Name _____

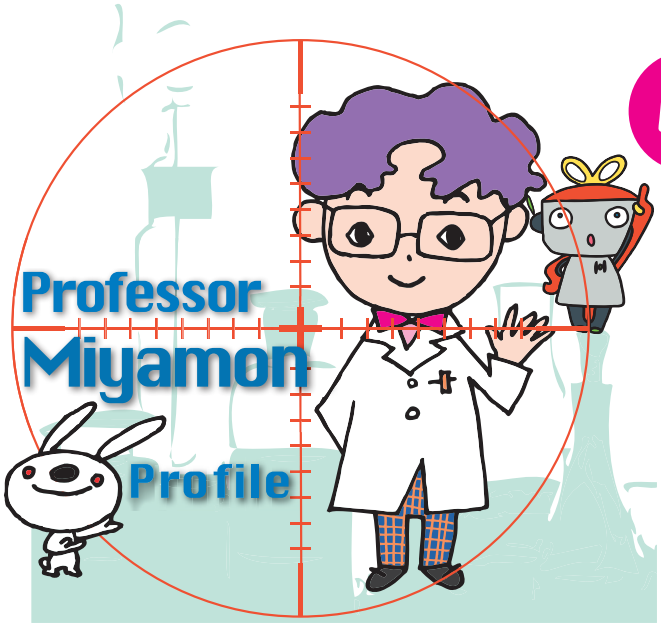
Class _____

Amazing Discoveries!
Science Experiments for Kids

Table of Contents

Purose of this Booklet

Do you know what an "experiment" is?
An experiment is something you do answer mysterious questions about the world.
This booklet is your easy, step-by-step guide to performing many exciting science experiments with the help of adults so that you can make amazing discoveries about the world around you!



Meet Your Teacher

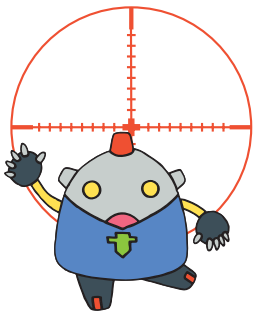
Hi! My name is Miyamon. I am a junior high and high school science teacher. And I'm an expert at making amazing discoveries! So join me as, together, we conduct fun experiments to discover things you want to know. But one word of warning first. Scientific experiments can sometimes be a little dangerous. So let's make sure we do them with the utmost care and safety at all times. With that firmly in mind, let's go make some amazing discoveries.

Our Experiment Pals

Note to Adults

This booklet was created to give young learners a chance to engage in scientific experimentation to answer questions, solve problems and discover many wonders about the world under the supervision of Kaisei Junior & Senior High School teacher, Kazuhiro Miyamoto, Tokyo, Japan. The booklet is targeted toward children ages 5-6 and designed to allow them to conduct experiments with adults supervision and guidance. When conducting any of the experiments in this booklet, please make sure to observe the following rules.

1) Always wear protective goggles when handling chemicals.
2) Always thoroughly wash away any chemicals that get on hands, clothes and other parts of the body.
3) Scissors or utility knives should be handled only by adults as part of the preparation prior to conducting the experiments with children.



Experiment 1

Make Paper Glide on Water!

Date: (Day)_____,(Month)_____(Date)_____

An experiment for moving a piece of paper across the surface of water without the use of hands.

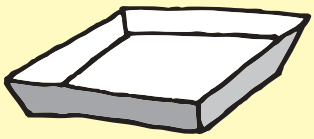
What to Prepare


paper


scissors


color pencils


dropper


tray

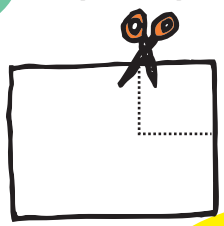

cups


ethanol for disinfection

Experiment Method

1

Cut a sheet of paper into 3cm by 3cm (1 in x 1 in) square piece.



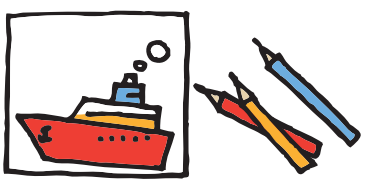
3cm(1 ")

3cm(1 ")

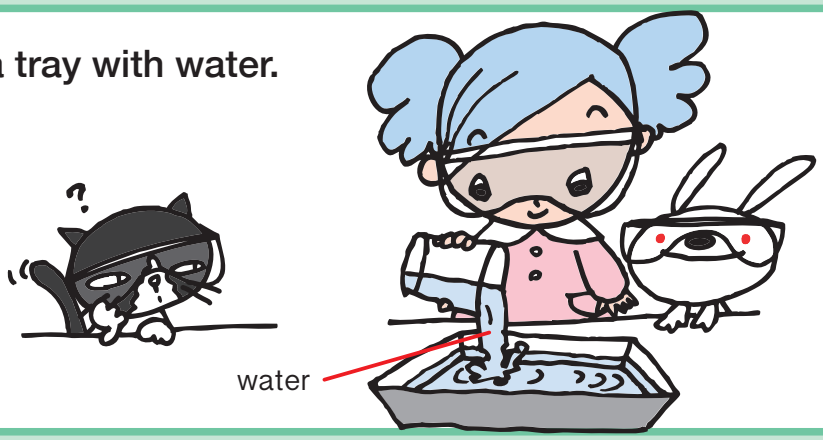
Be careful when using scissors!

2

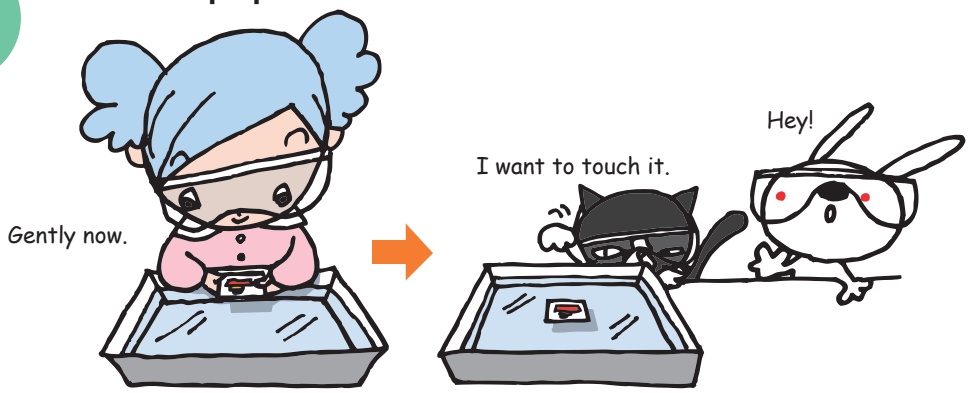
Using colored pencils, draw pictures on the piece of paper.



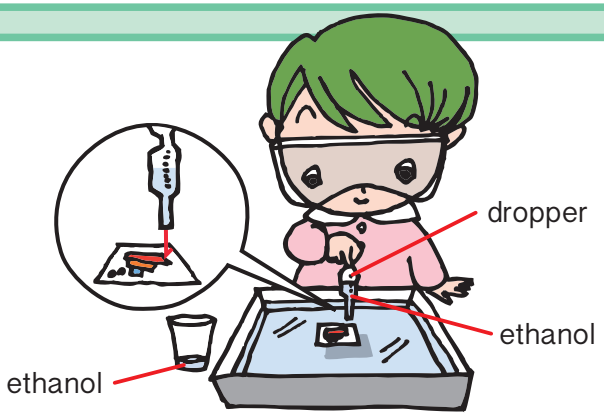
3 Fill a tray with water.



4 Float the paper on the water.



5 Using a dropper, drip a few drops of ethanol on the edges of the paper.



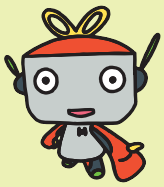
What's Happening?

When ethanol is dripped onto one edge of the piece of paper's surface, it soaks through and spreads, eventually contacting the water below. This makes the paper begin moving suddenly in the opposite direction. This is because when ethanol is dissolved in water, the surface tension around it weakens, and the paper gets pulled in the direction of stronger surface tension. →See P.30

Experiment 2

Let's Fish for Ice Cubes!

Date: (Day)_____,(Month)_____(Date)_____



An age-old, science game that uses string to capture a piece of ice!

What to Prepare


ice cubes


dish


salt

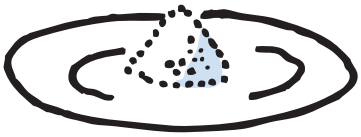

water


dropper


cotton string (20cm length) (8 in)

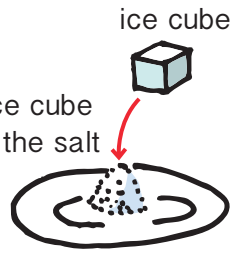
Experiment Method

1 Place a heaping tablespoon of salt in the center of the dish creating a small mound.



1 heaping tablespoon of salt

2 Place an ice cube on top of the mound of salt.

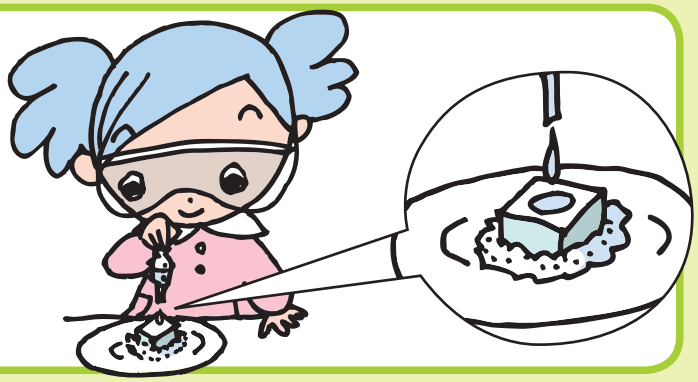


Gently push the top of the ice cube down about halfway into the mound of salt.

Attention!
Don't let any salt get on top of the ice cube!

3

Drip about 3 drops of water on top of the ice cube.

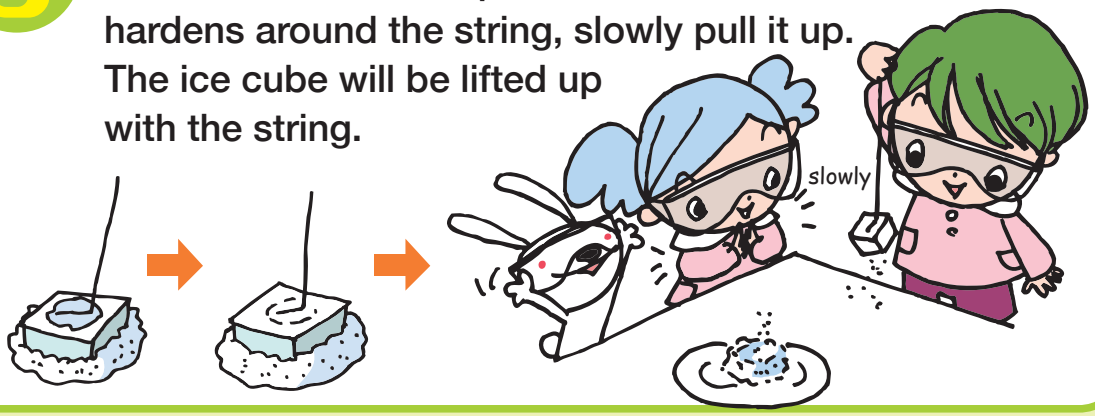


4

Lay one end of the string, about 1 cm (½"), on the top of the ice cube until it is soaking in the ice cube's surface water.

5

Hold the string still and wait a moment. When the water on top of the ice cube hardens around the string, slowly pull it up. The ice cube will be lifted up with the string.



What's Happening?

When the ice cube comes into contact with the salt, that portion of the ice cube begins to melt and absorbs heat in the process, cooling the area just around it. At that moment, water dropped onto the top of the ice cube will freeze over the string. So lifting the string will bring the ice cube up with it. →See P.31

Experiment 3

Suspend Soap Bubbles in the Air!

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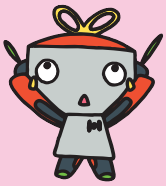


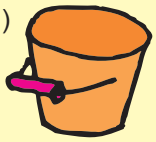
Suspend soap bubbles in the air indoors!

