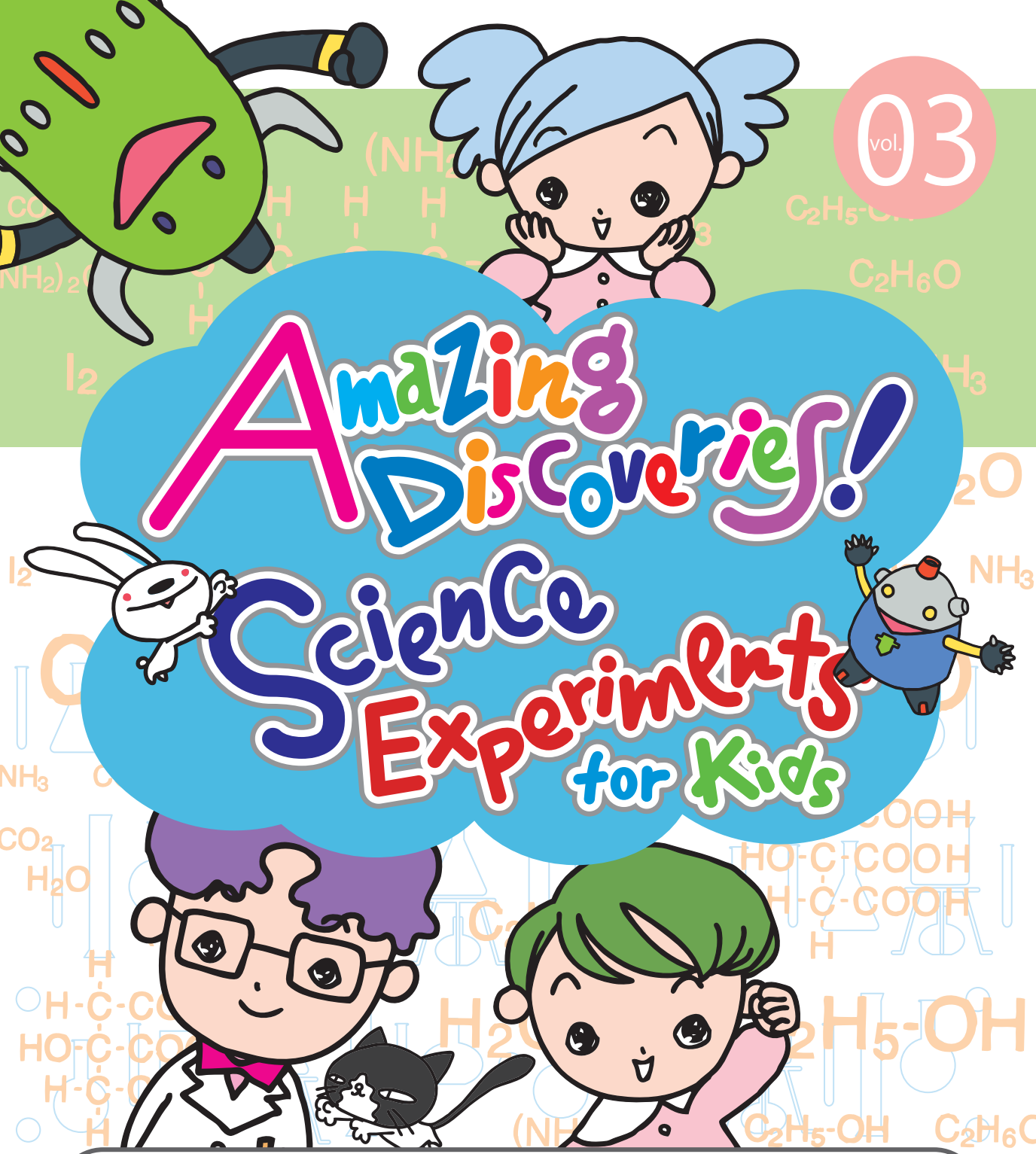
vol. 03

Amazing Discoveries!

