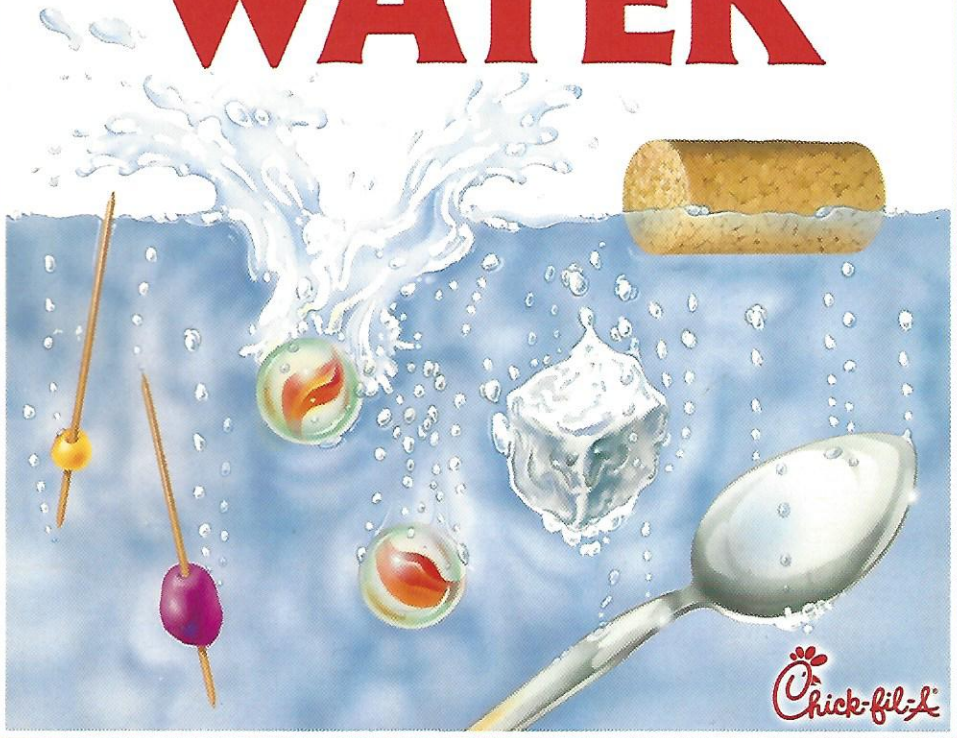
USBORNE SCIENCE ACTIVITIES

SCIENCE WITH WATER



SCIENCE WITH WATER

Helen Edom

USBORNE

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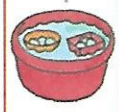


Dear Chick-fil-A® Family:

Chick-fil-A cares about the total personal development of the children we touch with our Kid's Meals. We strive to create Kid's Meal premiums that teach character development or provide educational value while stimulating adult-child interaction.

We are proud to present the Usborne Publishing Science Activities series as part of our Kid's Meal program. These fun-filled and educational books offer opportunities to learn about the amazing and wonderful world of scientific exploration.

This innovative series is filled with text and illustrations that are clear and simple so children can enjoy using the books by themselves. Further notes give full scientific explanations for adults who wish to work with their children. The experiments are safe and easy to carry out, using ordinary household equipment. They are all carefully designed to help young children explore the fascinating scientific world.

We hope this series affords parents the opportunity to share time with their children in an environment where learning and fun go together.

Sincerely,

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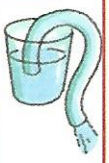








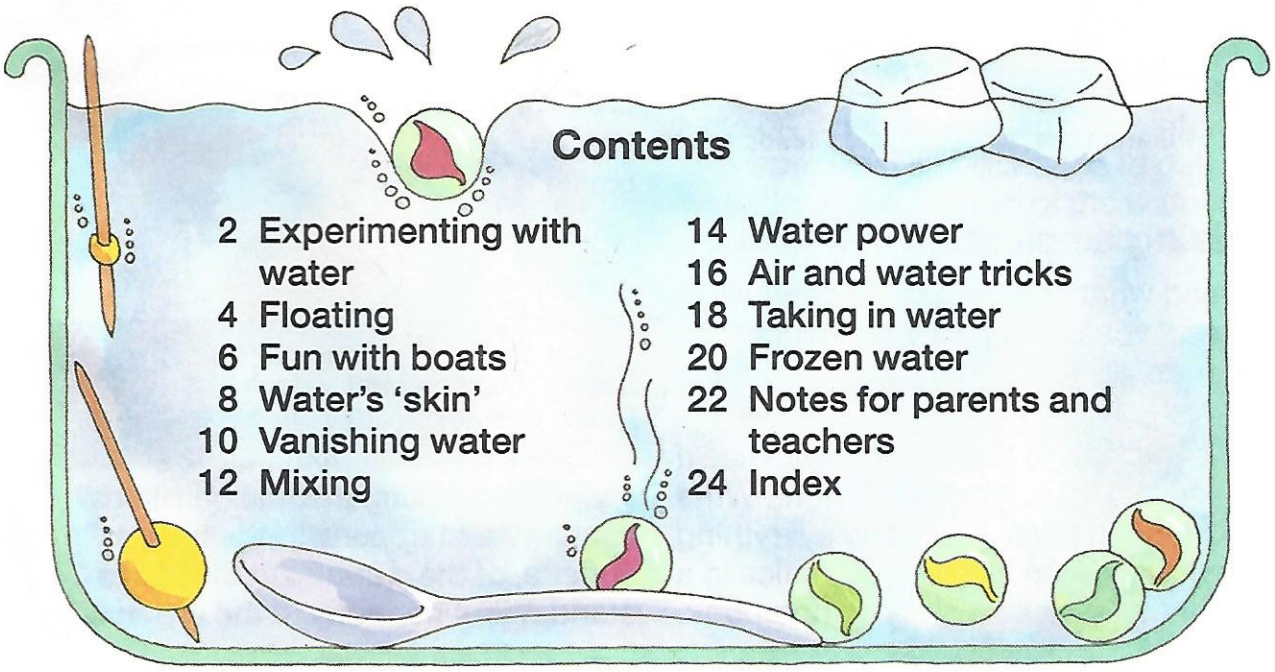

SCIENCE WITH WATER

Helen Edom

Designed by Jane Felstead

Illustrated by Simone Abel

Consultant: Frances Nagy (Primary Science Adviser)



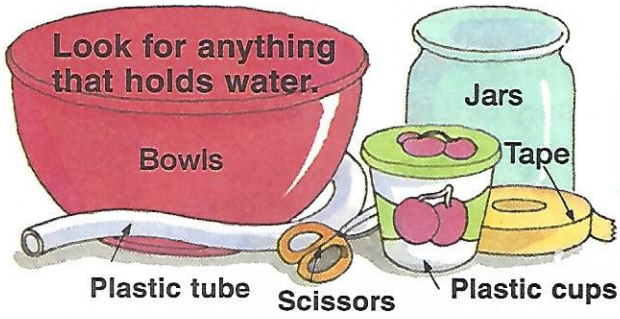
Contents

Experimenting with water

Water behaves in some surprising ways. The experiments in this book will help you find out about them.

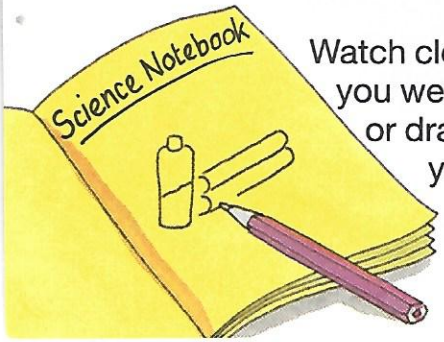
Things you need

You can do all the experiments with everyday things. Here are some useful things to collect.



Being a scientist

Read what you have to do carefully. See if you can guess what might happen before you try an experiment.

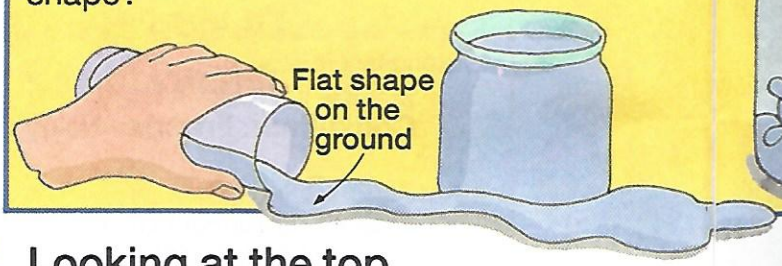


Watch closely to see if you were right. Write or draw everything you notice in a notebook.

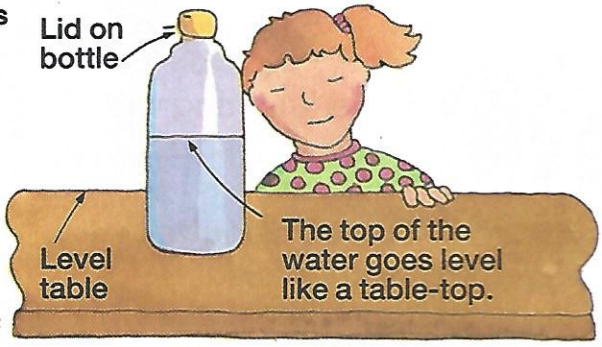
Changing shape

Try doing these things to start finding out about water.