3

What to Prepare

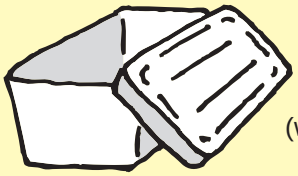
citric acid powder (200g)(7 oz.)

sodium bicarbonate powder (200g)(7 oz.)



small pail

large container (about 30cm [12 in] high, ie. plastic costume case)

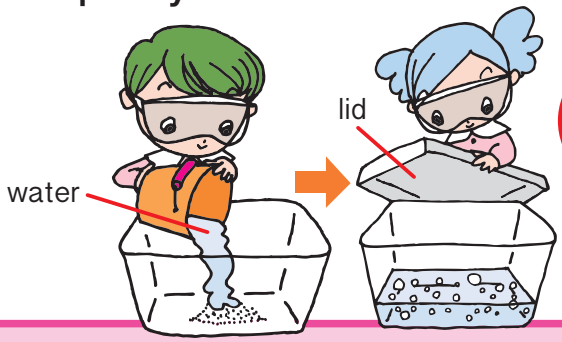


soap bubble kit (with soap bubble liquid and blowing straw)

Experiment Method

1 Pour the citric acid powder (200g) (7oz.) and sodium bicarbonate powder (200g) (7oz.) into a container.

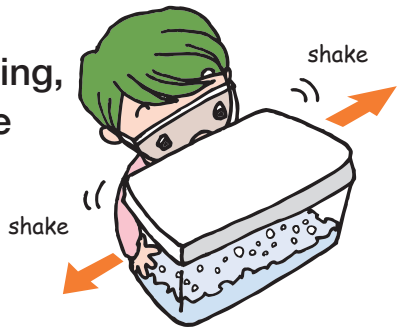
2 Pour a small pail full of water into the container, and quickly cover the container with a lid.



Attention!
Don't seal the lid tightly on the container, but merely set it on top.

3

The water in the container will bubble up. When it stops bubbling, pick up the container and shake it side to side 5 times. The water will begin to bubble up again.



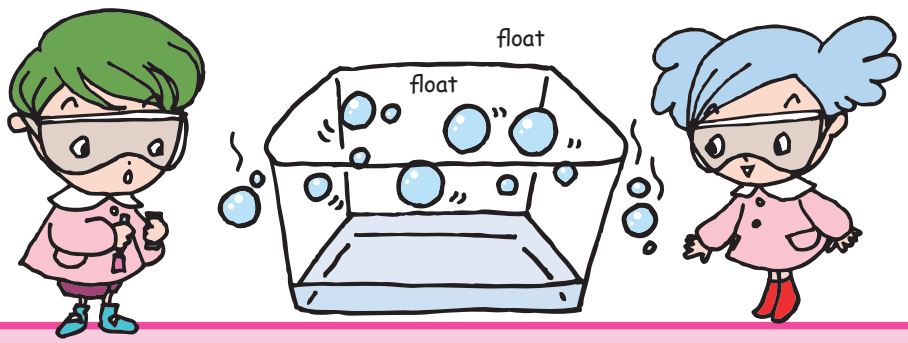
4

Gently remove the lid from the container. Now facing the container, blow soap bubbles over the container.

Attention!
Stand far enough away so that your warm breath doesn't enter the container.

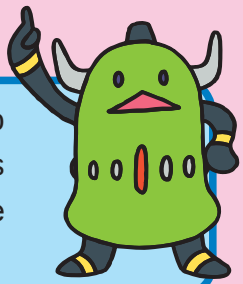
5

Bubbles that successfully enter the container will float suspended near the top.



What's Happening?

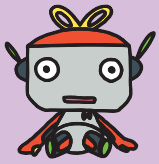
The citric acid powder reacts with the sodium bicarbonate powder to generate carbon dioxide gas, which is heavier than air. This experiment shows how soap bubbles can float in a suspended state upon a carbon dioxide layer. →See P.32



Experiment 4

That's So Cool!

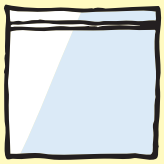
Date: (Day)_____,(Month)_____(Date)_____



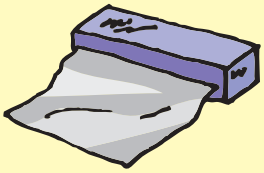
Make a cooling pack that instantly cools the moment you strike it!

What to Prepare

urea (carbamide)



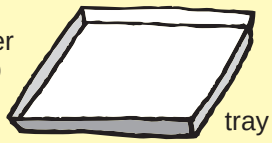
plastic bag with zipper (about 20cm by 20cm) (8 in x 8 in)



aluminum foil (25cm by 25cm) (10 in x 10 in)

paper cup

water



tray

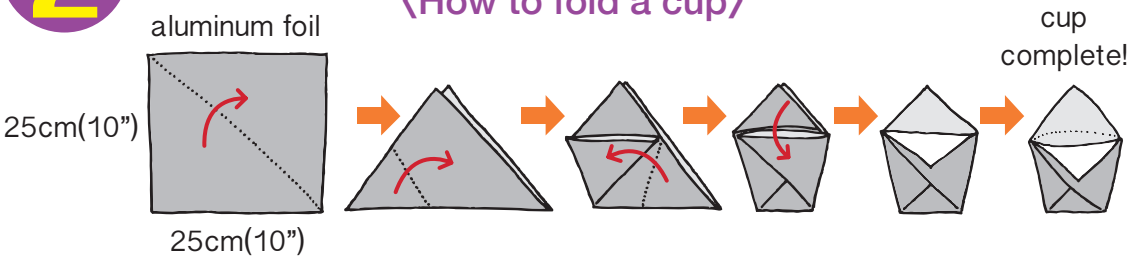
Experiment Method

1 Pour about half a paper cup full of urea into a plastic zipper bag.

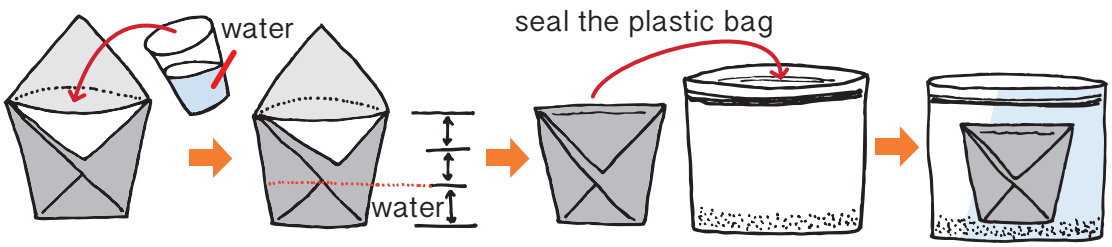
Hold the zipper bag in a tray when pouring urea or water into it.

2 Fold aluminum foil into a cup

〈How to fold a cup〉



3 Fill about one-third of the aluminum foil cup with water, seal it tightly, then place the cup inside the plastic bag.



4 Seal the plastic zipper bag trying to remove as much air from the bag as possible.

With your hands, lightly press on the sides of the bag to remove air.

Carefully seal the bag tightly.

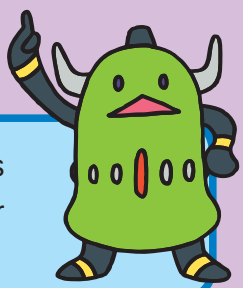
Ask adults to check that the bag is completely sealed.

5 Lay the plastic bag down in the tray, then gently strike it from above with your fist.

Pick up the bag and touch the part that contains water. It's now cool!

What's Happening?

When the cooling pack is struck, the water in the aluminum foil leaks out, causing the urea in the water to dissolve. Dissolving urea in water has a cooling effect on the water, and makes it cold. →See P.34



Experiment 5

Vanishing Art!

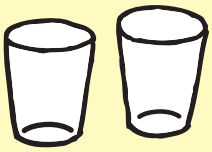
Date: (Day)_____,(Month)_____(Date)_____

Paint a picture with brown-colored water and watch it turn purple. Then make the picture vanish!

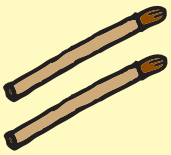
What to Prepare

iodine gargle liquid

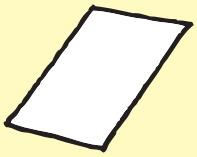
bottled green tea



2 cups



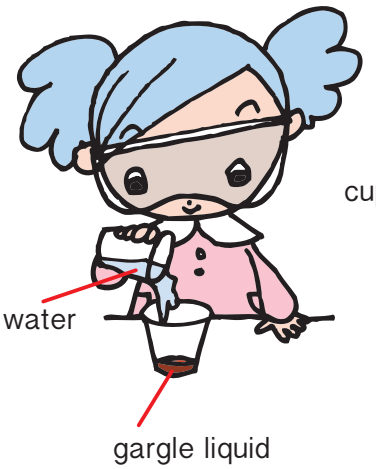
2 paintbrushes or calligraphy brushes

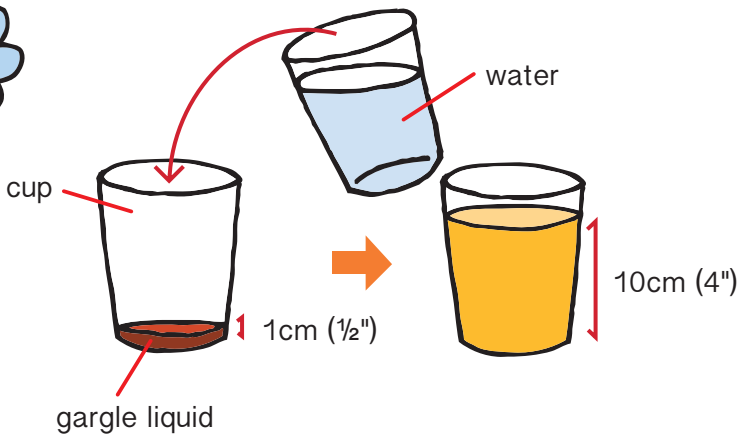


paper

Experiment Method

1 **Pour 1 cm (½ in) of iodine gargle liquid into a cup and dilute it with 10cm (4 in) of water.**

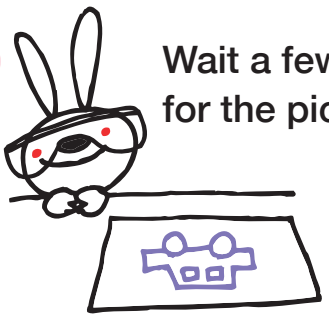




2 Dip a paintbrush into the water-diluted gargle liquid, and paint a picture on paper.

The brown gargle liquid will turn a bluish-purple on the paper.

3 Wait a few minutes for the picture to dry.

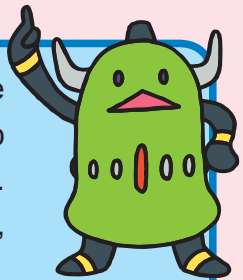


4 Dip another paintbrush into a cup full of bottled green tea, then retrace the lines of the picture you painted.

Retracing the picture will make the bluish-purple drawing disappear!

What's Happening?

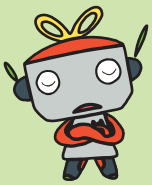
Paper, such as that used in copy machines, contains starch to make the paper strong. This starch reacts with iodine in the gargle liquid to turn it a bluish-purple color. Bottled green tea contains vitamin C. Vitamin C reacts with the iodine, changing its chemical composition, and causing the bluish-purple color to disappear. →See P.35



Experiment 6

Color Magic!

Date: (Day)_____,(Month)_____(Date)_____



Turn purple sweet potato powder into many different colors!

