

MARVIN AND MILO

Over 80 “Do try this at home!” experiments featuring Marvin and Milo, the IOP’s intrepid cat and dog team.

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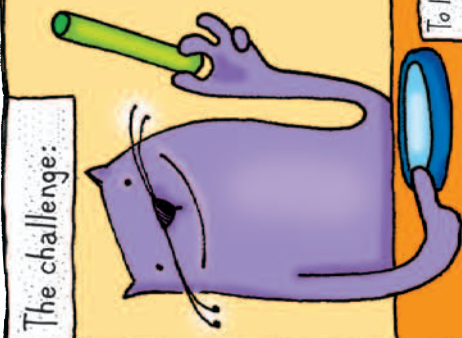
DO IT YOURSELF TRY THIS AT HOME #1



with Marvin

- what you need:**
- drinking straw
 - a friend
 - a ruler
 - scissors
 - sticky tape
 - saucer of water

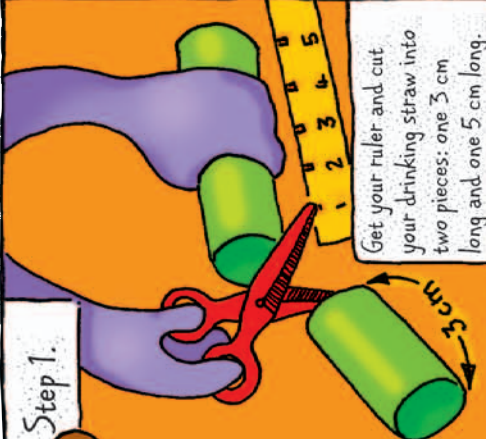
The challenge:



To lift the water from the saucer using a straw without sucking.

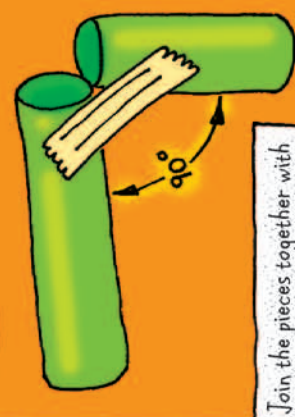


Step 1.



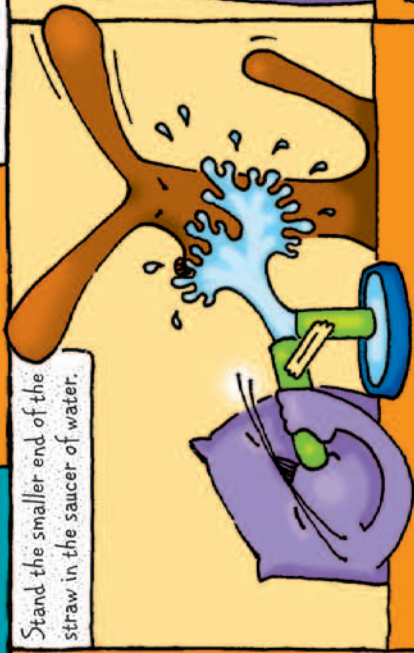
Get your ruler and cut your drinking straw into two pieces: one 3 cm long and one 5 cm long.

Step 2.



Join the pieces together with sticky tape along one side so they form a 90 degree angle, but leave both ends open.

Stand the smaller end of the straw in the saucer of water.



Now blow hard!

So what happened? Well, when air moves, its pressure falls. So when you blow, the pressure at the top of the straw drops. But the air over the saucer keeps the same pressure, so the water is pushed up the straw.

Vic Le Billon

The End

Visit www.physics.org keywords: air pressure, bernoulli

MARVIN AND MILO

02

DO IT YOURSELF TRY THIS AT HOME #2

with **Marvin**

What you need:

- a nylon comb
- a water tap

Turn on the tap until you have a very thin stream of water.

Slowly bring the comb towards the water, 10 cm below the tap.

When the comb is about 3 cm away, the water bends towards it!

Now grab your comb.

Some objects, like hair and plastic, develop an electrical charge when rubbed together. The charge in your comb attracts tiny electrical charges in the water molecules, pulling them towards it.

Run the comb through your hair several times.

The End

www.physics.org keywords: electrostatics, charge

Vic Le Billon

DO ~~NOT~~ TRY THIS AT HOME #3

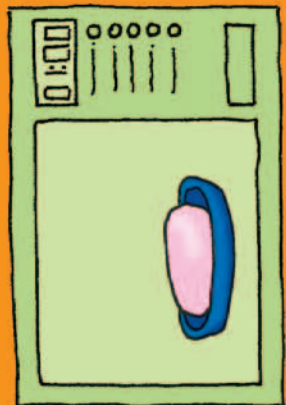
- What you need:**
- a microwave
 - a bar of quality soap

with **Marvin**

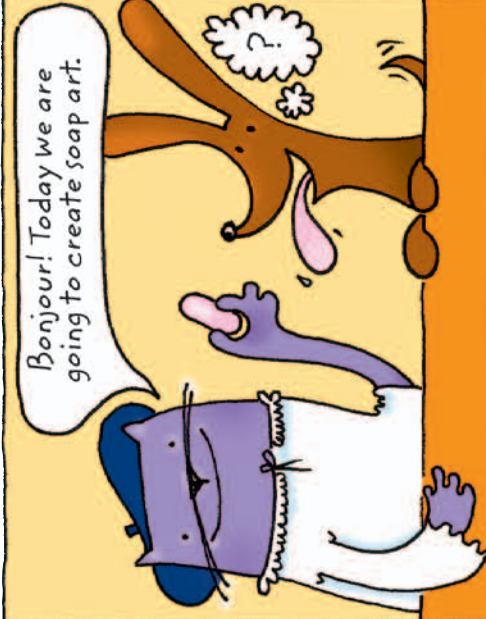
WARNING:

The soap may smell strongly so don't do this before heating food!

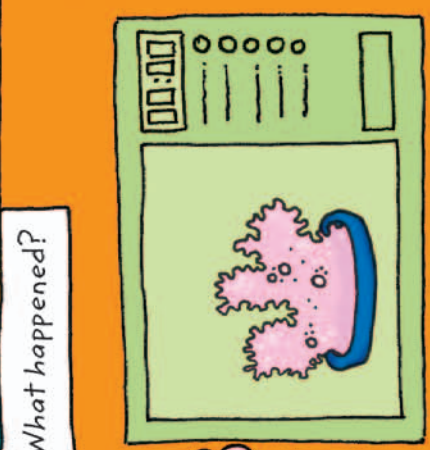
Put the soap on a dish in the microwave.



Heat it on full power for about 1 min.



Bonjour! Today we are going to create soap art.



What happened?

Tiny pockets of gas in the soap get hot and expand in all directions, pushing the soap into strange and artistic shapes.




Vic Le Billon

The End

www.physics.org keywords: thermodynamics

DO IT TRY THIS AT HOME #4

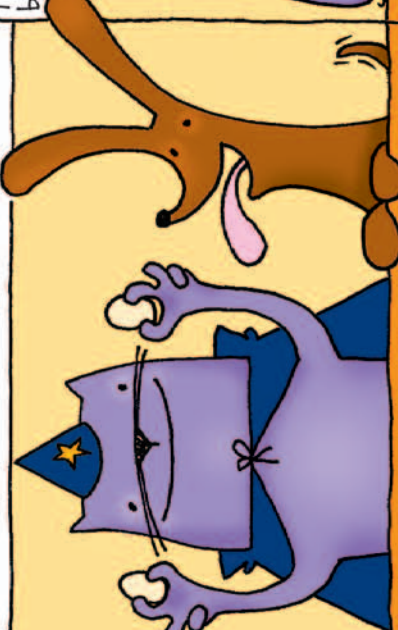


with Marvin


what you need:

- a raw egg
- a hard-boiled egg


Amaze your friends with this clever trick.




First, spin the hard-boiled egg. immediately.




Stop it and let go immediately.




Watch what happens.




Get a friend to mix up the eggs and use the trick to tell them apart.




The yolk and white aren't attached to the shell so they carry on moving when you stop the raw egg.



Now spin the raw egg.



The egg starts spinning!



The End

www.physics.org keywords: egg, spin

Vic Le Billon

DO TRY THIS AT HOME

Issue #5

featuring: **MARVIN** and **MILO**

What you need: • salt • a cup of cold water • 20cm of sewing thread • an ice cube

Float the ice cube in the cup of water.

Lay one end of the thread (or a loop) on the top of the ice cube.

Sprinkle a little salt over the top.

Wait one minute and then gently lift the thread.

Salt lowers the melting point of water, so the ice melts. But the water quickly refreezes, trapping the string in place.

www.physics.org keywords: melting, ice

MARVIN AND MILO

06

DO TRY THIS AT HOME

Issue #6

Featuring: **MARVIN and MILO**

What you need: • a large glass • lemonade (or fizzy water) • peanuts (or raisins)

Today we are going to make a simple lava lamp.

First, fill the glass with lemonade.

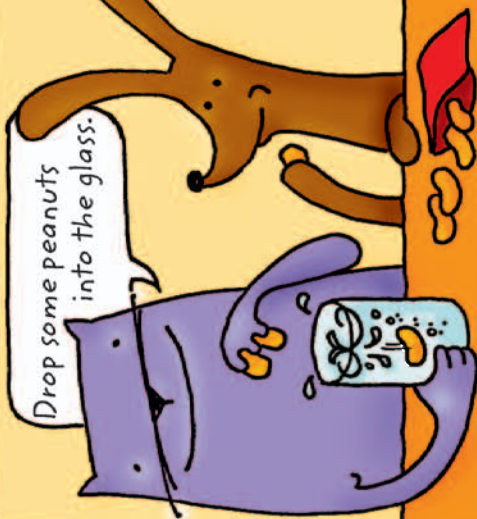
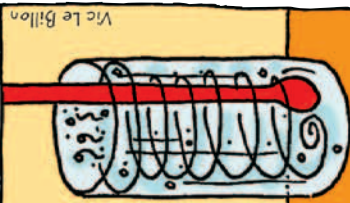
Stir for 1 min or leave to go slightly flat.

Drop some peanuts into the glass.

The nuts float up to the top and fall back down again, like in a lava lamp.

Gas bubbles grow on the peanuts, making them float upwards. When they reach the top the bubbles burst and the peanuts fall back down again.

Groovy, baby.



DO TRY THIS AT HOME

Issue #7

Featuring: **Marvin and Milo**

What you need: • a clear plastic bottle • a pen • a balloon (blow it up a few times beforehand)

Watch my amazing balloon trick!

Make a hole in the bottom of the bottle with the pen; it over the mouth.

Push the balloon inside and stretch it over the mouth.

Cover the hole with your finger and stop blowing.

Look! It stays inflated!

Blow up the balloon. Notice air is coming out of the hole.

As the balloon expanded, it pushed air out of the bottle. That made the air pressure inside the bottle lower than that in the balloon, so it wasn't strong enough to squeeze the air out.

www.physics.org keywords: air pressure

Vic Le Billon

MARVIN AND MILO

08

DO TRY THIS AT HOME

ISSUE #8

featuring: **MARVIN and MILO**

What you need: • a metal coat hanger
• two pieces of string • a fork

... and wrap the ends around your fingers.

Tie a piece of string to each corner...

Watch me tune in to this coat hanger.

Put your fingers in your ears and I'll tap the hanger.

Was it loud?

It sounds louder because the vibrations travel through the metal and string more easily than through air.

Vic Le Billon

www.physics.org keywords: sound travel

MARVIN AND MILO

09

DO TRY THIS AT HOME

Featuring: **MARVIN and MILO**

Issue #9

What you need: • an Alka-Seltzer tablet • an empty film canister • an old newspaper • water

Put the lid on... ...lightly shake the canister.

Put the tablet in the film canister.

Add about 1 cm of water.

Quickly place it upside down on the newspaper and stand back!

The Alka-Seltzer fizzes when in water, releasing gas.

This gas builds up in the canister until the pressure is too great, and the lid is forced off!

I can make a brilliant rocket!

Vic Le Billon

www.physics.org keywords: pressure

MARVIN AND MILO

010

DO TRY THIS AT HOME

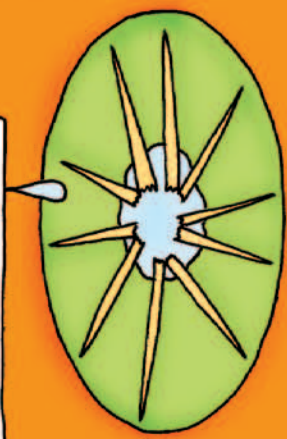
#10

featuring: **Marvin and Milo**

what you need: • five wooden toothpicks
• a small sponge • a plate • a little water

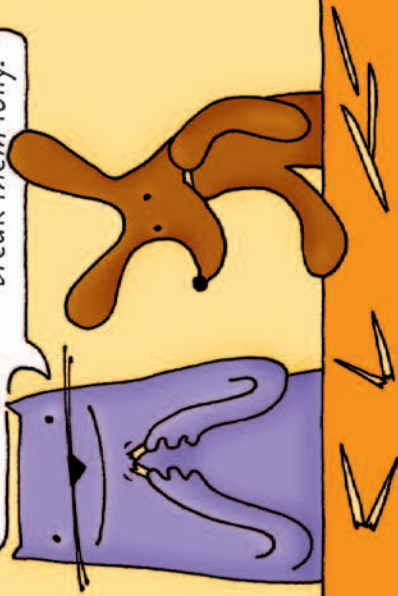


Carefully squeeze a drop of water into the middle.

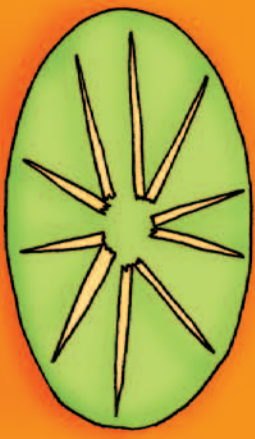


Make sure it touches the end of each toothpick.

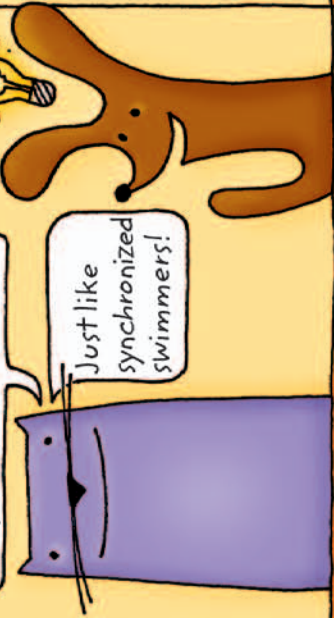
Snap the toothpicks in half but don't break them fully.



Arrange the toothpicks on the plate like this...



Did you see them move?



Just like synchronized swimmers!

The water makes the wood expand, the broken ends press against each other and the toothpick opens out. The same thing happens to doors when it's humid—they swell and get jammed.



Vic Le Billon

www.physics.org

MARVIN AND MILO

011

DO TRY THIS AT HOME

#11

featuring: **Marvin and Milo**

What you need: • a stick (1m long) • a lump of clay

Push a lump of clay about the size of your fist on to the stick...

...20cm from the end.

With the clay-end closest to your hand, try balancing the stick.

The stick rotates slower when the clay is at the top, so there's more time to adjust and keep it balanced.

It's much easier!

The further the mass is from the centre of rotation (your hand), the slower it rotates.

Now turn the stick upside down and try balancing it again.

www.physics.org keywords: "centre of mass"

Vic Le Billon

DO TRY THIS AT HOME

#12

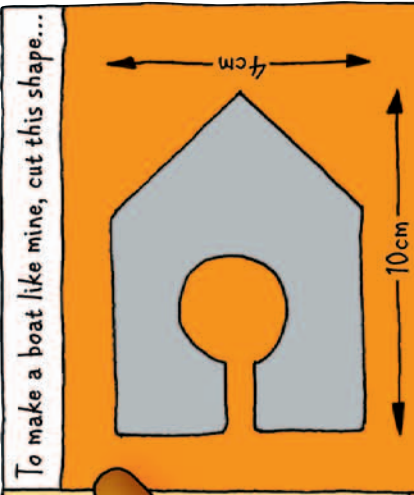
featuring: **Marvin and Milo**

What you need: • piece of foil • scissors
• washing-up liquid • sink or bath

Gently place your boat into a sink full of clean water.

Carefully place a drop of washing-up liquid into the boat's hole.

Ahoy there me land lubbers! Today we are going to race my metal boat against Milo's ship.



... out of the foil.

IT MOVES!



Water molecules are attracted to each other, creating "surface tension". The soap disrupts the surface behind the boat but the molecules in front are still pulling together,

so the boat is pulled forward.

MARVIN AND MILO

013

DO TRY THIS AT HOME

#13

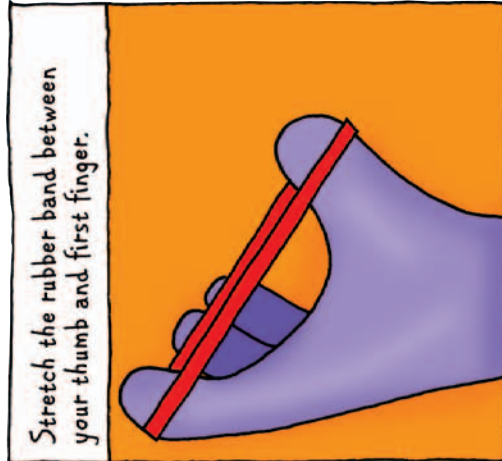
featuring: **Marvin and Milo**

What you need:

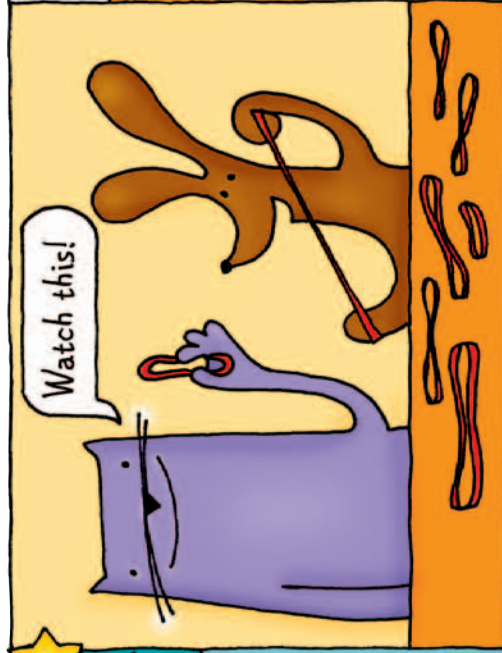
- a television (turned on!)
- a rubber band



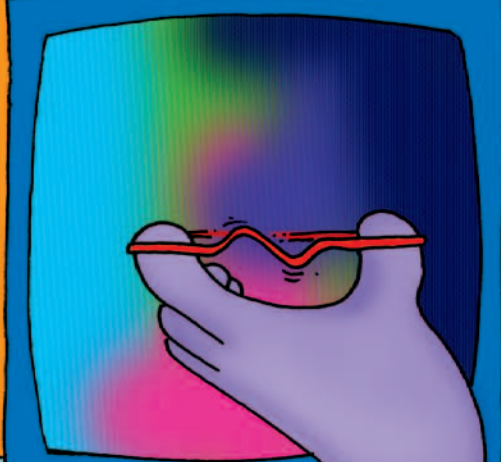
Stretch the rubber band between your thumb and first finger.



Watch this!



The television picture is made up of tiny dots flashing on and off. It acts like a strobe light, freezing the band's vibrations at different positions so it looks like it's moving in slow motion.



Holding the band between you and the television screen, pluck one side.



MARVIN AND MILO

014

DO TRY THIS AT HOME

#14

featuring: **Marvin and Milo**

What you need:

- a plastic bottle
- some hot water

...then pour out the water...

...and put the lid on.

Put the bottle down and wait a few minutes.

I can crush this bottle with no hands!

Very carefully pour a little hot water into the bottle, or ask a grown-up to help.

Shake the bottle...