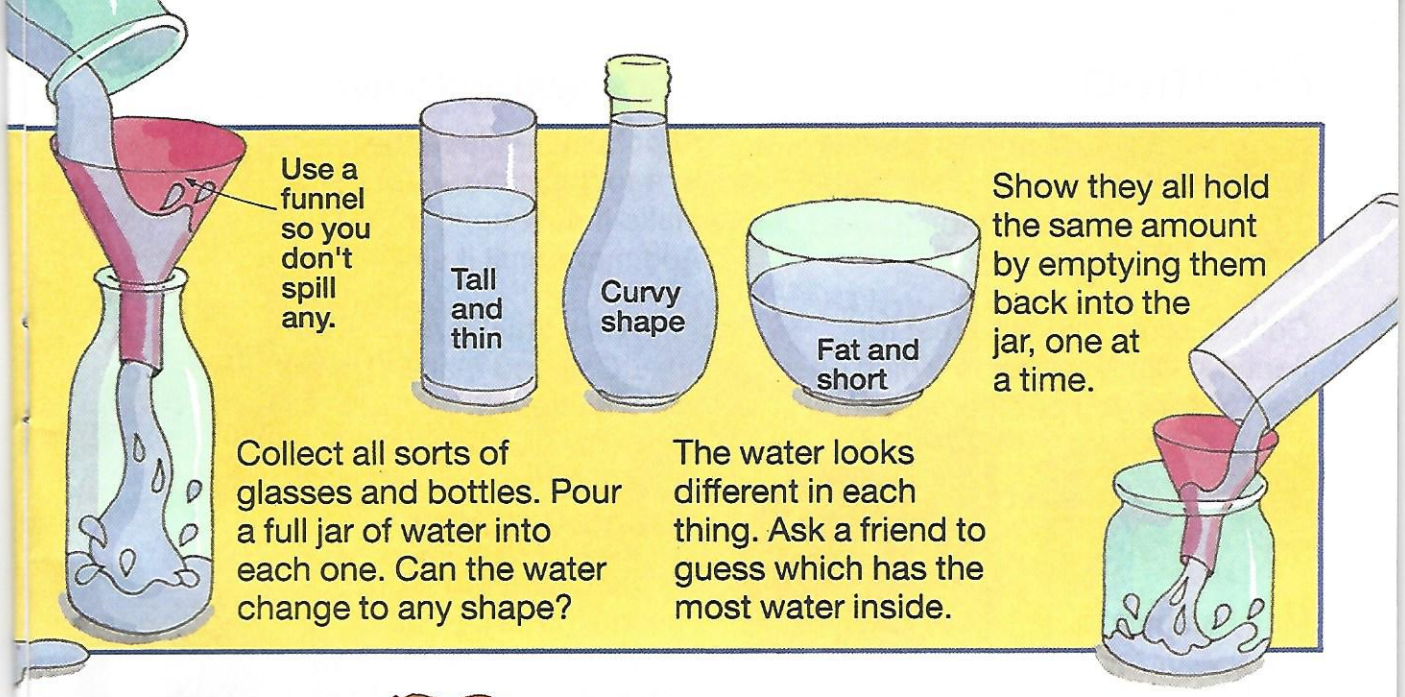
Pour water on some hard ground outside. Pour more water into a small jar. Does the water make the same shape?



Looking at the top



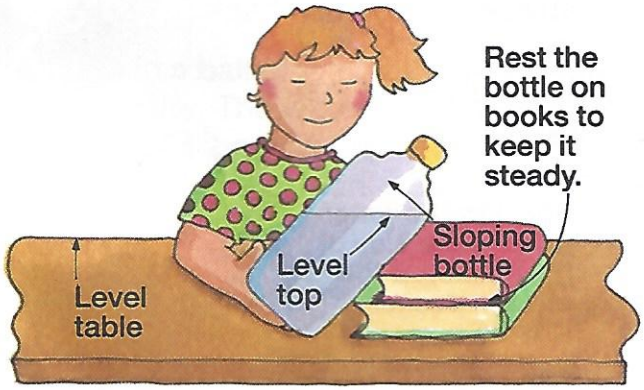
Try gently shaking a bottle half-full of water. What happens to the top, or surface, of the water? Let the bottle stand. What happens to the top now?



Collect all sorts of glasses and bottles. Pour a full jar of water into each one. Can the water change to any shape?

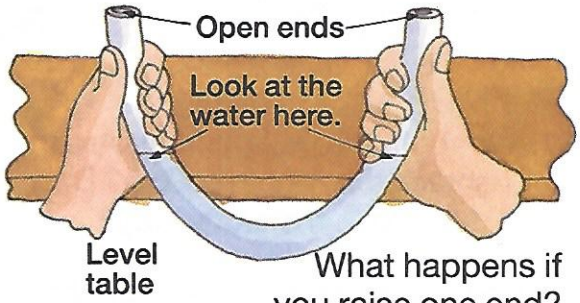
The water looks different in each thing. Ask a friend to guess which has the most water inside.

Show they all hold the same amount by emptying them back into the jar, one at a time.



What do you think will happen if you tilt the bottle? Can you make the top of the water slope? Try it and see. Check the top against a level table.

Now bend a clear plastic tube* into a U-shape. Hold it under a tap to get water inside. Is the top of the water at the same height (level) on both sides?



What happens if you raise one end? Watch very carefully.

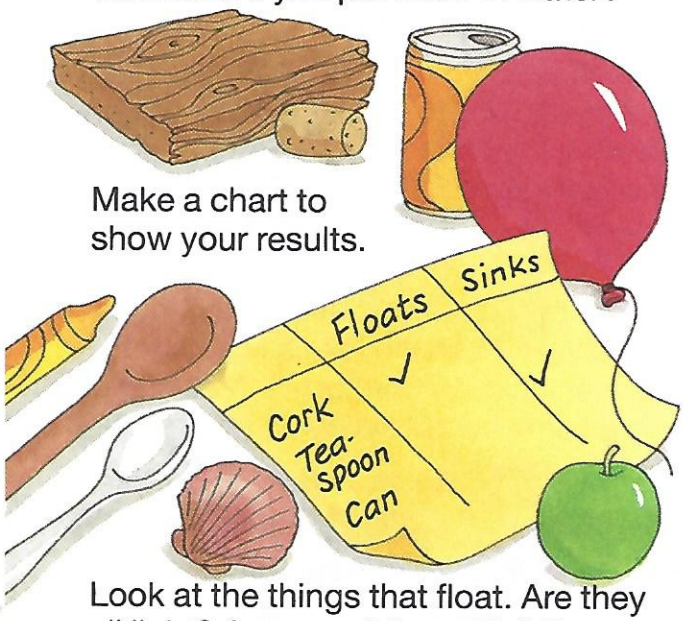
**You can buy this cheaply from a hardware shop.*

Floating

Some things float on water while others sink.

Which things float?

Collect some things to test for floating. Can you guess which ones float before you put them in water?



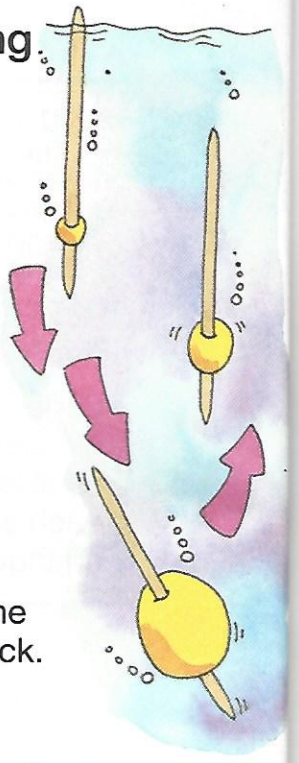
Make a chart to show your results.

Look at the things that float. Are they all light? Are any of them big? Do they all float in the same way?

Guess what happens if you attach a thing that floats to one that sinks.

Underwater floating

Attach some plasticine* to a toothpick to make it float upright. Add more until it sinks.

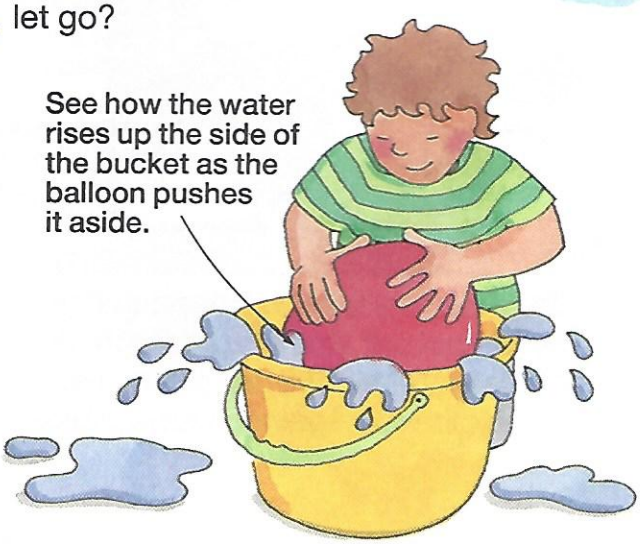


Take off a little at a time. Can you make the stick float just under the surface?