What to Prepare

purple sweet potato powder

transparent cup

stir stick

dry ice
(about 3cm cube)
(1 in cube)

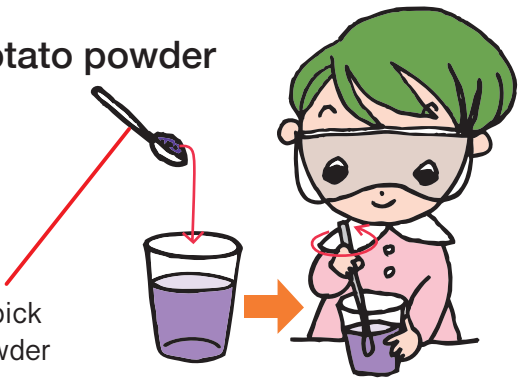
insect bite treatment containing dissolved ammonia

work gloves

6

Experiment Method

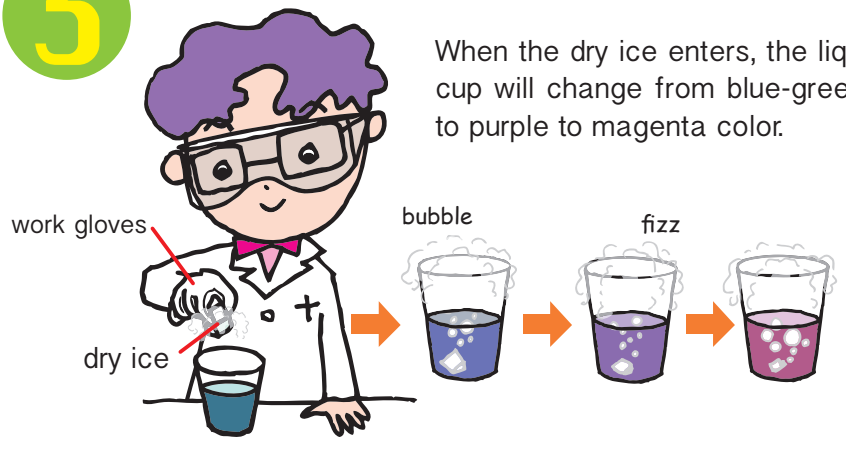
1 Using a stir stick, stir purple sweet potato powder into a cup of water until dissolved.



1 heaping ear pick spoonful of powder

2 Drip 5 droplets of insect bite treatment and mix with the stir stick.

3 Gently drop the dry ice into the cup.



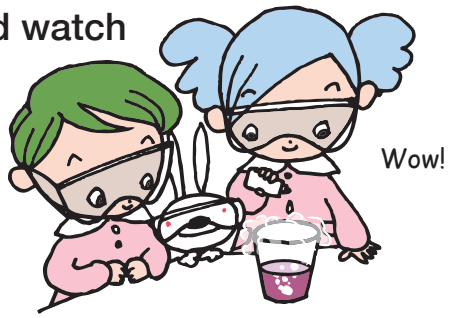
When the dry ice enters, the liquid in the cup will change from blue-green to blue to purple to magenta color.

Attention!
Make sure to wear work gloves when handling dry ice!

4 Now add another 3 drops of insect bite treatment.

The liquid will instantly turn blue-green again. But wait! It will again return to a magenta color.

5 Repeat Step 4 above and watch the colors change again!



What's Happening?

The purple pigment of the purple sweet potato powder changes depending on the acidic or alkaline levels of the liquid it is in. Insect bite treatment containing ammonia is alkaline, while melting dry ice in water turns the liquid acidic, thereby changing its color. →See P.36

Experiment 7

Make a String Phone!

Date: (Day)_____,(Month)_____(Date)_____

Talk with a friend through a string phone!

What to Prepare

2 plastic cups

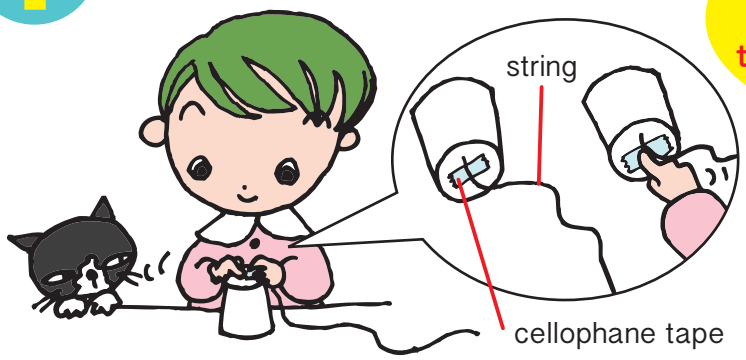
1 meter (3 feet) of string

cellophane tape

balloon

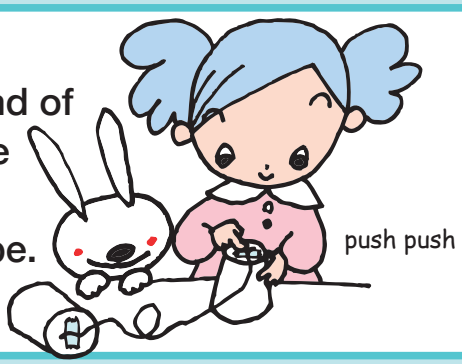
Experiment Method

1 Firmly tape one end of the string to the bottom of one plastic cup.



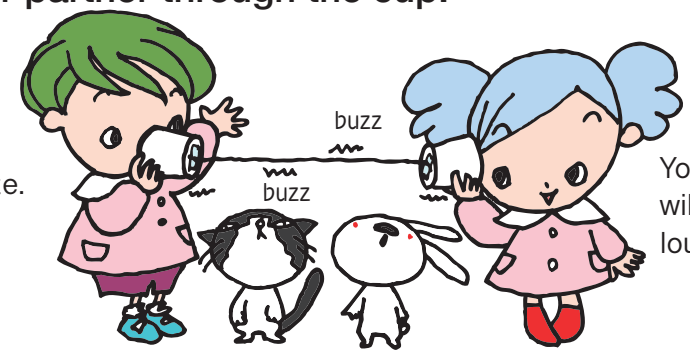
Press the cellophane tape down with your finger to make sure it is firmly attached.

2 Repeat the process with the other cup, taping the other end of the string to the bottom of the other plastic cup, and firmly press down the tape.



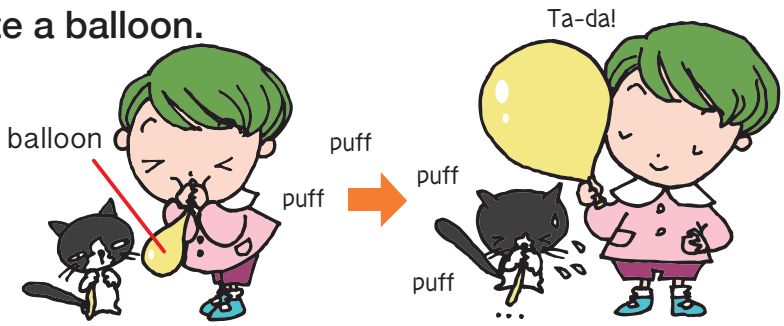
3 Make sure the string is pulled tautly between you and doesn't sag. Then try speaking to, and listening to, your partner through the cup.

The cups and string will vibrate.



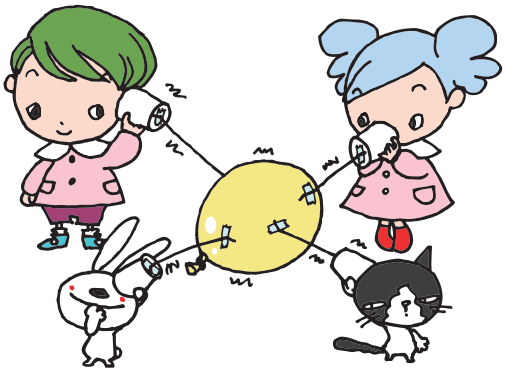
Your partner's voice will sound pretty loud in the cup.

4 Inflate a balloon.



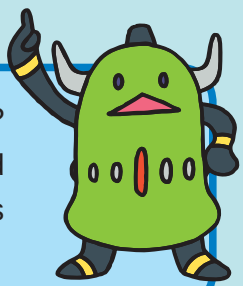
5 Remove the end of one string from one of the cups, and tape it to the balloon.

With the balloon between you and others, you can now talk to many friends through your string telephone! A group chat!



What's Happening?

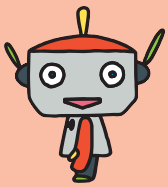
When speaking through a string phone, can you see the cup shaking? This is called "vibration", and that vibration carries the sound of you and your partner's voice. When you speak into the cup, your voice vibrates along the string and travels to your partner's cup. →See P.38



Experiment 8

Fishing with Static Electricity?

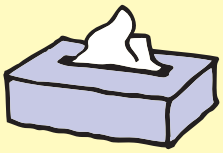
Date: (Day)_____,(Month)_____(Date)_____



Catch fish with static electricity!

What to Prepare

1 wide straw

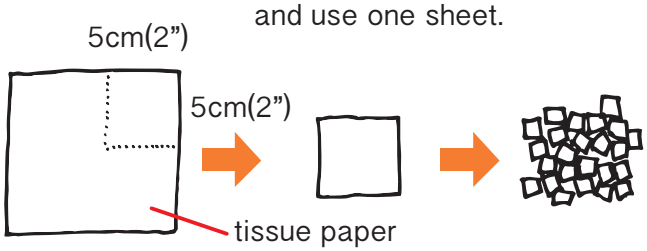


2 sheets of tissue paper

Experiment Method

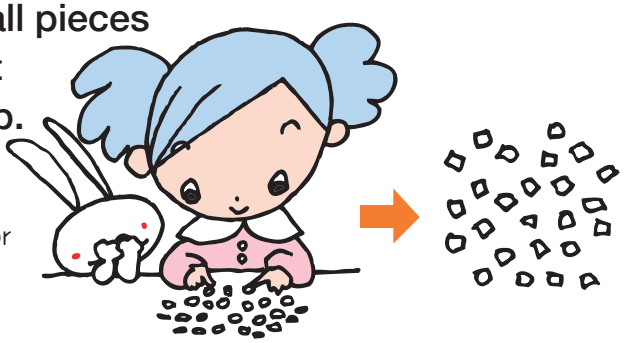
1 Cut a 5cm by 5cm (2 in x 2 in) piece of tissue paper into about 1cm by 1cm (½ in x ½ in) squares.

A sheet of tissue paper is usually 2-ply, so separate them and use one sheet.



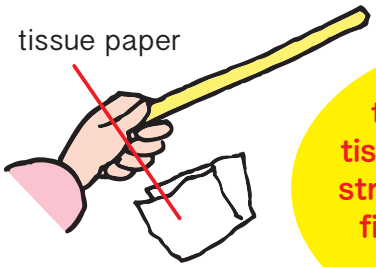
2 Separate the small pieces on a table so that they don't overlap.

Don't breathe too hard or they'll all blow away.

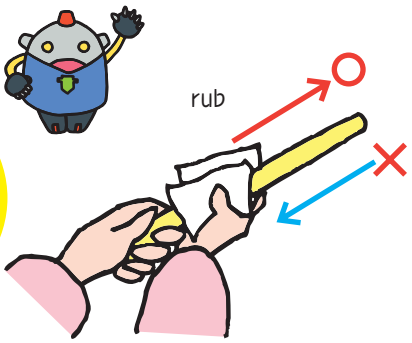


3

Hold one end of the straw, and with another sheet of tissue paper in your other hand, rub the straw about 20 times in the same direction, but not both directions.

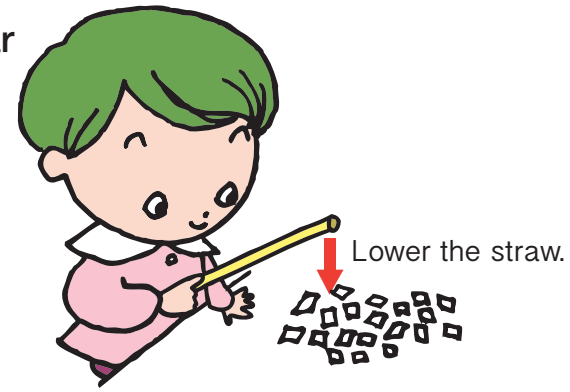


When rubbing the straw, wrap the tissue paper around the straw and rub the straw firmly enough so that the straw flattens as you rub it.



4

Bring the straw near the small squares of tissue paper on the table.

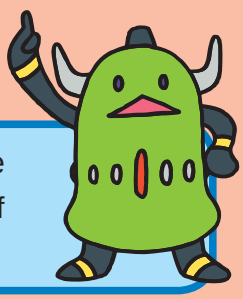


5

The small pieces of tissue paper will begin sticking to the straw.