The hot water gives the air energy – the pressure increases out (some leave the bottle). When the air cools, the pressure is lower than before because there are fewer molecules bouncing around. The air pushing on the outside of the bottle has more pressure, which crushes the bottle.

POFF PAFF POFF!

Vic Le Billion

www.physics.org keywords: air pressure

DO TRY THIS AT HOME

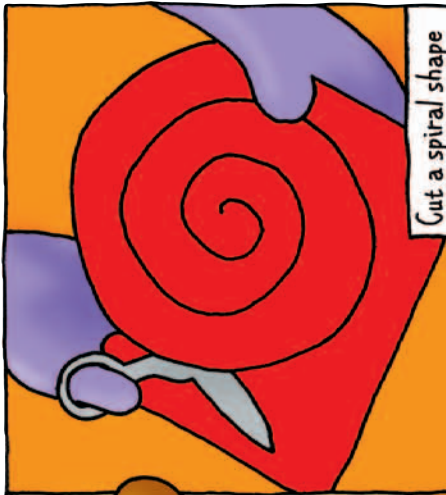
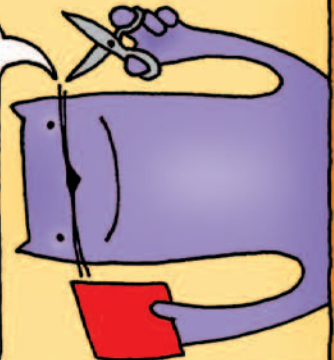
#15



Featuring:
Marvin
and
Milo

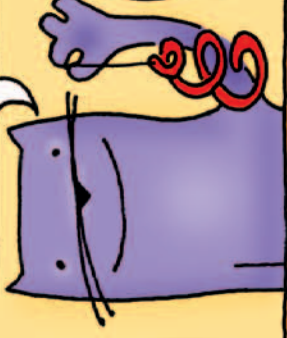
what you need: • a sheet of paper • cotton thread
• scissors

I can make a moving snake.



Cut a spiral shape from the paper.

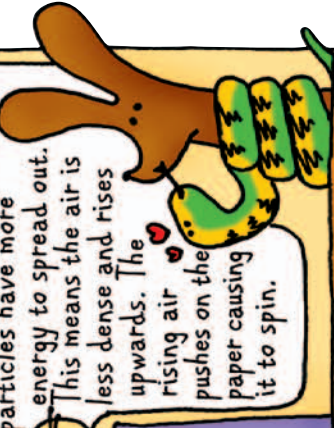
Make a hole in the centre and thread the cotton through.



Hang your spiral above the radiator.



The radiator heats the air around it so the particles have more energy to spread out. This means the air is less dense and rises upwards. The rising air pushes on the paper causing it to spin.



no snakes were harmed in the making of this cartoon

www.physics.org keyword: convection

Vic Le Billon

MARVIN AND MILO

016

DO TRY THIS AT HOME

#16



featuring:
Marvin and Milo

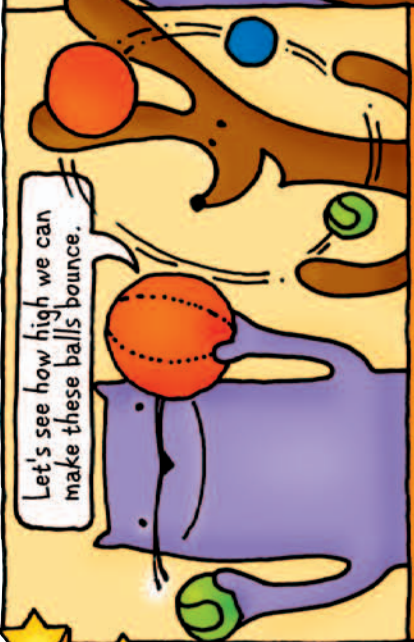
What you need:

- a tennis ball
- a basketball
- a room without breakables!

Now watch the basketball.

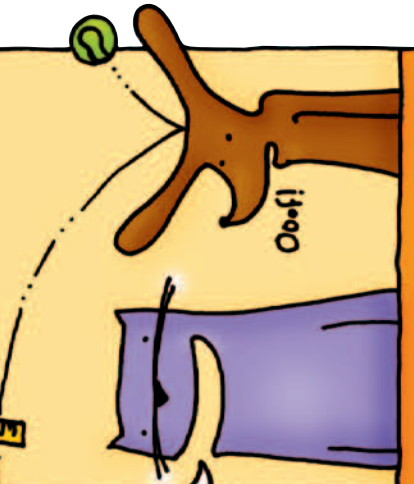
Put the tennis ball on top of the basketball and drop them both at arm's length.

Let's see how high we can make these balls bounce.



When the balls hit the ground, momentum from the basketball was transferred to the tennis ball making it go much higher than before.

Did you see how high that went?



Drop the tennis ball from waist height. See how high it goes.

Waist height.

Ooof!

Vic Le Billion

www.physics.org keyword: ball, momentum

DO TRY THIS AT HOME

#17

featuring **MARVIN and MILO**

What you need: • a glass of water • a piece of paper
• a marker pen

Panel 1: Marvin holds a glass of water. Milo says, "This is my reversing machine."

Panel 2: Marvin holds a piece of paper with three arrows pointing right. Milo says, "Hold the paper a little way behind the glass."

Panel 3: Marvin holds the paper behind the glass. A lightbulb icon indicates an idea. Milo says, "The water acts like a glass lens, bending the rays of light and reversing the image of the arrows."

Panel 4: Marvin holds the paper behind the glass. The arrows on the paper are now pointing left. Milo says, "Draw a column of short arrows."

Panel 5: Marvin holds the paper with a column of short arrows. Milo says, "Stoopid perSon"

DO TRY THIS AT HOME

#18

featuring: **Marvin and Milo**

What you need: • an empty juice carton • water • a piece of string • a pair of scissors • a washing-up bowl

You can make your own garden sprinkler.

Get an adult to poke a hole in the bottom left-hand corner of each face of the carton.

Poke another hole in the top flap...

Put some water in the bowl, stand the carton in it, then fill it up to the top.

Lift the carton out by the string.

As the water shoots out it pushes back on the carton with an equal force. Because the holes are off-centre this force makes it spin around.

...and thread the string through it.

do be doo doo

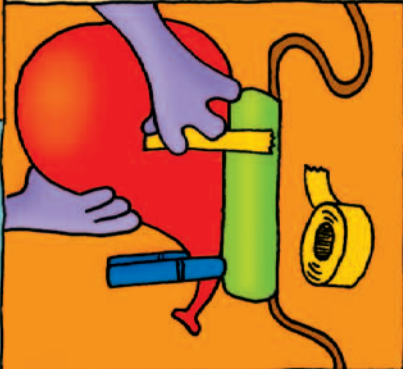
DO TRY THIS AT HOME

#19

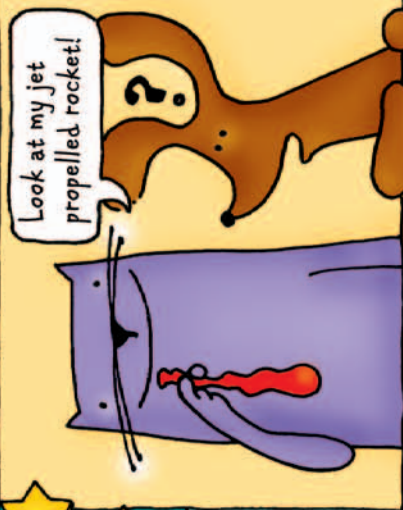
featuring: **Marvin and Milo**

What you need: • a drinking straw – cut in half
• a balloon • a long piece of string • a clothes peg • sticky tape

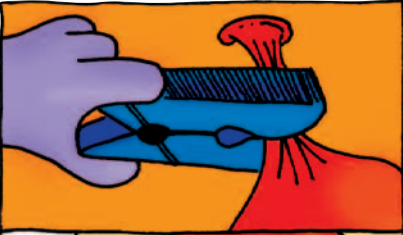
Thread the straw with the string...



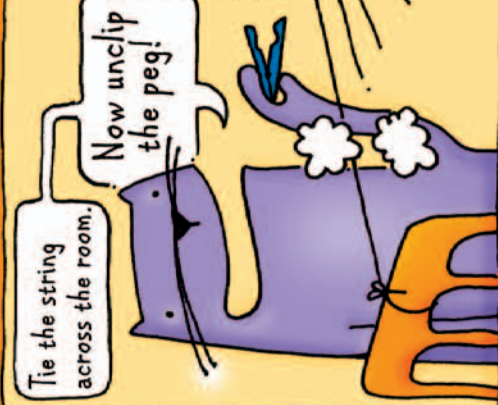
... and then tape it lengthways to the balloon.



Blow up the balloon...



... and peg the neck to keep the air in.



Tie the string across the room.

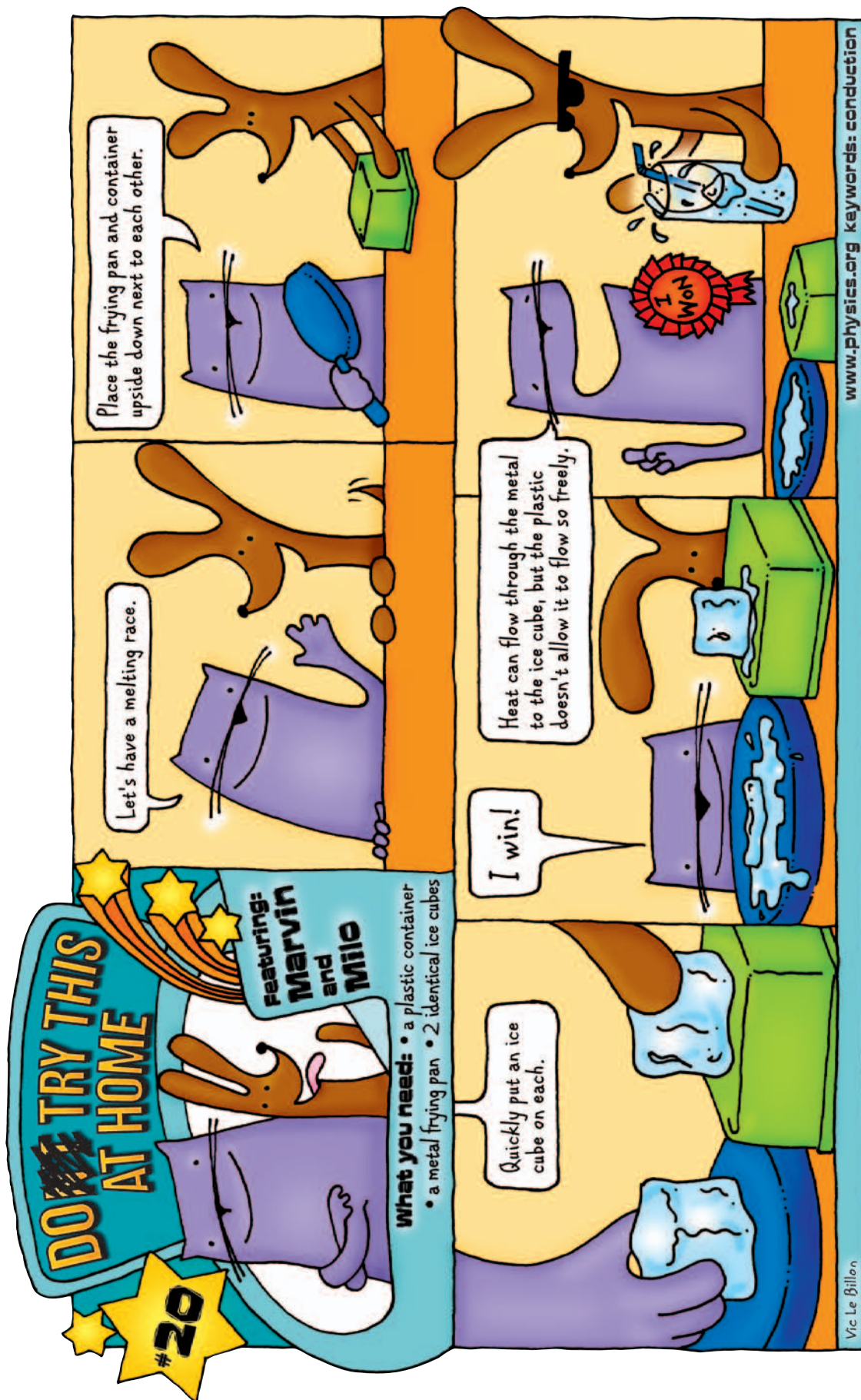
Now unclip the peg!



As the air rushes out it pushes back on the balloon, propelling it forward.

MARVIN AND MILO

020

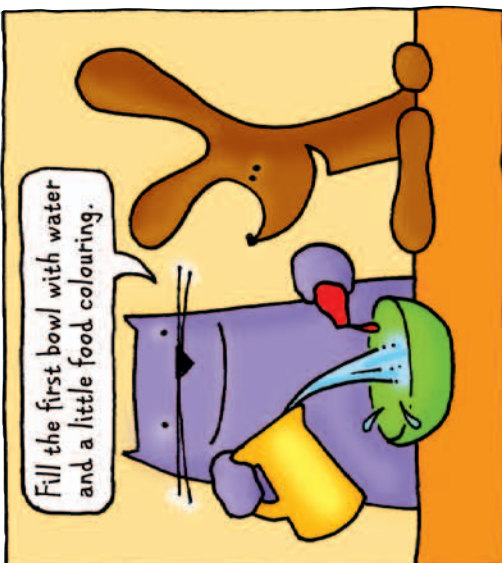


DO TRY THIS AT HOME

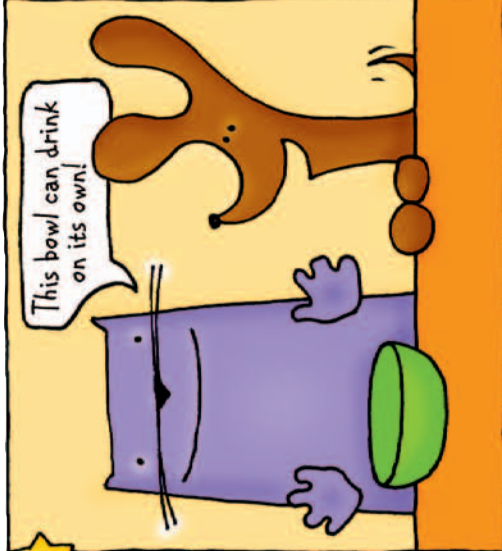
#21

featuring: **Marvin and Milo**

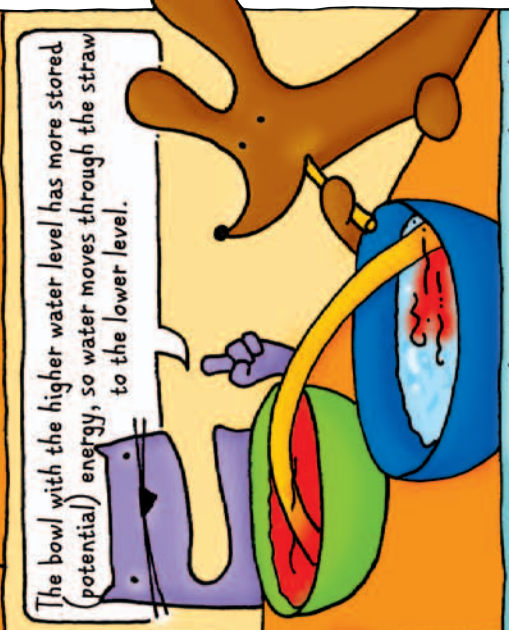
- What you need:**
- a bendy straw
 - water
 - two small flat bowls
 - food colouring



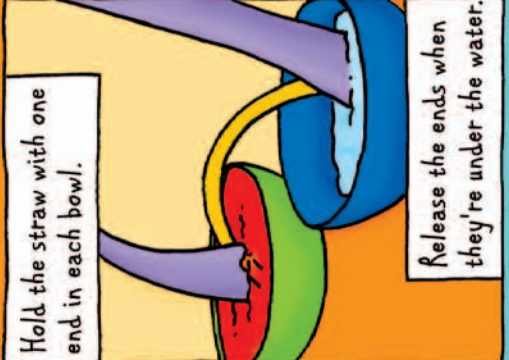
Fill the first bowl with water and a little food colouring.



This bowl can drink on its own!

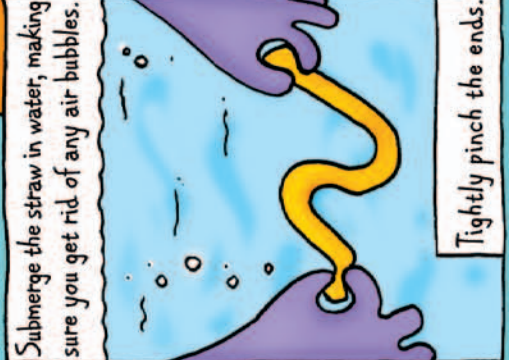


The bowl with the higher water level has more stored (potential) energy, so water moves through the straw to the lower level.



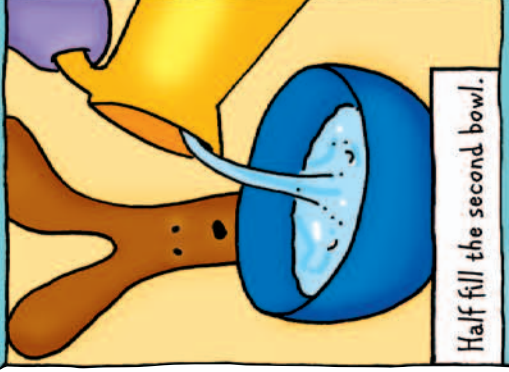
Hold the straw with one end in each bowl.

Release the ends when they're under the water.



Submerge the straw in water, making sure you get rid of any air bubbles.

Tightly pinch the ends.



Half fill the second bowl.

DO TRY THIS AT HOME

#22

featuring **MARVIN and MILO**

What you need:

- three straws
- glass of water or juice
- a drawing pin

Now try using this straw, which has a small hole 3cm from the top.

I bet you can't drink this using my special straws.

First try using two straws. One in the glass, and one outside the glass.

What Milo doesn't realise is that for the liquid to be forced up the straw, the pressure in your mouth needs to be lower than atmospheric pressure. So no matter how hard you suck, a straw won't work if air can get into your mouth.

Vic Le Billion

www.physics.org keywords: atmospheric pressure

DO TRY THIS AT HOME

#23

featuring: **MARVIN** and **MILO**

What you need: • a jug • water
• about 50cm of string • a basin or sink

I've invented a non-drip jug!

Tie the string around the handle of the jug of water and pull it across the top of the jug and over the lip.

Hold the string tight at an angle, below the jug, and begin to pour.

Try creating an amazing route for the water by holding the string at different angles, even getting the water to turn corners as it goes down. But be careful, no sharp turns or the water falls off!

The water is attracted to the string and as the flow slows down the water clings to the string. This is the Coanda Effect.

www.physics.org keywords: coanda effect

Vic Le Billon

DO TRY THIS AT HOME

#24

featuring: **Marvin and Milo**

What you need:

- some water
- small plastic drinks bottle • a drawing pin

Today we are going to make a water jet using this bottle.

Use the drawing pin to make three small holes about 4mm apart at the bottom of the bottle and one near the neck.

Fill the bottle with water and put the top on.

Tip: Cover up the top hole to stop the water shooting out of the bottom three.

Watch me turn three jets into one!

Simply rub or 'smear' the three jets with your fingers.

Once the jets have been forced together, they stay together because of surface tension.

MARVIN AND MILO

025

DO TRY THIS AT HOME

#25

featuring: **MARVIN and MILO**

what you need: • some water
• a clear plastic watertight bag • some pencils

Push a pencil through the bag.

Then another... and another.

Have you seen my Ingenious Indestructible Bag?

Fill the plastic bag with water.

If you take a pencil out, you can plug the leak simply by putting it back through the holesMILO!

The bag doesn't burst because the plastic stretches rather than tears as the pencils are pushed through it.

