
# Guidebook

little labs

THAMES KOSMOS

SCIENCE EDUCATION SET

**WARNING** — This set contains chemicals that may be harmful if misused. Read cautions on individual containers carefully. Not to be used by children except under adult supervision.

## General Recommendations and Advice for Parents and Users

Caution! Some components in this kit have sharp points, edges, or corners. They may cause injury.

Not suitable for children under 3 years due to small parts, balls, and balloons that could be swallowed.

Store the experiment kit out of reach of small children.

The right to technical changes is reserved.

# WARNING!

**CHOKING HAZARD** — Small parts. Toy contains a small ball. Children under 8 yrs. can choke or suffocate on uninflated or broken balloons. Adult supervision required. Keep uninflated balloons from children. Discard broken balloons at once. Not for children under 3 yrs.

Do not ingest the color tablets. Avoid contact between tablets and eyes or mouth.

The supervising adult should select suitable experiments and discuss procedures and advice with the child in advance and ensure that they are followed. Small children and animals should be kept away from the experiments. Nothing should be swallowed or eaten in the process. After the experiments, the used parts should be rinsed, dried with paper towel, and put back in their spots in the experiment kit. The worktable should be wiped off and hands should be washed.

**2nd Edition, Franckh-Kosmos Verlags-GmbH & Co. KG, Stuttgart/2006**

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Printed in Germany/Imprimé en Allemagne

# stepping into science

## guidebook

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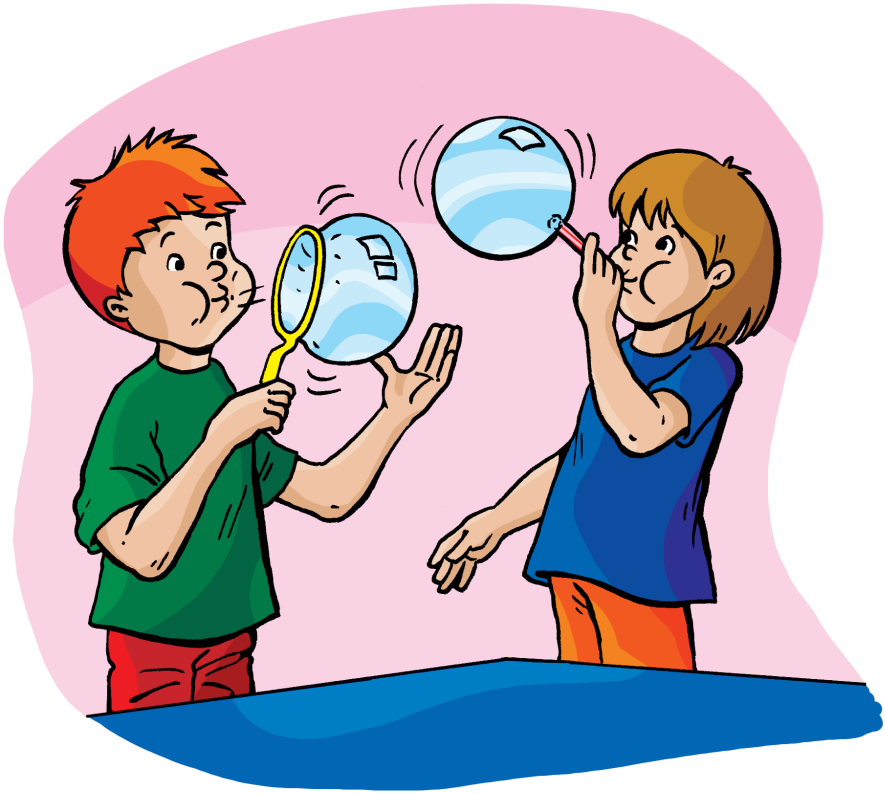


**Dear Parents,**

Children are curious and hungry for knowledge every day. They want to discover the world and understand their environment. With this kit, children five years and older can conduct their first exciting experiments. The experiments are playful and full of surprises to make learning fun. Children will develop an understanding of simple scientific principles and discover the fun of experimental research. In addition, some of the experiments can be staged as small presentations. It is great fun for children to show off an achievement and receive applause. Such experiences of success will reinforce their self-confidence.

The experiments are simple, but cannot be done totally without adult assistance. Therefore, support the little explorers, because their thirst for and ability to absorb knowledge are often better developed than their manual skills. If something does not immediately succeed, encourage your child to repeat the experiment one more time.

When experiments are marked with this symbol, it is to indicate that your help is required for a successful outcome.

Together with your child find a well-illuminated and simple place where you can experiment without being disturbed. Just like real experimenters do, it is recommended to wear old and easy-to-clean clothes. We also recommend having all items laid out and ready to use, so that it won't become necessary to go and look for something in the middle of an experiment. Because the experiment kit was developed for very young experimenters, the description and explanation of the experiments are also kept as short and simple as possible. They should be read aloud and reviewed together so that the children will understand the background and be able to proceed by themselves. According to their interest in science and urge for research, children may continue to experiment according to the suggestions for additional experiments given, and also try out their own ideas.

Spanish language instructions for this kit are available on the Thames & Kosmos website, at www.thamesandkosmos.com/littlelabs.

We wish you lots of fun and successful experiments!

## additional materials needed

The following items are needed for the experiments. They are indicated by a red plus sign ✚ at the beginning of each experiment.

Paper towels, water, milk- or orange juice bottle, matches, adhesive tape, toy block, plant parts, shovel, scissors, potted plant, string, confetti or tiny paper pieces, wool patch, glue, glass bowl, sugar, soap flakes, a glass, soup bowl, ballpoint pen, plant oil, baking powder, vinegar, sugar cubes, ink, white paper, salt.


## your experiment kit contains the following items:

| | Description | Quantity | Item No. |
|---|---|---|---|
| 1 | Paper sheets (1 sheet for cutting and 2 sheets for paper air-planes) | 1 | 703 545 |
| 2 | Cardboard cutout sheet | 1 | 703 546 |
| 3 | Garden cress seed | 1 | 532 122 |
| 4 | Plastic dish (2 halves) | 1 | 702 184 |
| 5 | Magnifying glass | 1 | 311 137 |
| 6 | Flexible straw | 2 | 529 118 |
| 7 | Straw | 6 | 000 414 |
| 8 | Clay pot | 1 | 121 816 |
| 9 | Plastic bag | 1 | 703 547 |
| 10 | Disk/Top | 1 | 703 548 |
| 11 | Sundial | 1 | 259 181 |
| 12 | Plastic stick | 1 | 700 401 |
| 13 | Rubber band | 5 | 700 420 |
| 14 | Styrofoam ball | 1 | 700 080 |

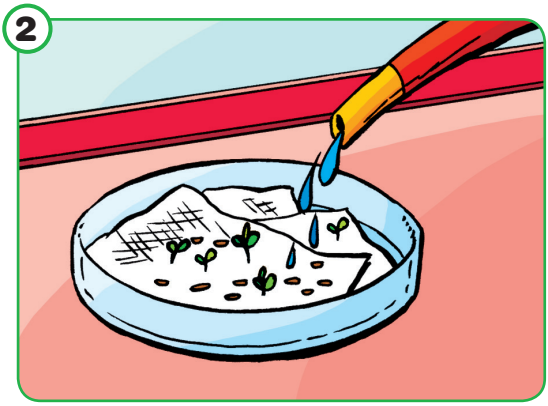
| | Description | Quantity | Item No. |
|---|---|---|---|
| 15 | Paper bag | 3 | 700 083 |
| 16 | Paper clip | 2 | 020 040 |
| 17 | Suction cup | 1 | 700 181 |
| 18 | Blotting paper | 1 | 000 569 |
| 19 | Soap bubble ring | 1 | 000 583 |
| 20 | Modeling clay | 1 | 000 588 |
| 21 | Wool thread | 1 | 702 751 |
| 22 | Small styrofoam soap boat | 1 | 700 633 |
| 23 | Pipette | 2 | 232 134 |
| 24 | Measuring cup | 2 | 061 150 |
| 25 | Measuring cup lid | 2 | 061 160 |
| 26 | Bag with air balloons | 1 | 703 549 |
| 27 | Styrofoam air cushion boat and styrofoam disk | 1 | 700 088 |
| 28 | Funnel | 1 | 700 364 |

# the cress garden

**you will need:**


✚ *paper towel, water*


1. Tear a paper towel into small pieces. They should be about the size of the plastic dish. Place four or five of the paper pieces in the dish. Open the seed envelope, spread some seeds onto the paper, and drip water onto the towels until they are soaked.