What's Happening?

Rubbing tissue paper along a straw generates static electricity. The stored up static electricity on the straw causes the small pieces of tissue paper to cling to it. →See P.39



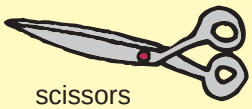
Experiment 9

Make a Static Electric Jellyfish!

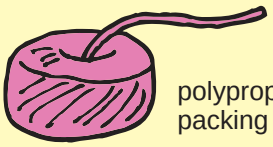
Date: (Day)_____,(Month)_____(Date)_____

Let's make and play with a static electricity jellyfish!

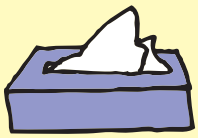
What to Prepare



scissors



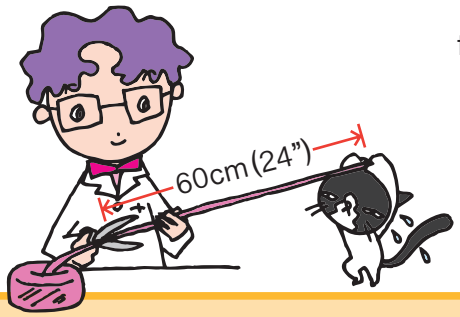
polypropylene packing string

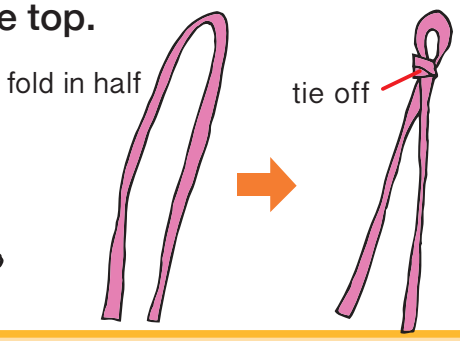


tissue paper

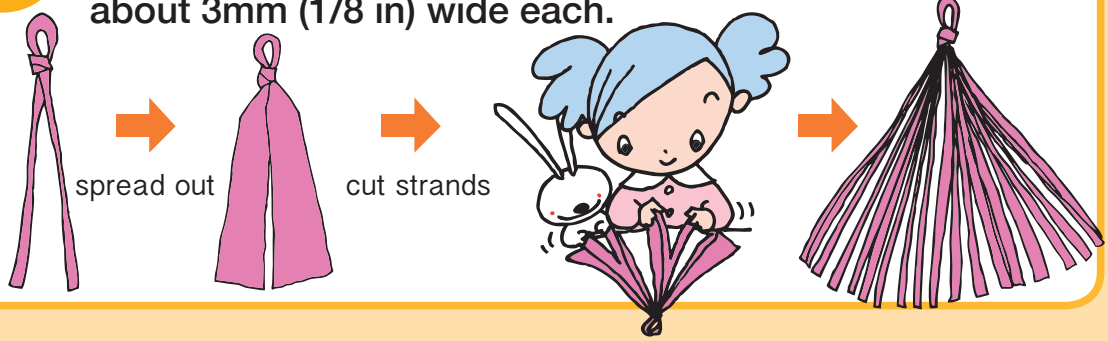
Experiment Method

1 Cut about a 60cm-piece (24 in) of packing string. Fold it in half and tie it off at one end, leaving a small loop at the top.

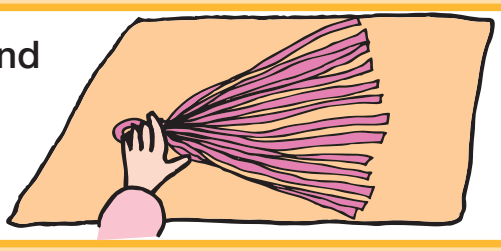




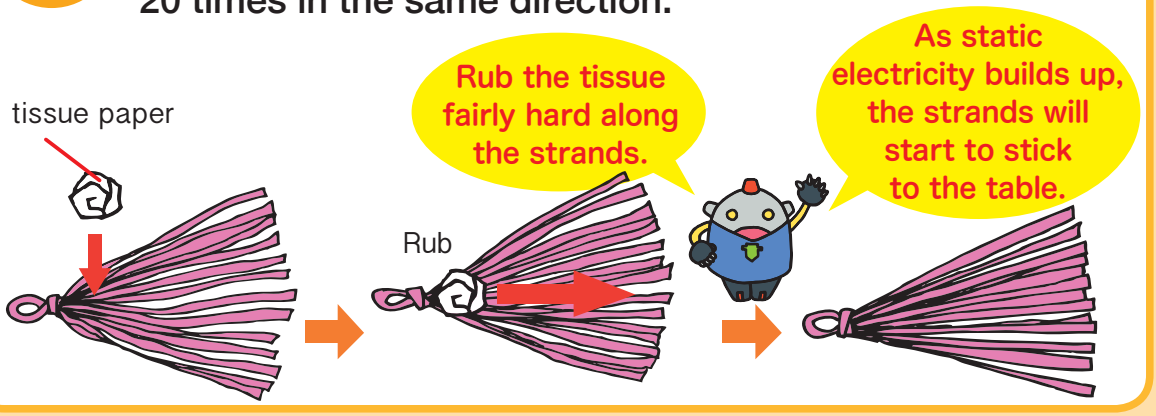
2 Spread out the hanging strands of the string. Then cut the ends into smaller strands about 3mm (1/8 in) wide each.



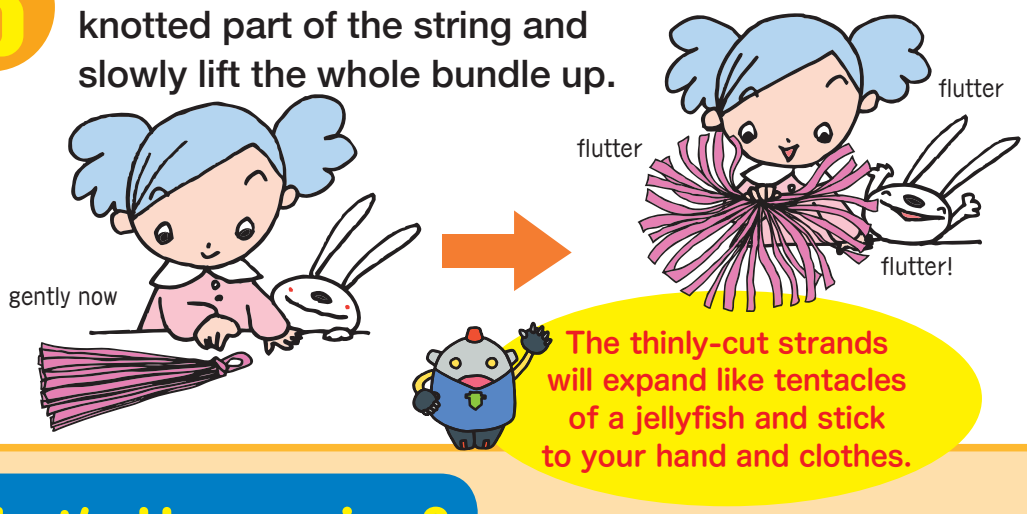
3 Put the string on a table and press down on the knot.



4 Using your other hand, take a piece of rolled up tissue paper and rub it along the strands about 20 times in the same direction.



5 Once enough static electricity is built up, grasp the knotted part of the string and slowly lift the whole bundle up.



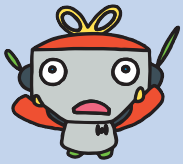
What's Happening?

Rubbing together two different types of materials generates static electricity. Rubbing slick polypropylene packing string with tissue paper stores up negative electricity on each thin strand. When two negatively-charged strands meet, they repel each other, causing the strands to spread out. →See P.40

Experiment 10

Playing with Light!

Date: (Day)_____,(Month)_____(Date)_____



Use a polarizing film to see lots of colors!

What to Prepare

polarizing film

2 paper cups

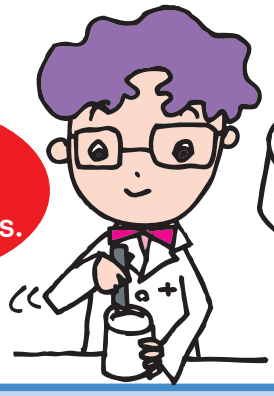
scissors

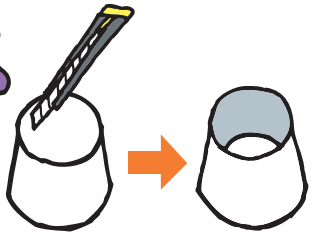
cellophane tape

Experiment Method

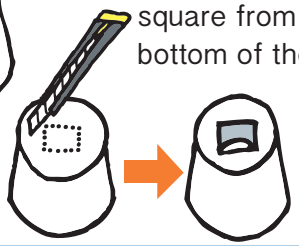
1 Prepare 2 cups with the bottoms cut out.

Attention!
Ask adults to cut the cups.





For one cup, cut out the circular bottom of the cup.

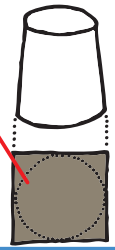


For the other cup, cut a 1.5cm by 1.5cm (½ " x ½ ") square from the bottom of the cup.

2 With a scissors, cut two pieces of polarizing film, one large and one small.

large polarizing film

big enough to cover the mouth of one of the cups.

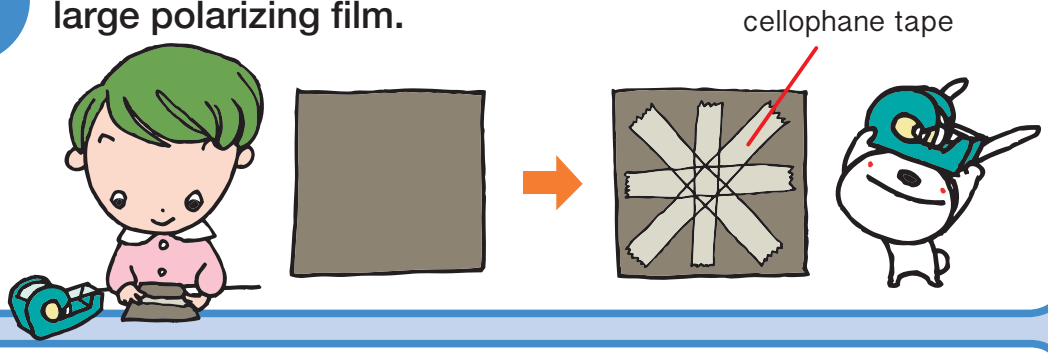


small polarizing film piece.

2cm(2/3")

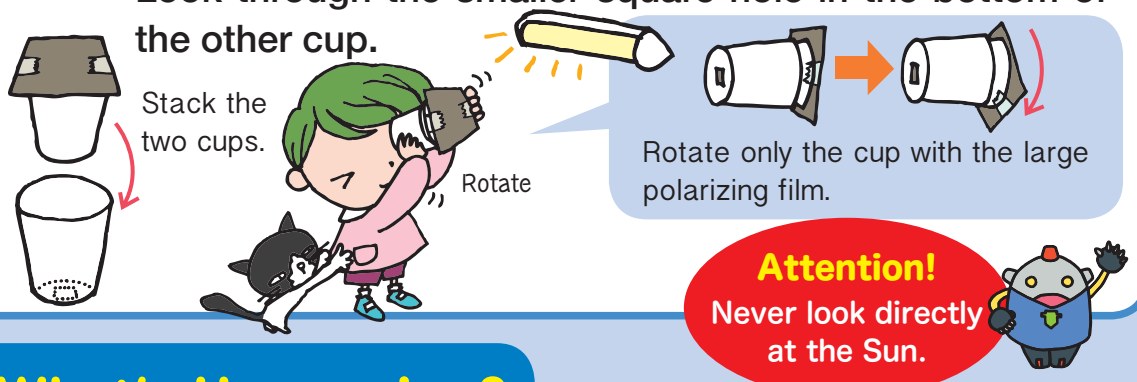
2cm(2/3")

3 Firmly stick several strips of cellophane tape to the large polarizing film.



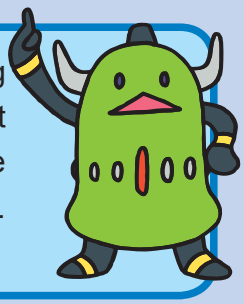
4 Attach the two pieces of polarizing film to the two cups.