Pushing power

Try pushing a blown-up balloon into a bucket of water. It is hard to do. The water seems to push back.

What happens if you let go?



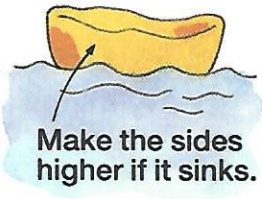
See how the water rises up the side of the bucket as the balloon pushes it aside.

*Plastic modeling clay.

Changing shape

Drop a ball of plasticine in some water. Does it float?

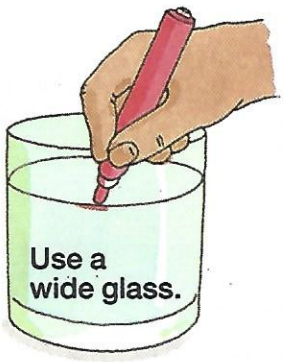
Flatten the ball and shape it like a boat with high sides. Does it float now?



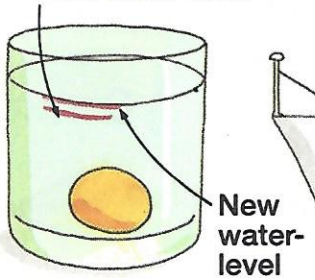
Testing shapes

Why does the plasticine float when you change its shape? Try this to help you find out.

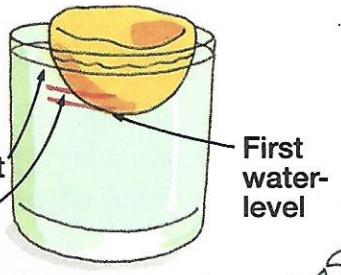
Use a felt-tip pen to mark the water-level in a glass of water.



Drop in a ball of plasticine. The water rises a little as the ball pushes it aside. Mark the new level.



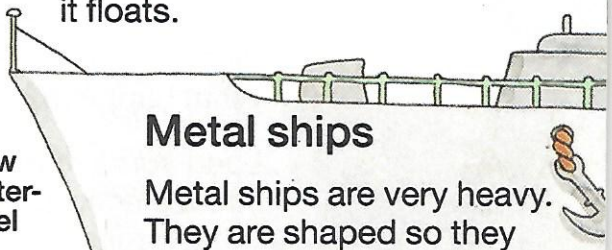
Shape the ball into a boat and float it on the water. Why does the level rise higher?



How it works

The boat-shape takes up a bigger space than the ball so it pushes more water aside.

The more water is pushed aside, the more it pushes back. It pushes the boat so hard that it floats.



Metal ships

Metal ships are very heavy. They are shaped so they push away a lot of water. The water pushes back hard enough to keep the ship afloat.

Fun with boats

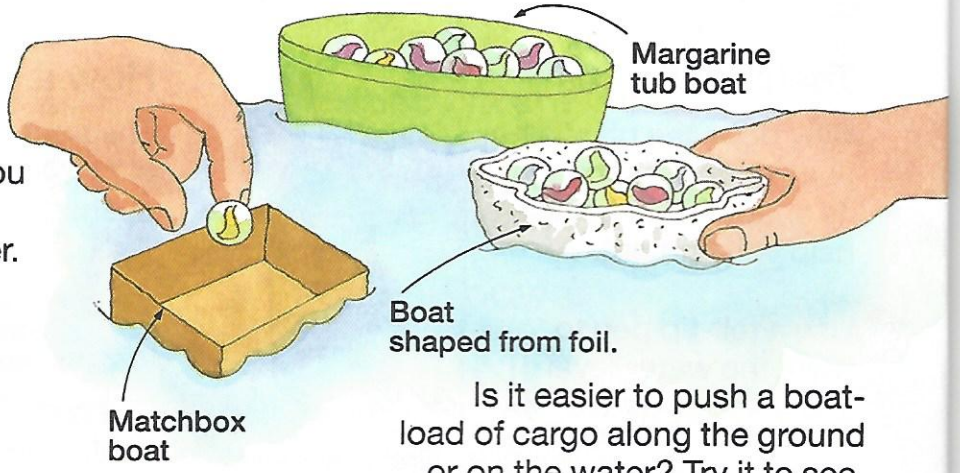
Boats float so well that they can carry heavy things across water.

Everything that a boat carries is called its cargo.

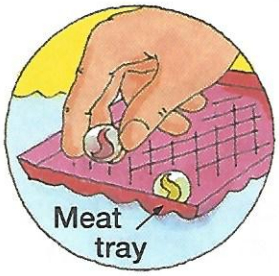
Loading boats

Think of some things which might make good boats. You can see some here. Try them out on water.

Load your boats with a cargo of stones or marbles. Can some carry more than others?

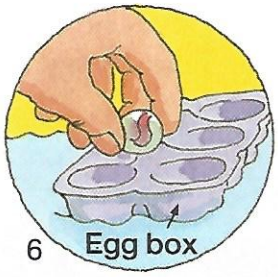


Is it easier to push a boat-load of cargo along the ground or on the water? Try it to see.



Try loading a plastic meat tray with marbles. What happens?

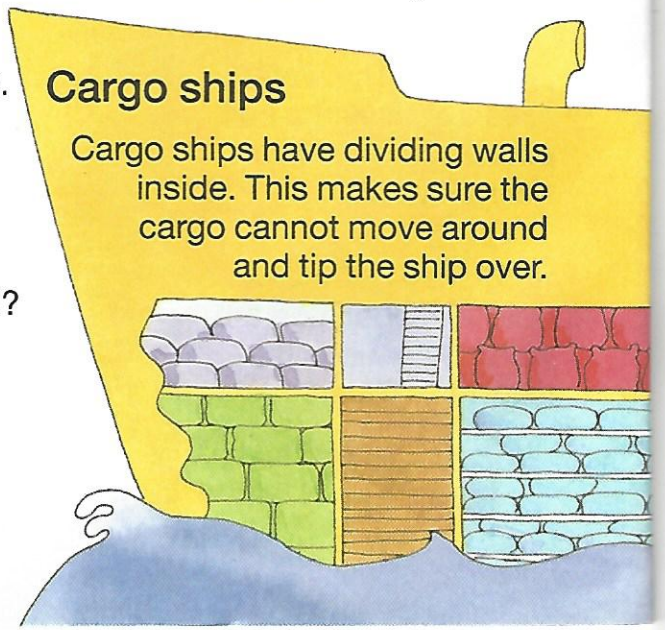
Load some marbles into a plastic egg box. What happens if you put them all at one end?



Try putting one marble in each cup-shape. Does it float better like this?

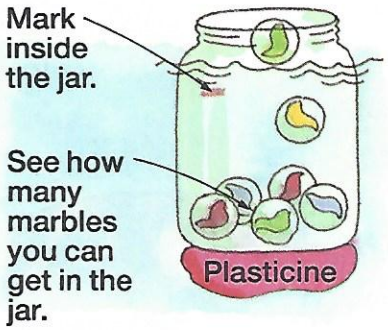
Cargo ships

Cargo ships have dividing walls inside. This makes sure the cargo cannot move around and tip the ship over.



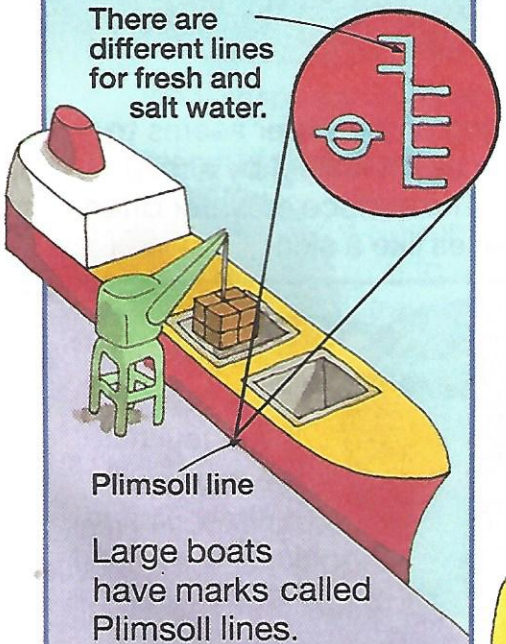
Sinking boat

Stick plasticine under an empty jar so it floats upright. Put a mark at the waterline. Load marbles gently into this boat. What happens to the mark?



Put lots of salt in the water. Float the jar now. Does the water come up to the same mark? Can the jar carry more marbles?