2. Place the plastic dish on the windowsill and observe the seeds every day with the magnifying glass. After about three days, the first sprouts will appear. These will quickly grow to small plants. Don't forget to give the sprouting seeds water. The paper must never dry out.

## what happened?

As long as the garden cress seeds are dry, they do not germinate, or start to grow. Only when they come in contact with water will the seeds swell and begin to grow. The seeds contain all the important nourishments that the young plants need for their first growth. The cress will get the rest from the water and the air. Garden cress is very healthy and contains many vitamins that we need daily. In addition, the young sprouts taste very good. Therefore, many people plant cress regularly to eat it in salads.

### continue to experiment

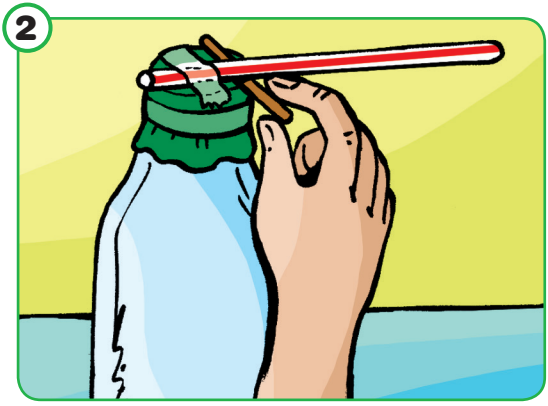
At a greenhouse or garden store, get some more seeds, such as radish or bean seeds. Sprout these as you did the garden cress. Observe with the magnifying glass whether they germinate and whether they grow faster or slower.

# weather station

**you will need:**


✚ *milk- or orange juice bottle, a match (without tip), adhesive taper*


1. Cut a round piece of the balloon surface that is large enough to cover the large opening of a milk- or orange juice bottle. Fix the tightly stretched rubber circle with a piece of adhesive tape around the bottleneck.




2. Press the end of the straw flat and attach it with a piece of adhesive tape to the middle of the stretched rubber circle. Close to the edge of the bottle opening, press the match under the straw. The straw will act as the indicator for your air pressure measurement device.

## what happened?

During nice weather, the air pressure will rise because there will be more air than normal above you. The air will press down on the balloon rubber so that the indicator will move upwards. If the air pressure falls, there is less air above you pushing down, so the indicator moves downwards. A low pressure area is approaching and will mostly bring rain with it.
This means you have a small weather station, which is also called a barometer. With it, you can predict approximately how the weather will be.

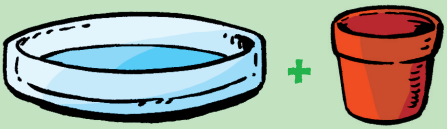

3. Now you will need a place without heat or direct sunshine. Ask your parents whether the air pressure is normal. Place the bottle along the wall so that you can attach the scale behind the indicator. The indicator must point directly at the middle between "high" and "low." When the air pressure changes, the indicator will show the variation precisely.

**continue to experiment**

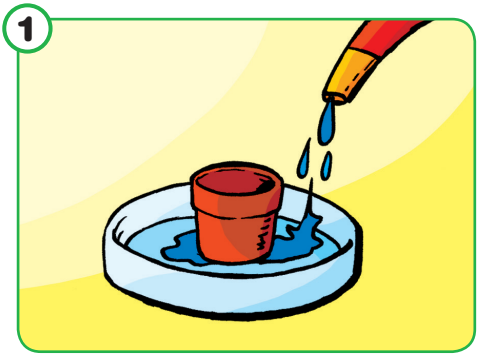
Make a small hole in the balloon rubber with a needle. Does your air pressure measurement device still work? Unfortunately it does not, because it needs a sealed-off air volume in the bottle. When the air can move from the inside to the outside and the air pressure can be equalized, the indicator will no longer move.

# the absorbing clay pot

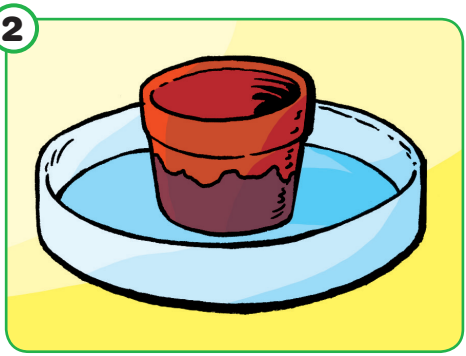
**you will need:**



✚ *water*




1. Pour water to the level of a finger in the plastic dish and place the clay pot in it.




2. Now you can observe how water slowly rises into the clay pot wall and reaches to the top edge in about two hours. This means water can sometimes flow upwards.

## what happened?

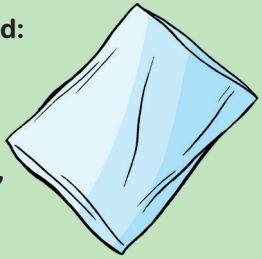
Fired clay is not a firm solid material. It has numerous small holes, almost like a sponge only the holes are much smaller. In these tiny holes, the water can slowly creep upwards because it has the need to fill small openings even when they are above the water surface. The water adheres to the holes like glue and does not flow down again. This characteristic makes clay pots ideal for flowerpots.

**continue to experiment**

Repeat the experiment with a large flowerpot that you put in a bowl. Observe how long the water takes to reach the upper edge.

# plants sweat

**you will need:**

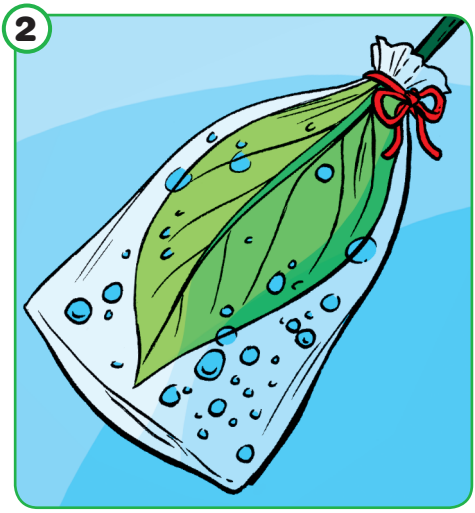


✚ *houseplant, string*

**1**

1. Find a houseplant with nice large leaves. Take the plastic bag, put it over one or several leaves and close it with a piece of string. Be sure not to break any parts of the plant.

**2**



2. After some time the bag will fog up. Small water droplets will form. Depending on the time of year and the plant, this can take up to a couple of hours.

## what happened?

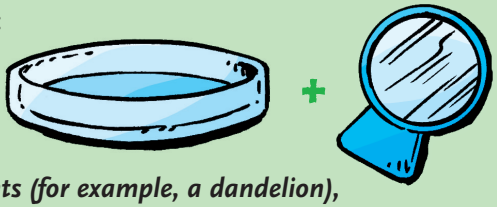
Not just people and animals sweat: plants sweat too. With their roots, they absorb water from the soil. They expel the excess water into the air. This happens through tiny openings on the underside of the leaves. The plant needs the water to transport and distribute nourishment to the entire plant.

**continue to experiment**

Repeat the experiment in the garden, for example with a leaf or branch from a hedge or bush. The leaf of a sunflower also works well for this experiment.

# growing plants

**you will need:**



✚ *parts of plants (for example, a dandelion), paper towel, small shovel, scissors, water*


1. Tear a paper towel into small pieces. They should be about the size of the plastic dish. Place four or five of the paper pieces in the dish and pour in so much water that the paper becomes moist but does not swim in water.


2. With a small shovel, dig out a dandelion root. Cut the root into small pieces no longer than the tip of your little finger. Place the pieces on the wet paper and observe how small leaves and roots sprout and begin to grow after about one week. Make sure that the paper is always wet.

## what happened?

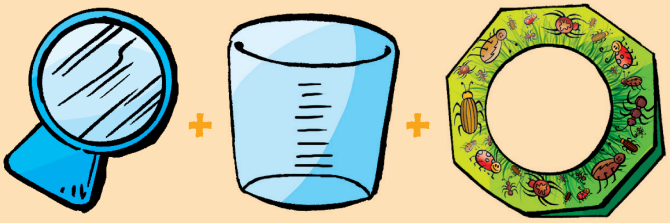
Plants do not multiply exclusively through seeds, but also through parts of plants and runners. Plants can also develop from damaged flowers or flowers eaten by animals. This characteristic is very important for plants because they serve as nourishment for many animals. Obviously they need fresh air, light, and fresh water to grow.