5 Place the cup with the large polarizing film inside the other cup, and point it toward a fluorescent light. Look through the smaller square hole in the bottom of the other cup.



What's Happening?

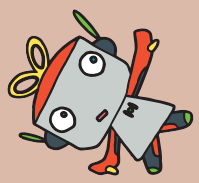
Looking at a light source through one polarizing film while rotating another polarizing film will cause the image to go from clear to dark. But attaching cellophane tape to one of the polarizing films and stacking the films with cellophane tape in between will allow you to see many colors.
→See P.42



Experiment 11

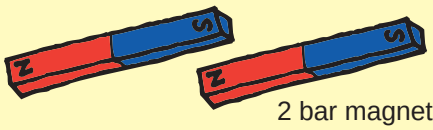
Magnet Magic!

Date: (Day)_____,(Month)_____(Date)_____

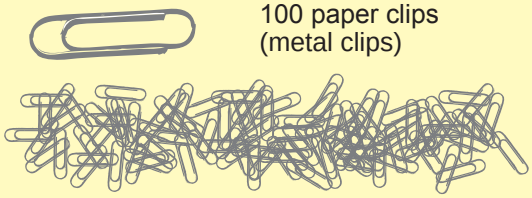


Magnets have the power to attract metal. Use a magnet to conduct many amazing experiments!

What to Prepare



2 bar magnets



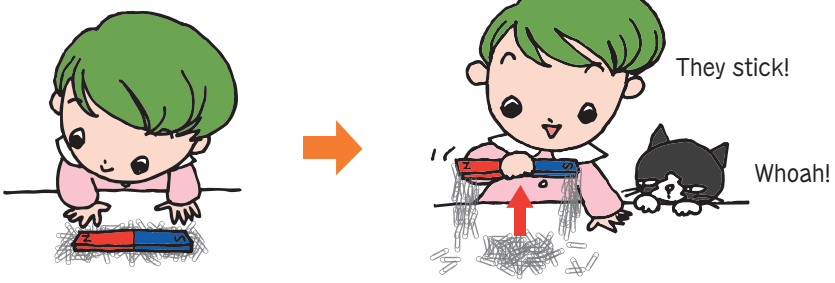
100 paper clips (metal clips)

Experiment Method

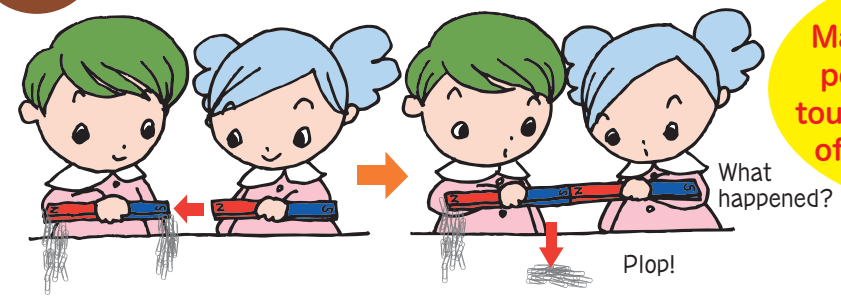
Experiment 1

1 Spread out 100 paper clips on a table.

2 Place a bar magnet on top of the pile of paper clips. Then pick up the magnet.



3 Connect the other bar magnet so that the two magnets are side to side.

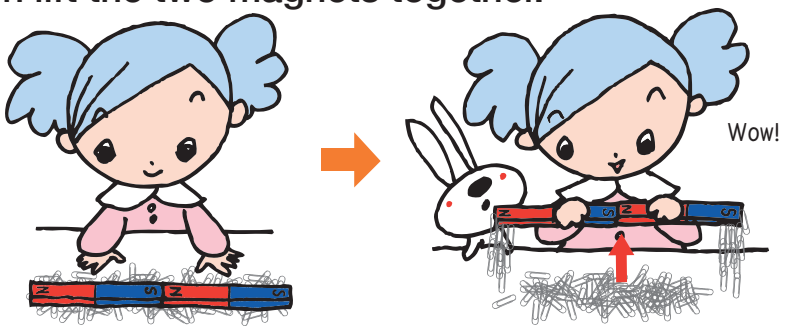


Make sure the south pole of one magnet touches the north pole of the other magnet

Experiment 2

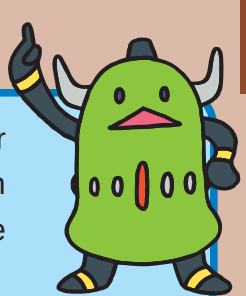
4 Spread 100 paper clips out in a pile on a table.

5 Connect the two bar magnets side by side. Then lay them on top of the pile of paper clips and then lift the two magnets together.

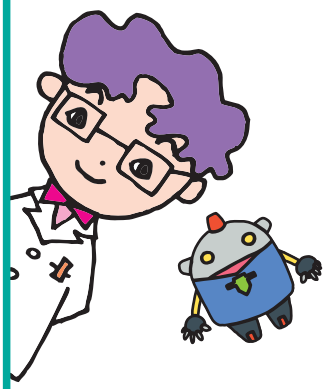


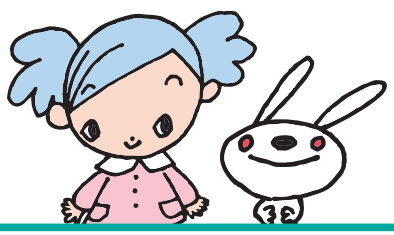
What's Happening?

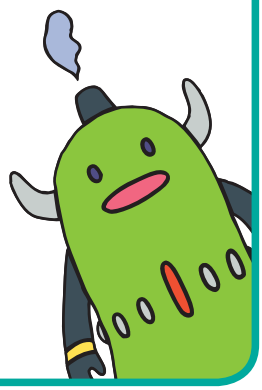
Magnets attract metal objects. This is called magnetism. With bar magnets, the magnetic force on the ends is at its strongest. Even when connecting two bar magnets side to side, the far ends will still have the strongest magnetism.→See P.43



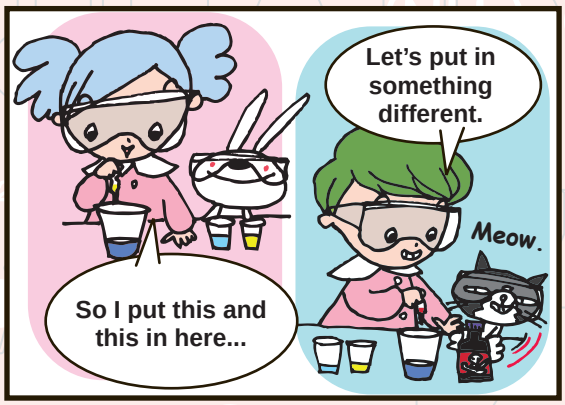
Free Drawing Space

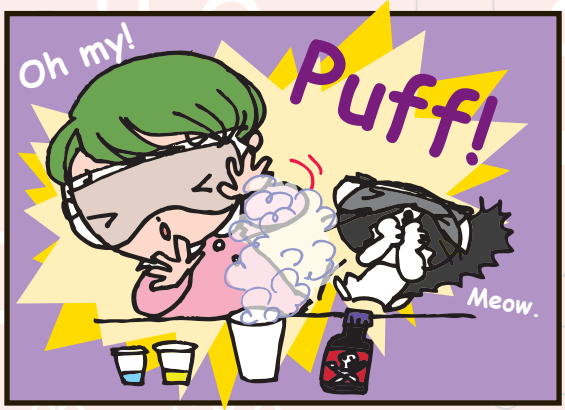


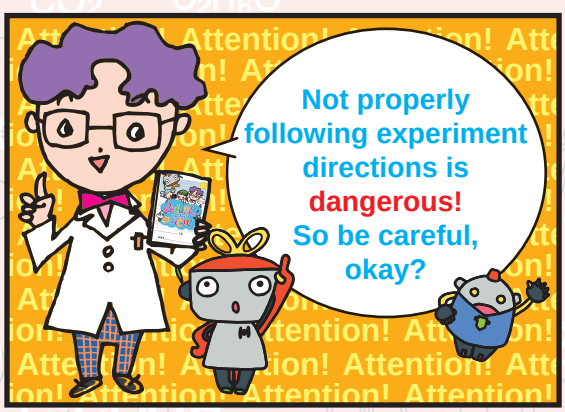


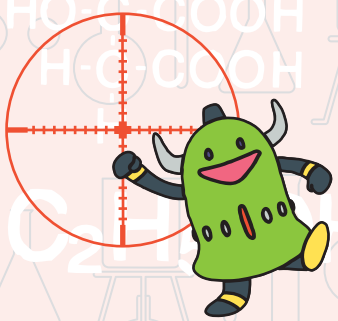


Let's do an experiment!









User Guide for Guardians and Instructors

Tips and pointers for conducting these experiments with children.

Experiment 1
Make Paper Glide on Water!

An experiment for moving a piece of paper across the surface of water without the use of hands.

Tips for a Successful Experiment

To ensure that the experiment goes smoothly, start by explaining the use of a dropper and give instruction on its proper use.

When conducting the experiment with multiple participants, use a large tub instead of a tray to hold water to ensure that many participants can enjoy the experiment together.

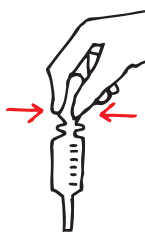
How to use a dropper

❶ How to hold a dropper

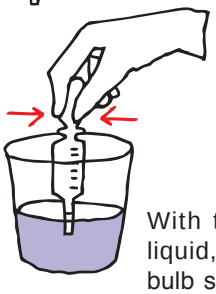
Grasp the round bulb of the dropper.

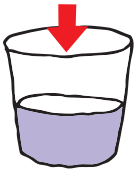
Point the tip of the dropper directly downward.

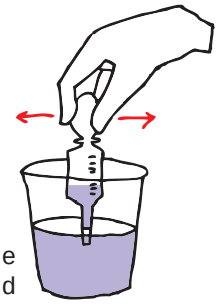
❷ How to draw up liquid with a dropper



Squeeze and deflate the round bubble of the dropper, then dip the dropper's tip into the liquid.



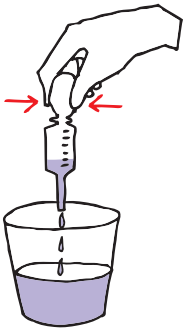




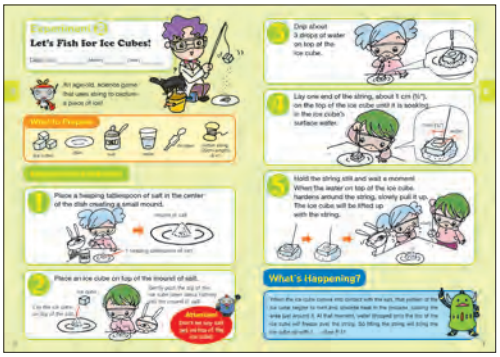
With the tip of the dropper in the liquid, relax your grip on the round bulb so that it re-inflates and returns to its original shape. When the bubble re-inflates to its original shape, liquid will be drawn up into the dropper.

❸ How to release liquid from the dropper

Remove the tip of the dropper from the liquid, then squeeze the round bubble to release the liquid from the dropper.



MEMO



Experiment 2
Let's Fish for Ice Cubes!

An age-old, science game that uses string to capture a piece of ice!

Tips for a Successful Experiment

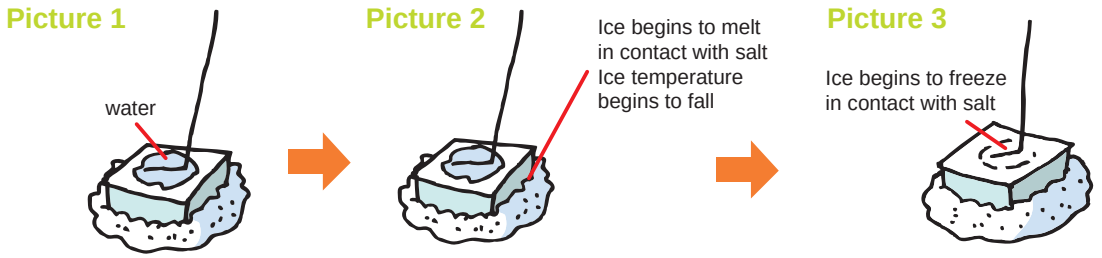
For this experiment, use string that absorbs water well. If the string is of a type that repels water, soak it in water first, work the water into the string with your fingers to make it absorbent. During the experiment, the timing for raising the string so that the ice cube attaches to it occurs when the water on the surface of the ice has frozen around the string.

