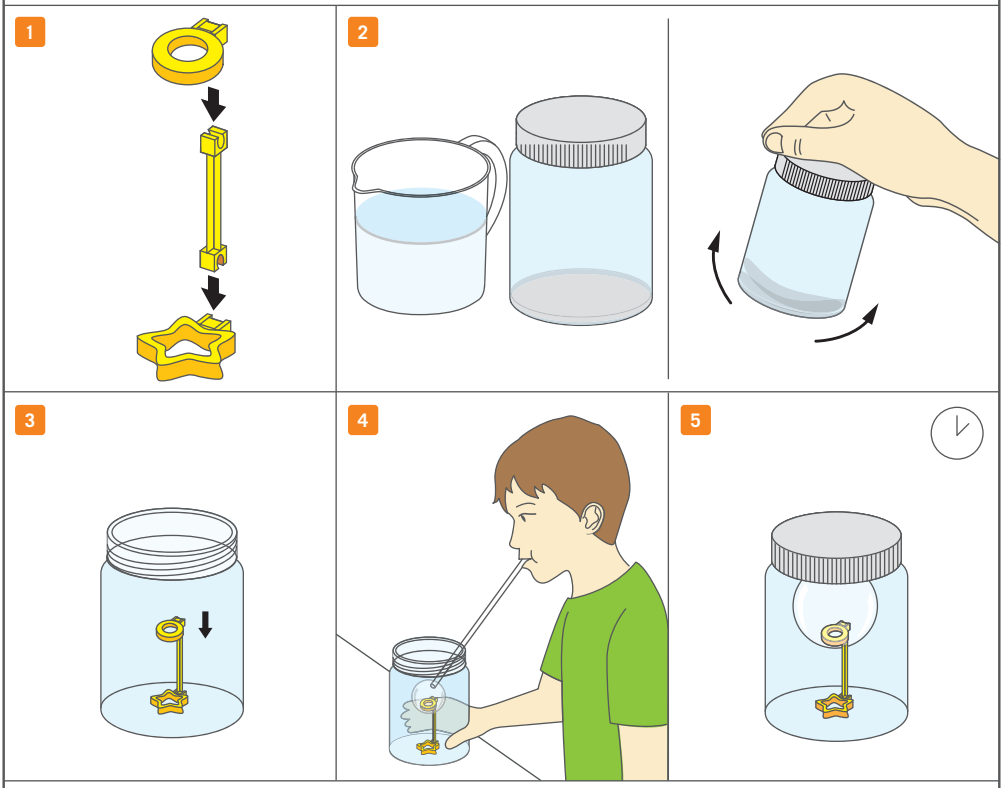
You'll need...
From the kit: bubble tray, cube framed wand, pyramid framed wand
From home: bubble solution, long straw



1. Pour bubble solution into the large cavity of the bubble tray.
2. Holding the cube by its edges and place it into the solution so that one face is submerged in solution. Roll the cube onto another face. The first face should now have a film of solution over it.
3. Keep rolling until each face has a film of solution. Lift the cube out of the solution. What happens to the films of solution? Amazingly, you should see films of solution leading into the centre of the cube, where there will be a small film.
4. Dip the end of the straw into the solution. Push the end into the film at the centre of the cube and blow gently. With luck, you'll make a cube-shaped bubble at the centre of the cube!
5. Repeat the activity with the pyramid. This time try to make a pyramid-shaped bubble in the centre of the shape.

ACTIVITY 30: UNBREAKABLE BUBBLE

You'll need...
From the kit: bubble tray, round wand, star wand, long wand handle
From home: bubble solution, long straw, empty jar with a lid (or a glass and a plate)