### continue to experiment

Repeat the experiment with other plants, for example, the cut-off top from a carrot. Ask your parents which plants you can use for this. Again you can observe the growing plants with the magnifying glass.

# the magnifying glass

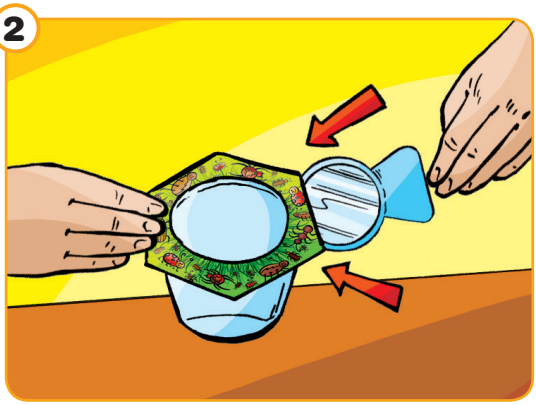
**you will need:**



1

1. Use the magnifying glass to observe small things. Postage stamps, newspaper pictures, dust, or the fibers of a rug are all interesting things to look at through a magnifying glass.

2



2. Build yourself a small beaker magnifying glass: Carefully punch the beaker magnifying glass frame out of the cardboard. Put the beaker through one side the frame. Glue or tape the two sides of the frame together, but leave an opening so you can insert the magnifying glass between the two frame sides. Now you can observe living insects in the measuring beaker. Catch the insects carefully and let them out again at the same spot after you have observed them.

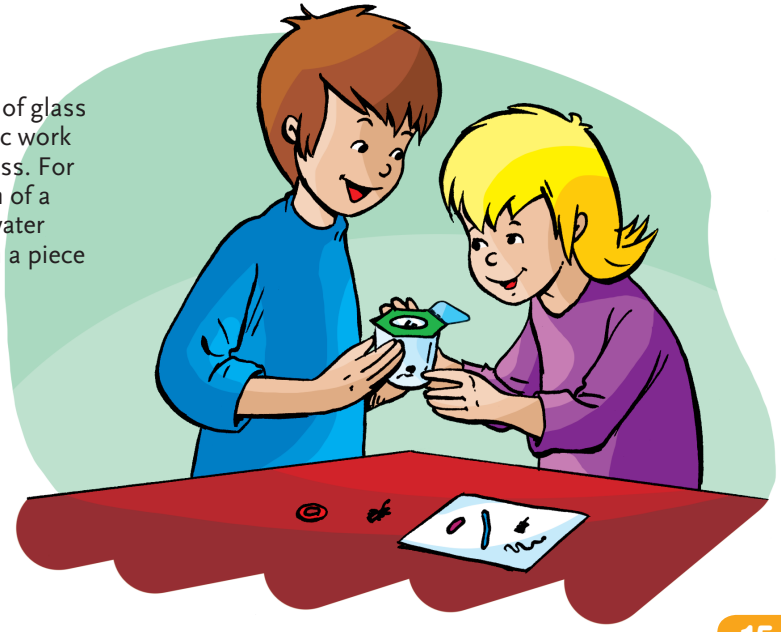
## what happened?

All objects reflect the rays of light that the sun or a lamp emits. These rays of light will reach the eye. Therefore you can see the object. If the rays first pass through a magnifying glass they will be pulled apart a little. This makes the object look larger than it really is.


3. Thanks to the magnifying glass everything looks larger so that you can observe things better and more accurately. In fact, everything looks twice as large. The beaker makes sure that the small critters do not run away while you are looking at them.

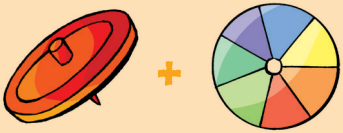
**continue to experiment**

Check if other items of glass or transparent plastic work like a magnifying glass. For example, the bottom of a drinking glass or a water drop that you put on a piece of plastic wrap.

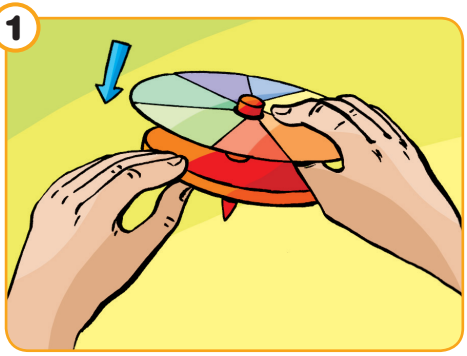


# spinning colors

**you will need:**



1



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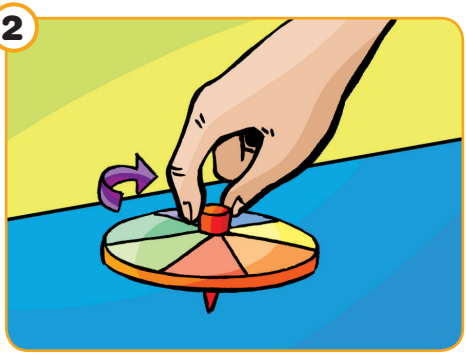


1. Punch the color disk carefully out of the cardboard sheet. Put the disk onto the top.

2. Now spin the top as fast as you can. Ask your parents for help in spinning the top. When spinning, the different colors can no longer be distinguished. They merge into a gray, almost white color.

## what happened?

White is a mixture of all colors even though it may not seem so to us. One could also say that all colors are contained in white light. This is why white can be composed of the different colors. And that is exactly what you do with the color wheel. It is really your eyes that are observing the change in color because they cannot follow the fast-spinning top, rather than the object actually changing color itself.

**continue to experiment**

Repeat the experiment with disks you have cut out and colored yourself. What happens when you make the disk blue and yellow?

# the confetti magnet

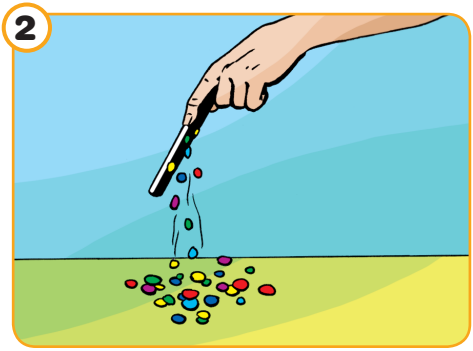
**you will need:**

+ *confetti or small paper pieces, woolen patch*

1

1. Put some confetti on a table. If you don't have any confetti, empty a hole-puncher or rip tiny pieces from a paper napkin.

2



2. Now rub the plastic rod several times with the wool patch, a wool scarf, or a wool hat. Point the rod at the confetti, a couple inches away. As if pulled by a magic force, the paper pieces fly onto the rod.

## what happened?

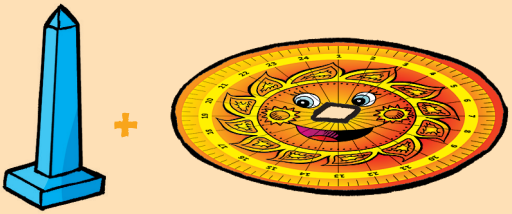
When you rub the plastic rod with the wool patch, the rod is charged with electrostatic energy. This works like a magnet although the energy does not attract any iron parts, but only paper, hair, and other light things.

**continue to experiment**

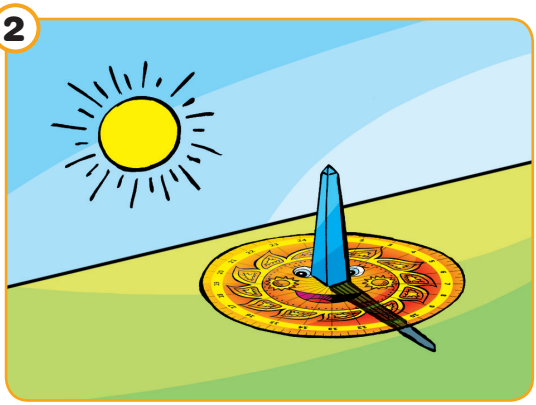
Repeat the experiment with someone who has long hair. Put the charged rod near their hair and watch what happens. Hair is also attracted by the rod. In addition, instead of confetti you can use a mixture of salt and pepper. When you hold the rod slightly above this mixture, the light pepper is attracted first while the salt initially remains on the table.

# the sun dial

**you will need:**



1. Carefully break the sundial disk loose from the printed sheet. Assemble the sundial by pressing the obelisk though the disk from the back.