Mark Book

www.physics.org keywords: plastic

DO TRY THIS AT HOME

#26

featuring: **MARVIN and MILO**

What you need: • 2 apples with stalks • 2 pieces of string about 30cm long • some sticky tape

Watch this! Tie a piece of string to the stalk of each apple.

The two apples move together!

Use the tape to hang up the two apples so that they are about 6cm apart and free to move around.

Blowing reduces the air pressure between the apples, and the air pushing on the outer sides of them makes the apples move together, into the area of lower pressure.

What do you think is going to happen if you blow hard between the apples?

www.physics.org keywords: air pressure

Vic Le Billon

DO TRY THIS AT HOME

#27

featuring: **MARVIN and MILO**

What you need:

- a paperclip
- water
- two identical wine glasses

I bet you can't make the paperclip move without touching it.

Put equal amounts of water in both glasses and stand them next to each other but not touching.

With a wet finger, rub the rim of the other glass until it "sings".

Straiten out the paperclip, bend it slightly and then balance it on the rim of one of the glasses.

The paperclip moves!

Rubbing the glass makes it vibrate at its natural frequency. As the other glass is identical, it has the same natural frequency, and the sound waves from the first glass make it vibrate as well — so the paperclip moves.

Vic Le Billon

www.physics.org keywords: resonance

DO TRY THIS AT HOME

#28

featuring: **Marvin and Milo**

What you need: • a plastic cup or yoghurt pot
• a damp cloth • smooth string

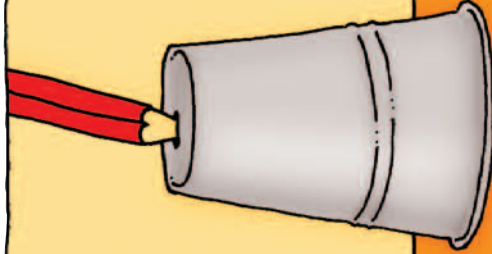
Cut a length of string, thread it through the hole, and tie a knot in the end inside the cup to stop it from slipping back through the hole.



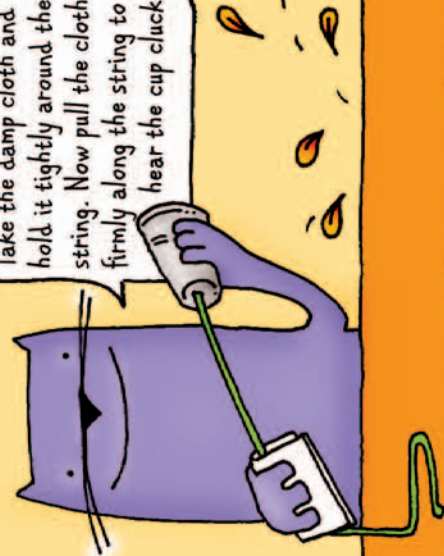
Hey Milo, let's do chicken impressions!



To do mine, make a hole in the bottom of the plastic cup. Get an adult to help.



Take the damp cloth and hold it tightly around the string. Now pull the cloth firmly along the string to hear the cup cluck.



Pulling the cloth along the string makes it vibrate and produce a faint sound. But the cup and the air around it also vibrate so the sound is amplified enough for us to hear it.



DO TRY THIS AT HOME

#29

Featuring: **MARVIN and MILO**

What you need:

- 2 litre plastic bottle
- Blue Tac
- a bowl of water
- a ketchup sachet

Today we are going deep sea diving with this ketchup sachet.

Put the ketchup sachet into a bowl of water to see if it floats upright – if not then add a little Blue Tac to its bottom.

Put the lid on tightly, squeeze the bottle hard and watch your diver dive.

Squeezing the bottle squeezes everything inside it, including the air bubbles in the ketchup sachet. As the air molecules squash together, the sachet gets more dense than the water and it sinks. What happens when you stop squeezing?

Push your ketchup diver water right to the very top through the neck.

Vic Le Billon

www.physics.org keywords: density

MARVIN AND MILO

030

DO TRY THIS AT HOME

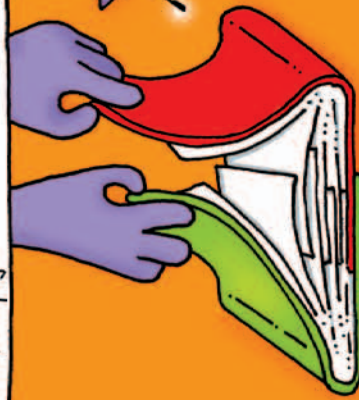
#30

Featuring: **Marvin and Milo**

What you need: • two very similar sized books with at least 100 pages each



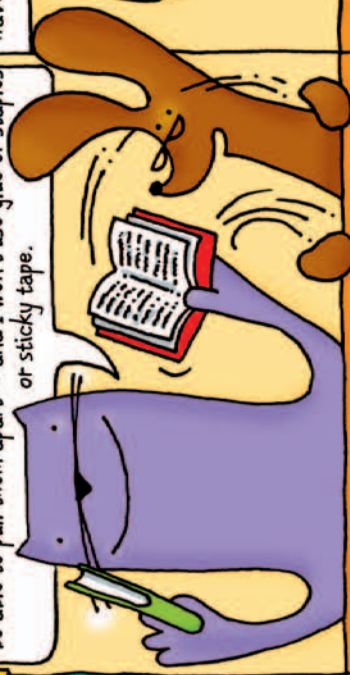
Carefully, and evenly, interweave the pages of the books so that they overlap to about the middle of the page.



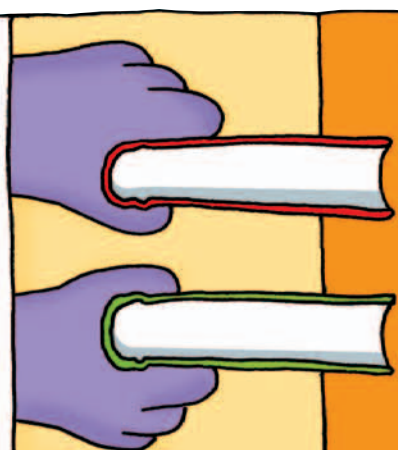
Hold the books by the spines and pull! The books don't separate, no matter how hard you pull, because of the friction between the pages.



I can join these two books together so well that you won't be able to pull them apart — and I won't use glue or staples or sticky tape.



My books are about the same size and have about the same number of pages.



Friction is the force that acts against the motion of two surfaces in contact. The friction between just two pages is tiny but with lots of pages in the books, the force becomes very noticeable!



DO TRY THIS AT HOME

#31

featuring:
Marvin
and
Milo

What you need:

- some water
- an empty fizzy drink can

Today I'm going to show you how to make a pop can pirouette!

Pour about 100ml of water into an empty fizzy pop can.

Once the can is stable, give it a gentle push and it will pirouette!

For something to balance, its centre of mass has to be above its point of support. Water can flow which means that as the can pirouettes, the water moves and the centre of mass always stays above where the rim touches the table.

Tip it slightly to one side and balance it so that the two parts of the bottom rim are touching the table.

Blip! Blip! Blip!

www.physigs.org keywords: centre of mass

DO TRY THIS AT HOME

featuring:
MARVIN
and
MILO

what you need: • a large clear, straight-sided glass
• water • milk • teaspoon • torch • darkened room

In a darkened room, shine the torch down onto the top of the water whilst looking through the side of the glass. Can you see the blue colour?



'Click'

Do you want to see my homemade sunset?



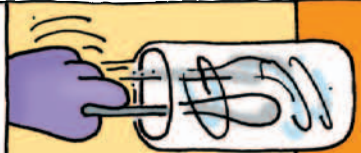
Fill the glass about $\frac{2}{3}$ full of water...



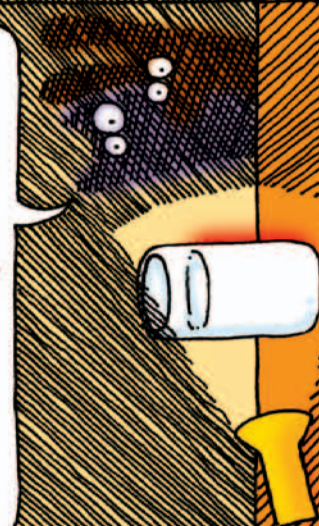
... add half a teaspoon of milk...



... and stir.



Then try shining the torch through the side of the glass whilst looking through the opposite side. What colours can you see now?



Finally, shine the torch up through the bottom of the glass and peer down through the water. What a lovely sunset!



The milk particles in the water scatter the light from the torch like dust and molecules in the atmosphere scatter light from the sun. The further the light has to travel through the water, the more of the blue light has been scattered, leaving only red light for you to see. Just like at sunset.

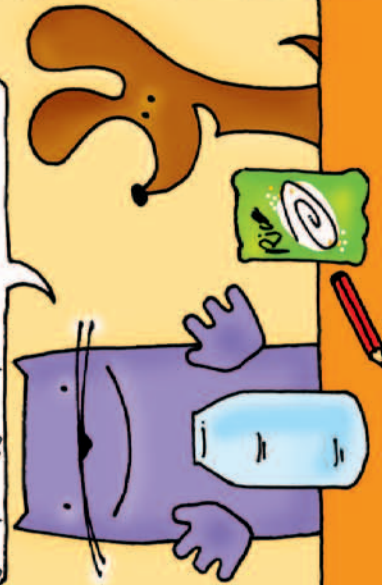
DO TRY THIS AT HOME



Featuring:
Marvin
and
Milo

What you need: • uncooked rice • a pencil
• a large empty jar with a narrow neck

Today I'm going to show you how to lift this jar up using just a pencil and some rice!

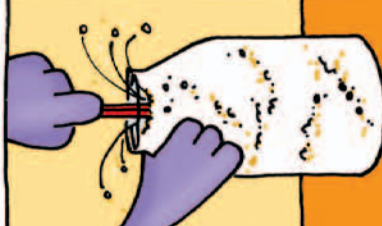


Fill the jar up to the brim with uncooked rice.



(Make sure you have a jar which narrows towards the top.)

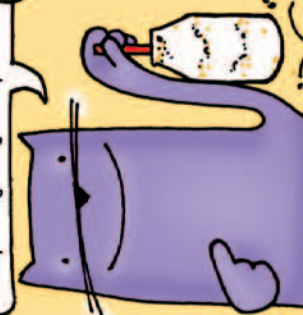
Push the pencil right into the rice.



Then, alternating between shallow and deep stabs, stab the rice repeatedly. It could take about 40 stabs, but you'll start to feel the pencil gripping the rice.



When you feel a firm grip, carefully lift up the jar by the pencil.



As you push it in, the pencil forces the grains sideways, but they fall back into the gap as you pull it out. The rice becomes more and more tightly packed until the friction between the rice and the pencil is so great you can lift the jar.



Vic Le Billon

www.physics.org keywords: friction

DO TRY THIS AT HOME

#34

featuring:

MARVIN
and
MILO

What you need: • two identical cups

I've got a great new party trick that will liven up this party.

Take two, empty, plastic cups and put one inside the other.

If you blow softly, the inner cup rises up slowly. But if you blow hard...

The moving air gets in to the gap between the cups and forces the top cup up, out and across the room.

Hold them quite close to your mouth and blow between the rims of the cups.

... the top cup launches itself across the room!

Vic Le Billon

www.physics.org keywords: air pressure

MARVIN AND MILO

035

DO TRY THIS AT HOME

#35

featuring:
Marvin and Milo

What you need:

- Kitchen towels
- Water
- Non permanent coloured felt tip pens

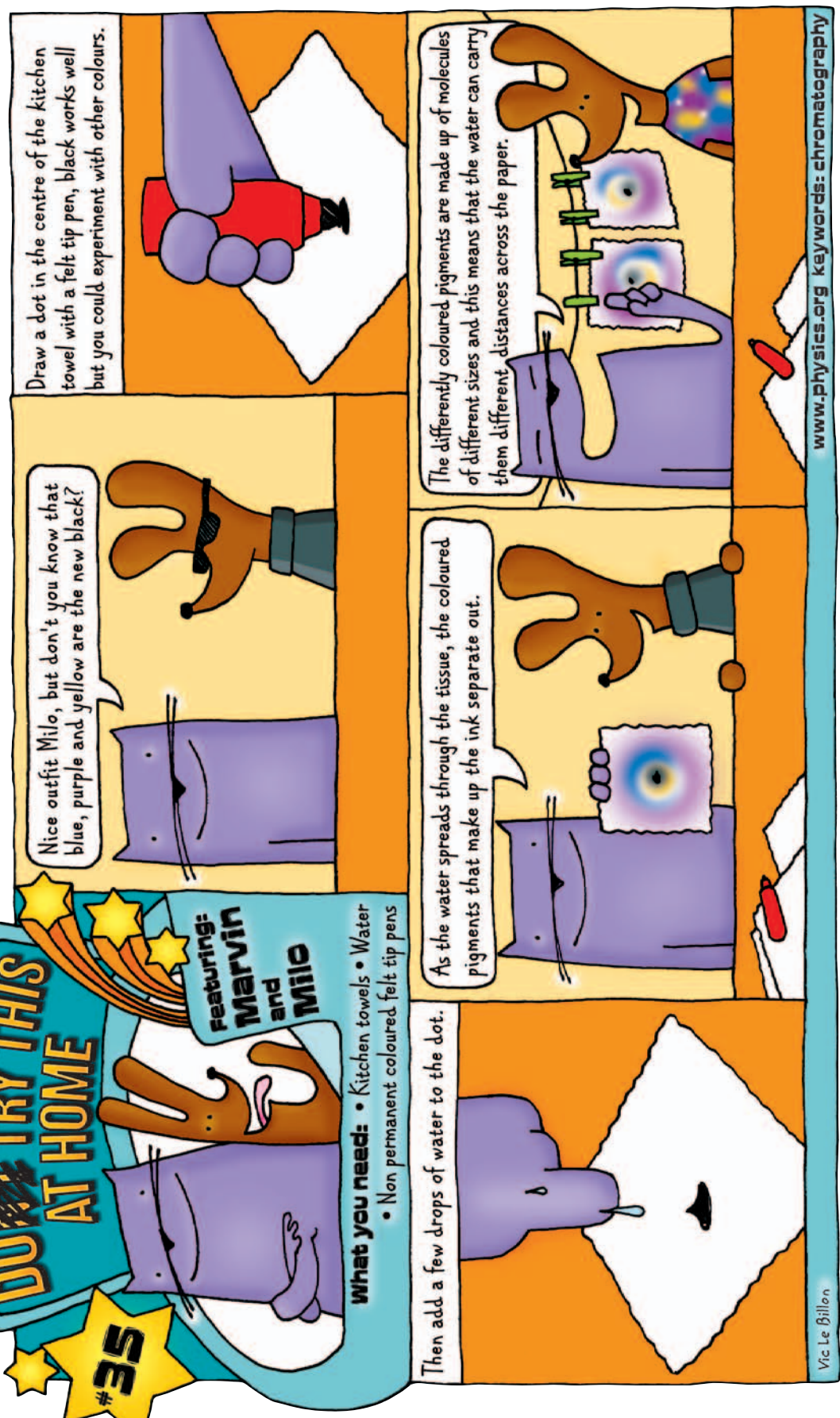
Nice outfit Milo, but don't you know that blue, purple and yellow are the new black?

Draw a dot in the centre of the kitchen towel with a felt tip pen, black works well but you could experiment with other colours.

Then add a few drops of water to the dot.

As the water spreads through the tissue, the coloured pigments that make up the ink separate out.

The differently coloured pigments are made up of molecules of different sizes and this means that the water can carry them different distances across the paper.



Vic Le Billon

www.physics.org keywords: chromatography


DO TRY THIS AT HOME

featuring: **Marvin and Milo**

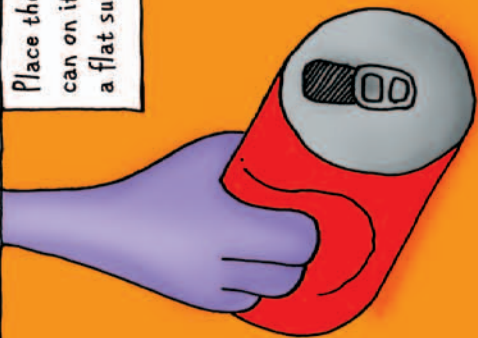
What you need: • A balloon
• An empty pop can (aluminium cans are best)



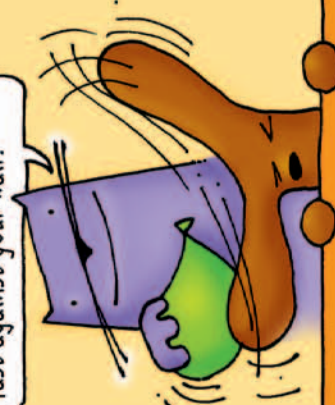
Watch me make this can roll across the table, with just a balloon!




Place the empty can on its side on a flat surface.



Then rub the balloon really fast against your hair.



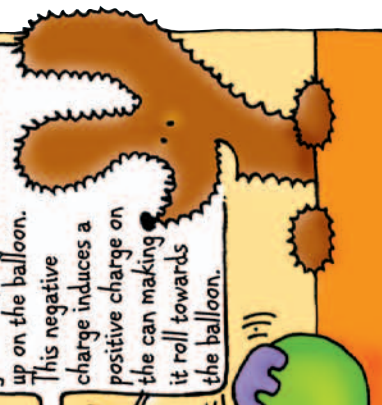
Hold the balloon close to the can. It will start rolling towards the balloon.



Slowly move the balloon away from the can and watch in amazement as the can follows the balloon.



When you rub the balloon against your hair, negative electrons build up on the balloon. This negative charge induces a positive charge on the can making it roll towards the balloon.



DO TRY THIS AT HOME

featuring: **Marvin and Milo**

what you need:

- A cone shaped party hat
- Scissors
- A soft ball
- A friend

Tests show that wearing a party hat makes you much worse at catching a ball.

Cut the tip off the party hat to make a hole about 2cm in diameter.

Wear the hat over your face.

Try to play catch with your friend using a soft ball.

When you're wearing the hat you can only see with one eye at a time. Without your normal, two-eyed, binocular vision you can't judge distances as well and it's much harder to catch the ball.

Ooof!

DO TRY THIS AT HOME

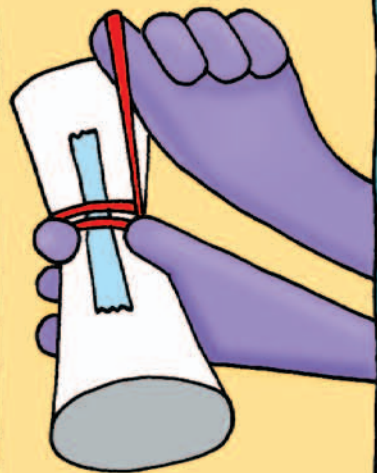
#39

featuring: **MARVIN and MILO**

What you need:

- Two polystyrene cups
- Two large elastic bands
- Sticky tape

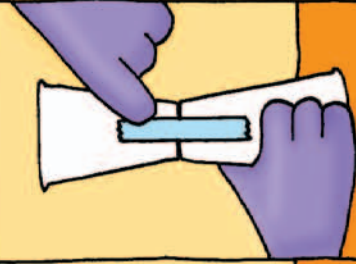
Hold one end of the elastic where the cups join and wind it around a few times until the other end of the elastic is at the bottom and pointing away from you.



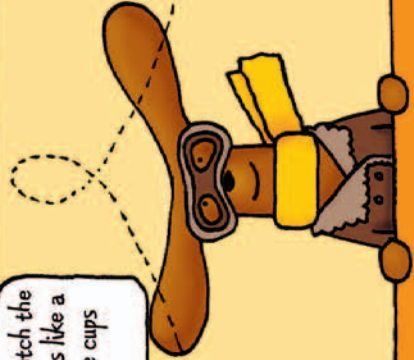
Choo away Milo! It's time to make these ordinary cups loop the loop!



Tape the two polystyrene cups together at the base, bands together. Then tie the two elastic bands together.



Hold the cups in one hand and stretch the elastic with the other. Fire the cups like a catapult. With a bit of practice the cups will soon be looping in the air.