Science Experiments for Kids



Name _____

Class _____

Amazing Discoveries!
Science Experiments for Kids

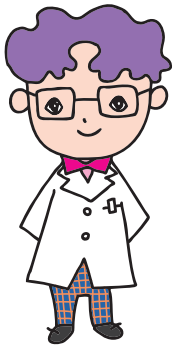
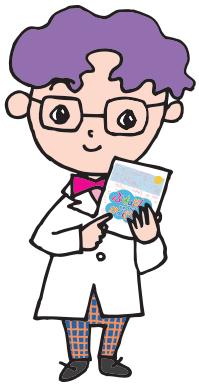
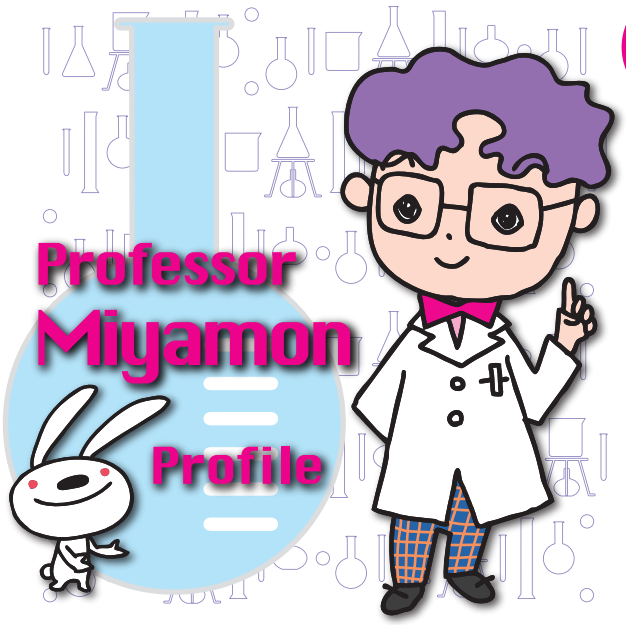


Table of Contents



Purose of this Booklet

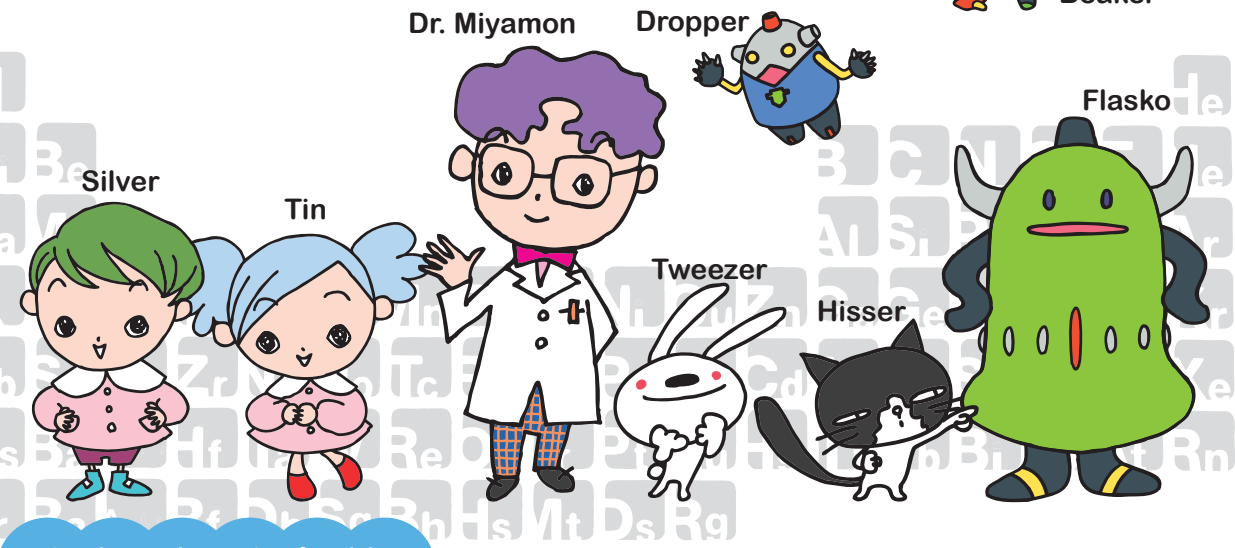
Do you know what an “experiment” is?
An experiment is something you do answer mysterious questions about the world.
This booklet is your easy, step-by-step guide to performing many exciting science experiments with the help of adults so that you can make amazing discoveries about the world around you!