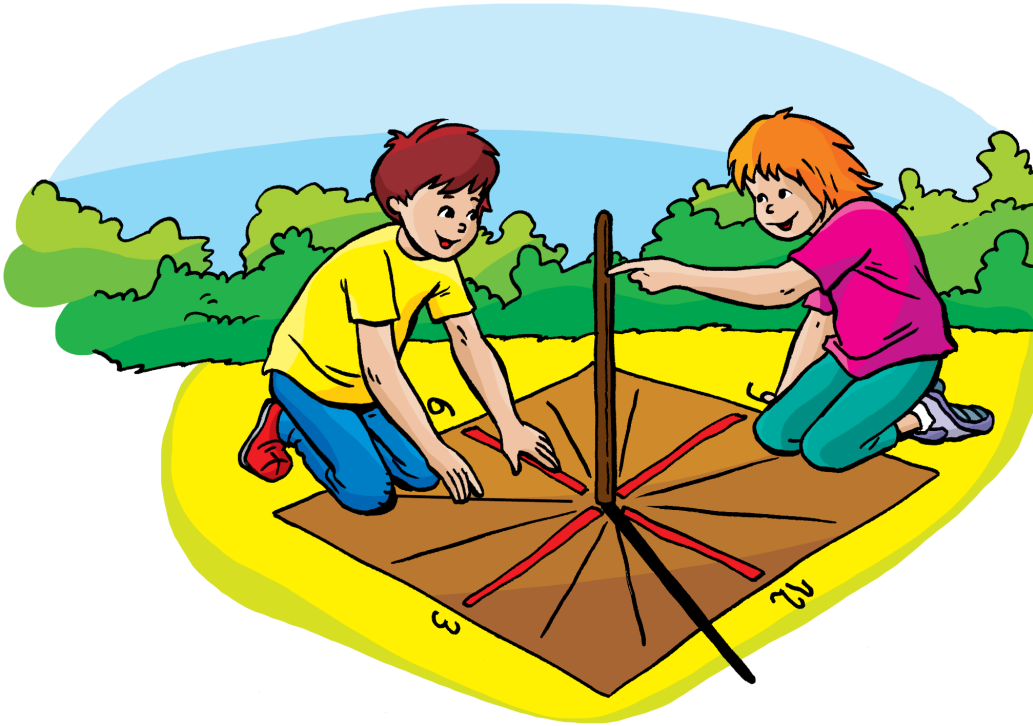
2. On a sunny day wait until the clock is at a full hour and place the sundial in the sun. If, for example, it is 12 noon, turn the sundial so that the shadow of the obelisk points directly at the number 12 on the sundial disk. Now the sundial is set, and from now on you can read the time on your sundial.

## what happened?

Because the Earth turns around its own axis, it appears to us as if the sun turns around the Earth. The shadow cast by the obelisk will therefore wander on the sundial. It is the hand of the sundial. But the sundial only works in nice weather and only from morning until night. Also don't forget that in the spring and summer we have daylight savings time. In the summer when your watch shows 12, the time according to the position of the sun is only 11 o'clock.

### continue to experiment

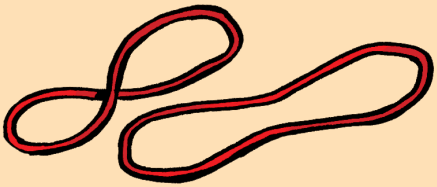
With the help of a large rod and a smooth surface in the garden or sandbox, try to make a large sun dial. For each half and full hour, draw a line in the ground where the shadow of the rod is.



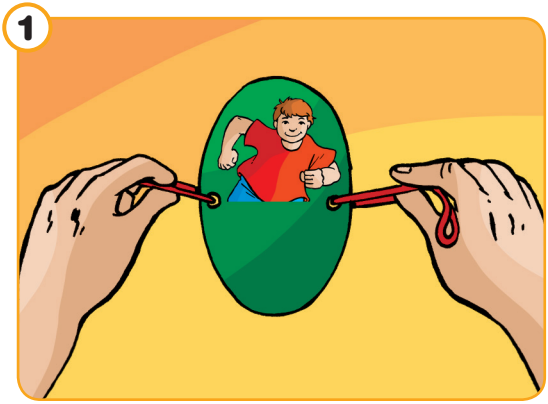
# two become one

**you will need:**

+



+ *glue*




1. Carefully detach the soccer player disk from the printed sheet. Fold it together so that the two unprinted sides are on the inside, and glue them together. Now you will have half a soccer player on each side. Attach a rubber band to each of the two holes and hold the soccer player at each end of the rubber bands.


2. Now you need someone to help you. Your assistant must turn the soccer player many times until the rubber bands are twisted tight. If the soccer player is now let loose, the disk will turn rapidly between your fingers. And instead of the two halves of the soccer player, you will now see the entire player ready to kick.

## what happened?

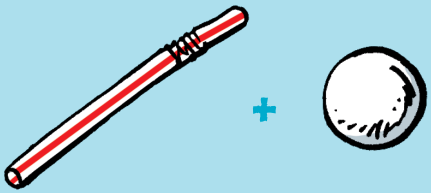
The human eye is fairly slow. It stores each picture that it sees for a short period. The cardboard oval with the soccer player turns so rapidly that the eye still has one half stored while it already sees the next half. Inside our head the picture of a full soccer player is now formed from the two halves. We see a movie in the same way; Each second, the human eye sees 25 individual pictures that are put together inside our head into a continuous movement.

**continue to experiment**

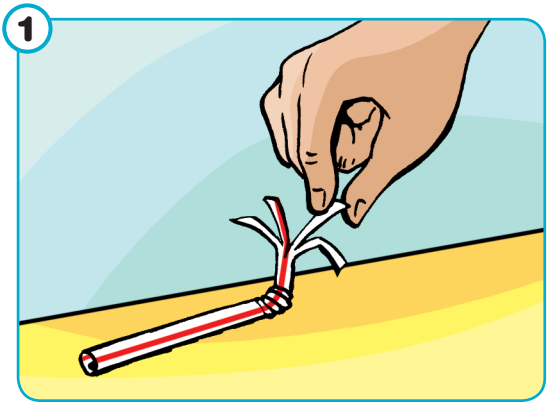
Cut a piece of cardboard into a suitable size. Make two holes in it and repeat the experiment with a drawing of yourself or a photograph that you cut in half at the middle. Notice carefully how the two half pictures must be arranged on a cardboard piece.

# the floating ball

**you will need:**



✚ *scissors*




1. Bend the straw at the flexible point and split the shorter end as shown in the illustration. Bend the four parts outward. Let an adult help you with this.


2. Put the straw in your mouth so that the cut end points exactly upward. Put the ball carefully onto the opening and simultaneously blow powerfully into the straw. The styrofoam ball will begin to float.

## what happened?

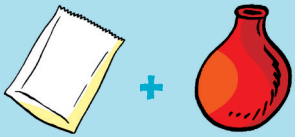
The styrofoam ball is so light that it can be supported by the flow of air. This airflow surrounds the ball on all sides and makes sure that it rides in the middle of the air stream. This, however, works only with a ball. Other shapes are not surrounded uniformly by the flow of air and will fall down.

**continue to experiment**

Ask your parents if they will carry out this experiment with you using a hairdryer, with the heat turned off. Now the flow of air comes automatically, and you can try to make several different items float in the air.

# the big bang bag

**you will need:**




1. Take the opening of the paper bag in your hand as shown. Blow into the bag, filling it with air. Squeeze the opening tightly together so that the bag does not lose any air.


2. Now hit the bag powerfully with the palm of your hand. The bag will burst with a loud bang.

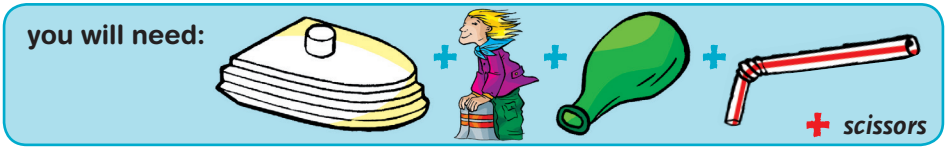
## what happened?

Contrary to a rubber balloon, a paper bag is not elastic. For comparison, hit an inflated balloon with the palm of your hand. It will not burst. When you hit the inflated paper bag, you compress the air in the bag. Because the bag is not elastic, the air has no place to go. Therefore it rips the bag and the air escapes. The ripping bag and the suddenly escaping air cause the bursting sound.