Plimsoll line



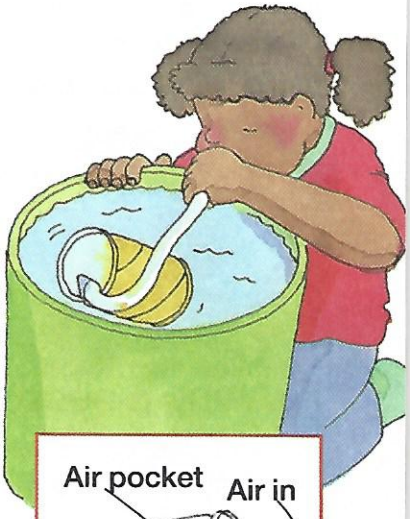
Large boats have marks called Plimsoll lines. People stop loading a boat when the water comes up to this mark.

Submarine can

Push an empty drink can underwater so it fills with water and sinks.

Poke one end of a plastic tube into the can. Blow into the other end. What happens?

The air you blow into the can pushes out the water. This makes the can lighter so it rises to the surface.



Submarines

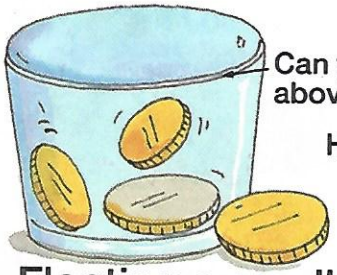
Tanks inside a submarine can be filled with water to make it sink. Air is pumped into the tanks to make the submarine rise again.

Water's 'skin'

Here are some surprises about the top, or surface, of water.

Bulging glass

Fill a glass to the brim ▶ with water. Look closely at the top of the water. Gently slide in some coins, one at a time.



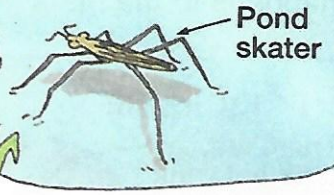
Can you see the top rise above the glass?

How many coins can you put in before the water overflows?

◀ The top of the water seems to bulge as if it is held by a thin skin. The surface of water often behaves like a skin.

Pond skaters

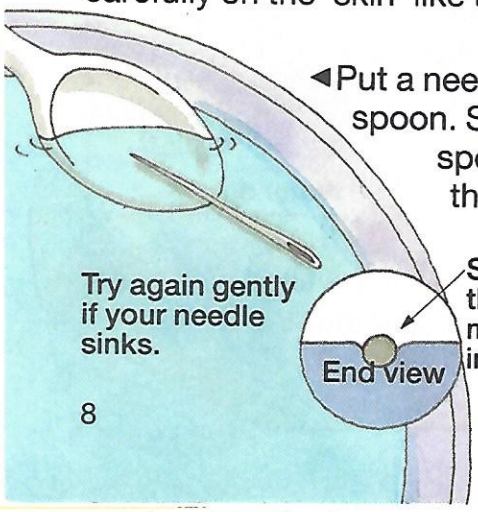
Insects called pond skaters can walk across the top of ponds. They are so light they do not break the water's 'skin'.



Pond skater

Floating a needle

You can float a needle by placing it carefully on the 'skin' like this.

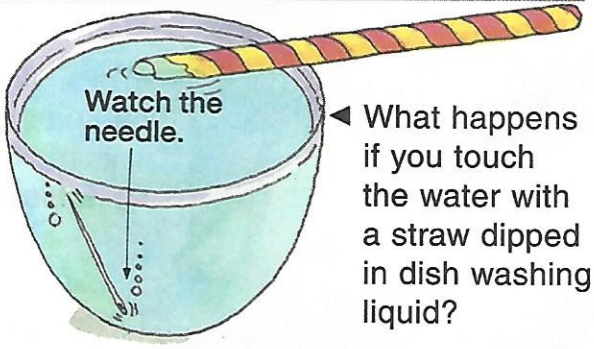


◀ Put a needle on a spoon. Slide the spoon into the water.

Try again gently if your needle sinks.

See how the needle makes a dip in the 'skin'.

End view



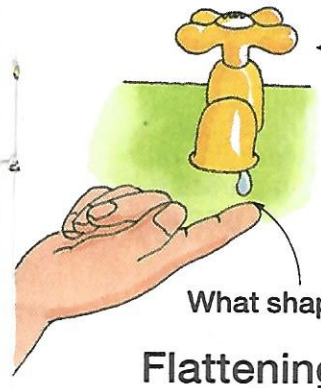
Watch the needle.

◀ What happens if you touch the water with a straw dipped in dish washing liquid?

The dish washing liquid makes the skin weaker so it stretches. It gets too stretchy to hold up the needle.

Drips and drops

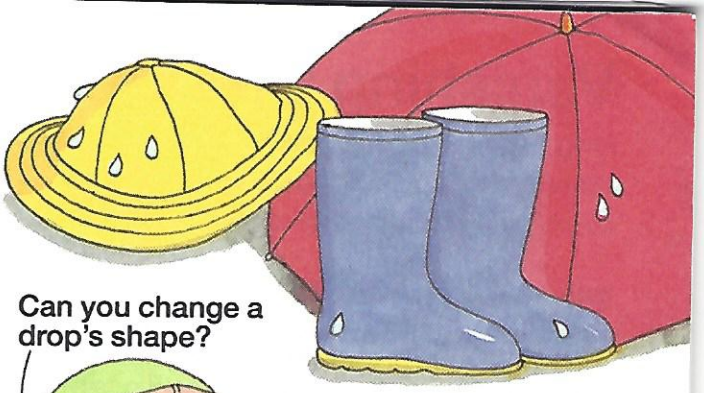
Look out for drops left behind after a rainstorm. Can you guess why water stays in drop shapes?



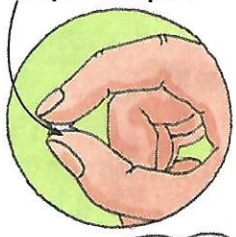
◄ Try catching a drop from a dripping tap.

Now roll it gently ► between your finger and thumb.

What shape are drops as they fall?



Can you change a drop's shape?

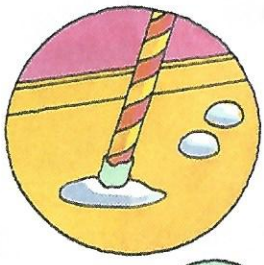


All drops are held by water's skin. This holds them even when they change shape.

Flattening drops

◄ Spoon some drops on to a clean plastic tray. Can you think of a way to make the drops flatter?

Try touching them ► with a straw dipped in dishwashing liquid.

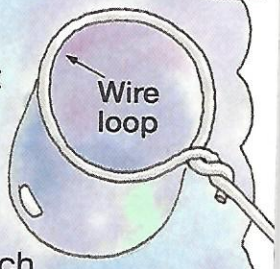


The dishwashing liquid makes the skin stretch so the drops spread out.

Blowing bubbles

Stir a spoonful of water into three spoonfuls of dishwashing liquid. This mixture has a very stretchy skin.

Bend some wire into a loop. Dip it in the mixture.



Look at the skin across the loop. Blow gently. Watch how the skin stretches to make a bubble.

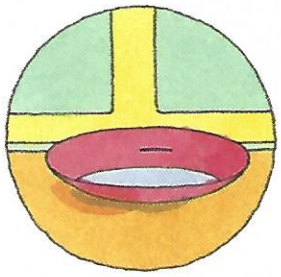
Vanishing water

You may have noticed how puddles dry up after rain. Have you ever wondered where the water goes?

Finding out

You might think the water just soaks into the ground or runs away. Try an experiment to see if this is true.

Pour some water into a saucer. Use a felt-tip pen to mark a line just above the water.

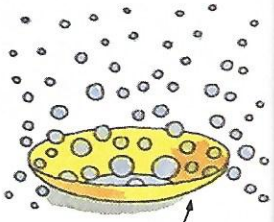


Leave the saucer on a table for a few days. Look at your mark and the water-level every day.

The water slowly vanishes. It cannot run out or soak through the saucer. It must get out another way.

How water 'vanishes'

The water escapes into the air in tiny drops called water vapor. They are too small to see.

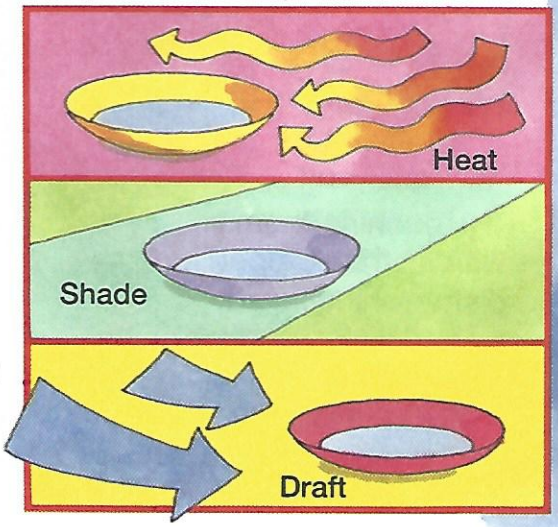


This shows water vapor evaporating from a saucer.