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

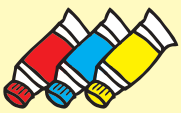
Build a Color Water Tower!

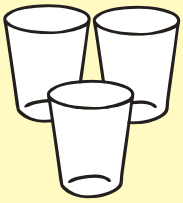
Date: (Day)_____,(Month)_____

Stack 3 different colors on top of each other to build a color tower!

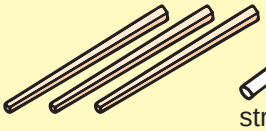
What to Prepare


water


paint (3 colors)


3 cups


tall slender container (100ml capacity)(3 fl.oz)


3 disposable chopsticks

straw

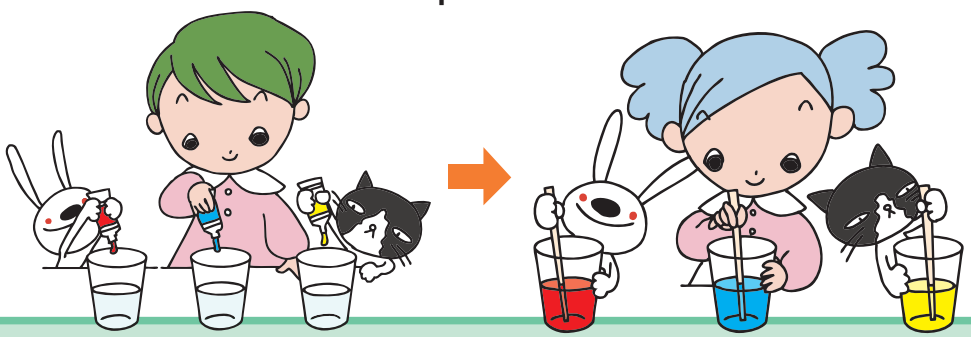

2 droppers


large spoon

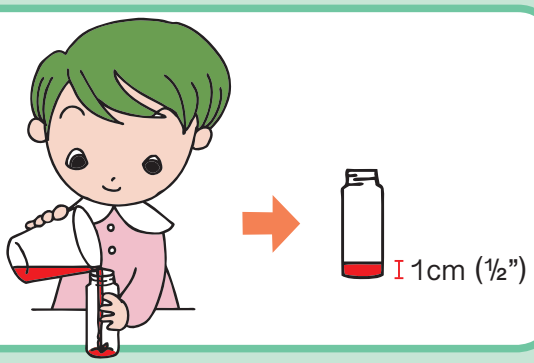
sugar

Experiment Method

1 Fill the cups halfway with water, then dissolve the three colors in each of the cups to make colored water.

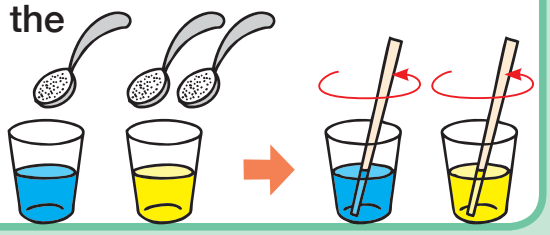


2 Pour about 1cm (½in) of colored water from one cup into the tall slender container.



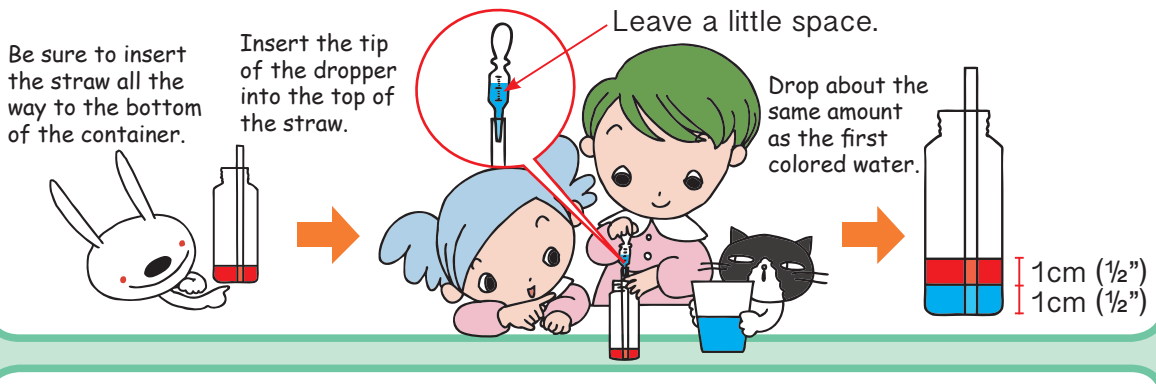
3

In the remaining two cups of colored water, add 1 spoonful of sugar in one of the cups, and 2 spoonfuls of sugar in the other cup, and stir well with chopsticks.



4

Suck up some of the colored water from the cup to which you added 1 spoonful of sugar, and then drop it through a straw into the tall slender container.



5