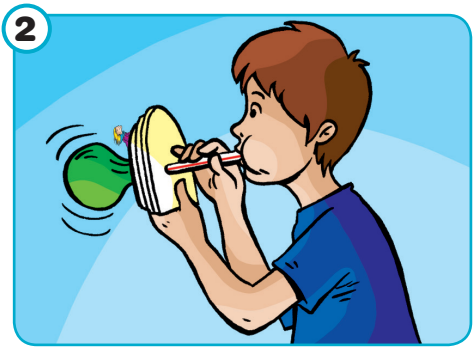
**continue to experiment**

Repeat the experiment with other bags. Which ones are particularly good? Which ones do not work? Try it with the paper bags you get at the bakery or supermarket.

# air cushion boat








1. Punch the boat driver out of the cardboard cutout sheet and fold him together in the middle. Put him into the slot at the bow of the air cushion boat. Have one of your parents blow up the balloon to a point where it is stretched somewhat. Let the air out of the balloon. Put the balloon tightly onto the cylinder on the top of the boat.

2. Cut about a 5 cm (2 in) piece from a straw and stick it into the hole in the boat from the bottom. Now, blow up the balloon through the straw. So that no air escapes, hold the balloon closed with your fingers before you pull out the straw. Put the boat on a smooth table surface and give it a small push. It will float along.

## what happened?

As soon as the air starts coming out of the balloon, there is more air under the boat. This means that you are increasing the air pressure there. The air will try to escape. It flows in all directions and lifts the boat a small amount. The boat will float on the air, like a real hovercraft, for a short while.

**continue to experiment**

Repeat the experiment on a rough surface, for example a carpet. Will the boat also float there?

# paper airplanes

**you will need:**

## I. the yellow glider

1. Place the yellow airplane sheet on the table so that the pilot side is facing up, and the pilot is at the bottom of the page. Fold the two upper corners to the centerline so that two yellow triangles are formed.

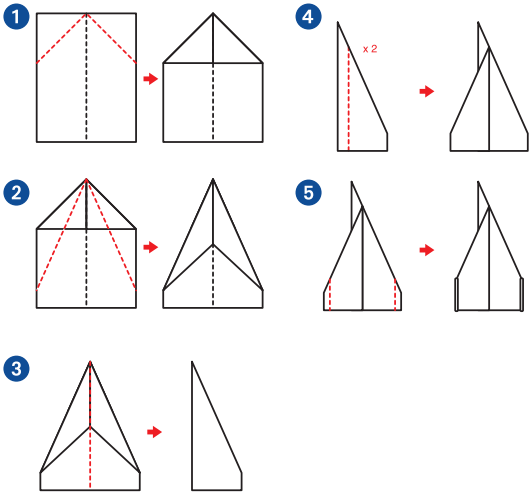
2. Fold the two folded triangles one more time towards the centerline. This will create two longer triangles with stars and stripes on them.

3. Now fold the whole airplane along the centerline so that the folded triangles are inside.

4. Take the wings, one after the other, and fold them along the dotted line – so that the pilot can be seen again.

5. Fold the wing tips up.

Now your glider is ready. Grab the glider at the tail between your thumb and index finger, and throw it gently forward into the air. It will glide through the air like a real airplane. After a couple of tries, you will get the hang of throwing it.




## II. the purple glider

1. Place the purple airplane sheet on the table so that the side with the pilot is towards the table and the solid purple area is at the top. Fold the two upper corners to the centerline so that two green triangles are formed.

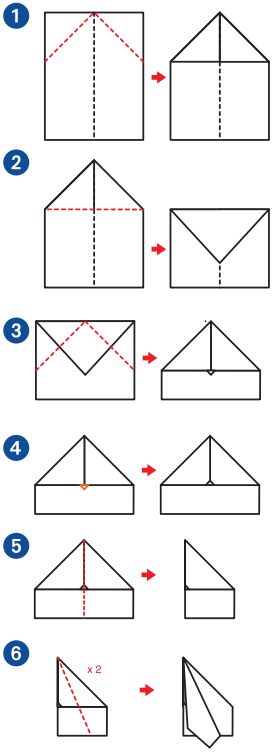
2. Fold the entire green, upper pointed part down to the dotted line.

3. Fold the two purple, top corners to the centerline so that two triangles are formed.

4. The small, remaining purple triangle should be folded upward.

5. Fold the two halves together so that the two folded triangles are on the outside.

6. Now fold the blue area with the stars under, one side after the other, so that the pilot is visible again. The glider is now ready to fly.



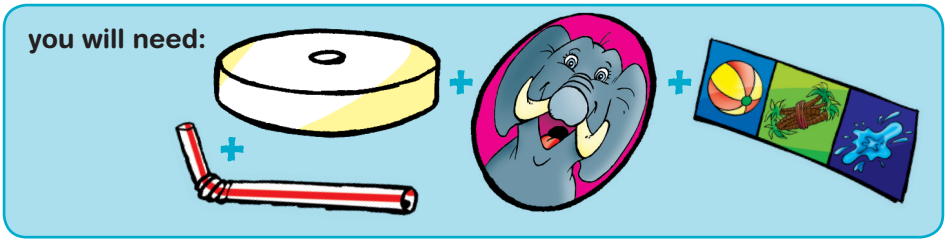

## what happened?

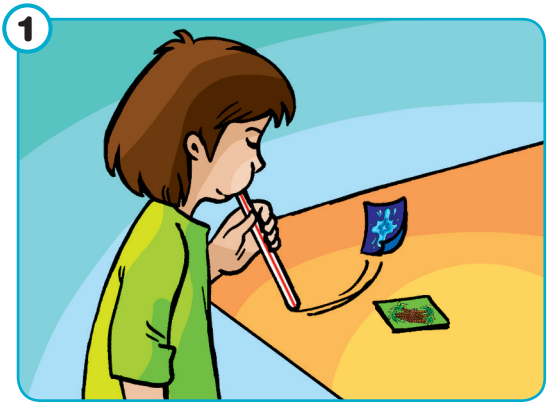
Airplanes can fly because their wings have a certain shape. The shape of a wing is called the airfoil. The shape ensures that the air through which the wing moves must travel different distances above and below the wing. The distance the air travels above the wing is longer than the distance it travels below the wing. This makes the air above the wing slightly less dense, which creates a slightly lower pressure that pulls the wing upward. This only happens when the wing is moving forward fast enough.

### continue to experiment

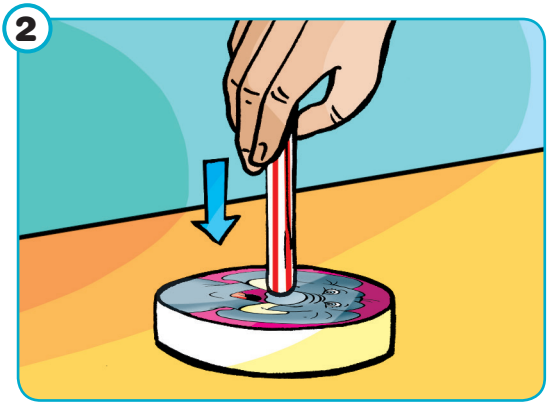
There are many ways of folding an airplane from a piece of paper. Think of different shapes by yourself or ask your parents or siblings. Test them out to determine which ones fly the best. Test different types of paper and thin cardboard.

# the bellowing elephant




1. Cut the ball, the tree trunk, and the puddle apart along the lines and place them on a table with a smooth surface. Take the straw, bend over the paper pieces, and blow powerfully. The paper pieces fly away.




2. Carefully punch the elephant out of the cardboard cutout sheet. Put the styrofoam disk on the table with the elephant disk on top, and stick the straw into the hole.

## what happened?

When you blow into the straw, the air will flow very quickly between the disk and the piece of paper. Because the air moves so fast, it becomes a little thinner than the rest of the air. This means that the air pressure between the disk and the paper will decrease and suck the paper up. It lasts only a brief moment because the paper shuts off the opening of the straw. As soon as the air flows again, the event is repeated.


3. Now hold the disk horizontally quite close to the paper, and blow powerfully again. For a brief moment, the paper is not blown away but rather sucked up to the styrofoam disk.

**continue to experiment**

Repeat the experiment with other materials, such as with a piece of foil or a piece of cardboard. Does the experiment work with these?