The elastic makes the cups spin backwards as well as move forward through the air. This back spin creates lift, forcing the cups upwards. But air resistance soon slows the cups down and they fall towards the ground, completing the loop.

Vic Le Billon

www.physics.org keywords: Magnus effect

DO TRY THIS AT HOME

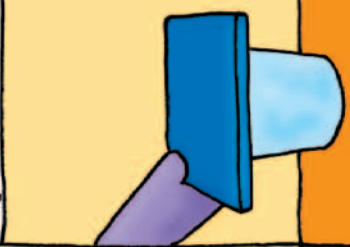
#40

featuring: **MARVIN and MILO**

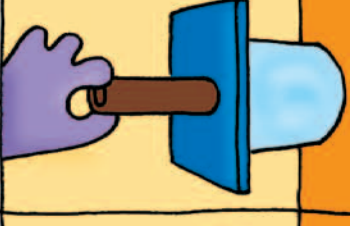
What you need:

- An egg
- A glass of water
- An empty Smarties tube
- A placemat

Put the placemat on top of the glass of water, shiny side down.



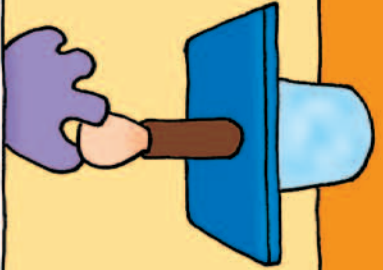
Stand the Smarties tube on the placemat directly over the glass...



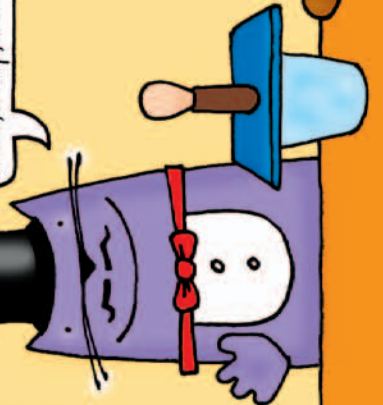
Roll up, roll up for the amazing daredevil eggstravaganza!




...and balance the small pointy end of the egg on top of the tube.




Give the side of the placemat a short, sharp, horizontal whack.



And the egg falls into the glass!



The egg doesn't go flying because the sideways force is only on the mat and the bottom of the tube, not the egg.

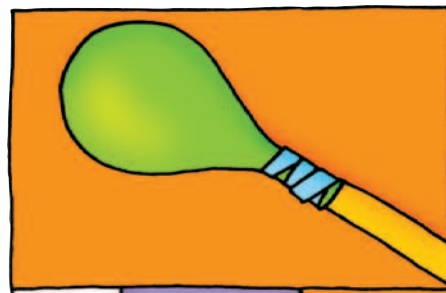


DO TRY THIS AT HOME

#41

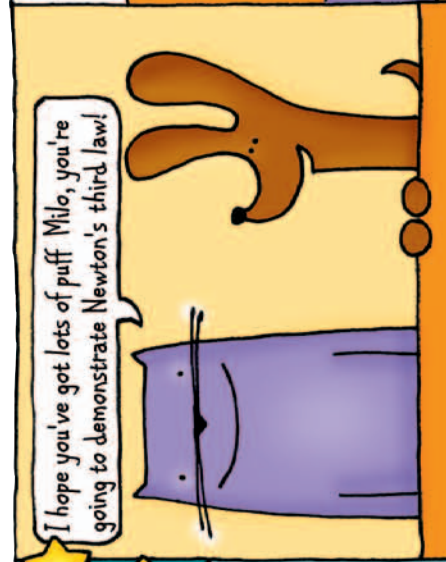
featuring: **MARVIN and MILO**

What you need: • Pencil with a rubber on the end.
• Drawing pin • Drinking straw • Sticky tape

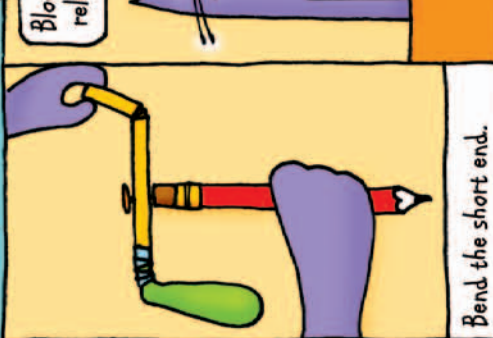


Insert the long end of the straw into the balloon...

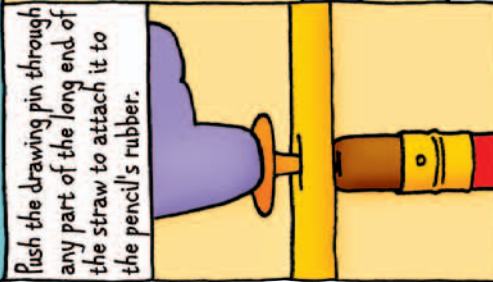
... and tape it in place.



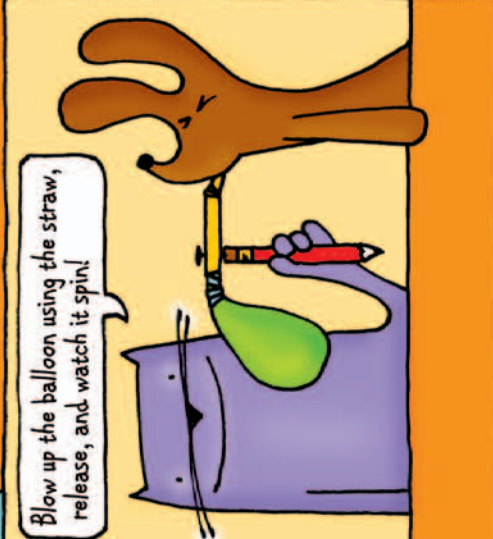
I hope you've got lots of puff Milo, you're going to demonstrate Newton's third law!



Bend the short end.

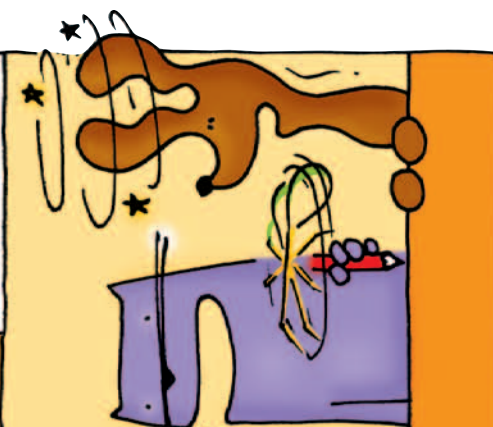


Push the drawing pin through any part of the long end of the straw to attach it to the pencil's rubber.



Blow up the balloon using the straw, release, and watch it spin!

Try changing the position of the drawing pin and the angle of the short end to make it spin faster. The air rushes along the straw and around the bend. As the straw pushes on the air to force it round the corner, the air pushes back on the straw - making it move.



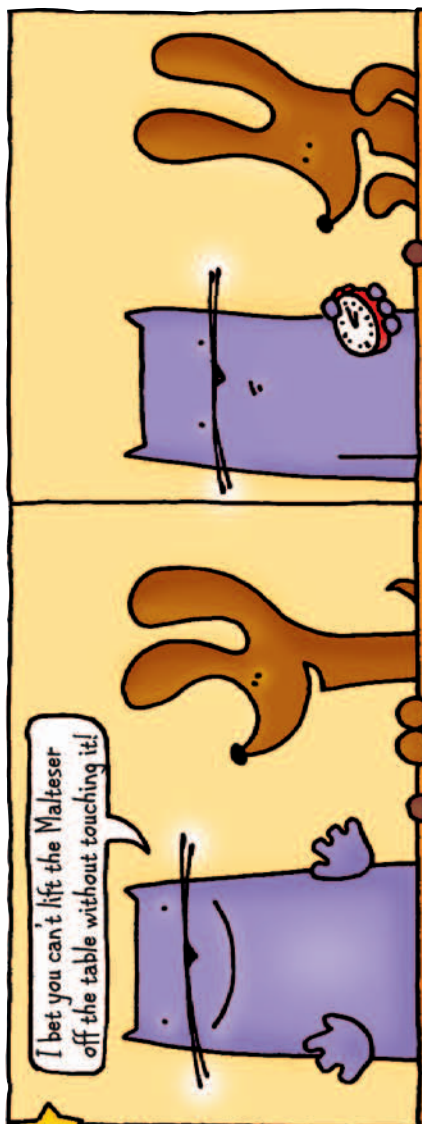
DO TRY THIS AT HOME

#42

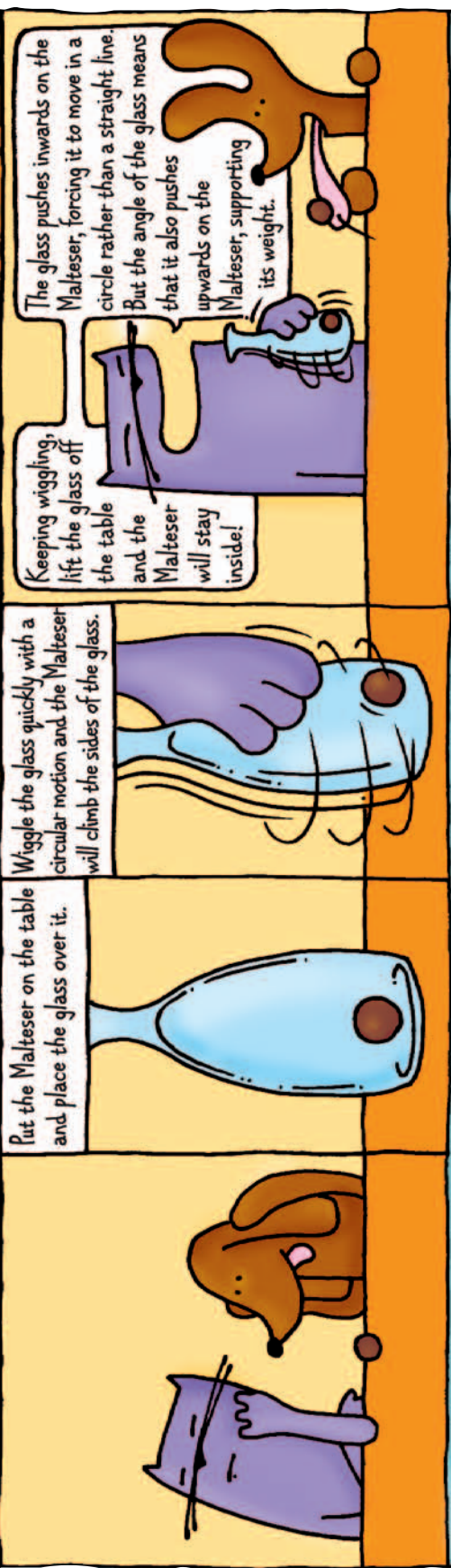
featuring: **Marvin and Milo**

What you need:

- A Maltese
- A wine glass (narrower towards the top)



I bet you can't lift the Maltese off the table without touching it!



Put the Maltese on the table and place the glass over it.

Wiggle the glass quickly with a circular motion and the Maltese will climb the sides of the glass.

Keeping wiggling, lift the glass off the table and the Maltese will stay inside!

The glass pushes inwards on the Maltese, forcing it to move in a circle rather than a straight line. But the angle of the glass means that it also pushes upwards on the Maltese, supporting its weight.

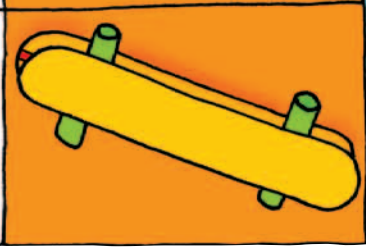
DO TRY THIS AT HOME

#43

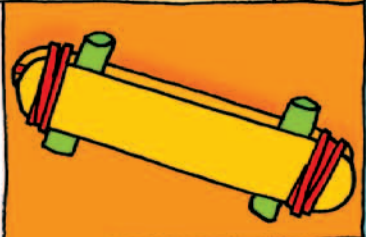
featuring: **MARVIN and MILO**

What you need: • 2 lolly sticks • A wide elastic band • 2 smaller, narrower elastic bands • A straw • Scissors

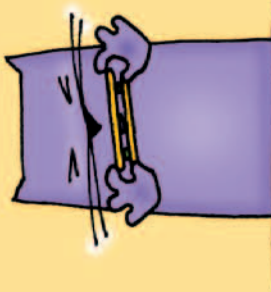
Place the other stick on top of the pieces of straw.



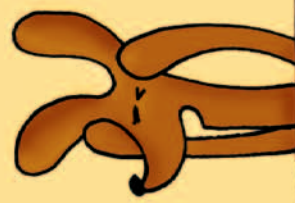
Hold the ends of both sticks together with the smaller elastic bands.



Then blow!



What happens if you move the straws closer together?



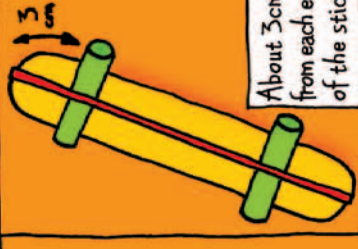
Blowing through the Loud Lollies makes the elastic band vibrate and create a sound. Moving the straws closer together shortens the section of the elastic band that can vibrate, raising the pitch of the sound produced.



Wrap the wide elastic band lengthwise around one of the sticks.



Cut two short pieces of straw and place them in between the stick and elastic band.



DO TRY THIS AT HOME

#44

featuring:
Marvin and Milo

- What you need:**
- An old CD
 - Blu Tack
 - A sports cap from a drinks bottle
 - A balloon

I know a much better use for that old Barry Manilow cd.

Place the sports cap over the hole in the cd...

... and fix in place with some Blu Tack.

Blow up the balloon and, making sure the sports cap is closed, pull the open end of the balloon over the cap.

Place your hovercraft on a flat surface and open the sports cap.

Give it a quick tap and watch your hovercraft go!

The air rushes out of the balloon and through the cap, lifting the cd on a cushion of air. The air reduces the friction between the cd and surface it's on so the hovercraft can travel a surprising distance before stopping.

DO TRY THIS AT HOME

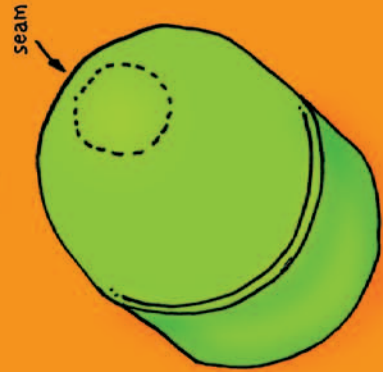
#45



featuring: **MARVIN and MILO**

What you need: • A ramp or slope • A lump of plasticine
• A round biscuit tin (or similar container)

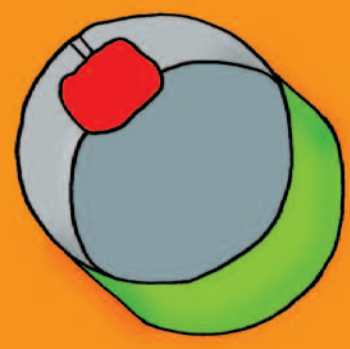
... and put the lid on.



Watch me defy gravity and make this biscuit tin roll up hill.

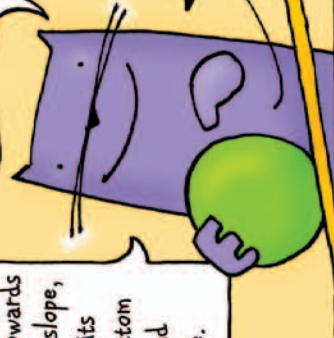


Attach a large fist-sized lump of plasticine to the inside of the wall of the tin at the seam...

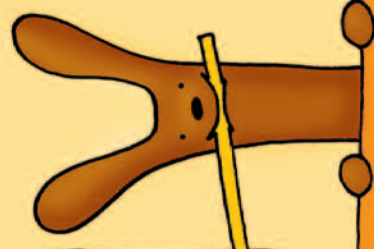


With the seam facing upwards but towards the top of the slope, put the tin on its side at the bottom of the slope and hold it in place.

Let go and, ta da! The tin rolls up the slope.



The weight of the plasticine creates a turning force on the tin that levers it up the hill when you let go, and makes it look as though you're defying gravity.

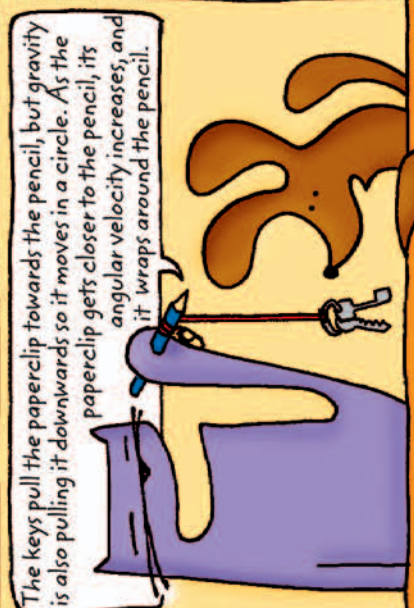
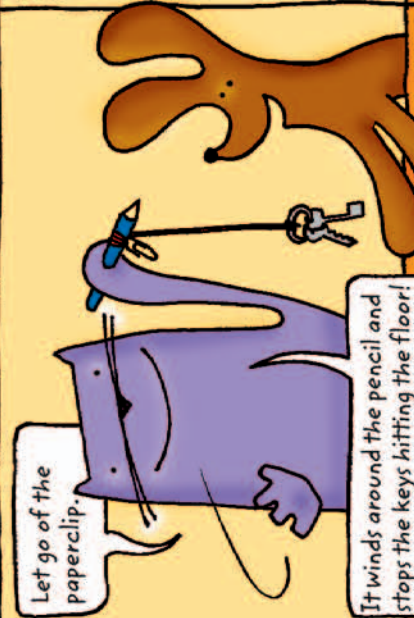
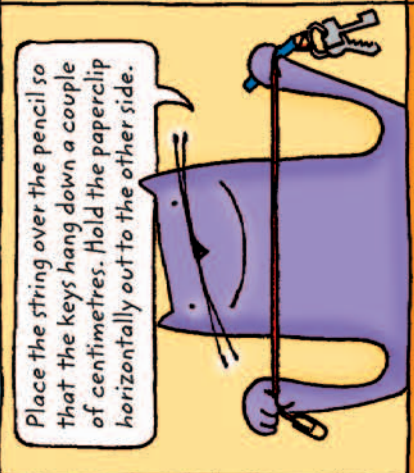
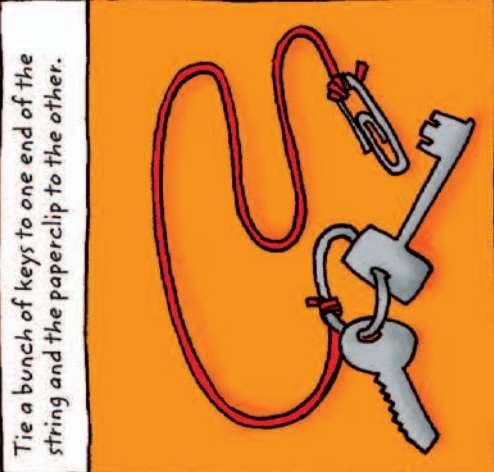
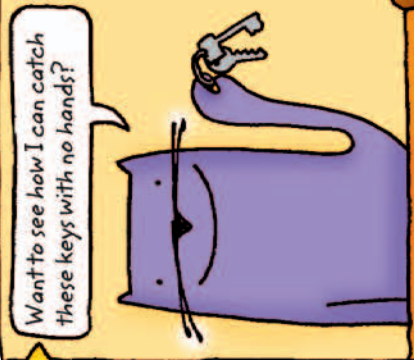


DO TRY THIS AT HOME

#46

featuring: **MARVIN and MILO**

What you need: • A bunch of about 3 keys • A pencil
• A large paperclip or washer • 1 m of string



MARVIN AND MILO

047

**DO TRY THIS
AT HOME**

#47

featuring:
Marvin
and
Milo

What you need: • A bowl • Water • A tissue

Hey Milo, this trick will make your cold feel better. Check out my submarine!