Follow the same procedure as in Step 4 with the last colored water into which you added 2 spoonfuls of sugar, and drop it into the bottom of the tall slender container.

What's Happening?

The colored water of each of the three cups are same weights. Dissolving different amounts of sugar into each color gave them different weights. The more sugar, the heavier the water. In this experiment, you are inserting a heavier layer of colored water under a lighter layer of colored water. Try dissolving even more sugar to a color and build your tower even higher! → See P.28

Experiment 2

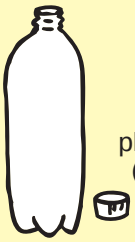
Create Clouds in a Plastic Bottle!

Date: (Day)_____,(Month)_____

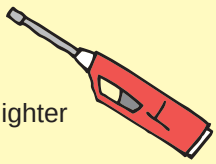
Make clouds inside of a plastic bottle!

What to Prepare

water



plastic soda bottle (500ml) (17fl.oz)



lighter

incense sticks

water

Experiment Method

1 Pour a small amount of water into the bottle, cap it and then wet the inside of the bottle by shaking it.

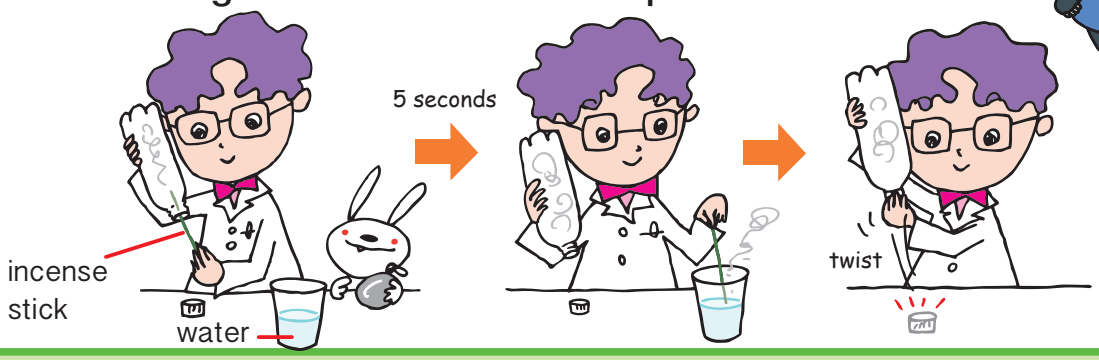
plastic soda bottle (500ml) (17fl.oz)

2 Pour the water out of the bottle.

3

Hold the bottle upside down, and insert a burning incense stick inside the opening. Hold it in there for about 5 seconds, then extinguish the incense and cap the bottle.