Make sure that salt does not contact the surface of the ice cube. If that occurs, the water will not freeze, and the ice cube will not stick to the string when lifting. If you're having trouble capturing the ice with the string, prepare the ice cube and salt again.

Experiment Explanation

When salt is mixed with the ice, you create a temperature that is below the ice's freezing point to about minus 20°C (68F) if all goes well. The resulting blend of ice and salt can then be used as a refrigerant. When contacted by salt, ice begins to melt, lowering the ice temperature. By placing an ice cube on top of a mound of salt (Picture 1), the lower portion of the ice cube in contact with the salt starts melting, and temperature drops (Picture 2). When that happens, the temperature near the top of the ice cube's surface also begins to drop, and the water on the surface of the ice cube will start to freeze (Picture 3). When this happens, the water will also freeze around the tip of the string so that raising the string will also raise the ice cube with it. Observe how the water on the surface of the ice cube begins to freeze. The timing for when to raise the string is when you can see that the water on the ice cube's surface has frozen solid.

You can conduct this experiment even without the use of salt. When ice cubes are removed from a refrigerator freezer of 0°C (32F) or lower in temperature, the ice will being to melt allowing you to freeze the surface of the ice cube around a piece of string, and raise it up. But use salt in this experiment to demonstrate its effect on ice as the ice melts and its surface hovers near the freezing point of 0°C (32F).



Experiment 3
Suspend Soap Bubbles in the Air!

Suspend soap bubbles in the air indoors!

Tips for a Successful Experiment

The children are likely to be tempted to blow soap bubbles toward the container in an attempt to get the bubbles inside the container. But doing this will scatter the carbon dioxide that has built up in the container. When blowing the soap bubbles, instruct the children to blow the bubbles above the container as opposed to into it. Soap bubbles that successfully enter the space above the container will remain floating near the top of the container's opening. On the other hand, soap bubbles that don't enter the container will not remain afloat and will drop to the ground. While there is a tendency to focus only on those soap bubbles that remain afloat, it is instructive for participants to observe this difference.

Experiment Explanation

Sodium bicarbonate powder and citric acid do not react with each other when mixed together, but do react when dissolved in water. When this occurs, it generates carbon dioxide gas. Because the gas is heavier than air, it will settle for a while in the container. Soap bubbles that enter the container's space will then float on the carbon dioxide strata. Because carbon dioxide is a colorless gas, it is not visible to the eye, but the children will be able to notice that something is there keeping the soap bubbles afloat.

■ About Soap Bubbles

When blowing soap bubbles outdoors, they float up into the sky. This is because wind and air currents outside carry them up. Indoors, however, where air is relatively still, soap bubbles quickly fall to the floor. Children may tend to assume that soap bubbles will automatically float up into the air. Try blowing a few soap bubbles indoors prior to conducting this experiment to demonstrate how they immediately descend. This will convey to the children the significance of the experiment. Eventually, even the soap bubbles floating on the carbon dioxide gas will gradually drop over time. This is due to the carbon dioxide in the container slowly escaping.

■ About Having a Large Container

Use a large translucent container such as a clothing or costume storage case. This will allow participants to observe many bubbles forming inside from the reaction between sodium bicarbonate powder and citric acid as gas is formed.

Simply place a lid over the top of the container while it is forming gas. It is not necessary to seal the container securely.

■ About Effervescent Bath Salts

Reacting sodium bicarbonate powder with acid will generate carbon dioxide. This employs the same principle as when putting an effervescent bath ball into bath water. Children will feel a greater connection with science if you demonstrate this familiar chemical reaction from everyday life.

Effervescent bath salts contain fumaric acid and sodium bicarbonate powder (labeled on product packages as sodium hydrogen carbonate). Solid effervescent bath agents containing these chemicals will melt in hot water, initiating a chemical reaction. The carbon dioxide that is created from this reaction is said to have a heat insulating effect, and is therefore used in bath salts.

Bonus Experiment : **Cool the palm of your hand**

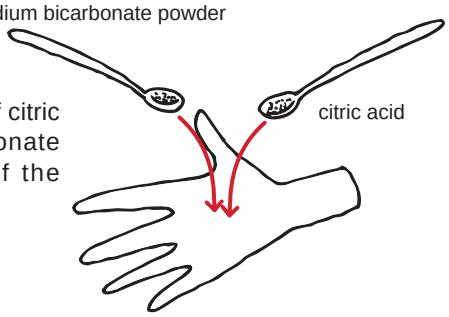
Sodium bicarbonate powder and citric acid react together to absorb heat, leaving the affected area cooler to the touch. This can be shown with a brief experiment that creates a cooling sensation in the palm of the hand. Experiment 3 may be more effective if this experiment is done first.

What to Prepare

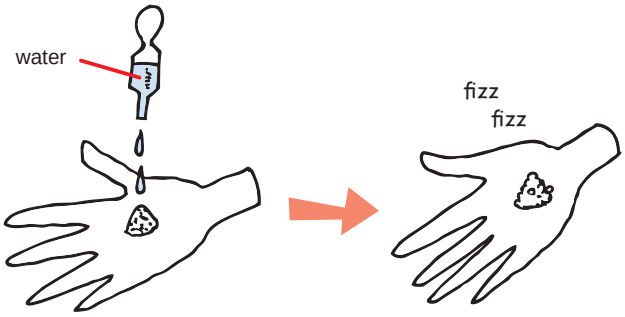
Sodium bicarbonate powder, citric acid powder, a small stirring spoon, dropper, water, cup

Experiment Method

❶ Place a small amount of citric acid and sodium bicarbonate powder in the middle of the palm of your hand.



❷ Using a dropper, drip 3-5 drops of water onto your palm over the powder.



* Dripping water will cause bubbles to start forming, indicating the chemical reaction has begun. The reaction absorbs heat, making the affected portion of your hand feel cool.
* Wash your hands after each experiment!

Experiment 4
That's So Cool!

Make a cooling pack that instantly cools the moment you strike it!

Experiment Explanation

Dissolving urea in water produces a cooling effect. This is the principle that is employed in commercially-available cooling packs. If measured with a thermometer, the drop in temperature is about 10-15°C (50-60F). Not only urea, but also any substance can change temperature of water. For example, dissolving table salt in water will lower water temperature by a few degrees centigrade. On the other hand, dissolving sodium hydroxide or anhydrous calcium chloride (used in dehumidifying agents) raises temperature.

Urea is a substance that can have a soothing cooling effect on the body when one is sick or injured. Commercial cooling packs contain ammonium nitrates in addition to urea to increase that effect.

Urea can be purchased online, at pharmacies or in gardening stores as nitrogen fertilizer. Because this experiment requires water, conduct it over a tray to avoid getting clothes and other things wet.

■ Experiment Warnings

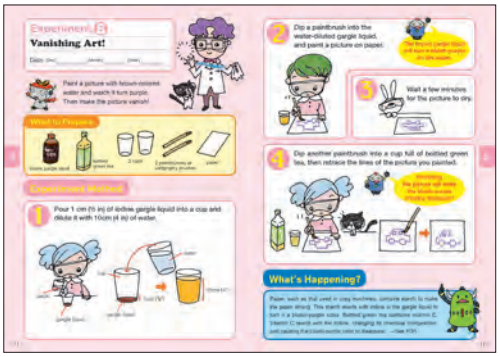
In Step 4 of this experiment, it is important to remove as much air as possible from the bag when sealing the plastic bag with its zipper. Otherwise, the pressure of leftover air molecules trapped in the sealed bag may force open the seal on the bag when the bag is struck in Step 5. Before sealing the bag, lightly press on the sides to remove as much air from inside the bag as possible.

In Step 4, check to make sure the plastic bag is completely sealed. If it is even slightly open, water will seep out.

■ Cleaning Up after the Experiment

Drain the urea away in the sink. After draining, you may get some urea on your hands, which will feel slippery. If so, wash your hands well with water. Any urea still in the sink may form crystals after a few days, so wash the sink well to ensure that no urea remains. Follow your local disposal rules when disposing of aluminum foil and plastic zipper bags.

Urea from the experiment can also be used as botanical fertilizer. When doing so, sow a small amount in soil away from plant roots. Pouring all of the urea from the experiment onto plants may rot the roots, so please be careful.



Experiment 5
Vanishing Art!

Paint a picture with brown-colored water and watch it turn purple. Then make the picture vanish!

Experiment Explanation

Most paper has been treated with starch to reinforce its strength. Starch is a common substance found in rice and potatoes. When mixed with the iodine contained in gargle liquid solution, it reacts to turn the liquid a bluish-purple.

Bottled green tea contains vitamin C, which also reacts with iodine to convert the iodine's chemical composition. As a result, the iodine starch stops reacting, and the bluish-purple color disappears. Since lemon juice contains vitamin C, it is a good substance for this experiment.

Some paper does not contain starch, so check to see what kind of paper contains starch.

Iodine can be purchased in pharmacies (for example, in gargle solution or povidone-iodine disinfectants).

For this experiment, prepare a calligraphy or paintbrush, gargle solution (or povidone-iodine) and 2 bottles of green tea. If you insert a paintbrush that has been dipped in gargle solution into the green tea, the iodine remaining in the brush will react with the vitamin C. If you have only one brush to use, be sure to rinse the brush well with water after each use.

Demonstration Experiment

This is a demonstration using starch paste to show how colors can change.

What to Prepare

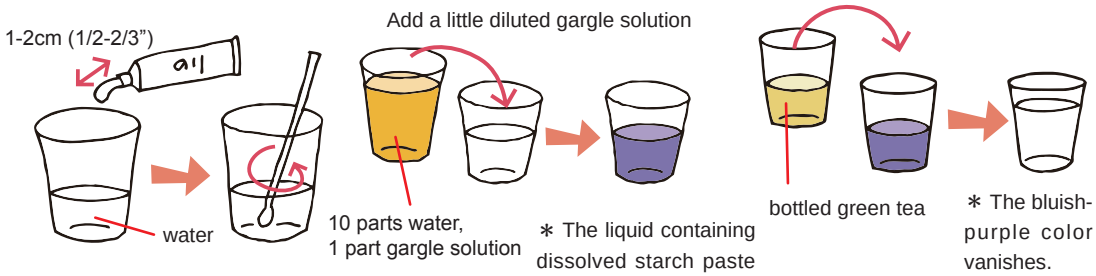
Solution containing iodine, starch paste, transparent cups, stirrer, bottled green tea

Experiment Method

❶ Fill a cup about 40 percent with water, add starch paste (1-2cm length)(1/2-2/3 in) and stir well until dissolved.

❷ Now add a little bit of gargle solution that has been diluted in water about 10 parts water to 1 part medicine.

❸ Fill another cup about 40 percent with bottled green tea and add to the cup in ❷ above.



∗ It is okay if not all of the starch paste dissolves

∗ The liquid containing dissolved starch paste will turn bluish-purple.

∗ The bluish-purple color vanishes.

Experiment 6
Color Magic!

Turn purple sweet potato powder into many different colors!

Experiment Explanation

Purple sweet potato dye contains a pigment called anthocyanin. The purple color of a liquid into which purple sweet potato dye has been dissolved will change as the liquid goes from alkaline to acidic in nature: blue-green → blue → purple → magenta → red. Insect bite treatment containing ammonia is an alkaline substance. Dry ice is solid carbon dioxide. When converted from a solid to gas form by being dissolved in water, the dry ice reveals itself as an acidic carbon dioxide gas. Although adding insect bite treatment to the purple sweet potato-dyed liquid changes the color to blue-green, adding dry ice will neutralize the liquid, turning it from alkaline to neutral and then acidic, resulting in changes in the liquid color: blue-green → blue → purple → magenta.