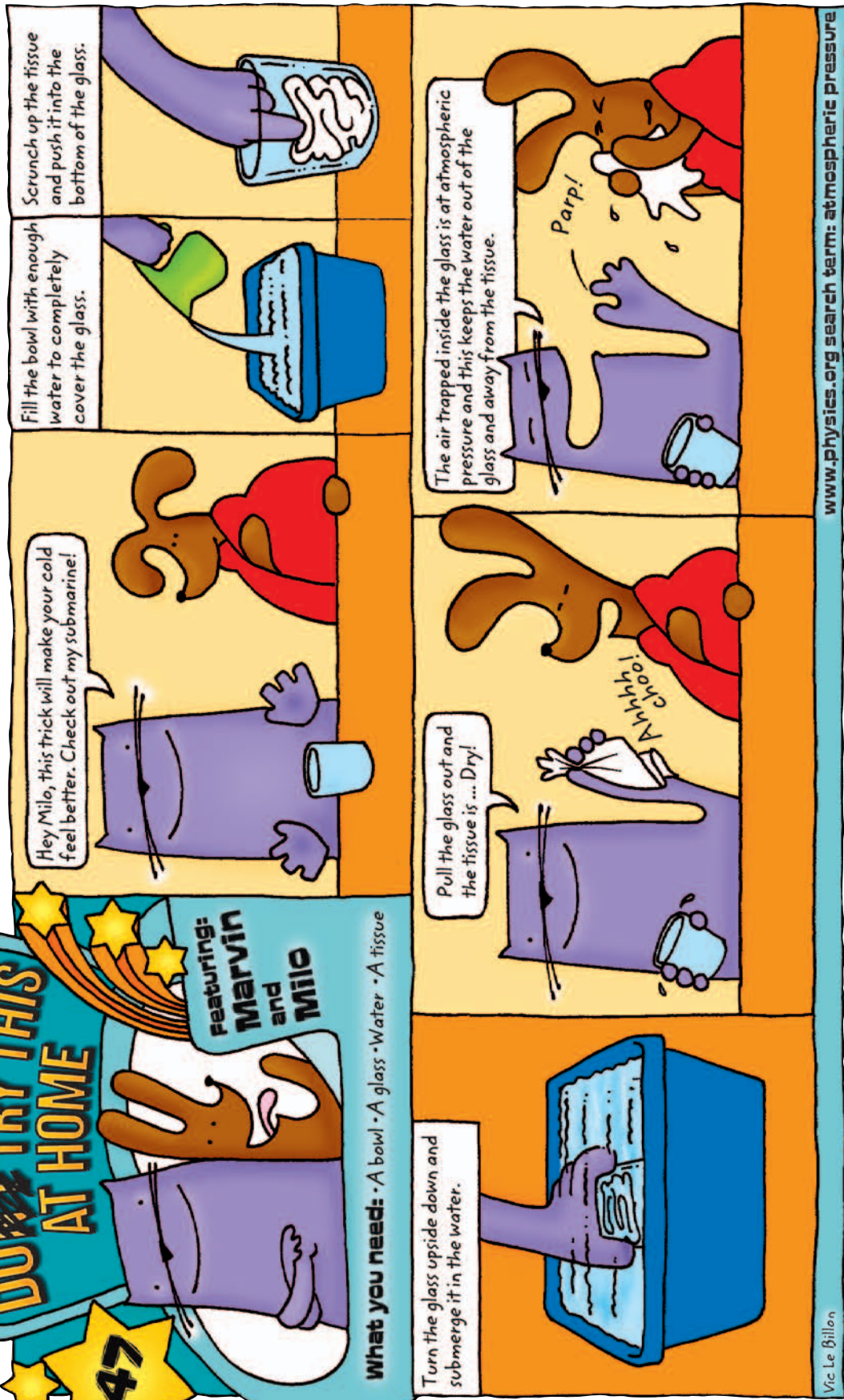
Turn the glass upside down and submerge it in the water.

Pull the glass out and the tissue is ... Dry!

The air trapped inside the glass is at atmospheric pressure and this keeps the water out of the glass and away from the tissue.

Fill the bowl with enough water to completely cover the glass.

Scrunch up the tissue and push it into the bottom of the glass.



Vic Le Billon

www.physies.org search term: atmospheric pressure

DO TRY THIS AT HOME

#48

featuring: **MARVIN** and **MILO**

What you need: • Two glasses • Skimmed milk • Whole milk • Two straws • A friend

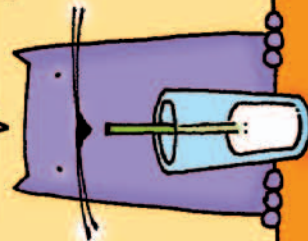
Let's see which milk will make better froth for my cappuccino!



Fill one glass about five centimetres deep with whole milk and pour the same amount of skimmed milk into the other glass.



Both starting at the same time, blow through the straws and into the milk.



The skimmed milk froths up much faster than the whole milk, and the bubbles last longer too!



Bubbles can form in milk because the milk proteins form a strong skin. But the fat in whole milk interacts with these proteins, weakening this skin and popping the bubbles.



DO TRY THIS AT HOME

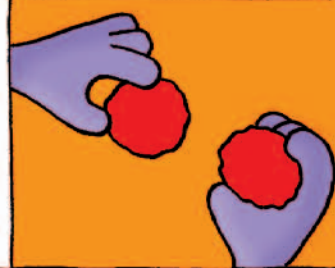
#49

Featuring: **MARVIN and MILO**

What you need:

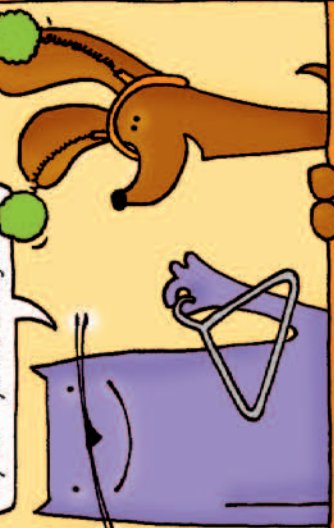
- A metal clothes hanger
- Plasticine • (An adult to help)

Make two equal-sized Plasticine balls...



... and stick them on to the legs of the 'M'.

Fab deely boppers Milo, but try out my Head Hanger.



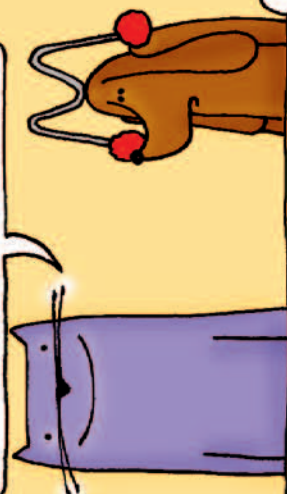
Straighten out the clothes hanger...



... and then bend it into an 'M' shape with long 'legs'.

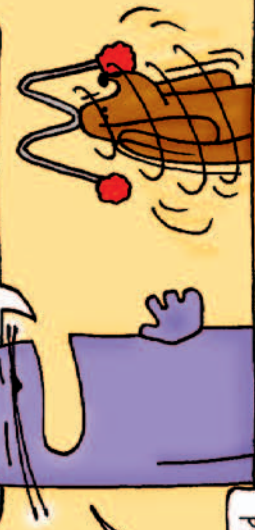


Balance the hanger on your head with the Plasticine balls well away from your ears. This may take some practice.



Spin round quickly.*

As you turn, the hanger remains almost stationary! The friction between your head and the wire is very low so the hanger doesn't move with you.



DO TRY THIS AT HOME

#50

featuring: **Marvin and Milo**

What you need: • A dark room • An envelope • Roll of sticky tape • A Polo mint or similar sugary sweet • A friend or mirror

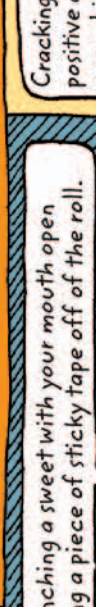
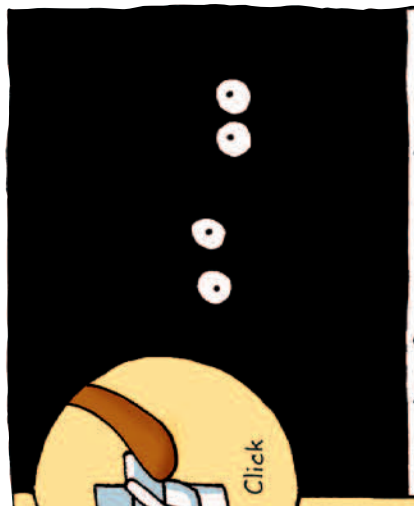
Milo, you're going to love this one! I can make these everyday objects glow.

Rip open the seal of the envelope - you will see a blueish glow.

Try crunching a sweet with your mouth open or ripping a piece of sticky tape off of the roll.

Cracking sugar or ripping apart glued surfaces separates positive and negative electrical charges. When they recombine the surrounding air is excited, producing a flash of blueish light.

Wait about five minutes in a dark room so that your eyes become dark adapted and you can make out some objects.



DO TRY THIS AT HOME

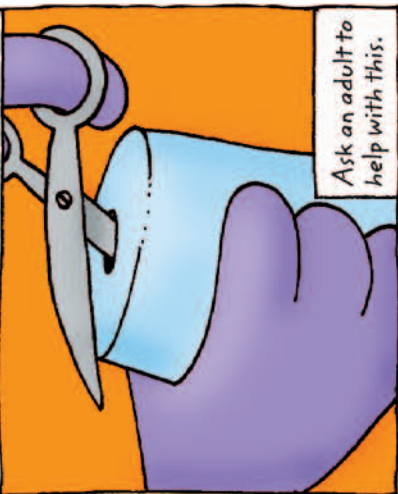
#51

Featuring: **MARVIN and MILO**

What you need: • A plastic cup
• A pair of scissors • Some water



Cut a hole in the bottom of the plastic cup about 1cm in diameter, making sure that your finger can cover it.

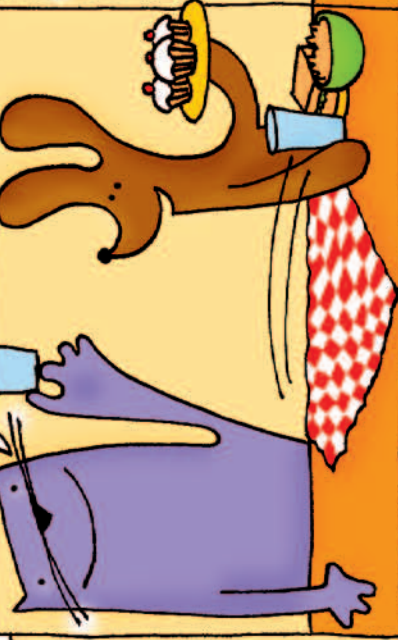


Ask an adult to help with this.

This is a great trick to do at a picnic, Milo. Do you think I can get water to stay in a cup with a hole in it?



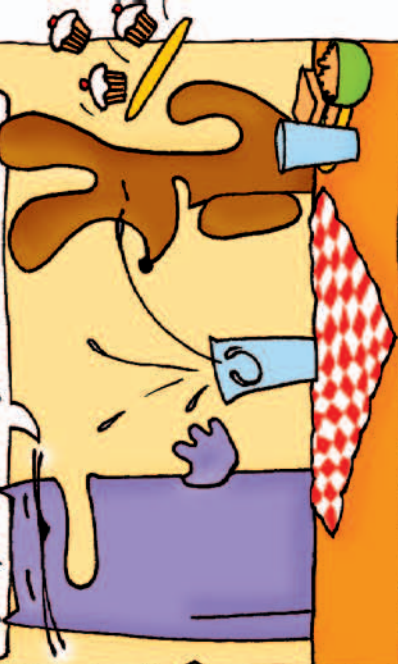
Drop the cup, removing your finger from the hole as quickly as possible.



Cover the hole with your finger and fill the cup with water. Make sure you're somewhere that can get wet.



The water stays inside the cup despite the huge hole! The cup and the water are falling at the same rate due to gravity so they hit the ground at the same time.



DO TRY THIS AT HOME

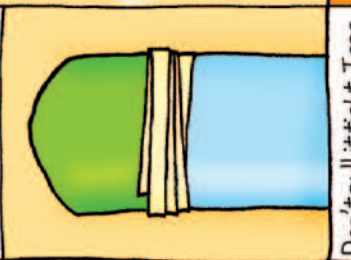
featuring: **MARVIN and MILO**

What you need: • An empty plastic bottle • A balloon • A pair of scissors • Sticky tape • A target

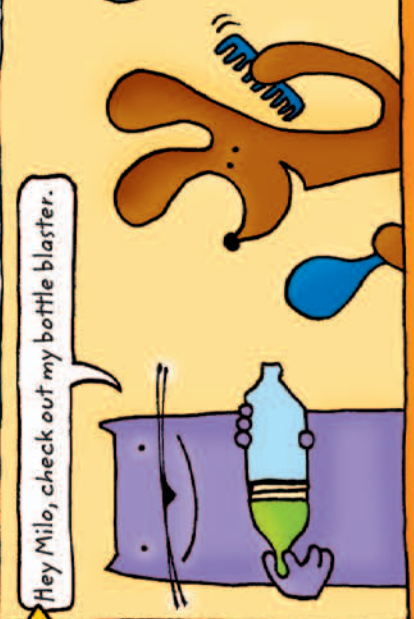
Carefully cut the bottom of the bottle off.*



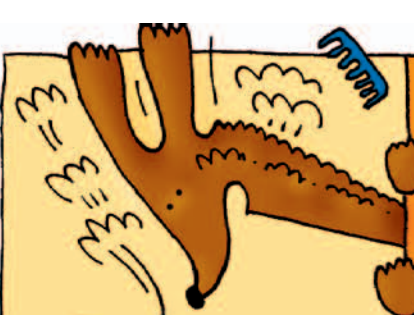
Cut the neck off the balloon.*



Don't pull it tight. Tape the balloon in place around the bottle.



KERPOW



KERPOW



DO TRY THIS AT HOME

#53

featuring: **MARVIN and MILO**

What you need: • A piece of polystyrene • Drawing pin
• Clean foil quiche tin • Pencil with a rubber end • Woollen glove

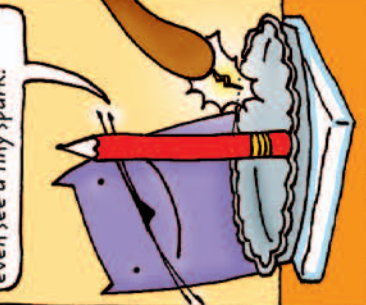
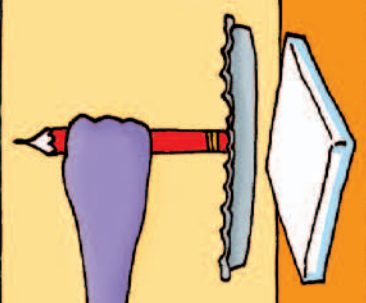


Push the drawing pin through the centre of the foil tin and push the rubber end of the pencil on to it to form a handle.

Using the pencil handle, put the foil tin on top of the polystyrene. Don't touch the foil or the polystyrene.

Bring an outstretched finger close to the tin and you'll hear, feel and maybe even see a tiny spark!

Rubbing the polystyrene makes it negatively charged. This excess charge repels the electrons in the foil. Your finger provides an escape route for the electrons in the foil and as they jump the gap you get a small electric shock.



DO TRY THIS AT HOME

#54

featuring: **MARVIN and MILO**

What you need: • A buzzing egg timer • Sticky tape
• A piece of string about 1 metre long • A friend

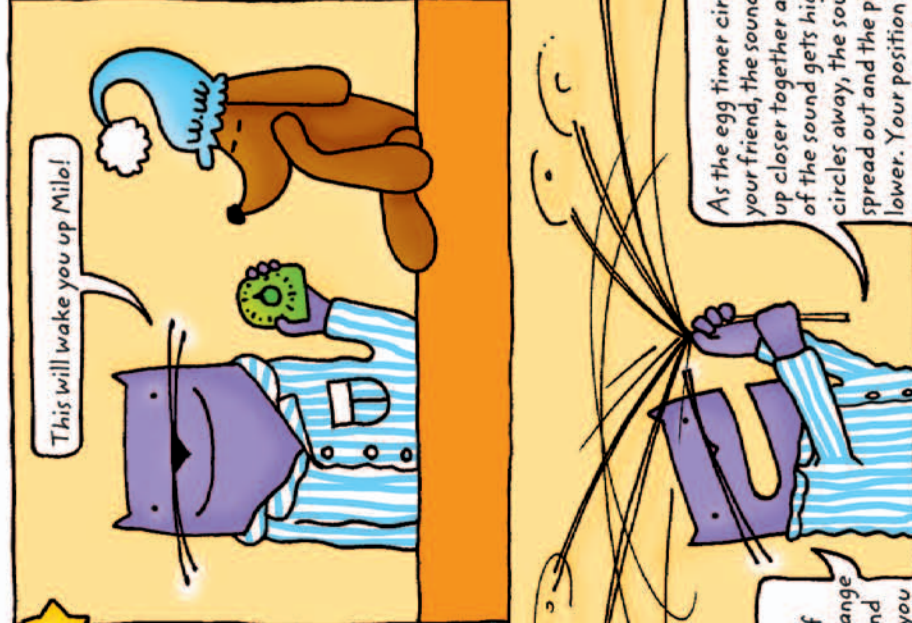
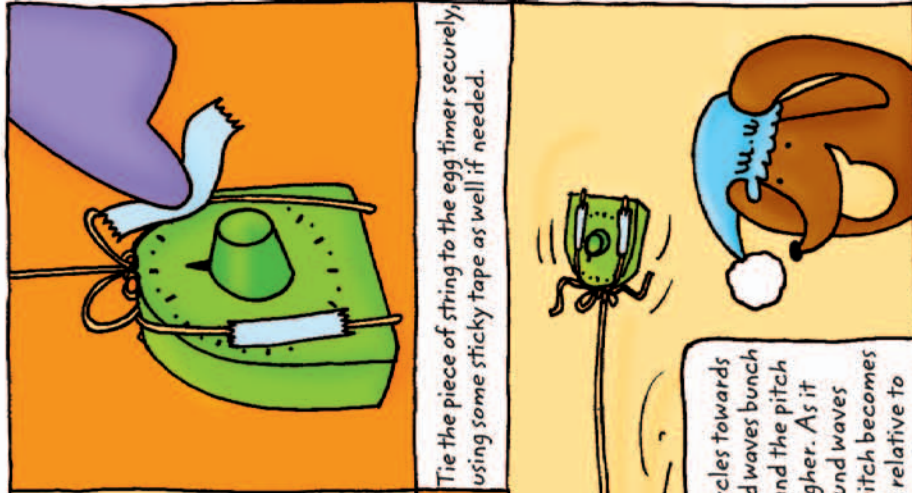
This will wake you up Milo!

Tie the piece of string to the egg timer securely, using some sticky tape as well if needed.

With the timer buzzing, hold the other end of the string very tightly and start to swing it in a circle around your head. Make sure your friend is standing well back and there's nothing breakable near you.

Your friend will hear the pitch of the egg timer change as it moves around your head - but you won't hear any change at all!

As the egg timer circles towards your friend, the sound waves bunch up closer together and the pitch of the sound gets higher. As it circles away, the sound waves spread out and the pitch becomes lower. Your position relative to the egg timer is always the same so you don't hear any difference.



DO TRY THIS AT HOME

featuring: **MARVIN and MILO**

What you need: • Bouncy ball or ball of Plasticine
• Piece of paper • Sticky tape • Scissors

Roll the paper into a column around the top of the ball and hold it in place with sticky tape.

I know a good way to stop your balls rolling off all over the place, Milo.

Cut the bouncy ball in half. (Get an adult to help.)