This is how a puddle dries up.

Which dries fastest?

Fill three more saucers. Leave one in a cool, shady place, one in a warm place and one in a drafty place. Do they all dry out just as quickly?



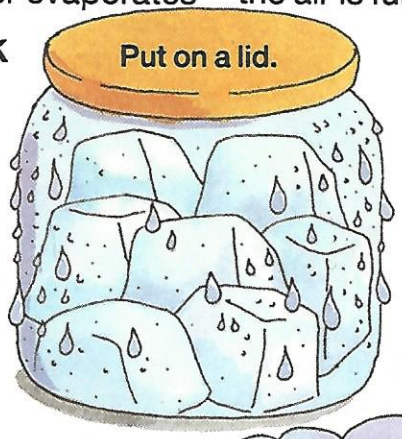
Water in the air

The way water escapes into the air is called evaporation. Water evaporates all the time from rivers and seas so the air is full of invisible water vapor.

Getting water back

Fill a jar with ice-cubes to make it cold. Does anything happen to the outside of the jar?

Wipe it with a dry tissue. Does the tissue get damp?



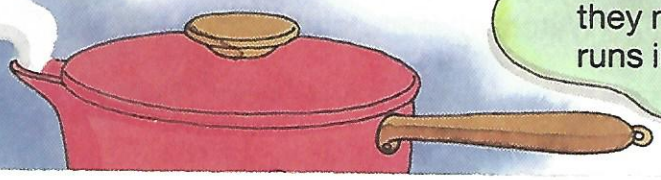
Water drops form on the jar because the cold jar cools the air nearby. When water vapor in the air cools, its drops get big enough to see. This is called condensation.

Steam

Sometimes condensation happens in mid-air. Then the drops look like mist. This happens when water boils.

The water gives off hot water vapor. This cools as it meets colder air and turns to drops you see as steam.

Never touch steam as it can burn you badly.



Clouds and rain

Clouds are also made up of condensation drops. These form when water vapor rises from the ground and meets cold air above.

Drops in the cloud join up and get heavier. Then they fall as rain.

Everlasting seas

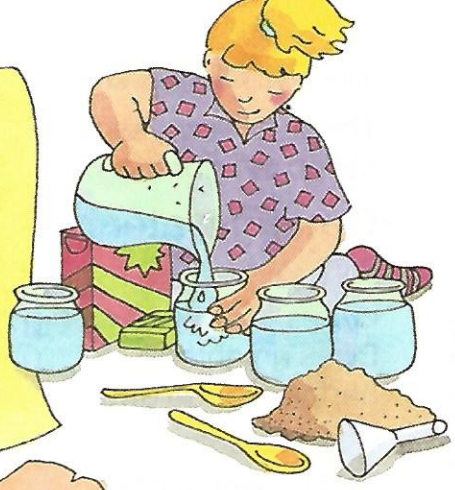
Although water evaporates from seas they never dry up. Enough rainwater runs into them to keep them full.

Mixing

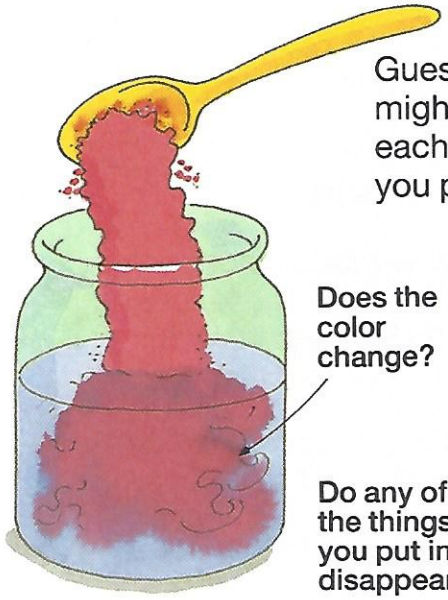
Water mixes well with many different things. To find out more about the way water mixes, first collect some jars.

Pour some water into each jar. Add a different thing to each one.

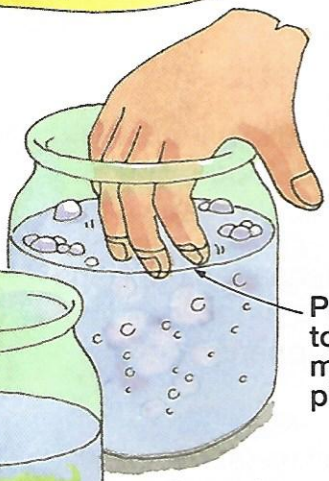
You could try: soap powder, sand, salt, flour, sugar, shampoo, cooking oil, powder paint, orange juice and jelly.



Guess what might happen to each thing before you put it in.

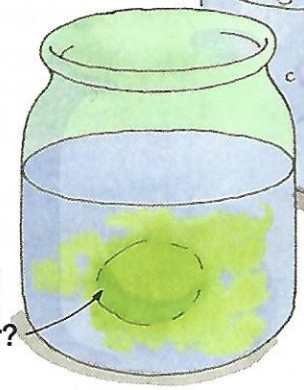


Does the color change?



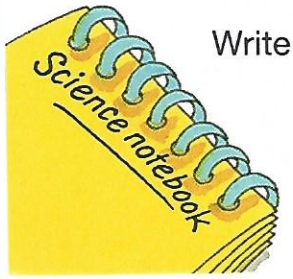
Put your fingers in to see if the mixtures feel like plain water.

Does anything change if you put the same things into warm water?



Do any of the things you put in disappear?

Does the water get cloudy or look clear?



Write everything that does happen in your notebook.

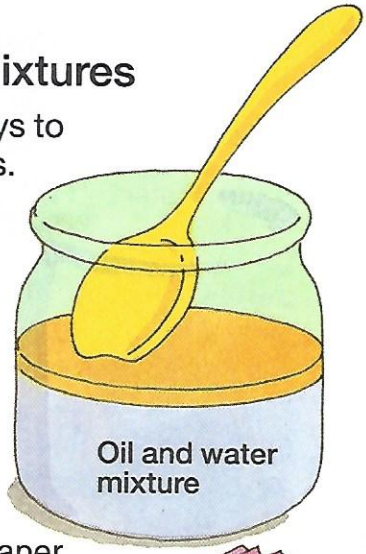
Does it make a difference if you stir the mixtures? Watch what happens.

Separating mixtures

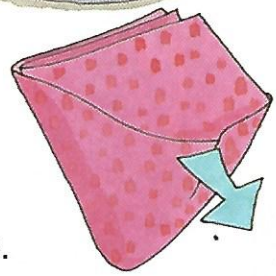
Try to think of ways to separate mixtures.

Oil floats so you can scoop it out with a spoon.

Does this work with any other mixtures?



You could use a paper towel like a fine sieve. First fold the paper towel in fourths.



Pull open one side to make a cone.

Put the cone in a funnel. Try pouring the sand mixture into it.

Can you separate other mixtures like this?

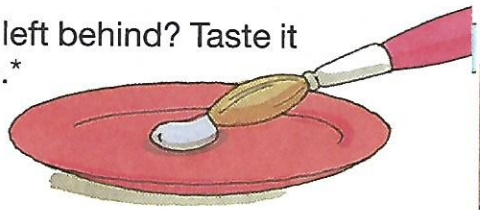
Solutions

Some things mix so well that you cannot separate them by scooping or sieving. A mixture like this is called a solution.

Separating solutions

Salt water is a solution. Put a drop on a saucer. Leave it until the water evaporates (see pages 10-11).

What is left behind? Taste it and see.*



Can you separate other solutions like this?

Instant food

Many foods are partly made of water. Soup, milk and potatoes are often dried and stored as powder.

When people want to eat them they just mix them with water again.

Never taste things unless you know that they are things you can eat.

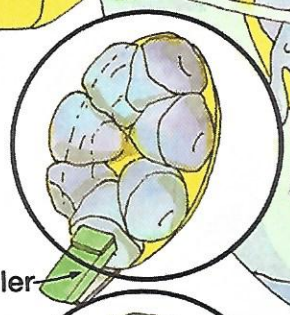
Water power

Water nearly always flows downhill. Its flow can push things strongly.

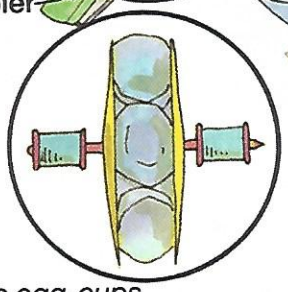
Make a model water wheel

You need:
2 plastic egg boxes,
2 small cardboard plates,
a stapler, some scissors,
2 empty thread spools,
a pencil, 2 long rulers or
flat sticks, plasticine,
and cellophane tape.

Cut cups* out of the egg boxes. Staple them on to one plate as shown. Staple the second plate on to the other side of each cup.



Push the pencil through the center of the plates. Then push the thread spools on to the ends of the pencil.



Can you get the wheel to turn faster?

What happens if you pour from higher up?

How does the water turn the wheel?