# the suction cup

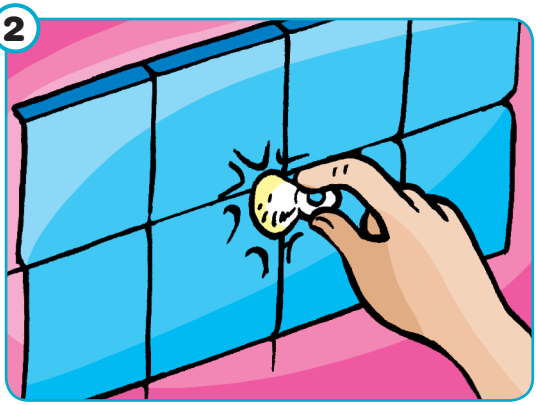
**you will need:**

✚ *water*

1

1. Look for different surfaces in the house on which you can test out the suction cup. It is best to ask your parents to be sure that you do not damage anything. But don't worry, there are plenty of surfaces that you can try it on.

2



2. Press the suction cup onto a tile or a door. You will find that it will adhere to smooth surfaces without glue. And it works best if you moisten the suction cup first with some water.

## what happened?

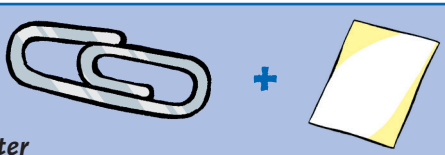
When you press the suction cup onto a surface, some air will escape from the cavity on the underside. This creates a small space in which there is less air than there really should be. Therefore, there is a lower air pressure than on the outside of the suction cup. Or said another way: There is a higher air pressure outside than in the cavity of the suction cup. This higher air pressure presses the suction cup to the surface. If, however, air seeps into the cavity, the air pressure is equalized and the suction cup loosens.

**continue to experiment**

Try it on rough surfaces. You will see that here the suction cup cannot hold on because it cannot make an airtight seal; A lower air pressure cannot be created in the cavity. You can also test how much weight the suction cup will hold.

# the floating paper clip

**you will need:**



✚ *scissors, glass bowl, water*


1. Fill the bowl with water. Cut off a narrow piece of blotting paper and place the paper clip on it.

2. Carefully put the blotting paper with the paper clip on the surface of the water. After a short time, the blotting paper will suck itself full of water and sink. But the paper clip will remain floating on the surface. If it does not work the first time, try it again.

## what happened?

Water forms a kind of skin on its surface. This skin is also called "surface tension" and keeps the water together fairly well; at least so well that small, lightweight things do not sink. This surface tension is also used by water bugs that can walk on the surface of water. You can observe these insects on a pond or slow stream.

**continue to experiment**

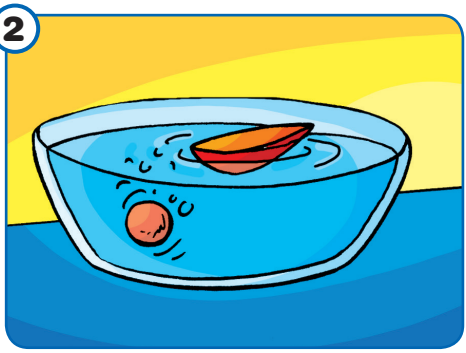
Repeat the experiment with other lightweight items, such as a blunt sewing needle or a strip of aluminum foil. You can also try to put the paper clip on the water surface without the blotting paper.

# the clay boat

**you will need:**

+ *large glass bowl, water*


1. Divide the roll of clay into two halves of equal size. From one half, form a ball. From the other half, make a small boat with thin walls and lots of space inside.




2. Put the boat and the ball carefully on the water. Despite being of about the same weight, the boat will float on the water while the ball sinks immediately.

**continue to experiment**

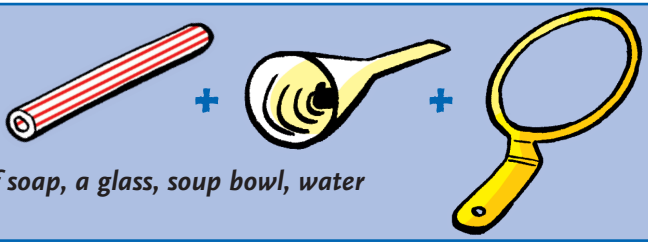
Form a lot of small balls from the large one and try to load the boat. How many balls can it carry before it sinks?

## what happened?

The important factor is not the weight but the shape, because the balls and the boat are about the same weight. This is also the reason why ships made of iron can float. They are hollow inside and displace more water than their own weight. This way the entire ship with the air inside is lighter than water and can float on it.

# super soap bubbles

**you will need:**



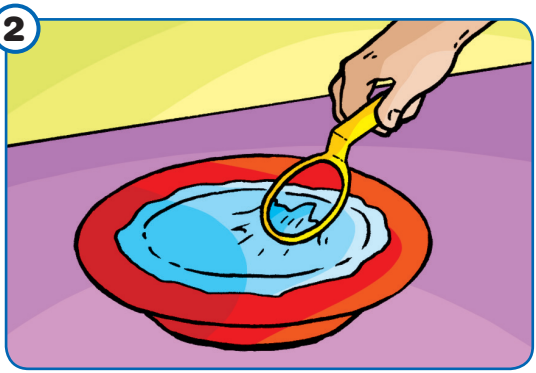
+ *sugar, bar of soap, a glass, soup bowl, water*

**The soapy water is not for consumption and must not come in contact with eyes. If it should do so, flush the eye with running water.**

1

1. In a glass of water, stir up one teaspoon of sugar and one tablespoon of soap flakes. An adult can help you scrap some soap flakes from the bar of soap. Now go outside. Dip the straw into the soap solution, blow into it and make nice soap bubbles.

2



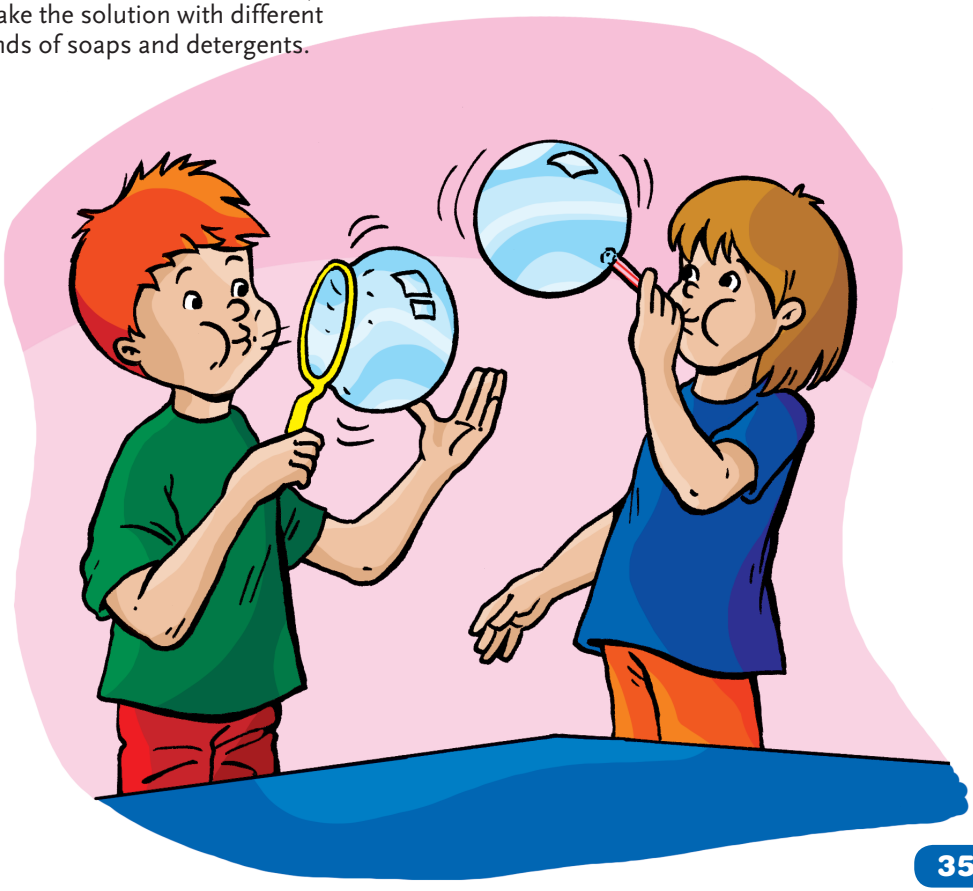
2. In order to make larger soap bubbles, fill a soup bowl with soap solution. Dip the large plastic ring into the bowl and blow into it or move the ring through the air. Or try it with the funnel. What makes the nicest bubbles?