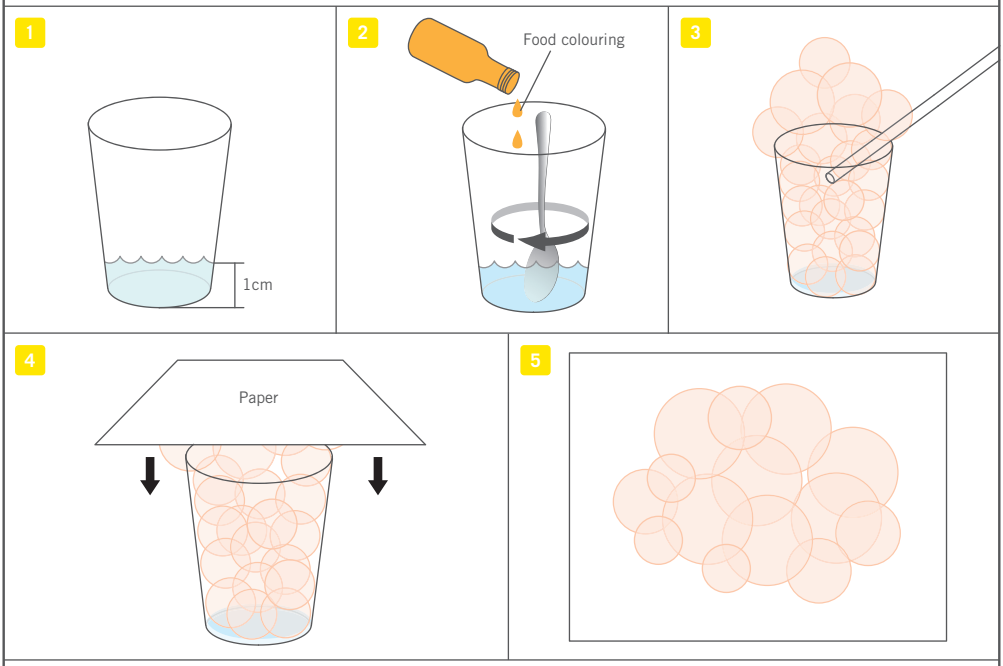
1. Clip the round wand onto one end of the long wand handle, then clip the star wand onto the other end. This will be the stand for your bubble.
2. Pour a little bubble solution into the jar, put the lid on, and then shake the jar. Pour away the solution. This will coat the inside of the jar with bubble solution.
3. Wet both ends of the stand, then place it in the jar, with the star at the bottom, so that the circle wand is not touching the sides of the jar.
4. Dip the end of the long straw into bubble solution and carefully blow a bubble onto the round wand. The bubble should be about 5 cm (2 inches) across and not touching the sides of the jar.
5. Put the lid on the jar quickly.

Check your bubble every few minutes. How long did it last? It might last for more than an hour. Why? Because the air inside the jar is moist, which means the bubble does not evaporate and burst.

Why Do Bubbles Burst?
Sadly, bubbles don't last forever! They burst because the water they are made from slowly evaporates. The water turns to water vapour and mixes with the air. As the water evaporates, the skin gets thinner and thinner, until it breaks. In dry, warm weather, evaporation is quicker, so bubbles don't last long.

ACTIVITY 31: BUBBLE ART

You'll need...
From home: bubble solution, long straw, food coloring, small plastic pots, old spoon, clean white paper



1. Pour bubble solution into a small plastic pot until the solution is about 1 cm deep.
2. Add two tablespoons of food coloring (choose your favourite colour) to the bubble solution and mix it in.
3. Push the long straw into the mixture and blow quickly until bubbles rise out of the pot.
4. Carefully lower a sheet of paper onto the bubbles. Be careful not to let the paper touch the pot. Lift the paper off again.
5. You should be left with a beautiful bubble print on the paper. Let it dry.

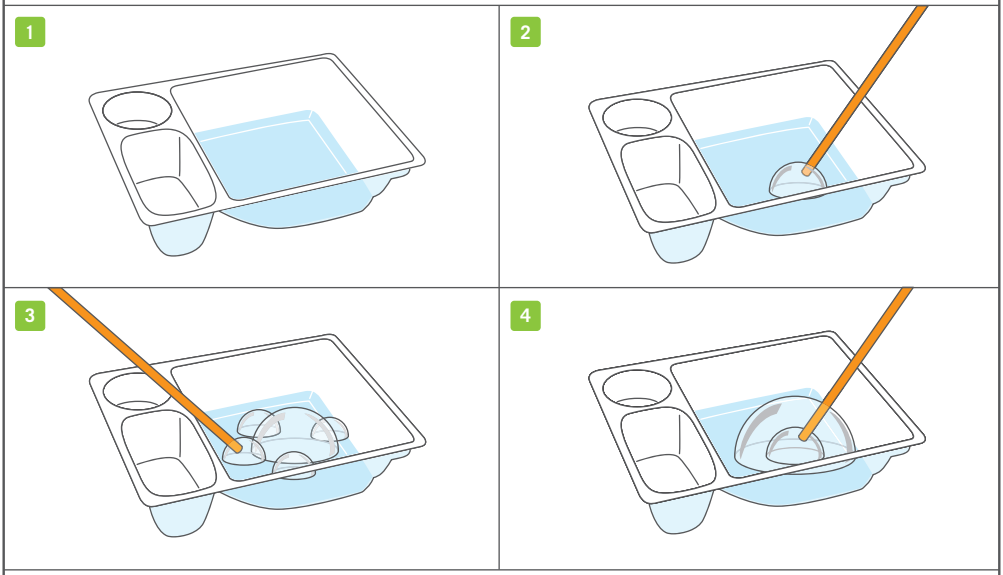
By using different colours of bubbly paint in separate pots, you can put one set of bubble prints over another to make amazing patterns.
Try making greetings cards, party invitation and thank you notes with bubble art. To make a card, fold a piece of white card in half, then make bubble prints on the front.