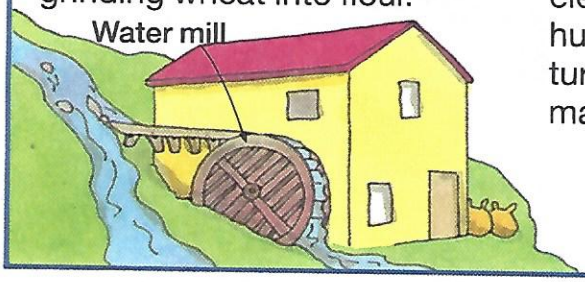
Attach the rulers in place with plasticine.

Tape a ruler below each reel. Place the rulers across a bowl. Pour water on the wheel and watch what happens.

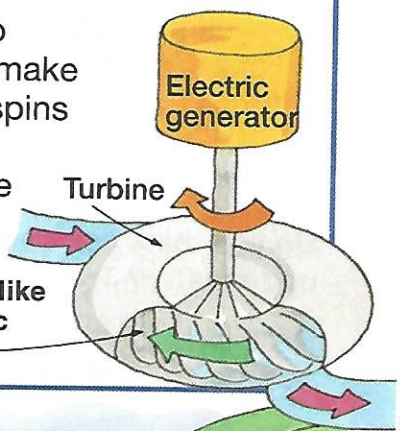
**You may not need all the egg-cups.*

Powering machinery

Long ago people used water wheels to turn machinery for grinding wheat into flour.

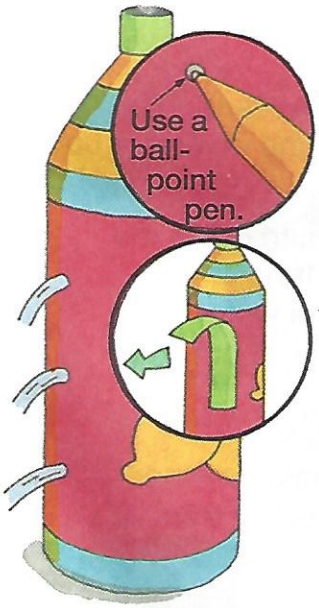


Today water is used to power machines that make electricity. The water spins huge wheels called turbines to make these machines work.



Electricity is made like this in hydroelectric power stations.

Getting stronger



- Take the top off an empty squeeze bottle*. Make three holes in the bottle, one above the other.
- Tape over the holes. Fill the bottle with water. Then rip the tape off quickly.

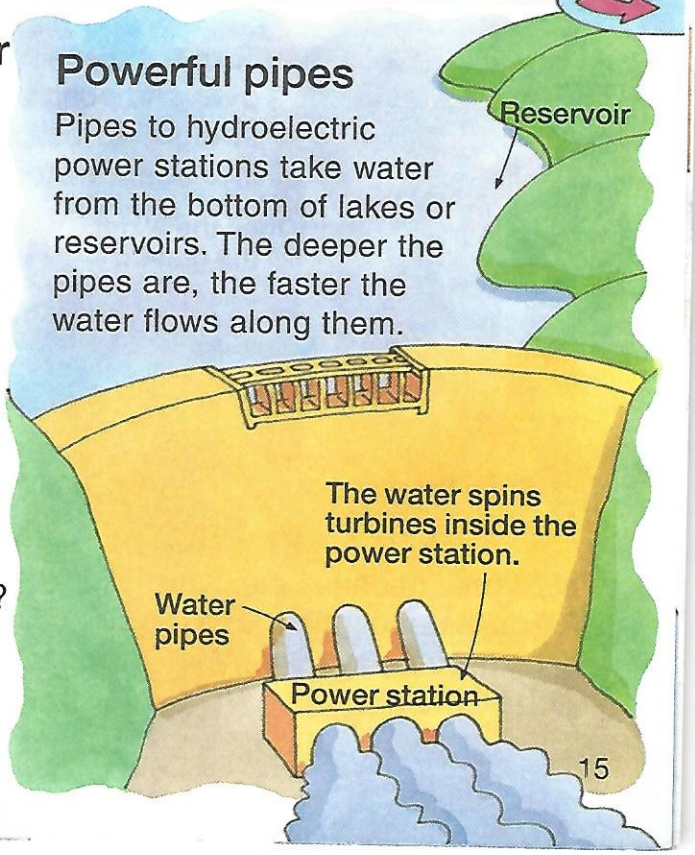
Watch how jets of water spurt out. Which goes furthest?

The lowest jet should go furthest as water above it helps to push it out.

**Get an adult to help you take the top off.*

Powerful pipes

Pipes to hydroelectric power stations take water from the bottom of lakes or reservoirs. The deeper the pipes are, the faster the water flows along them.



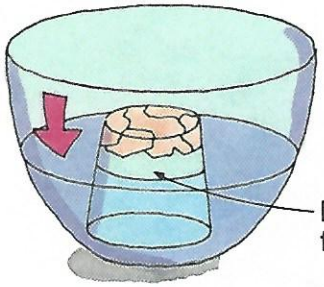
Air and water tricks

Most things that look empty are really full of air. Water has to push the air out before it can get in them.

Tissue trick

Do you think you can keep a tissue dry underwater? Try this.

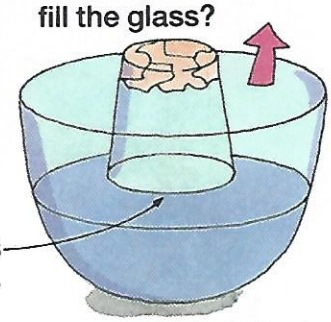
First, stuff the tissue tightly into a glass so it cannot fall out.



◄Turn the glass over and push it straight down into some water.

Does the water fill the glass?

Take the glass ► out. Is the tissue wet?

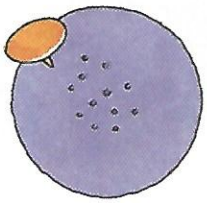


Keep the glass straight.

This works because the glass is full of air. The water cannot push the air out so the tissue stays dry. What happens if you tilt the glass?

Magic container

Find an empty plastic container with a tight lid. Use a thumbtack to make holes in its base.



Take off the lid and push the container underwater. Now put the lid on.

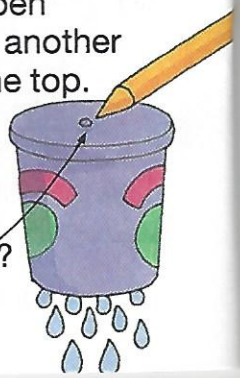
Does any water fall out?

What happens when you lift the container up?

Air tries to get in the holes. It pushes so hard the water cannot get out.

Now push a ball-point pen through the lid to make another hole.This lets air in at the top. The air helps to push the water out below.

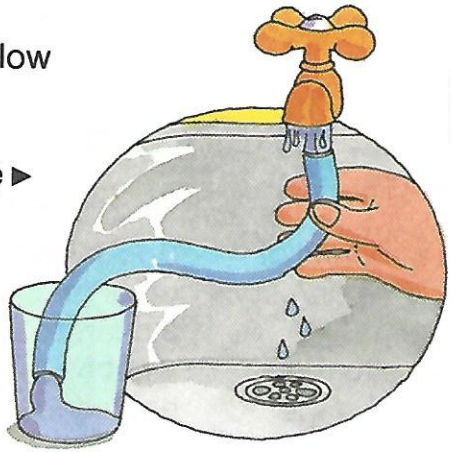
What happens when you lift the container up?

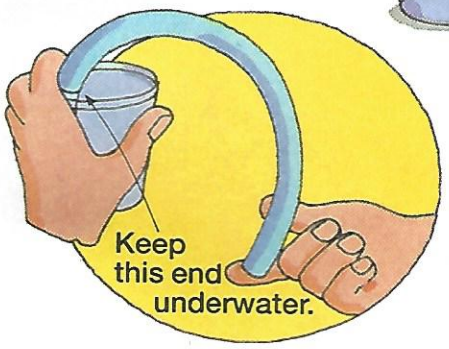


Flowing upward

Can you make water flow upward?

1. Stand a glass in the ▶ kitchen sink. Put one end of a plastic tube in the glass. Put the other end under a tap to fill the glass.