## what happened?

Sugar and soap make water into a tough solution. In the tip of the straw and in the ring, a strong film will be formed from this solution. When you blow air into it, the film will stretch and form a bubble, which encloses the air blown into it. Because the air pressure inside the bubble is slightly higher than outside, the bubble will remain round and stable. The bubble will only burst if it gets a hole in it or too much water evaporates from the solution.

### continue to experiment

While a soap bubble is floating in the air, try to stick the straw into it and blow a second soap bubble inside the first. You can also try to make the solution with different kinds of soaps and detergents.

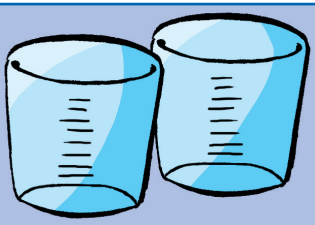


# the string pipe

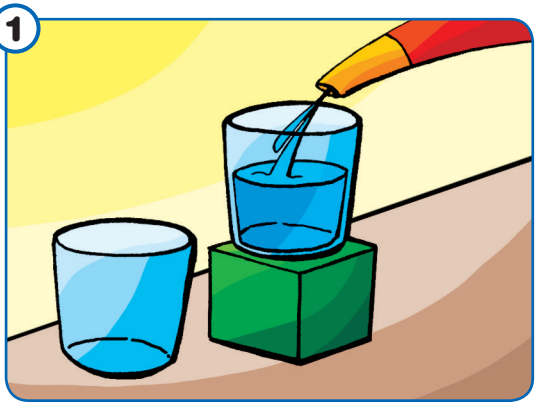
**you will need:**

+ *building block, scissors, water*

+

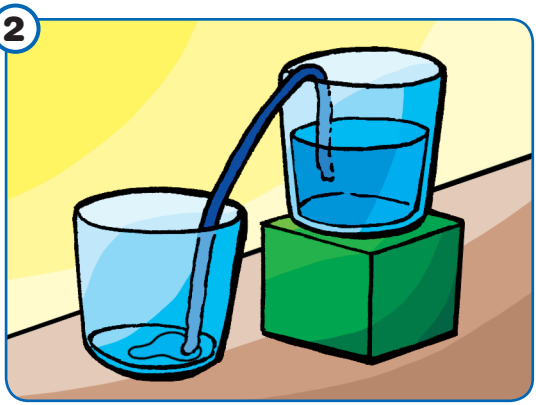


1



1. Place the two measuring cups next to each other with one of them on a building block, so that it stands somewhat higher. Fill the higher cup with water.

2



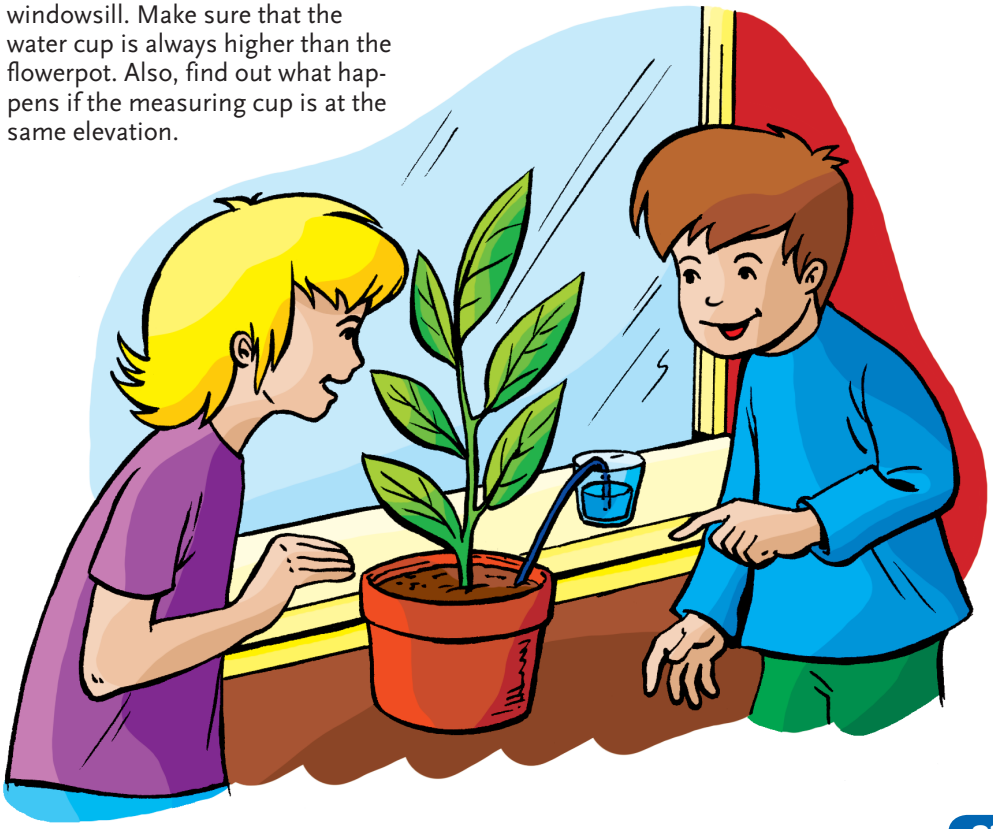
2. Cut a piece from the wool thread about 10 cm (4 in) long and put one end into the measuring cup filled with water. Put the other end into the empty cup. Soon, water will slowly flow through the thread from the full cup into the empty cup.

## what happened?

The thread consists of many individual fibers. Between the fibers there is air, like in a sponge. These spaces will suck themselves full of water. This means that the thread works like a hose. Except here the water doesn't flow through a large opening but through many small ones.
When the thread has filled itself, water begins to drip out of the lower end. It will drip out because a lot of water has accumulated in the thread and this water becomes too heavy for the thread. As additional water flows in from above, the small water pipe begins to run.

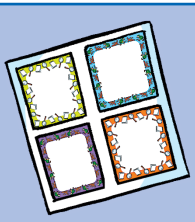
### continue to experiment

You can use the water pipe to supply water to your flowers in the windowsill. Make sure that the water cup is always higher than the flowerpot. Also, find out what happens if the measuring cup is at the same elevation.



# secret writing paper

**you will need:**



+ *white paper, ballpoint pen, scissors, water*

1

1. Cut one piece of the secret writing paper and a piece of the same size from the regular white paper. Wet the secret writing paper, place the dry paper on top of the wet one and write your secret message on the dry paper with the ballpoint pen. Press down hard.

2

2. Throw the dry piece of paper away and place the wet one in the sun or on a heating radiator to dry out. Now the message that was pressed in can no longer be seen. In order to read it you must wet the paper again.

## what happened?

The fibers in the wet paper are compressed by the pressure that you applied with the ballpoint pen. If the paper is dry, these places can no longer be seen. Only when you dunk the paper into water will the writing become visible again. This makes the paper transparent to light except at the compressed spots of your secret message. This is why you can now read it. Here you have a secret writing method totally without secret ink or special secret signs.

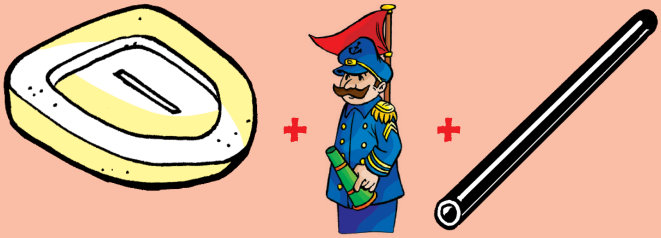
**continue to experiment**

Repeat the experiment with different kinds of paper and find out which paper is best suited for this type of secret writing.

# the soap boat

**you will need:**

✚ *soap, large water bowl, water*




1. Fill the bowl with water. Carefully punch the captain with the flag out of the cardboard cutout sheet, fold him together in the middle, and stick him into the slot in the boat. Now put the boat in the middle of the bowl and wait until the water is completely calm again.


2. Put a small piece of soap at the end of the plastic rod and dip it into the water. As if pulled by a magic hand, the boat suddenly begins to move.

## what happened?

The surface tension of the water makes sure that the boat floats calmly on the water. You can think of the surface tension as a type of skin on the water. The soap disturbs this skin. This puts the water at the surface into motion, and as it flows around it takes the boat along with it.