If you flick the column of paper, it will fall over. Cut off bits of paper until when you flick it, it rights itself again.

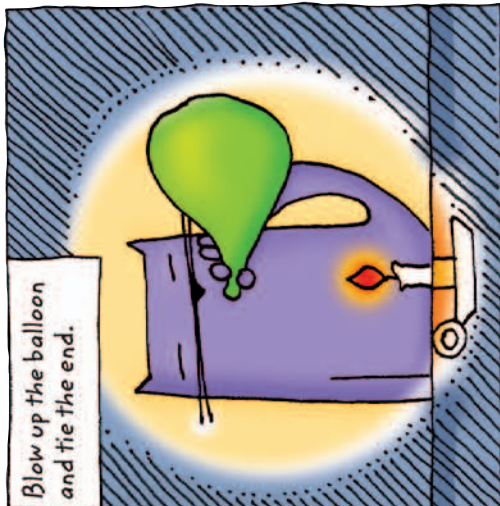
The wobbler is now self-righting because its centre of mass is lower. As the wobbler leans over, its centre of mass rises but gravity pulls the wobbler back upright before it can topple over.

DO TRY THIS AT HOME

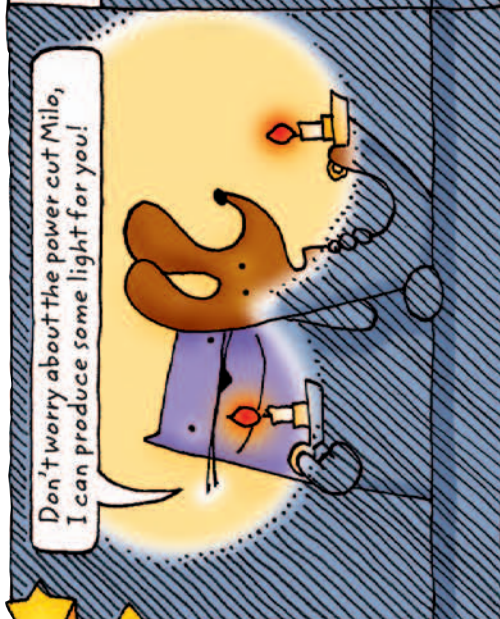
featuring: **MARVIN** and **MILO**

#56

What you need: • Party balloon
• Energy saving light bulb



Blow up the balloon and tie the end.



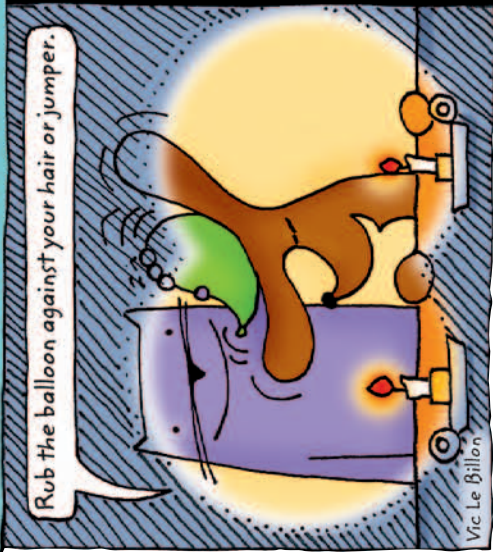
Don't worry about the power cut Milo, I can produce some light for you!



Waving the electrically charged balloon close to the bulb causes a current to flow through the charged gas inside the bulb and it lights.



In a dark room, hold the bulb in one hand and move the balloon back and forth close to it.



Rub the balloon against your hair or jumper.

www.physics.org
search term: static electricity

Vic Le Billon

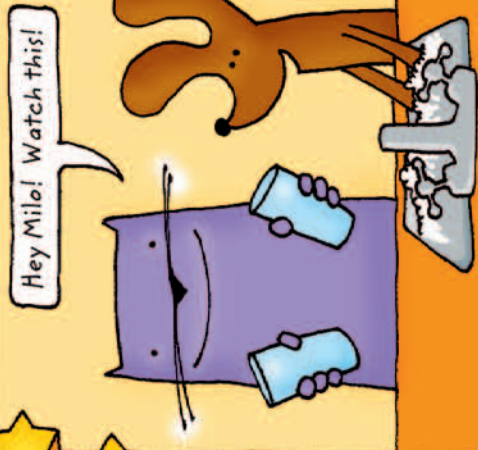
DO TRY THIS AT HOME

Featuring: **MARVIN and MILO**

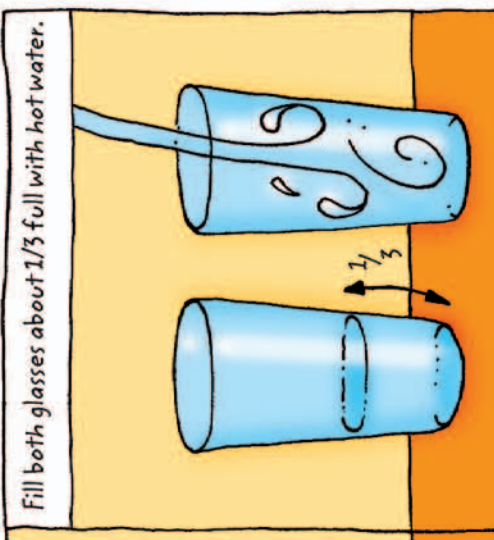
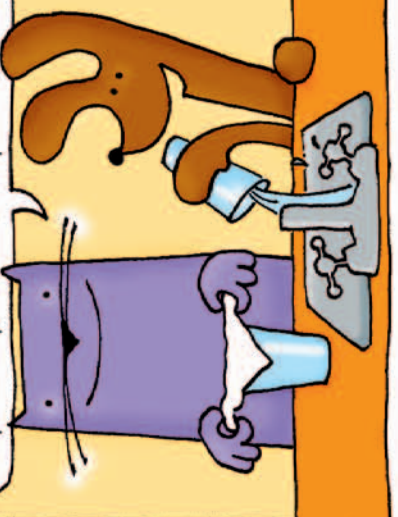
#57

What you need: • Two plastic glasses • Paper towel
• Hot water • Sink • Adult help

Carefully swirl the water around one of the glasses and pour the water away.
* Mind not to splash yourself.



Dampen the paper towel and place it over the empty glass. Swirl and empty the second glass and place it upside down on top of the first.



Fill both glasses about 1/3 full with hot water.

Hold the top glass in place for ~20 seconds; then use the top glass to pick up both glasses. The hot water heats up the air inside the glasses, which expands and some escapes. With the two glasses held together



The escaped air can't get back in as the air inside cools and shrinks. This means that the air pressure outside the glasses is higher than inside and the glasses are pushed tightly together.

DO TRY THIS AT HOME

Featuring: **MARVIN and MILO**

#58

What you need: • Raw egg • Large pop bottle • Salt • Sticky tape • Water

Fill the bottle with enough water so that the egg is well covered.

Add salt to the water, stirring, until the egg floats.

Tape the top of the bottle back on.

Watch me drop this egg without it smashing!

Cut the top off the bottle and put the egg inside.

The egg doesn't break because the salt water spreads the impact across the whole egg. Try dropping the egg in the bottle without the salt water.

Drop the bottle to the floor from waist height.

waist height

Vic Le Billon

www.physics.org search term: impact

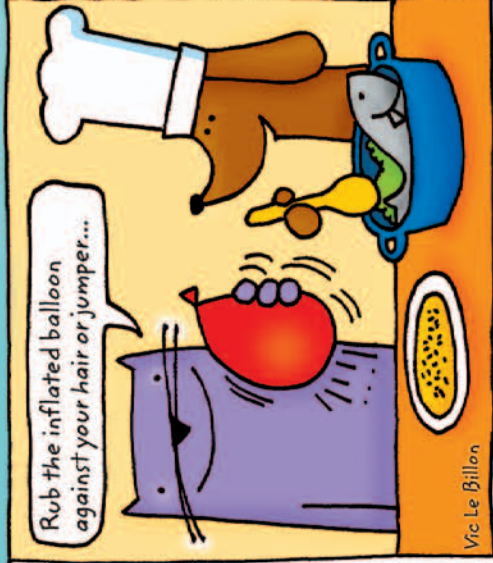
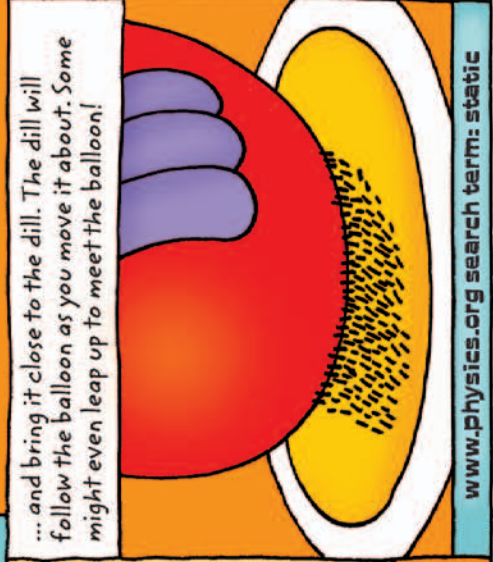
DO TRY THIS AT HOME

featuring: **MARVIN and MILO**

#59

What you need:

- A saucer
- Vegetable oil
- Dried dill
- Balloon



www.physics.org search term: static

Vic Le Billon

DO TRY THIS AT HOME

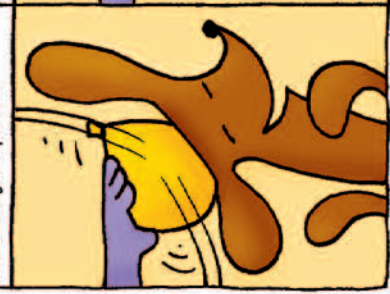
Featuring: **MARVIN and MILO**

#60

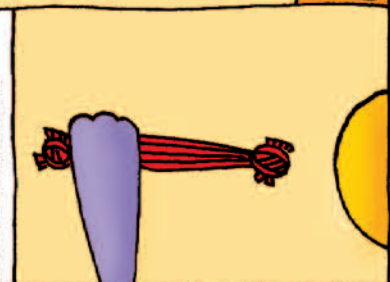
What you need:

- Balloon
- Very thin strands of tinsel, about 15cm long

Rub the inflated balloon against your hair or jumper...



...and hold the tinsel above the balloon by one of the knots.



Milo, here's your chance to see a "real" UFO!



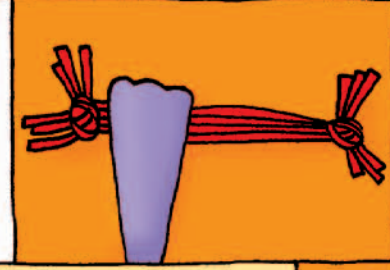
Vic Le Billon

Drop the tinsel. The tinsel will touch the balloon, be repelled and start floating! Use the balloon to direct where it goes.

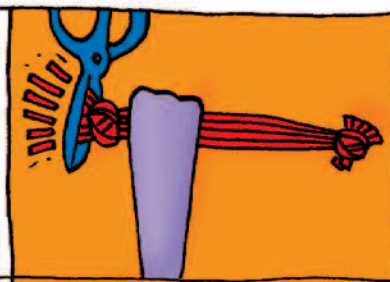


(If your UFO won't fly, try again with thinner tinsel or on a very dry day.)

Tie six strands of tinsel together with a knot at each end...



...and cut any loose ends off close to the knot.



Rubbing the balloon makes it negatively charged and the tinsel is attracted to it. When the tinsel hits the balloon, it picks up some of the negative charge and is repelled away.

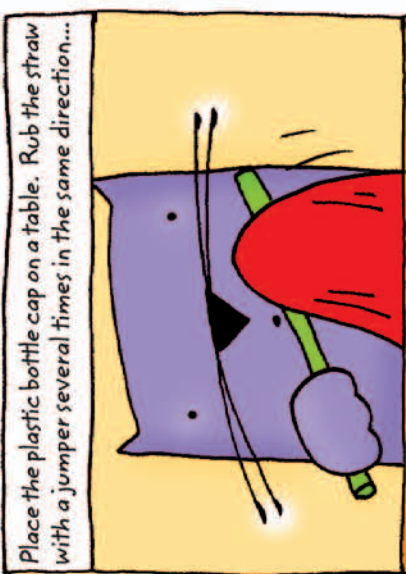


DO TRY THIS AT HOME

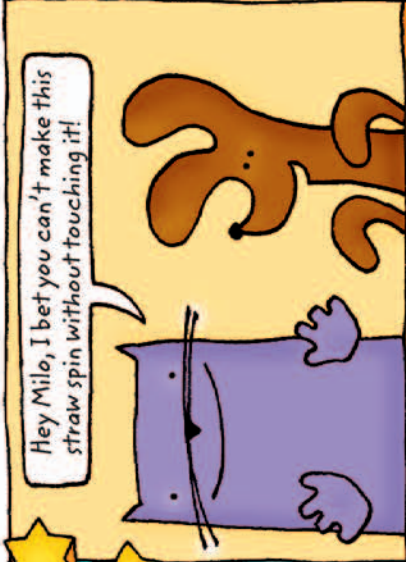
#61

Featuring: **MARVIN** and **MILO**

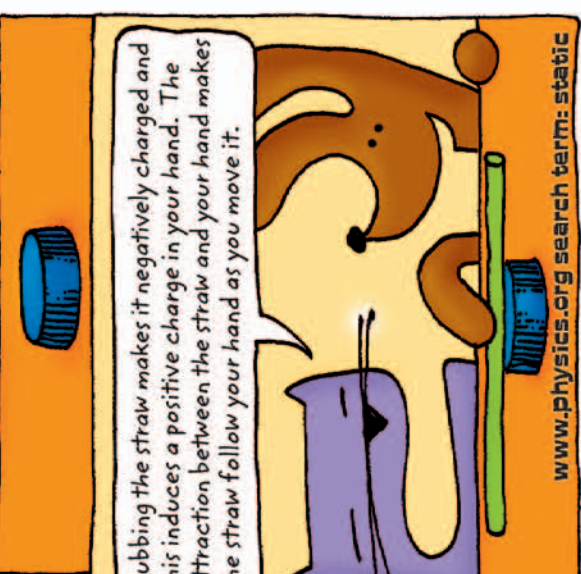
What you need: • A drinking straw
• Plastic bottle cap • A jumper • Your hands



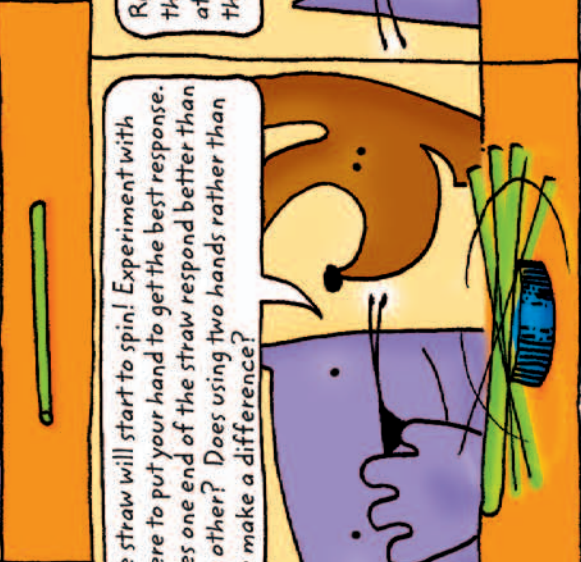
Place the plastic bottle cap on a table. Rub the straw with a jumper several times in the same direction...



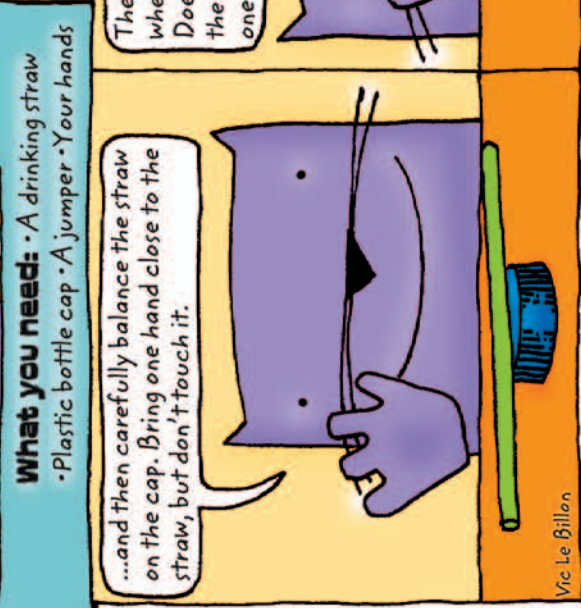
Hey Milo, I bet you can't make this straw spin without touching it!



Rubbing the straw makes it negatively charged and this induces a positive charge in your hand. The attraction between the straw and your hand makes the straw follow your hand as you move it.




The straw will start to spin! Experiment with where to put your hand to get the best response. Does one end of the straw respond better than the other? Does using two hands rather than one make a difference?



...and then carefully balance the straw on the cap. Bring one hand close to the straw, but don't touch it.

DO TRY THIS AT HOME

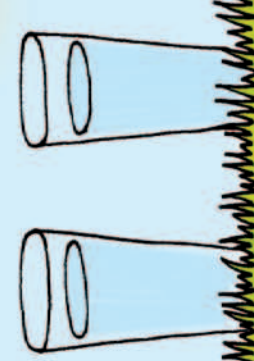


featuring: **MARVIN** and **MILO**


#62

What you need: • Two clear glasses
• Tap water • Tonic water • Dark paper

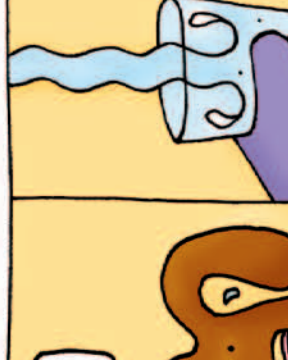
... and put them both in direct sunlight.



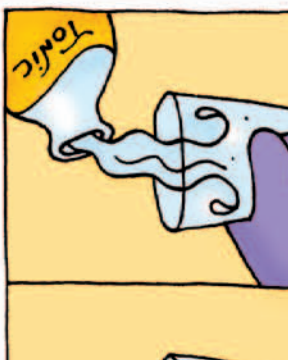
Hey Milo, I've got a cool trick for a sunny day!



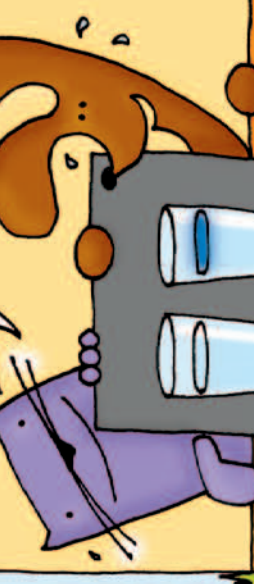
Fill one glass with tap water...




... and the other with tonic water...



Holding the dark paper behind them, but not blocking the light, look across the surfaces of the water. The tonic water will be giving off an eerie blue glow!



Tonic water contains quinine. The quinine absorbs ultraviolet light from the Sun and re-emits it as visible blue light.



www.physics.org search term: ultraviolet light

DO TRY THIS AT HOME

#63

featuring: **MARVIN and MILO**

What you need: • Freezer
• Bottled or distilled water (not tap water)

Put the bottle of water in to the freezer.

Vic Le Billion

Check this out Milo - I can make this bottle of water freeze just by tapping it!

Water can stay liquid for several degrees below 0°C if there are no impurities or disturbances to start ice crystals forming. Tapping the bottle disturbs the 'supercooled' water and kicks off freezing.

While the water is still liquid, take the bottle out of the freezer carefully, then tap it suddenly on the edge of a table. The water will freeze!

TAP!

Leave it alone for two to three hours. You'll need to experiment with the exact timing as all freezers are different. Check regularly that the water is still liquid - but don't move the bottle!

www.physics.org search term: supercooling

DO TRY THIS AT HOME

featuring **MARVIN and MILO**

#64

What you need: • Shallow bowl • Milk • Food colouring • Washing up liquid

Pour a couple of centimetres of milk in to the bowl.

a couple of centimetres

Woah, Milo, take a look at this!