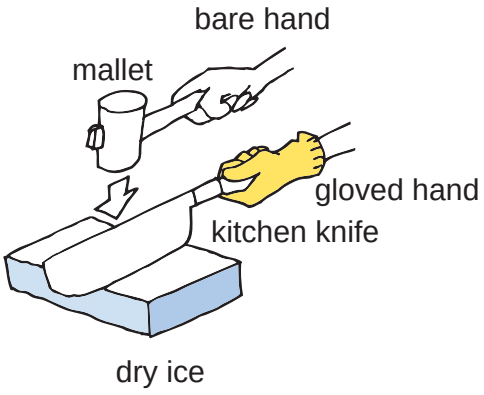
Purple sweet potato dye powder can be purchased online. Ammonia-based insect bite solution can be purchased in pharmacies. An internet search should also tell you where you can purchase dry ice.

■ Warning when using ammonia-based insect bite solution

Ammonia has a pungent odor, so take extra care not to inhale it directly. Pouring some of the solutions into a container, such as an empty dropper bottle, will reduce the odor's pungency. Also, some lids may require use of a flathead screwdriver to open, so be extra careful when using it.

■ Handling Dry Ice

Only adults should handle dry ice. When doing so, be sure to wear work gloves. Never handle dry ice with your bare hands. During the experiment, use solid, not crushed, dry ice. You can cleanly break the dry ice into 2-3cm(1 in cubes) square blocks by placing the blade edge of a kitchen knife on the surface and tapping the knife blade (blunt side) from above with a mallet. Be sure that you wear a work glove on the hand holding the kitchen knife to prevent slippage. It's best not to wear a work glove on the hand that holds the mallet.



Demonstration Experiment

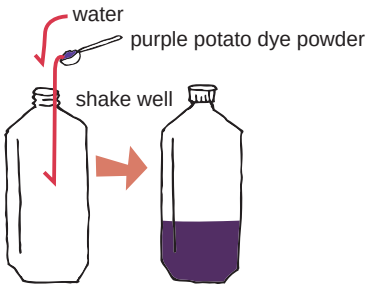
Conduct the experiment on a larger scale to more clearly see color changes.

What to Prepare

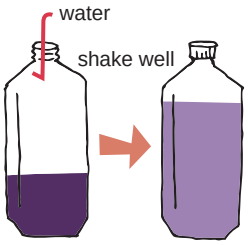
Purple sweet potato dye powder, plastic bottles (2L)(68 fl.oz), large graduated cylinder (1L)(34 fl.oz), ammonia-based insect bite solution (in an eye drop cup), 2-3 blocks of dry ice (2-3cm cubes) (1 in cubes), toilet detergent containing hydrochloric acid, a tray

Experiment Method

❶ Fill about one-third of a 2-liter (68 fl.oz) plastic bottle with water containing purple sweet potato dye powder (about 10 heaping ear pick spoonfuls, app. 20-50mm) (2/3 in – 2 in), then cap the bottle and shake vigorously until the powder is dissolved.

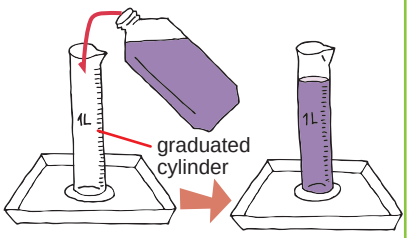


❷ Fill the plastic bottle to about 80 percent with water and shake vigorously until the liquid has turned a consistent color.

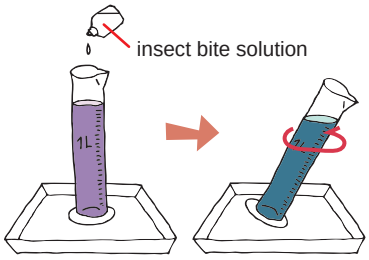


❸ Pour 1 liter (34 fl.oz) of the dissolved purple potato powder liquid into a large graduated cylinder.

Place the graduated cylinder in the center of a tray.



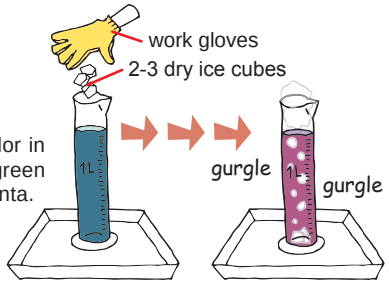
❹ Add a few drops of insect bite solution, and then rotate the graduated cylinder in a circular movement to mix the solution in well. Repeat this process until the purple liquid turns blue, and then stop adding insect bite solution.



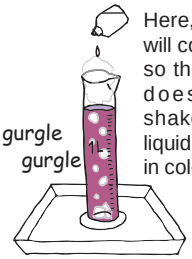
The purple liquid will start to change to blue-green from above.

❺ Drop 2-3 dry ice cubes into the graduated cylinder.

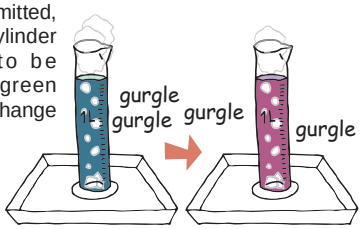
The liquid will change color in the following order: blue-green → blue → purple → magenta.



❻ When the liquid turns a magenta color, add about 3 more drops of insect bite solution.



Here, carbon dioxide gas will continue to be emitted, so the graduated cylinder does not need to be shaken. The blue-green liquid will instantly change in color from above.

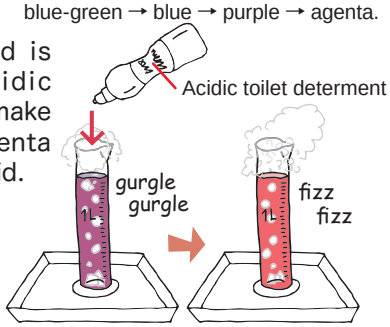


Wait and watch the color changes; blue-green → blue → purple → agenta.

❼ When the liquid turns magenta, repeat Step 6 to continue watching the colors change.

❽ When the liquid is magenta, add acidic toilet detergent to make the red in the magenta liquid even more vivid.

The detergent contains surfactants which cause immediate bubbling up.



Warning: Hydrochloric acid is a powerful acid so do NOT let children handle it. If by chance it gets on hands, rinse away well with water right away.

Experiment 7
Make a String Phone!

Talk with a friend through a string phone!

Tips for a Successful Experiment

Children may have difficulty when cutting cellophane tape. Please show them how. Pull out a short length of cellophane tape, turn the tape a little to one side and pull down. Many children try to pull the tape straight down without turning it, which requires considerably more strength, and makes the tape harder to tear off.

Experiment Explanation

The point of this experiment is to make children aware of how the cups vibrate when talking into or listening to them. When the speaker speaks into a cup, it vibrates. The vibration travels along the string and vibrates the listener's cup on the other end, conveying the sound of the voice. Talking through string-and-cup phones attached to a balloon also demonstrates balloon vibration.

The string can be lengthened to make longer-distance phone calls. If you have access to open space outside, try an experiment to see how far apart the speakers can go from each other and still converse through the string phone.

Related Experiment : Use an enamel wire!

Instead of string, use a piece of enamel wire. The vibration of sound when using a metal wire will make it sound like one is talking inside of a tunnel.

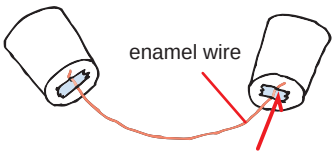
What to Prepare

2 plastic cups, 1m-length (3ft) of enamel wire, cellophane tape

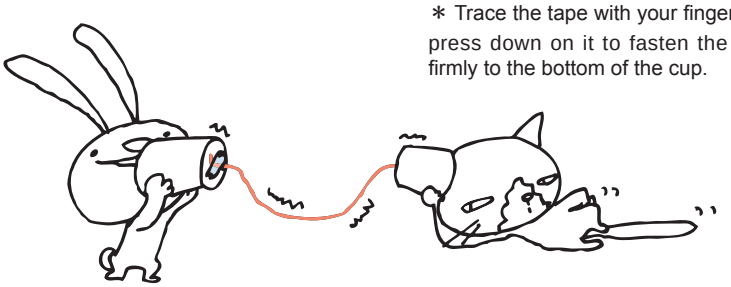
Experiment Method

❶ Using cellophane tape, tape the ends of the enamel wire firmly to the bottoms of two cups.

❷ Now make a call!



＊ Trace the tape with your finger and press down on it to fasten the wire firmly to the bottom of the cup.



＊ For metal wiring, you can still hear each other even if the string is not taut.

Experiment 8
Fishing with Static Electricity?

Catch fish with static electricity!

Experiment Explanation

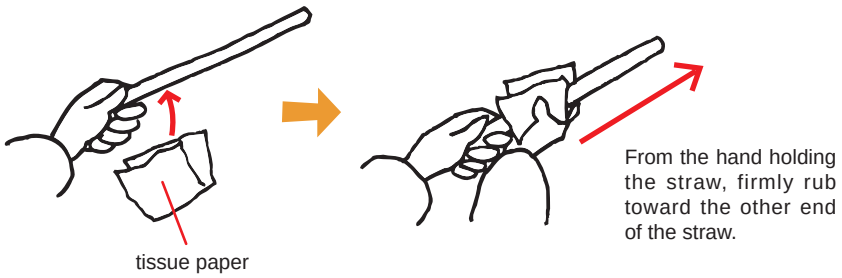
Rubbing a straw with tissue paper gathers up negative static electricity on the straw. Small scraps of tissue paper will start clinging to the straw as you bring it toward them since the positively-charged tissue paper are attracted to the negatively charged straw.

Bonus Experiment : Using a Straw

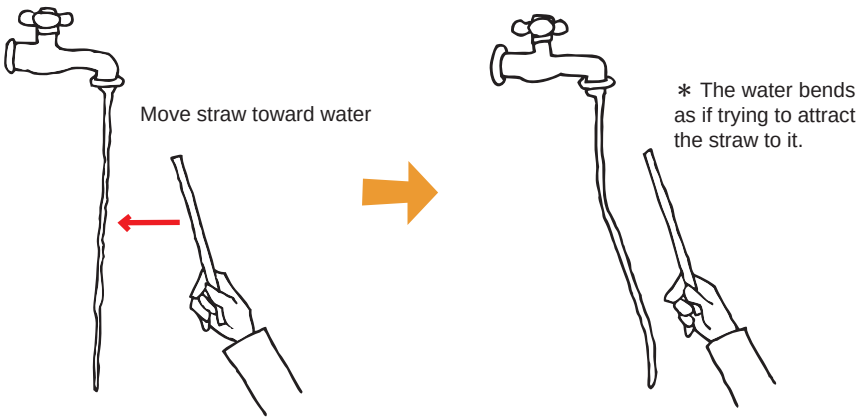
Rubbing a straw with tissue paper collects negative static electricity on the straw. But water molecule contain both positive and negative electricity portions. The portion of water molecule with positive electrical charges are attracted to the negatively-charged static electricity stored on the straw, causing a stream of water to bend.

Experiment Method

❶ Rub a straw with a tissue paper in the same direction about 20 times.



❷ Turn on a water faucet and release a thin stream of water. Bring the straw close to the stream.



Experiment 9
Make a Static Electric Jellyfish!

Let's make and play with a static electricity jellyfish!

Tips for a Successful Experiment

For this experiment, you will need to use polypropylene (PP) or polyethylene (PE) packing string. Most packing string comes in 2-ply form. For this experiment to succeed, each strand of string should be as lightweight as possible to promote greater expansion when storing up static electricity. Spreading out the 2 pieces of string in Step 2 of the Experiment Method. If you keep the 2-ply formation intact when further cutting the string into 2-3mm-wide (1/8in) strips, you will automatically double the number of strands, making for a more successful experiment.

When children are conducting the experiment and rubbing the packing string with tissue paper, they often hold the string upwards, but this can cause the string to string strands to start spreading out before they have stored up a lot of static electricity, preventing the strings from fully expanding. To avoid this, tape down the knot on a table using cellophane tape and instruct the children to press down on the knot portion with one hand as they rub using the tissue paper with their other hand. When the string has stored up plenty of static electricity, remove the cellophane tape. Then instruct them to grasp the knot and slowly raise the string bundle from the table. This will ensure that the experiment works to its full effect.