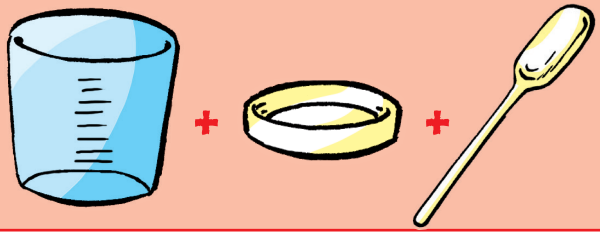
### continue to experiment

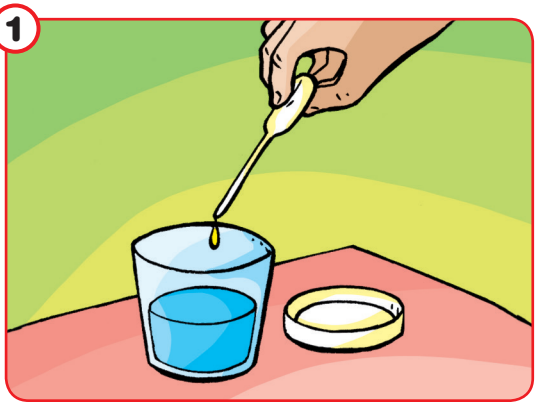
Repeat the experiment with other types of soap. Obviously you must always fill the bowl with fresh water without soap. Does it also work with detergent or shower gel? Or try it with other small things that will float on the water (for example, matchsticks).

# oil and water

**you will need:**

+ *vegetable oil, water*





1. Fill the measuring cup about half way with water, add a few drops of vegetable oil with the pipette and close the cup with the lid.

2. Hold your thumb on the cover, shake the cup, and try to mix the two liquids. Put the cup down and observe what happens. After a short while, the two liquids will separate again with the oil floating on top of the water.

## what happened?

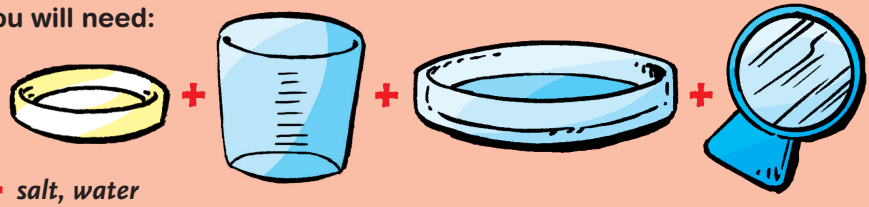
Water and oil repel each other. You could say they don't like each other. This is why it is so difficult to wash oil off with water. Because oil is lighter than water, it floats on top. But how can you, in spite of this characteristic, use water to wash oil and fat off pots and plates? Very simply, you use an agent that "makes friends" of the two liquids. This agent is soap. It allows the blending of water and oil.

### continue to experiment

Repeat the experiment in the other measuring cup and, in addition to the water and oil, add a dash of dish detergent to the mix. When you shake it now, a gray, milky mixture will form, which will not separate into oil and water again. Compare the liquids in the two measuring cups.

# evaporation

**you will need:**



+ *salt, water*


1. Pour some water into the measuring cup and add some salt to it. Close the cup and shake it until the salt is dissolved. Now pour the saltwater into the plastic dish and place it open in the sun or near a heating radiator.


2. The next day, or the day after at the very latest, the water will have evaporated. Only the salt is left in the plastic dish. Observe the crystals with the magnifying glass.

## what happened?

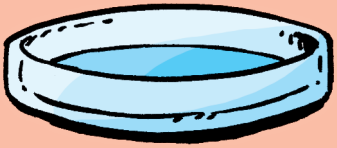
Water consists of tiny parts that can be absorbed by the air. This is why the water evaporates. This happens wherever water comes in contact with air: for example, on the wet pieces of laundry on the drying line or in a puddle of water. The salt is completely dissolved by the water. It has, however, not disappeared, but will show up as crystals when the water evaporates.

### continue to experiment

Repeat the experiment and use sugar instead of salt. Will the sugar also remain in the dish?

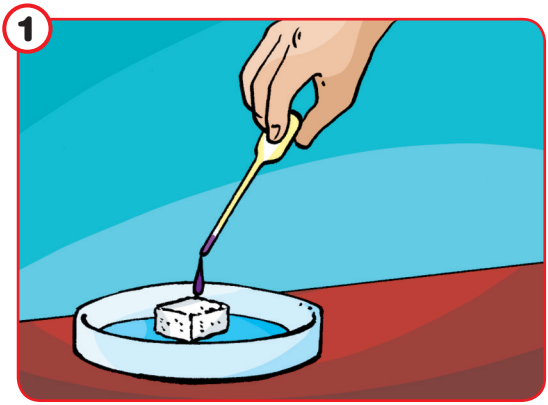
# the colorful sugar star

**you will need:**

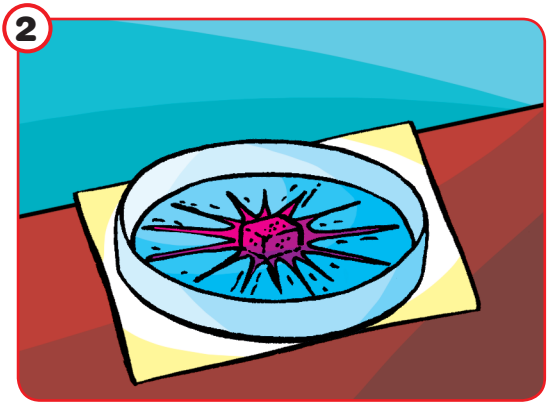


+

+ *colorful ink, sugar cubes, white paper, water*




1. Place a sugar cube in one half of the dish, put a few drops of ink on it with the pipette, and wait until it has dried. Do not put so much ink on the sugar cube that it falls apart.




2. Pour some water in the other half of the dish, put it on a piece of white paper and place the colored sugar cube in the dish. The sugar will dissolve and take the color along with it. A star shaped pattern will appear in the water.

## what happened?

The sugar and ink will dissolve into the water. The sugar particles will thereby move towards the edge of the dish and the ink follows along. In this way, a beautiful sugar star is created.

### continue to experiment

Repeat the experiment, but this time with two sugar cubes. Add different colors to each cube. This will create a wonderful two-colored star. You will get a large star when you try the experiment on a flat dinner plate.

# self-inflating balloon

**you will need:**

+ *baking powder, vinegar*

1. Ask one of your parents to blow up the balloon and then let the air out. Now put the funnel into the opening of the balloon and fill it with two heaping tablespoons of baking powder. Next, pour in half a measuring cup of vinegar.


2. Close the balloon with a knot or simply hold it firmly closed. Shake the balloon briefly so that the vinegar and baking powder are mixed. After a few seconds, the balloon will begin to inflate itself.

## what happened?

When vinegar and baking powder are mixed, a gas is formed that will expand rapidly. This gas is harmless. It is the same gas that bubbles in mineral water and soda. Chemists call it carbon dioxide ($CO_2$). In the balloon, the forming gas creates an increasing pressure that cannot escape through the opening. This makes it appear as if the balloon magically inflates itself.

**continue to experiment**

As the gas is also present in mineral water and soda, try this: Open a fresh bottle, pour some of the liquid into a glass, and pull a rubber balloon over the bottle neck. As soon as the balloon is tightly in place, shake the bottle. The balloon will inflate.

## Parent and Adult Supervisors:
## Introducing Your Child to the Scientific Method

This kit is designed to introduce children not only to the various scientific principles demonstrated by each experiment, but also to the process of scientific experimentation itself. The scientific method is the process that scientists use to answer questions. It consists of the following basic steps:

**Observation** – A question or problem that arises from observations and research. Why does a particular phenomenon occur?

**Hypothesis** – The hypothesis is an explanation for the observation that has yet to be proven. It is an educated guess as to why something happens.

**Experimentation** – Experimentation is the process by which the hypothesis is tested, to see if it is right or wrong. Logical reasoning is used to analyze the results of experiments.

**Conclusion** – The conclusion is a statement of the results of experiments, and whether they prove or disprove the hypothesis.

**Repetition** – Often experimentation does not result in a definitive answer, and thus the process must be repeated to refine the hypothesis or test a new hypothesis.

For each experiment you do with your child, try to incorporate the scientific method into your dialog with the child:

1. While preparing an experiment, ask your child what they think the parts might be used for and what the parts remind them of.

2. After preparing and experiment, but before actually conducting the experiment, ask your child what they think will happen during the experiment. In a sense, you are asking them to come up with a hypothesis.

3. After the experiment, ask them what they observed and how it was similar or different to their hypothesis.

4. Finally, ask them to come up with a conclusion based on the experiment, and discuss with them any ideas they might have for additional experiments which might relate to the experiment.


little
labs