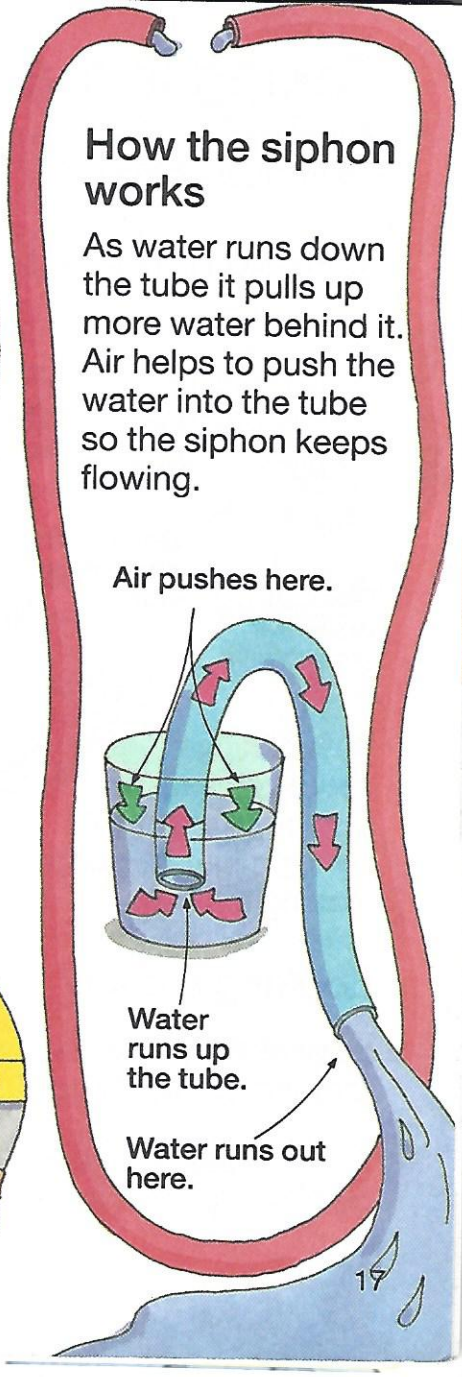
◀ 2. Put your finger over the top of the tube to keep the water in. Lift the glass up on to the draining board with your other hand.

3. Bend the tube until your finger ▶ is lower than the glass. Take your finger off.

The water should run up out of the glass through the tube. Can you think why?

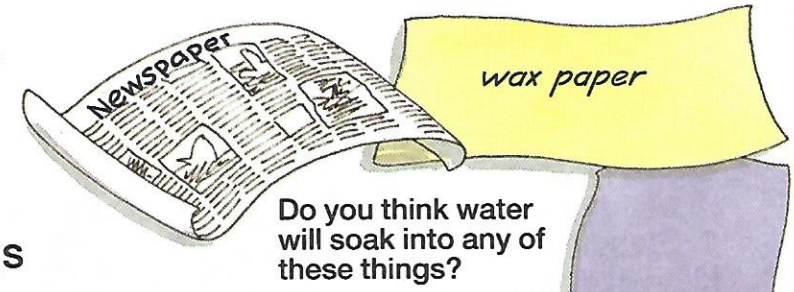
How the siphon works

As water runs down the tube it pulls up more water behind it. Air helps to push the water into the tube so the siphon keeps flowing.



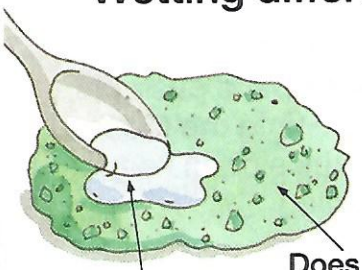
Taking in water

Some things soak up water while others keep water out.



Do you think water will soak into any of these things?

Wetting different things

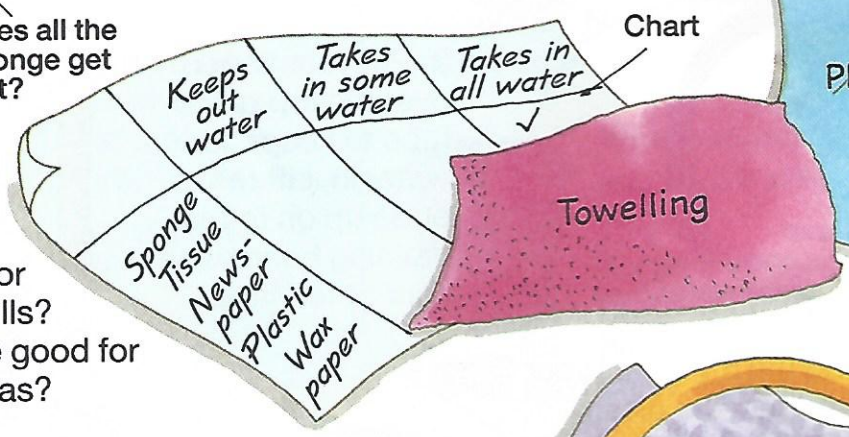


Put a spoonful of water on a dry sponge. What happens to the water?

Does all the sponge get wet?

Does all the water disappear?

Spoon water on to other things. Make a chart to show what happens to each one.

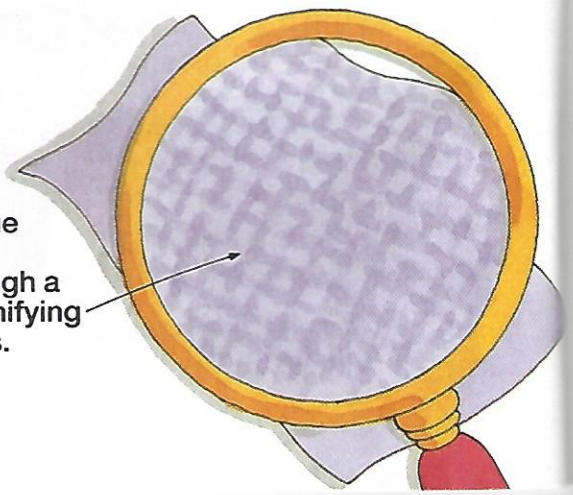


Which things could you use for mopping up spills? Which might be good for making umbrellas?

Looking closely

Look at things that take in water through a magnifying glass.

Can you see tiny gaps? The water gets in through these gaps.



Tissue seen through a magnifying glass.

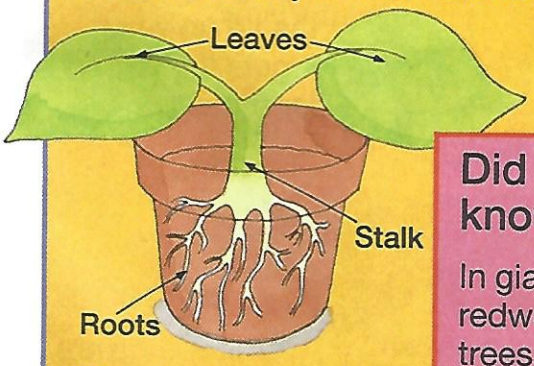
Rising water

Do you think water can climb upward?

Dip a paper towel into some water. Watch what happens.

How plants drink

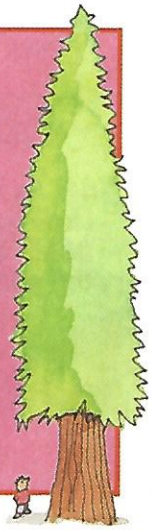
A plant has roots under the earth. These have tiny holes in them.



Water in the earth goes into the roots. It is sucked up to the leaves through thin tubes in the stalk.

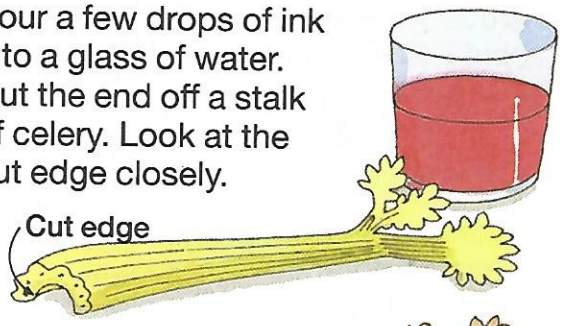
Did you know?

In giant redwood trees, water has to climb over 300 feet to reach the highest leaf.

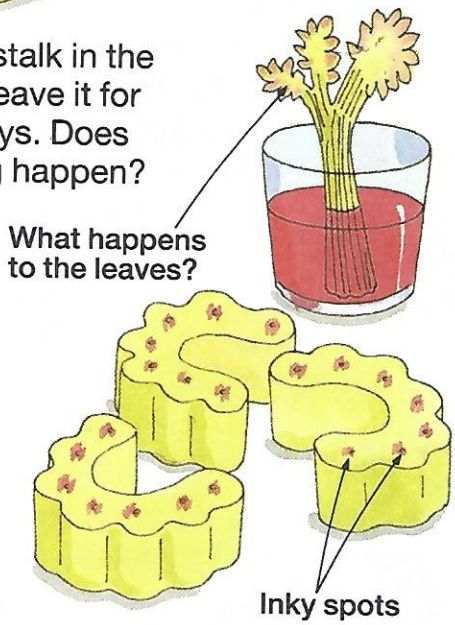


Climbing through celery

Pour a few drops of ink into a glass of water. Cut the end off a stalk of celery. Look at the cut edge closely.



Put the stalk in the water. Leave it for three days. Does anything happen?



