

# How to Grow a Rainbow

You will need:

- Kitchen roll/paper towel
- Felt tip pens
- Two small bowls of water
- Paper clip
- Thread



1. Cut your kitchen roll into the shape of a rainbow.
2. Colour a rainbow with felt tips about 2 cm up on both sides.
3. Attach your paper clip to the top and tie a piece of thread to it. This will give you something to hold your rainbow with.
4. Fill each small container with water.
5. Hold your rainbow with the ends slightly submerged in the water then watch your rainbow grow!



## THE SCIENCE

A brief introduction to 'capillary action'! Water molecules like to stick to things - including themselves. Sticking to things is called *adhesion* and sticking to itself is called *cohesion*. The fibres in kitchen roll make lots of little holes. Water is 'sucked' through the holes because of adhesion (liking to stick to other things) and cohesion (liking to stick to itself) means the rest of the water follows. The water pressure will eventually slow down and the pressure of gravity will mean it stops moving.

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# Shadow Puppet Theatre

You will need:

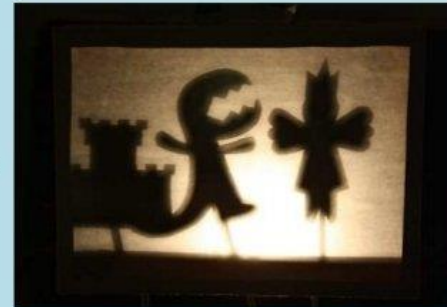
- Cardboard box (e.g. cereal box)
- Tissue paper or a couple of tissues
- Tape
- Straws or skewers
- Lamp

## THE SCIENCE

Light travels in a straight line. A shadow is formed when the path of the light is blocked by an object that isn't see-through.

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1. Tape the box closed then cut a large rectangle from the front and back – leave about an inch border around each edge. Save the cardboard you have cut away!
2. Tape the tissue paper or tissues (1 ply) over the hole on one side only. The side with the tissue faces your audience. The other side is where you, the puppet master, will work your magic.
3. Draw and cut out your puppets using the leftover cardboard and add a straw or skewer. To make them more life-like, you could add hinged body parts with split pins. Just make sure each part has a straw attached.
4. Set up your room with the audience on one side of the theatre and the lamp on the other. You need to be between the lamp and the theatre but not blocking the light. Now it's show time!



Ready for a challenge?  
Look up how to make  
shadow creatures using  
your hands!

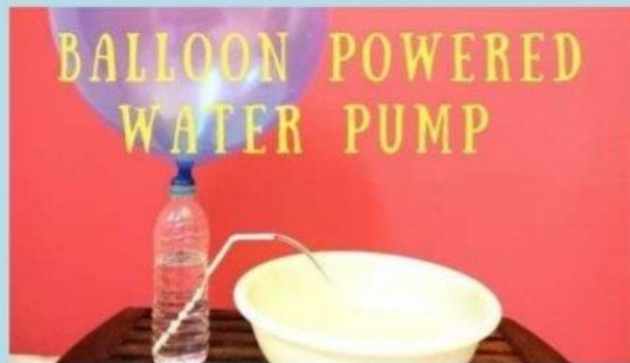


# Balloon Powered Water Pump

## You will need:

- Plastic bottle
- Scissors
- Straw
- Blu-tack/plasticine/glue
- Balloon
- Peg
- Glass/bowl

1. Cut a hole about half way up the plastic bottle (heating scissors with a candle and poking the end through the plastic can help with this but PLEASE ASK AN ADULT!)
2. Push the straw through the hole then seal with blu-tack, plasticine or glue.
3. Fill the bottle about two thirds full with water.
4. Blow up a balloon, twist and secure it with a peg and then carefully attach it to the top of the bottle.
5. When you're ready, remove the peg and watch the water shoot out into the glass or bowl. Use the peg like a tap!



## THE SCIENCE

This works because of changes in air pressure. When the balloon is pegged, air pushes down on the water in the bottle and the water already in the straw equally so there is no movement. When the peg is removed, air is forced into the bottle from the balloon, increasing the air pressure pushing down on the water, causing it to rise through the straw.

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# Upside Down Glass of Water Trick

You will need:

- Glass
- Card big enough to cover the top of the glass (a playing card is good)
- Water

Try filling your glass with different amounts of water and see if the trick still works.

1. First, check the card is big enough to completely cover the opening of the glass.
2. Fill your glass with water almost to the top.
3. Place the card over the opening of the glass and tip the glass upside down (with your hand on the card).
4. When you're feeling brave, remove your hand. Make sure you practice over the sink a few times first!
5. Mastered the technique? Hold it over someone's head!



## THE SCIENCE

In fact, this isn't a trick at all – it's all to do with air pressure! Even though it doesn't feel like it, the air around us pushes in all directions. The water acts as a 'seal' between the glass and the card. The air pushing up from underneath the paper is strong enough to stop the weight of the water from pushing the card down. Because of this air pressure, the card will stay on the glass and the water will not spill out. When the seal is broken (even a tiny bit), air enters into the cup and gravity pushes the water out.



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# Ice and Salt Rainbow

## You will need:

- Plastic containers and bowls
- Water
- Salt
- Tray
- Food colouring/liquid watercolours
- Pipette/spoon/paintbrush



1. Fill different sizes and shapes of container or bowl with water and freeze overnight.
2. Remove the ice from the containers and place in a tray. Mix food colouring/paint with water and put aside for now.
3. Sprinkle salt over the ice or leave small piles of salt and watch the ice begin to crack.
4. Using a pipette, spoon or a paintbrush, dot the surface with food colouring/paint. This won't colour the ice – but will highlight the ravines, crevasses and tunnels that form in the ice as the salt melts it.
5. You can add more salt and colouring - or not - explore however you like!