Experiment Explanation

Rubbing together two different types of substances collects static electricity. The following is a “triboelectric series” chart showing what materials tend to store either positive or negative static electricity. If you want to collect a lot of static electricity, rub together two items that are farthest apart from each other on the chart.

Charge rate

positive														negative
acrylic (rod or plate)	glass	human hair	nylon	wool	fur	aluminum	paper	cotton	rubber	acrylic (fiber)	polypropylene	polyethylene	polyvinyl chloride	

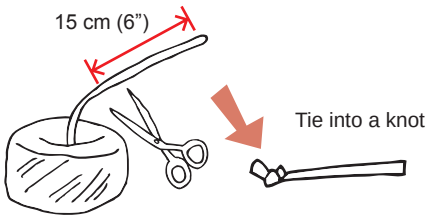
Demonstration Experiment

This is an experiment demonstrating the collection of static electricity. When conducting this experiment, repeated practice is recommended beforehand. The balloons for this experiment should be of the long and thin variety used for balloon art.

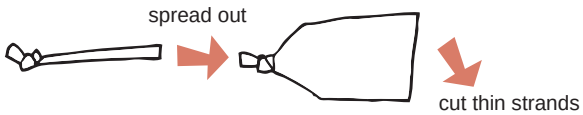
What to Prepare polypropylene (or polyethylene) packing string, scissors, long art balloons, wool scarf

Experiment Method

❶ Tie a knot near the end of a piece of packing string about 15cm (6in) in length.

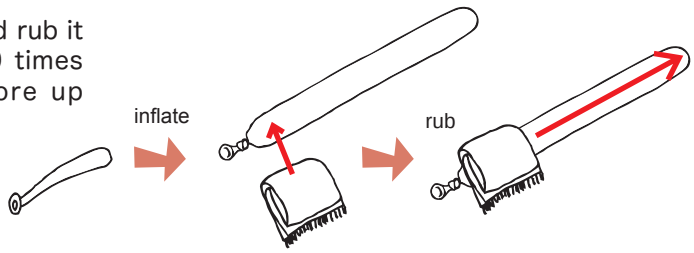


❷ Spread out the string and then cut 1-2mm (0.1in) wide strands.

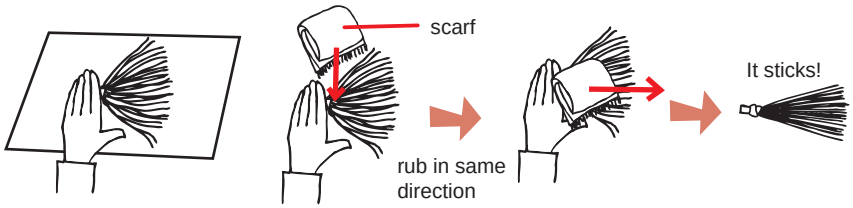


＊ Most packing string is 2 ply, so cutting 1-2mm (0.1in) wide strands should automatically double the number of strands.

❸ Inflate an art balloon and rub it in one direction about 20 times with a wool scarf to store up static electricity.

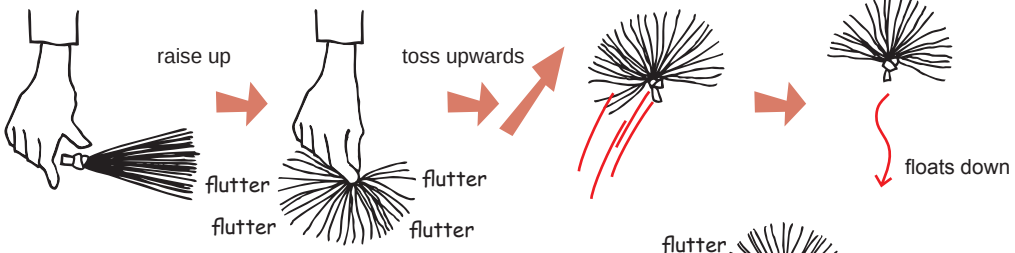


❹ On a table, hold down the knotted end of the string bundle, and using the wool scarf, rub the strands away from the knot about 20 times to store up static electricity.



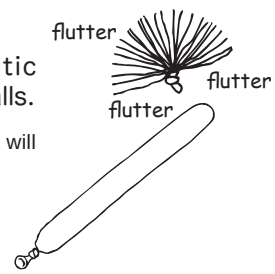
＊ Apply firm force when rubbing.
＊ When static electricity builds up, the string should stick to the table.

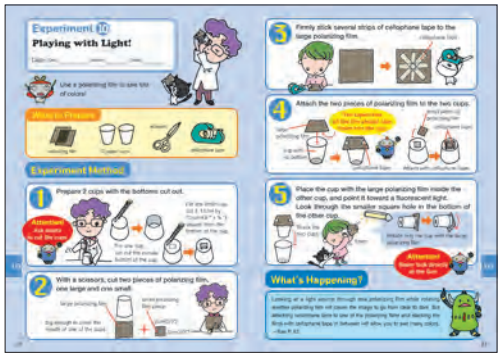
❺ Grasp the knot of the string bund and gently pull it directly upwards.



❻ Quickly hold the balloon with stored up static electricity directly under the tossed up bundle as it falls.

＊ Holding the balloon under the string bundle in just the right way will keep the string afloat.





Experiment 10
Playing with Light!

Use a polarizing plate to see lots of colors!

Tips for a Successful Experiment

Polarizing film (about 25cm x 25cm piece) (10 in x 10 in) can be purchased online or in the lighting department of a Do-It-Yourself store or at a store that handles science equipment. Colored polarizing plates are also available, but for this experiment, use a colorless one.

How pieces of cellophane tape are overlaid onto polarizing film affects what colors are seen, so try using different patterns when laying down the tape.

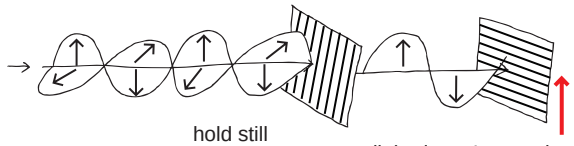
Only adults should handle scissors and utility knives. Take extra precaution to prevent accident or injury.

Experiment Explanation

Light behaves as a wave, and vibrates in a vertical direction with respect to the light's traveling direction. The plane of light vibration orients itself in various directions.

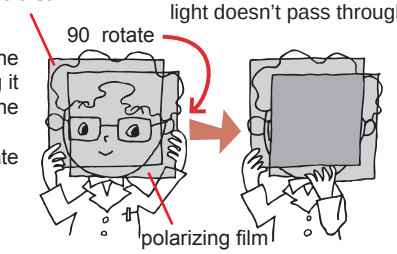
Shining light upon one polarizing film will allow vibrating light to pass through in only one direction. Polarizing film is like a latticed window and therefore only allows through a vibrating light in a certain direction. Stacking two polarizing plates will allow light to pass through if oriented the same way, but if oriented differently will block the passage of light, resulting in a darkening of the polarizing plate.

If a transparent object is placed between two polarizing films, the progress of the light will change and various colors can be seen. Liquid crystal displays use materials constructed similarly to polarizing films. Therefore, placing a clear plastic container, bag, spoon, or CD case in front of a liquid crystal display and viewing it through a polarizing film will also produce many colors.

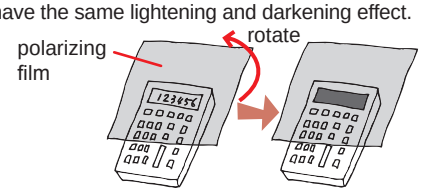


Experiment 1 Stack two polarizing films on top of each other and rotate just one of them. Rotating one polarizing film 90°will darken the transparent view, while rotating it another 90°will return transparency. If the plates are held in front of a person's face, the face will appear and disappear.

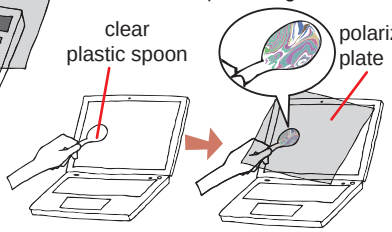
Moreover, place the small polarizing film used in the experiment on a table, and rotate the larger polarizing plate on top. It will have the same lightening and darkening effect.



Experiment 2 Looking through a polarizing film that is rotated in front of a PC, calculator liquid crystal display screen will cause the screen to go from transparent to dark.



Experiment 3 Hold a clear plastic container, bag, spoon or CD case in front of a PC liquid crystal display screen, and then view it through a polarizing film. You will see various colors. Opening software on a computer that brightens the screen will make the colors even more vivid.



Experiment 11
Magnet Magic!

Magnets have the power to attract metal. Use a magnet to conduct many amazing experiments!

Tips for a Successful Experiment

Bar magnets can be purchased online or in stationery stores.

Children are generally familiar with the kinds of magnets that are put on refrigerators, but they are not familiar with the bar magnets. Please teach them how magnets have a north pole, a south pole and the power to attract metal. (Refer to "Magnetic Traits" below.)

Experiment Warning

Bringing electrical devices and magnetic cards too closely to magnets can cause electrical devices to malfunction, and render magnetic cards unusable, so keep such items away from magnets.

Experiment Explanation

The magnetic strength of bar magnets is most powerful at its two ends. This is demonstrated in the Experiment Method Step 2 when many paper clips attached themselves to the ends of a bar magnet. The same applies when two bar magnets are placed together end to end. The two ends are magnetically the strongest. In the Experiment Method Step 3, attaching one more bar magnet showed that the area of the magnets in the middle, or no longer at the ends, had grown weak in magnetism, resulting in the paper clips falling away.

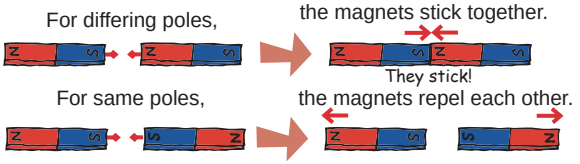
As was seen in Experiment Method Step 5, connecting two bar magnets together from the start turns them into one longer bar magnet with the magnetism strongest at the two ends. As you conduct the experiment, such as when connecting two bar magnets, ask the children to predict what will happen to the paper clips depending on their location along the magnets.

Magnetic Traits

Begin by conducting experiments that teach children about a magnet's north and south poles, and where magnetic strength lies on a bar magnet.

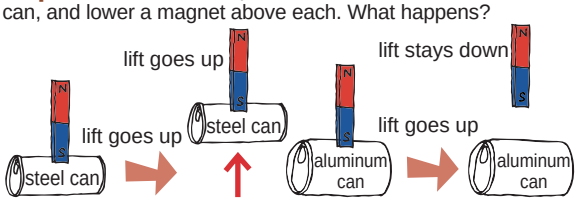
Show them that the different poles of a magnet (north and south) will be attracted to each other, but that the same poles (north and north, or south and south) will repel each other. When seeing how metal is attracted to a magnet, one is likely to think that all metal will behave similarly, but among metals, only steel, cobalt and nickel stick to magnets. Other metals do not.

Experiment 1 Bring the north and south poles of two magnets toward each other. Then bring the same poles (north and north, and south and south) toward each other.



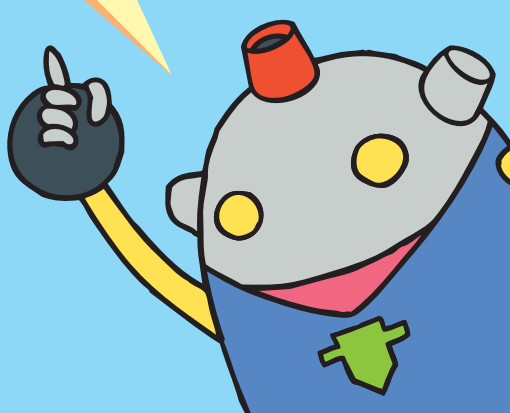
* Differing poles of a magnet (north and south poles) attract each other, but the same poles (north and north poles, or south and south poles) repel each other.

Experiment 2 Prepare a steel can and an aluminum can, and lower a magnet above each. What happens?



* Steel cans attach to magnets while aluminum cans do not.

Showa Denko Materials encourages children's curiosity in science



Amazing Discoveries!
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