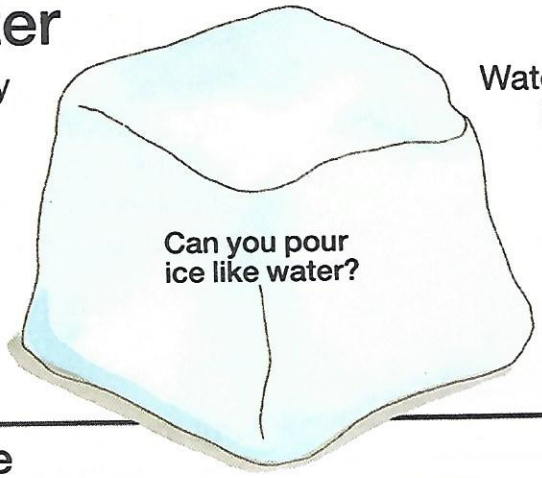
Cut the stalk into slices. Look for inky spots inside. These show where water has risen up the stalk.

Frozen water

When water gets very cold it freezes hard and turns to ice.

Differences

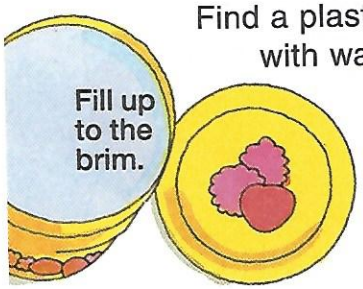
Look at an ice-cube. How is it different from water?



Water can change shape because it is a liquid. Ice keeps one shape unless it melts and turns back to water.

Anything that keeps its shape, like ice, is called a solid.

Taking up space

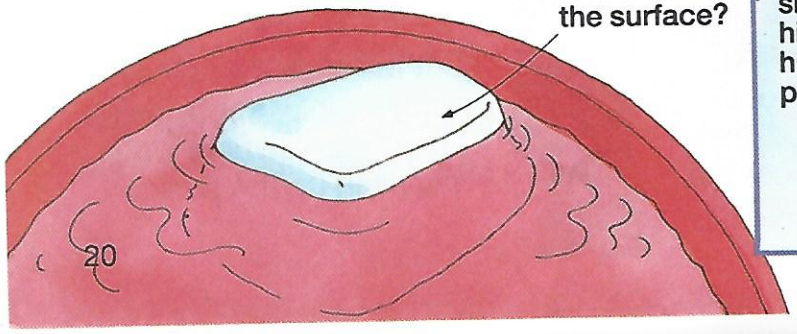


Find a plastic cup with a lid. Fill it with water and put on the lid. Ask if you can put the cup in a freezer. What happens when all the water turns to ice?

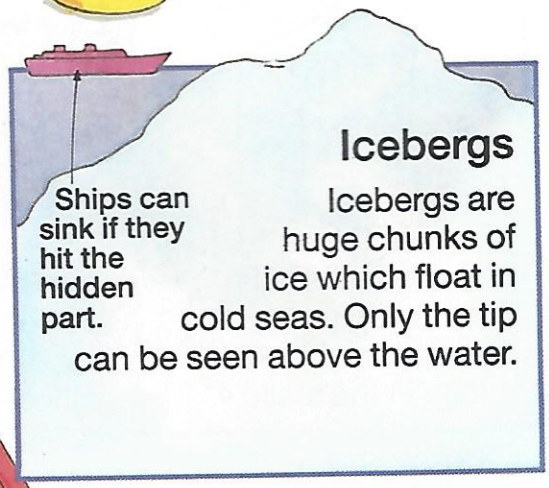
Ice takes up more space than water. It pushes the lid up when it gets too big for the cup.

Does ice float?

Put some ice in a bowl of water to see if it floats.



Icebergs



Icebergs are huge chunks of ice which float in cold seas. Only the tip can be seen above the water.

Melting ice

Ice melts when it gets warmer.

Guess what happens if you put one ice-cube in cold water, one in hot water and one on a plate.

Try this out to see if you are right.

Use a watch to time how fast they melt.

Melting without heating

Try sprinkling an ice-cube with salt.

What happens to the salt?

The salt mixes with the ice. Salty ice melts quickly because it melts at cooler temperatures than plain ice.

Try pressing an ice-cube with a spoon-handle.

What happens to the ice here?

Ice always melts when it is pressed.

Why ice is slippery

Ice melts when your feet press on it. A thin layer of water forms under your shoes. This stops them from gripping so you slide around.

Notes for parents and teachers

These notes give more detailed explanations of the scientific topics covered in this book.

Experimenting with water (pages 2-3)

In common with all liquids, water flows, changes shape to fit any container, keeps the same volume and finds its own level.

Floating (pages 4-5)

When an object is dropped in water its bulk pushes some water aside. The water pushes back, exerting a force called upthrust. If an object is heavy, its weight may overcome the upthrust so it sinks. If it is light enough, it floats.

It is possible to make something push aside more water by changing its shape. The boat-shaped plasticine pushes aside more water than the ball. This increases the upthrust so it now keeps the plasticine afloat.

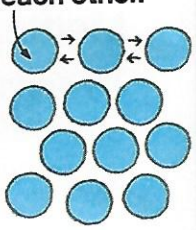
Fun with boats (pages 6-7)

A boat sinks into water until it displaces the same weight of water as its own weight. When loaded, the boat sinks lower into the water until it displaces the weight of its cargo as well as its own weight.

Salt water weighs more than fresh water. A boat has to displace less salt water to equal its own weight. This makes it float higher in salt water. It can also carry more.

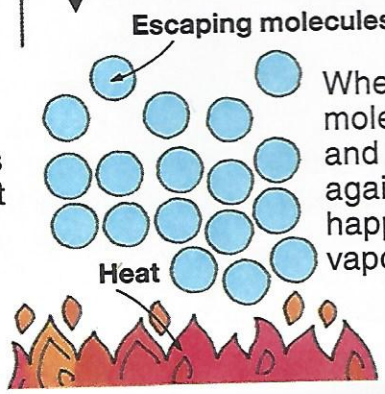
Water's 'skin' (pages 8-9)

Like all substances, water is made up of tiny particles called molecules. Water molecules hold together most strongly at the surface. This makes it able to resist slight pressure, just like a skin. This effect is known as surface tension.



Vanishing water (pages 10-11)

Molecules move constantly in a liquid. They often break free and escape as gas (evaporation). Heat gives molecules more energy so they move faster and break free more easily.



When a gas cools, its molecules lose energy and can form a liquid again. That is what happens when water vapor condenses.

Mixing (pages 12-13)

Water forms different mixtures with various other substances.

Solutions

A solution is formed when a substance, such as salt, dissolves in water. Its molecules spread out among the water molecules so they are thoroughly mixed.

Suspensions and emulsions

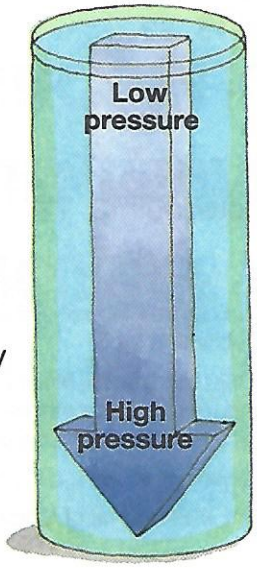
A suspension is formed when a powdery substance, such as fine sand, does not dissolve. Its particles stay large enough to see. They can be easily filtered out.

A liquid, such as oil, that refuses to mix with water can form an emulsion. It stays in droplets suspended in the water.

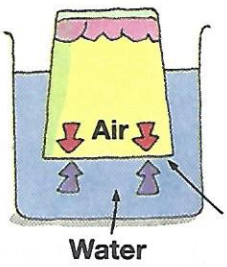
Water power (pages 14-15)

Water flows downward due to gravity (Earth's pull). The force of its flow is useful for powering machinery.

Its flow is also affected by its depth. The deepest parts of any volume of water are under the most pressure because of the weight of water above.



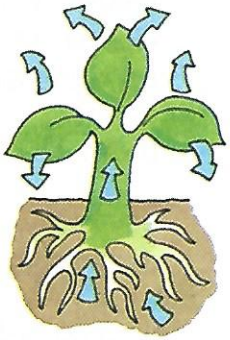
Air and water tricks (pages 16-17)



When a glass is pushed underwater, air is trapped inside. The air pressure balances the water pressure outside.

The water compresses the air but cannot push past it.

Taking in water (pages 18-19)



Water molecules can be more attracted to other substances than they are to each other. The attraction enables water to travel a long way into some substances. This is called capillary action.

Capillary action encourages water to climb up plants. Plants allow water to evaporate from their leaves which also helps to 'suck up' the water.

Frozen water (pages 20-21)

When water becomes very cold the molecules lock together to form a solid (ice). Heat gives the molecules energy so they can break free and change to liquid. This also happens if pressure is applied.

Index

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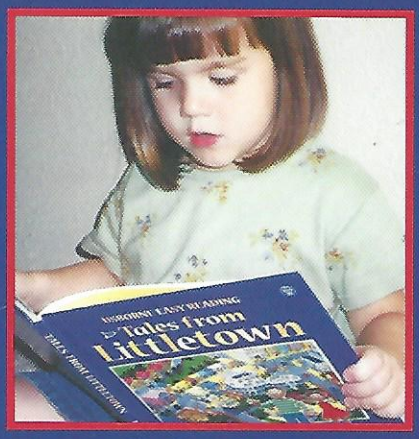

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