The washing up liquid reduces the surface tension of the milk causing swirls and eddies as the detergent spreads through the liquid. What happens if you use skimmed or full fat milk? Does warming the milk first make any difference?

Add a drop of washing up liquid to the centre of the bowl and watch the colours start to mix and churn!

Add a couple of drops of food colouring at even spaces around the edge of the bowl.

Vic Le Billon

www.physics.org search term: surface tension

DO TRY THIS AT HOME

#65

featuring: **MARVIN and MILO**

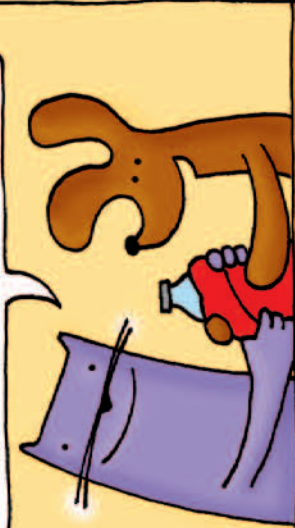
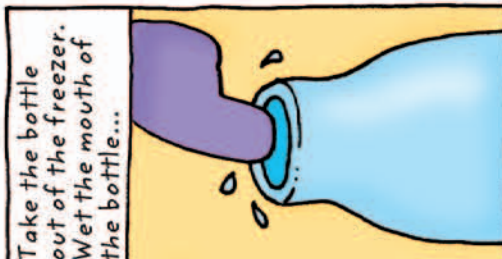
What you need: • A penny or other small coin
• Empty bottle with narrow neck • Some water • A freezer

... and quickly put the coin over the mouth, making sure there are no air gaps.

Put the bottle back in the freezer for another hour.

Take the bottle out of the freezer and, using a cloth, grasp the bottle with both hands*. Wait.

* Make sure the bottle is pointing away from you and anything breakable!



Vic Le Billon

www.physics.org search term: air



#66

What you need: • Sticky tape • Water • Teaspoon
• Clear plastic, e.g. from a pop bottle

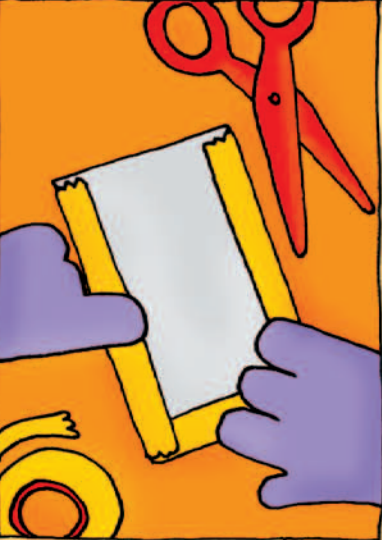
Use the Teaspoon to put a single small drop of water onto the middle of the plastic.



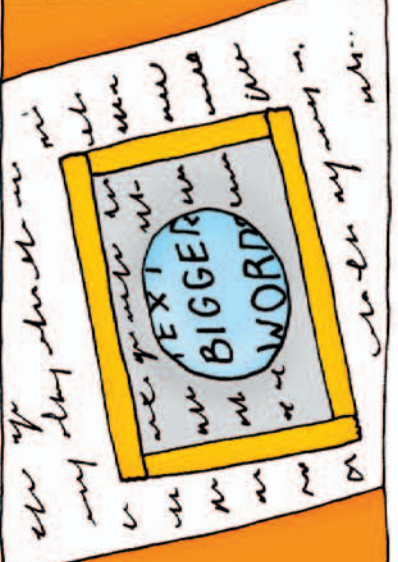
Don't worry about finding your glasses Milo, you can use my mini-magnifier!



Cut out a small piece of clear plastic (approx 5cm by 5cm) and put sticky tape around the edges if they are sharp.



Place the plastic carefully over some text and look straight down through the top of the drop - the text will look bigger!



The water drop acts as a magnifying lens. Light from the page travelling through the drop is bent (refracted) making the text look much bigger.



www.physics.org
search term: refraction

Vic Le Billon

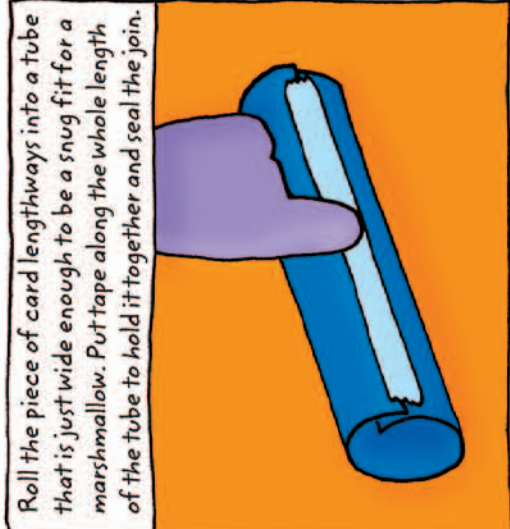
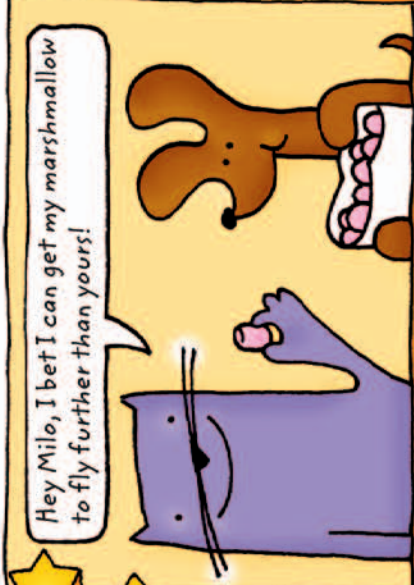
DO TRY THIS AT HOME

#67

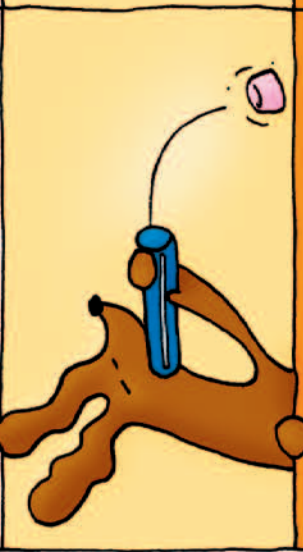
featuring: **MARVIN and MILO**

What you need:

- Sticky tape
- Marshmallows
- Piece of thin card (~A4 size)

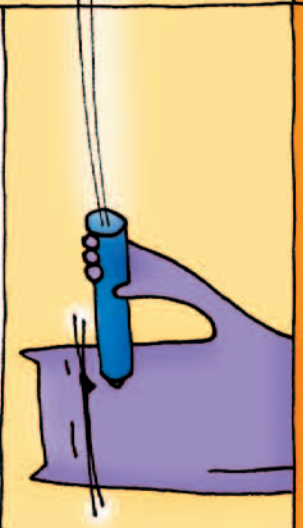


Put a marshmallow in one end of the tube, hold the tube horizontal, and blow from the opposite end. * Note how far it flies.

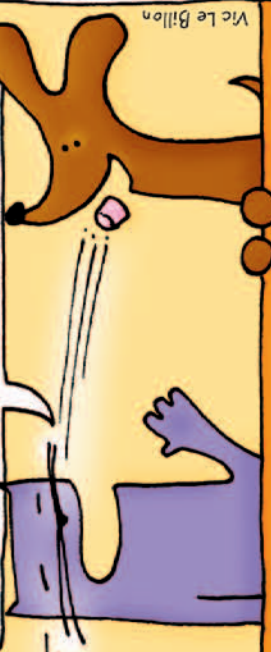


* If the marshmallow doesn't move, adjust the diameter of the tube.

Try again with a new marshmallow but this time blow from the end with the marshmallow. Keep blowing until the marshmallow leaves the tube.



By blowing as the marshmallow travels along the whole length of the tube, you're applying a force for longer. This means the marshmallow accelerates for longer, emerges from the tube at a greater speed and flies further.



www.physics.org search term: Newton's second law

Vic Le Billon

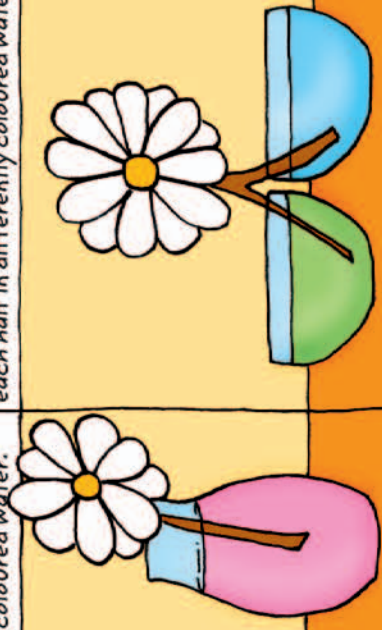
DO TRY THIS AT HOME

#68

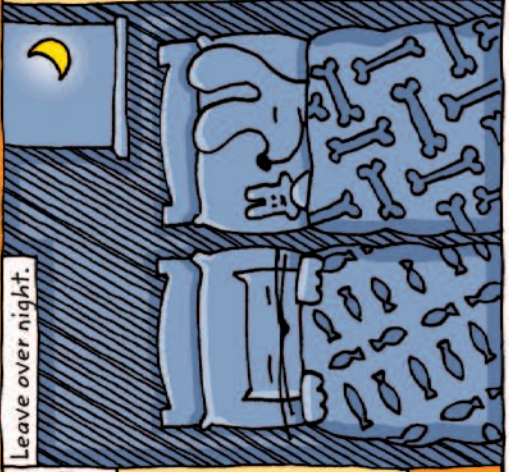
featuring: **MARVIN and MILO**

What you need: • White carnation or similar
• Vase • Water • Food colouring • Scissors

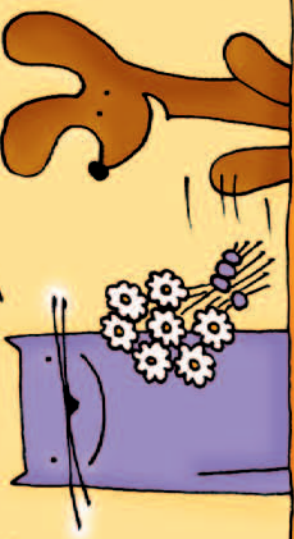
Cut the end of the stem and place the flower in the coloured water.



Leave over night.



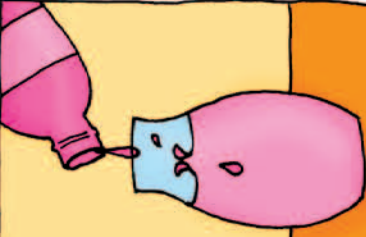
I know how to jazz up those blooms, Milo!



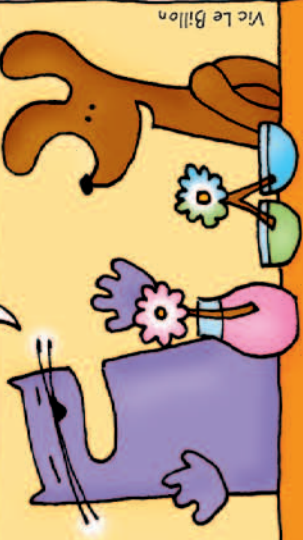
Pour water into the vase...



... and add a capful or two of food colouring.



Capillary action forces the water up through the stem and into the petals. The food colouring shows the paths the water takes.



Mic Le Billon

www.physics.org
search term: capillary action

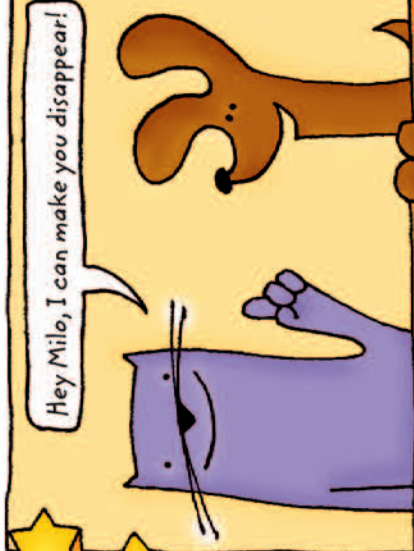
DO TRY THIS AT HOME

#69

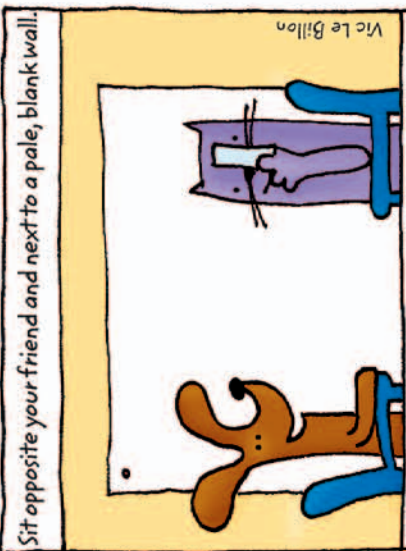
featuring: **MARVIN and MILO**

What you need:

- A small mirror
- A blank wall
- A friend



Hey Milo, I can make you disappear!



Sit opposite your friend and next to a pale, blank wall.

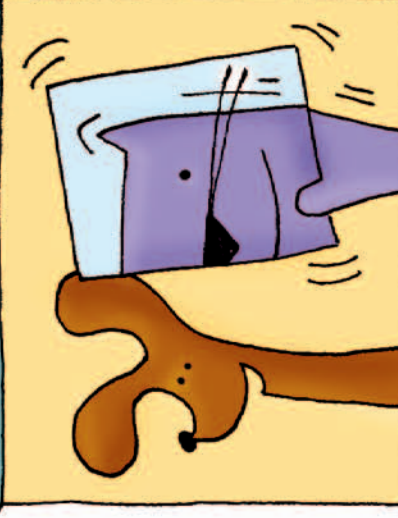
Vic Le Billion

With the wall to your right, hold the mirror in your left hand and put it next to your nose.



With your left eye looking at your friend, wave your right hand so your right eye can see it reflected in the mirror.

Watch bits of your friend's face disappear! Don't give up if it doesn't work straight away — try switching eyes, holding your head very still and making sure your friend doesn't fidget.



Angle the mirror so that your right eye sees only a reflection of the wall.



Each eye is seeing something very different and as your brain tries to make a sensible single image, it combines bits from both eyes. But your brain is sensitive to movement so it focuses on your moving hand and your friend disappears.

www.physics.org
search term: **binocular vision**

DO TRY THIS AT HOME

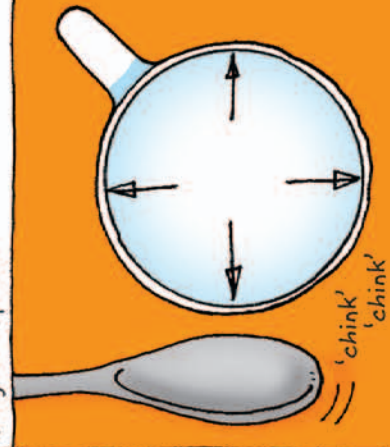
#70

Featuring: **MARVIN and MILO**

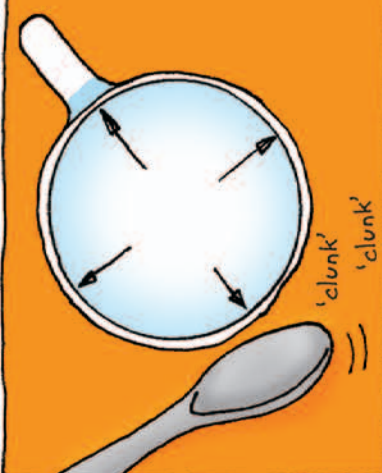
What you need:

- A teacup or mug
- A teaspoon • Good ears

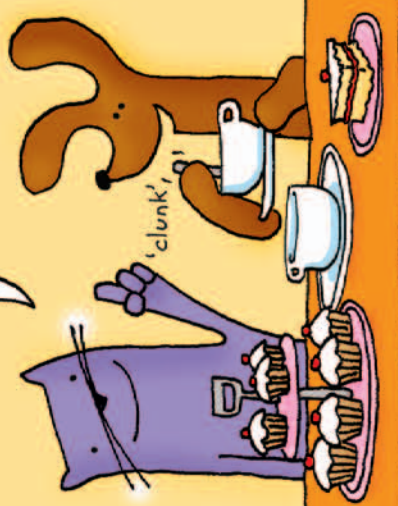
But if you tap the rim of the teacup halfway between those points, you hear a sound that is higher in pitch.



If you tap the rim of the teacup by the handle, opposite the handle or at the two points half way round the rim, then you hear a low pitched sound.

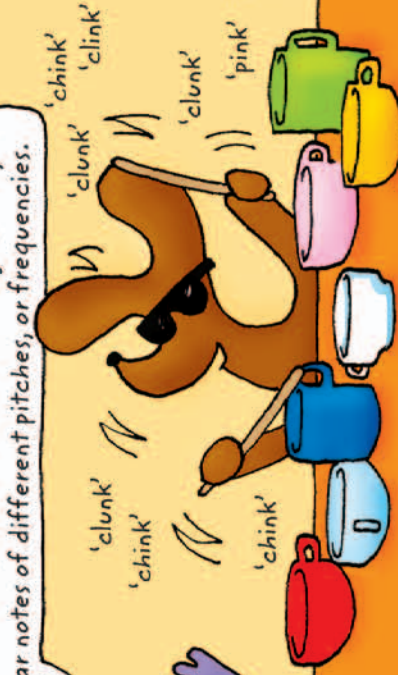


That's strange, did you hear that Milo?



So tapping at the specific points on the rim sets up vibrations with different wavelengths and you hear notes of different pitches, or frequencies.

Tapping the rim causes vibrations around the cup, but at the handle the movement is always at a minimum.



www.physics.org
search term: sound waves

Vec Le Billion

DO TRY THIS AT HOME

Featuring: **MARVIN** and **MILO**

#71

What you need: • A hosepipe • a garden • a sunny day

Hey Milo, don't just lie there, take a look at this!

Stand with your back to the Sun and turn on the hosepipe. Put your thumb over the end of the hose to get a fine spray of water.

Look at the spray against a dark background such as a wall, hedge or grass.

Adjust your position and the fineness of the spray until you see a rainbow!

White light from the Sun is made up of light of different wavelengths, or colours. The different wavelengths of light are bent by different amounts as they pass through the water, splitting the white light into all the colours of the rainbow.

www.physics.org
search term: rainbow

vic le billion

DO TRY THIS AT HOME

#72

What you need: • A piece of paper smaller than the book
 • A copy of Marvin and Milo's Adventures in Science*
 * Available NOW from all good bookshops and online retailers

Phew Milo, now we've signed all those copies of our NEW BOOK, we can get back to experimenting.

Take a copy of our NEW BOOK and a piece of paper, smaller than the book. Hold them horizontally and drop them both at the same time. Notice which one hits the ground first.

Now put the piece of paper flat against the bottom side of the book and drop them together. What happens?

Drop them again, but this time with the paper on top of the book. What happens?

Air resistance means that when dropped separately, the book and paper hit the ground at different times. But when they are dropped together, the larger book sweeps the air out of the way and the two fall at the same rate.

WINNER
Dog Booker Prize
£50'000

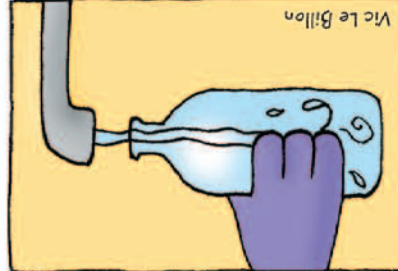
www.physics.org search term: air resistance

Vic Le Billion

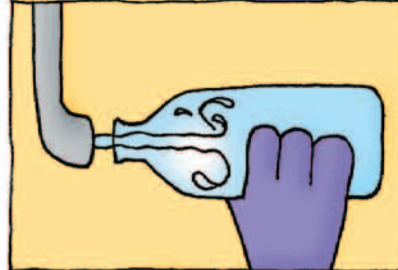
DO TRY THIS AT HOME

Featuring: **MARVIN and MILO**

What you need: • Two glass bottles • A wooden spoon • A jug of water • Good ears



... and the other $\frac{3}{4}$ full of water.