## THE SCIENCE

Water turns to ice at  $0^{\circ}\text{C}$ . Ice without salt melts due to the difference in temperature of the ice and the air round it. When you add salt, it dissolves into the water on the surface of the ice. Salt water has a lower freezing point than water so there is a bigger difference between the air temperature and ice. This is why ice with salt melts quicker.



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# Grow your own Edible Crystals

You will need:

*This will be enough for 3 jars*

- 4 cups sugar
- 1 cup boiling water
- Food colouring (optional)
- 3 jars (or glasses)
- Thread or string
- 3 skewers, straws or pencils



1. The day before starting your sugar experiment, cut a piece of string a little longer than your jars. Tie one end of the string to a straw (skewer or pencil) and tie a knot in the other end. Wet the string, coat in sugar and leave it to dry overnight.
2. The following day, add four cups of sugar to one cup of water and heat in a pan until boiling. Add the food colouring at this point if you're including it. Stir the sugar until it has dissolved.
3. Remove from the heat and leave it to cool slightly.
4. Pour the mixture into your jars – lower in the string and leave in a safe place.
5. Let the sugar crystals form for at least a week.
6. Once they have grown as big as you want them, leave to dry for several hours.



## THE SCIENCE

You've created a super-saturated solution containing more sugar than could be dissolved in water under normal conditions. The sugar molecules bump into each other and start sticking together. When you give the sugar molecules something to cling too (in this case the string), they form into crystals faster.

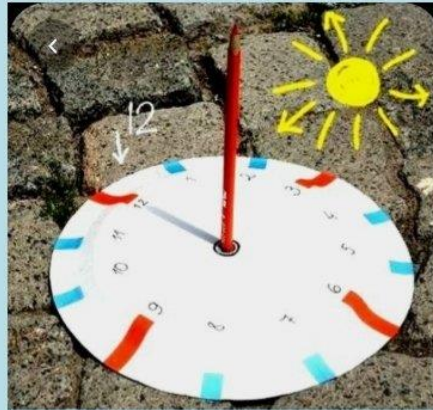




# Paper Plate Sundial

You will need:

- Paper plate
- Pencil or straw
- Pens
- A sunny day!



1. Use a sharp pencil to push a hole through the centre of a paper plate.
2. Write the number 12 at the top of the plate.
3. At 12pm on a sunny day, take the plate outside. Push a pencil/straw through the hole so it stands up. Position it so the shadow it makes falls on the 12.
4. Secure the plate to the ground with pins or a stone!
5. One hour later, at one o'clock, check the position of the shadow along the edge of the plate and write the number one on that spot. Continue each hour predicting the position and then checking and marking the actual position and time on the edge of the plate.
6. At the end of the day you will have your very own sun clock. On the next sunny afternoon, you will be able to tell the time just by watching where the shadow of the pencil/straw falls on your clock.

## THE SCIENCE

The sun looks as though it moves in the sky throughout the day – actually, it is the Earth that is moving around the sun! Shadows change direction depending upon the time of day. A sundial like this one uses a shadow's position to tell the time.

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# Tea Bag Rocket

You will need:

- A tea bag (the folded type with a string and label)
- Matches or a lighter
- Plate
- Scissors



1. Cut the top off your tea bag and empty out the tea leaves.
2. Unfold the tea bag and hollow it out using your finger.
3. Stand your tea bag upright onto the plate and light both sides (at the top) with the lighter/matches.
4. Stand back as the flame burns down your rocket then 'takes off'!

## THE SCIENCE

Hot air rises! Lighting the top of the teabag cylinder heats the air inside - the hot air then rises above the cooler air. As the tea bag burns, it turns to ash which is light and doesn't require much force to lift it. As the hot air rises, it has enough force to lift the ash of the teabag.



Does the rocket work with different types of tea bag?



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# Balloon in a Jar

You will need:

- Balloon
- Water
- Jar
- Match and a piece of paper



1. Fill the balloon with water so that it is just too large to fit inside the jar and rests on top.
2. Notice how the balloon won't fit through the opening. Do you think it is possible for the balloon to enter the jar?
3. Light a piece of paper and quickly drop it into the jar. Place the balloon on top.
4. The balloon will start to shake a little, then be sucked into the jar. It probably won't be sucked in all the way but about halfway into the jar.

## THE SCIENCE

The reason the balloon is sucked into the jar is due to air pressure. Initially, the air pressure outside the jar and the air pressure inside the jar are the same. As the paper burns, the air inside heats up (remember – hot air rises!). This air escapes out of the jar, causing the balloon to shake. Since there is less air inside the jar, the pressure inside is less than outside so the balloon is sucked in.

Once the fire dies and the jar cools, see if you can pull the balloon out. It will take a bit of work to get it loose!



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# Rain Cloud in a Jar

You will need:

- A glass or jar
- Shaving foam (not the gel variety)
- Food colouring (blue if possible!)
- Water
- Small bowl
- Pipette or spoon



1. Fill the glass or jar with water, leaving about 2 inches at the top.
2. Add the shaving foam so it looks like a cloud and let it stand for a few minutes until it is fully sitting on top of the water.
3. In the small bowl, add some water and blue food colouring (or other colours if you want rainbow rain!)
4. Use the pipette to add drops of the mixture to the top of the shaving cream cloud.
5. Observe your 'rain' as it breaks through the cloud!

## THE SCIENCE

The shaving cream represents the clouds and the water represents the air. The coloured water represents rain. As the coloured water saturates the "cloud", it gets heavy and eventually is so heavy that it can no longer hold the water. It "rains" down into the jar – through the "air." It is just like real rain as it falls through the air.



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