Fun Facts

- The skin of a bubble is less than a thousandth of a millimetre thick. That means you would need to put the skins of a thousand bubbles together to make a layer a millimetre thick.
- You can tell when a bubble is about to burst because the colours of its skin disappear. That means its skin has got extremely thin and it's about the break.
- The world record longest-lasting bubble didn't burst for 341 days — nearly a year!
- The world's biggest bubble was blown in 2005. Its volume was 3 cubic metres. It could have contained 3 tonnes of water!
- The walls of joined-up bubbles always meet at an angle of 120°.

ACTIVITY 32: BUBBLE SCULPTURE

You'll need...
From the kit: bubble tray
From home: bubble solution, long straw



1. Pour bubble solution into the bubble tray until the bottom of the tray is covered with solution.
2. Dip the end of the long straw just into the solution and blow gently. You should be able to blow a dome-shaped bubble about 10 cm (4 inches) across. Keep the straw off the bottom of the tray, or you will blow lots of small bubbles.
3. Now add some other bubbles around the first one to make a bubble sculpture.
Can you make a bubble bug (one large bubble for the body and one small one for the head)? What about a flower (one central bubble and six petals around it)?
4. Try blowing a bubble in a bubble. Start with a large dome about 10 cm (4 inches) across. Carefully push the straw though it and blow another dome inside it. Are your bubble-blowing skills good enough to add a third dome inside the second?

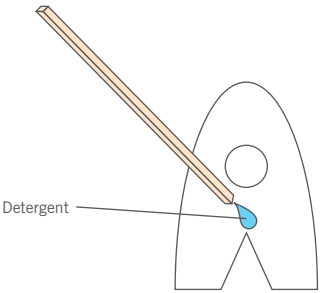
You can use a dry finger to burst any bubble you no longer want.

ACTIVITY 33: INVISIBLE ENGINE

You'll need...
From the kit: tiny plastic boats
From home: dish washing detergent, toothpick, large tray of water (must be clean and free of any oil or detergent)

1. Whilst the audience isn't looking, dip the toothpick in detergent and fill the tray with water. Announce that you have the world's tiniest boat, which is powered by the world's smallest engine. Don't forget to mention that it's also invisible.
2. Ask a volunteer to help you with the trick. Get them to place the boat on the surface of the water and see if it moves by itself. Of course, it won't move, but they don't know that. Look exasperated and swiftly announce that the volunteer forgot to pump the fuel to power the boat.

3



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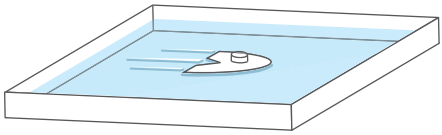

3. Now show the audience the fuel: the toothpick dipped in detergent! To them it will just look like a plain old toothpick. Explain that this is the most expensive petroleum on earth and wait for their stunned reactions. Use the toothpick to place the detergent on the back of the boat.
4. Slowly place the boat onto the surface of the water and, hey presto, watch it go! You are well and truly on your way to becoming a cunning conjurer.

How Does It Work?
Water has something called surface tension. When you apply the detergent, the surface tension at the back of the boat is reduced. Since the surface tension at the front of the boat is greater than that at the back, it creates a forward force that makes the boat travel forwards. After the boat has sailed for a while, the detergent is carried and spread over the water surface. This means the boat will eventually stop working as the water tension difference no longer exists.

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

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