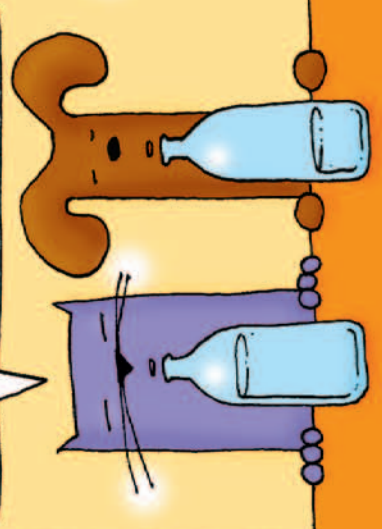


Fill one bottle $\frac{3}{4}$ full of water...

Tap both bottles and listen to the sound they make. Which one is higher pitched?



Now blow across the top of each bottle. Which bottle makes the higher pitched sound now?



The easier it is for the glass to vibrate when you tap it, the higher the frequency. So the bottle with less water in will sound higher pitched.

The less air there is in the bottle when you blow over it, the faster it vibrates. So the bottle with more water in will sound higher pitched.

Vic Le Billion

DO TRY THIS AT HOME

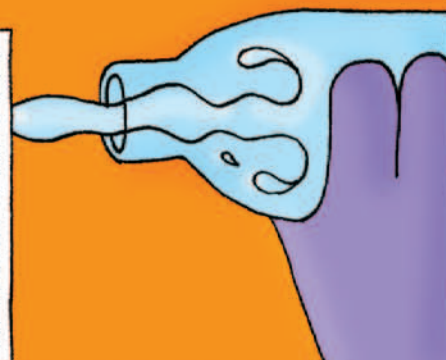
#74

featuring: **MARVIN and MILO**

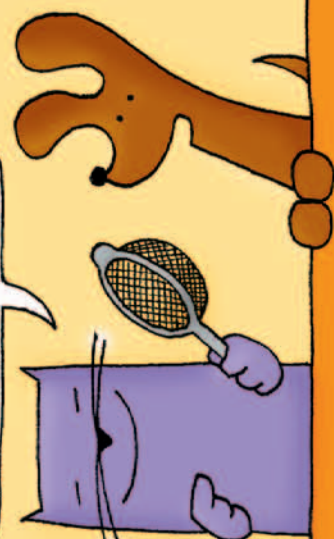
What you need: • A glass bottle • A sieve • Water



Fill the bottle with water ...



Hey Milo – do you trust physics to make this sieve waterproof?



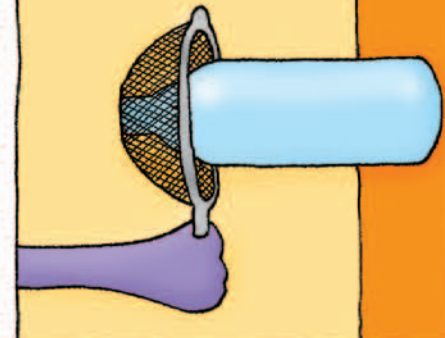
The water stays in the bottle! The surface tension of the water across the fine mesh of the sieve stops the water flowing through the holes.



Turn them both upside down, making sure that the top of the bottle is in contact with the sieve at all times.*




... and hold the sieve over the top of it.



www.physics.org
search term: surface tension

(* It's best to do this over the sink or outside...)

DO ~~NOT~~ TRY THIS AT HOME



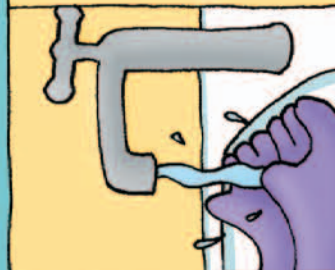
featuring:
Marvin
and
Milo

What you need:

- A small glass bottle
- Water
- An effervescent indigestion tablet




Break the tablet in two, and put both halves into the bottle.



Wash your hands while you wait for it to stop fizzing.



Before you take that tablet Milo, I have an experiment which will make you feel better!




Pour about 2cm of water into the bottle.



Blow across the top of the bottle and listen to the sound it makes now.



Blow across the top of the bottle and listen carefully to the sound it makes.



You hear a lower pitched note because sound travels more slowly through carbon dioxide (the gas given off by the fizzing tablet) than through air.



Blow across the top of the bottle and listen carefully to the sound it makes.

www.physics.org
search term: speed sound

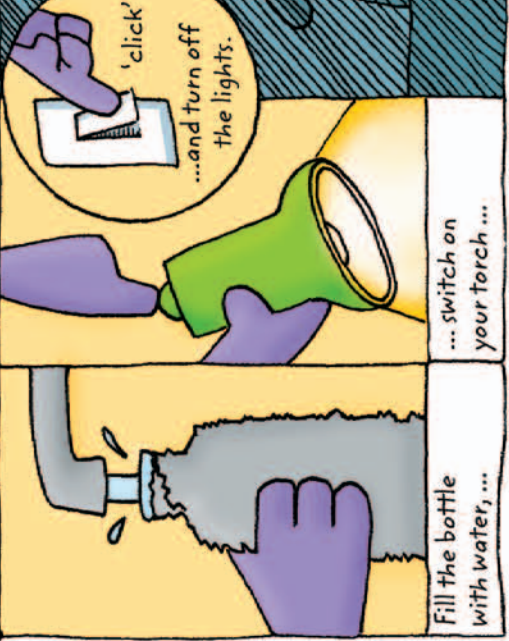
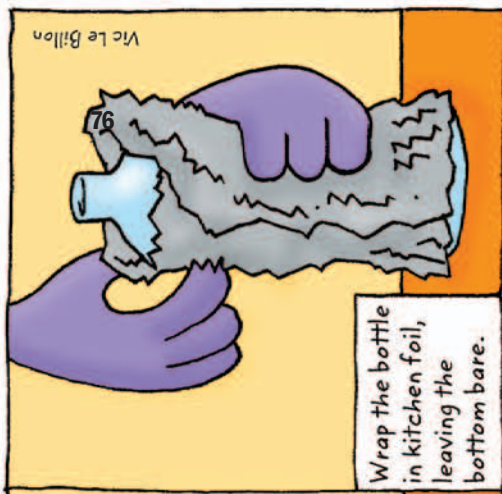
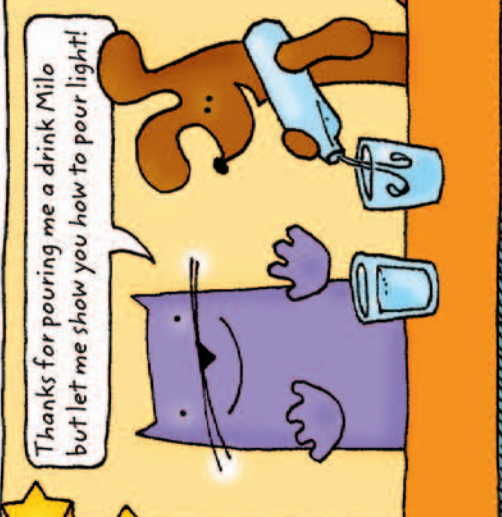
Vic Le Billon

DO TRY THIS AT HOME

#76

featuring: **MARVIN and MILO**

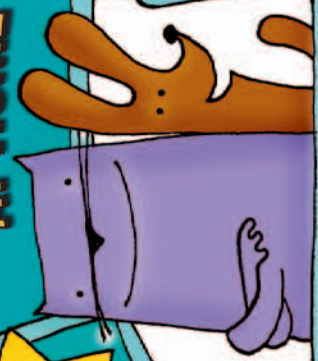
What you need: • A clear plastic bottle • A torch
• Kitchen foil • Sticky tape • A dark room with a sink



www.physics.org search term: total internal reflection

Vic Le Billon


DO TRY THIS AT HOME



featuring:
Marvin
and
Milo


what you need:

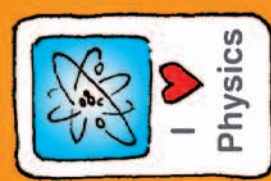
- Two flat, rectangular fridge magnets*
- * If you only have circular magnets, you'll need to do some experimenting to feel this effect!




Put one magnet on top of the other so that the two magnetic sides are touching. Try to slide them apart along the longest side. How easily do they slide?

That's a great collection Milo. Can I borrow two?






Try sliding them apart again, but this time along the shortest side. How well do the magnets slide now?



www.physics.org
search term: magnets

Place the magnets side by side on a table: one face up and one face down.

Fridge magnets are made from thin strips of magnets with alternating north and south poles. As you try to slide the magnets across each other, the thin strips are being attracted and then repelled, making the magnets judder.



Mc Le Billon

DO TRY THIS AT HOME

featuring **MARVIN and MILO**

#78

What you need: • An adult* • Two balloons • Some water • A tea light • Matches *Only do this experiment with a responsible adult and only hold the balloon over the flame for a short time.

That was a great party Milo! I know what we can do with these spare balloons.

Place the tea light on a flat surface* and light it. * Make sure it is away from anything flammable or electrical.

Vic Le Billion

Add some water to the second balloon...

Blow up one of the balloons and hold it over the flame. The balloon will pop!

...and then blow it up. What happens when you hold this balloon over the flame?

It doesn't pop as the heat from the candle is transferred to the water. Water takes a long time to heat up, so it stays relatively cool and stops the rubber from getting so hot that it bursts.

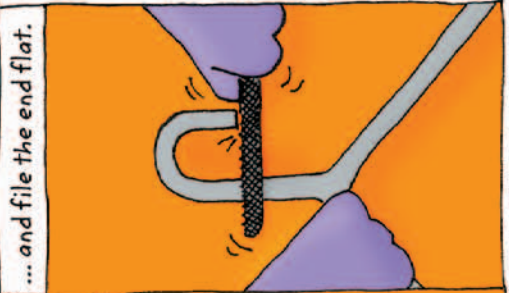
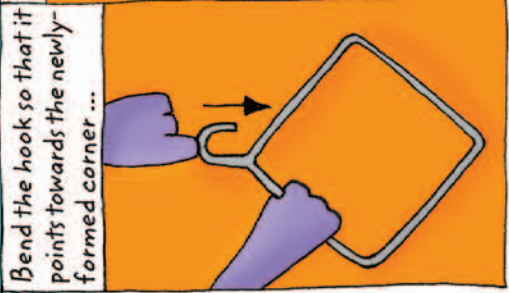
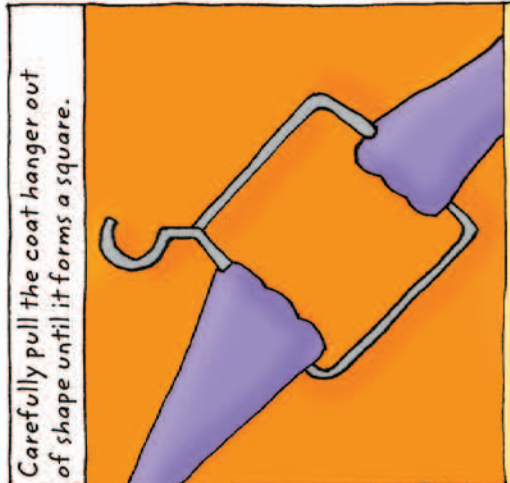
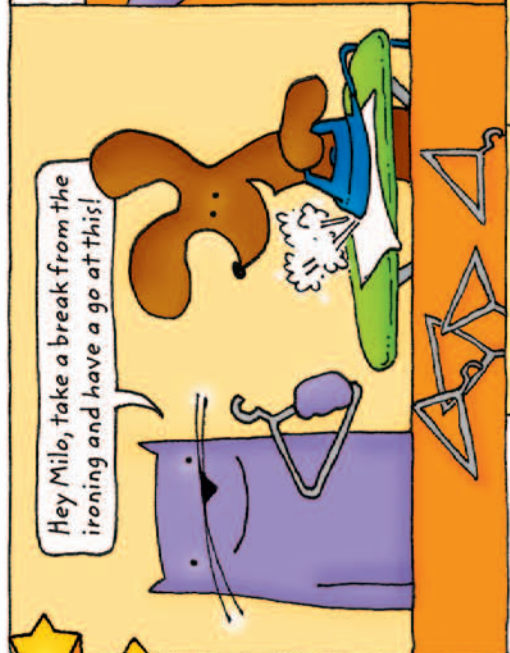
www.physics.org
search term: specific heat capacity

DO TRY THIS AT HOME

featuring **MARVIN and MILO**

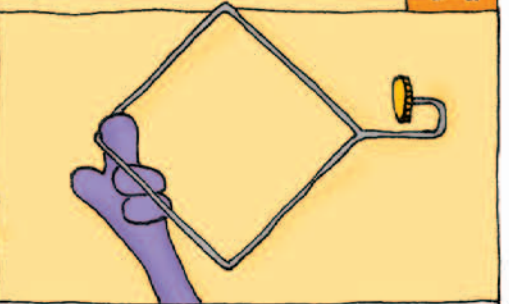
#79

What you need: • A metal coat hanger
• A pound coin • A file



With the coat hanger on one finger, balance the coin on the hook. This might take some patience!

Once the coin is in place, start swinging the hanger back and forth. Can you get the hanger to swing in a complete circle without the coin falling off?



www.physics.org
search term: Centripetal force

DO TRY THIS AT HOME

#80

Featuring: **MARVIN and MILO**

What you need: • A plastic drinks bottle • Water

Put the lid on tightly...

...and throw the bottle in the air.

Watch it carefully on the way up and down. The air inside the bottle will form a spherical bubble as it's falling!

Hey Milo, do you want to see how bubbles act in space?

Fill the bottle with water so it is very nearly full.

When the bottle is in free fall, surface tension forces the air into a bubble with the least possible surface area – a sphere. In space, the same effect can be seen with liquid drops in air.

Vic Le Billion

www.physics.org search term: free fall

DO TRY THIS AT HOME

#81

featuring: **MARVIN** and **MILO**

what you need: • A metal skewer (or knitting needle)
• An apple • A hammer • An adult*

Yum, delicious Milo but this kebab can demonstrate Newton's First Law. Now, first eat the kebab....

...push the skewer through the centre of the apple until it is sticking out by about 5cm.

* Ask an adult to help with the skewering

Holding the skewer horizontal, hit the blunt end with the hammer. What happens?

Holding the skewer vertically, what happens this time when you hit the skewer?

In both cases, the skewer moves further through the apple each time you hit it because of the apple's inertia.

Vic Le Billion

DO TRY THIS AT HOME

featuring **MARVIN and MILO**

#82

What you need: • Two plastic drinks bottles • Cold water • Hot water • Sink • Piece of card • Red food colouring

Phew Milo, I needed that drink in this heat but before you recycle that bottle let me show you an experiment.

Fill one bottle with cold water.

Fill the other with hot water from the tap.

Add some red food colouring to the hot water.

Align the bottles and carefully remove the card. Do this in the sink just in case!

Hot water is less dense than cold water so it rises into the top bottle while the cold water sinks into the bottom bottle. This convection continues until the water is the same temperature throughout both bottles.

Hold the card firmly over the top of the cold water bottle, turn it upside down and balance it on top of the hot water bottle.

DO TRY THIS AT HOME

#83

featuring: **MARVIN and MILO**

What you need:

- Coin • Mug
- Jug of water • Blu Tack • A friend

Step back, or move your head...


...until you can no longer see the coin in the mug.


While you stay in position, get your friend to slowly pour water into the mug.

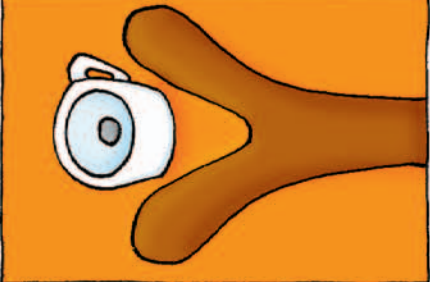
www.physics.org search term: refraction

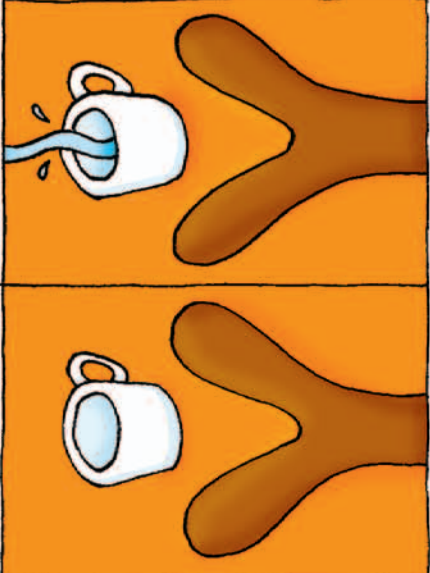
Hey Milo, what are the chances of me making a coin appear as if by magic?

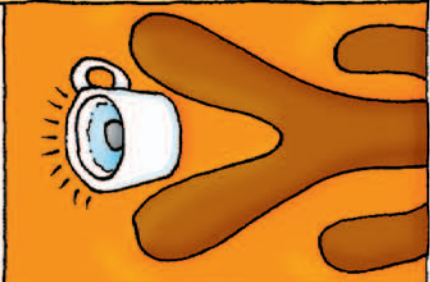
Stick the coin to the bottom of the empty mug.




















Vic Le Billion

DO TRY THIS AT HOME

#84

featuring: **MARVIN and MILO**

What you need:

- Ground pepper
- Ground salt
- Balloon



Don't worry, I can separate the salt and pepper using this balloon.

Vic Le Brillon



Could you pass the pepper Milo?



Rub the balloon on your hair or a jumper...



Rubbing the balloon makes it negatively charged and both the salt and pepper are attracted to it. However, the pepper grains are lighter than the salt, so it is the pepper that leaps towards the balloon.



...and then hold it about 2cm above the pile of salt and pepper. The pepper jumps out of the pile and onto the balloon!



www.physics.org
search term: static electricity

DO TRY THIS AT HOME

#85

featuring: **MARVIN** and **MILO**

What you need: • A slinky • A friend

Hey Milo, what do you think's going to happen to the bottom coil of this slinky when I drop it?

?

Hold the slinky up at arm's length by its top coils.

Vic Le Billion

With your friend keeping a close eye on the bottom of the slinky, let go of the top.*

The bottom coil of the slinky remains stationary until the top coils reach it and then the whole slinky drops to the floor together!

When the top coils are released, the forces on the bottom coil (the tension in the spring and gravity) are still balanced. It is not until the slinky has contracted that gravity exceeds tension in the bottom coil and it starts to fall.

*You may need to do this several times to see what's happening.

DO TRY THIS AT HOME

featuring: **MARVIN and MILO**

#86

What you need:

- A large Pyrex® bowl
- A small Pyrex® bowl
- Vegetable oil

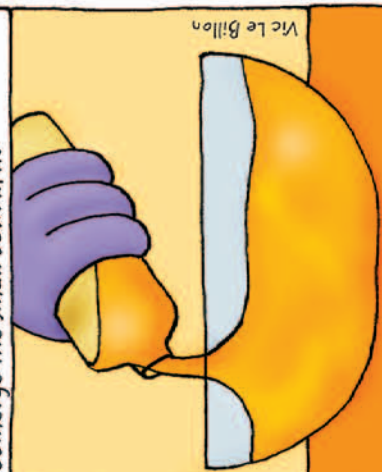


Carefully lower the small bowl into the vegetable oil.

The small bowl disappears as it gets covered in oil!

Hey Milo, I can help you with the washing up by making this bowl disappear!

Pour enough vegetable oil into the large Pyrex® bowl so you'll be able to completely submerge the small bowl in it.



Mc Le Billon

The refractive index of Pyrex® glass is the same as that for vegetable oil, so as light passes through the glass of both bowls and the oil it doesn't bend — refract — at all and you can't see the small bowl.



www.physics.org search term: refractive index