Have a glass of water ready so you can put out the burning incense stick.

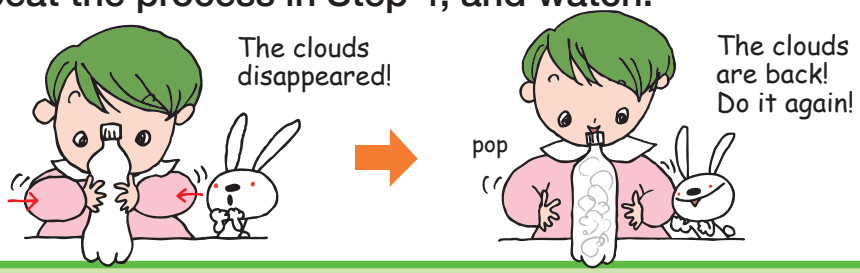


4

With two hands, squeeze the sides of the bottle, and then quickly let go!

5

Repeat the process in Step 4, and watch.



What's Happening?

Rinsing the bottle fills it with water vapor. This is followed by filling the wet bottle with smoke from the incense stick. Squeezing the bottle and then quickly letting go causes the air inside to rapidly expand, slightly lowering temperature inside the bottle and making the water molecules in the water vapor condense and cluster around the smoke particles as cloud condensation nuclei. → See P.29

Experiment 3

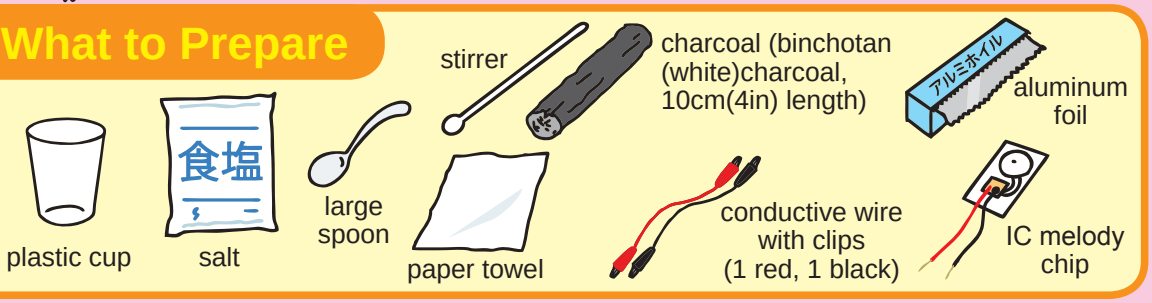
Make a Charcoal Battery!

Date: (Day)_____,(Month)_____

Let's make a charcoal battery and play an IC melody!

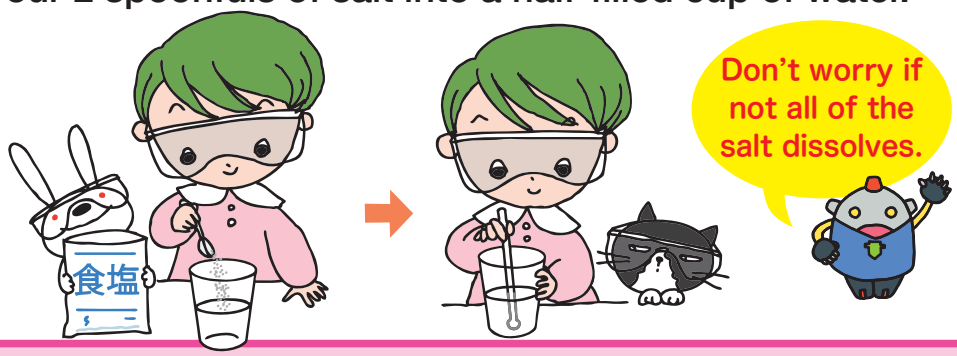
3

What to Prepare

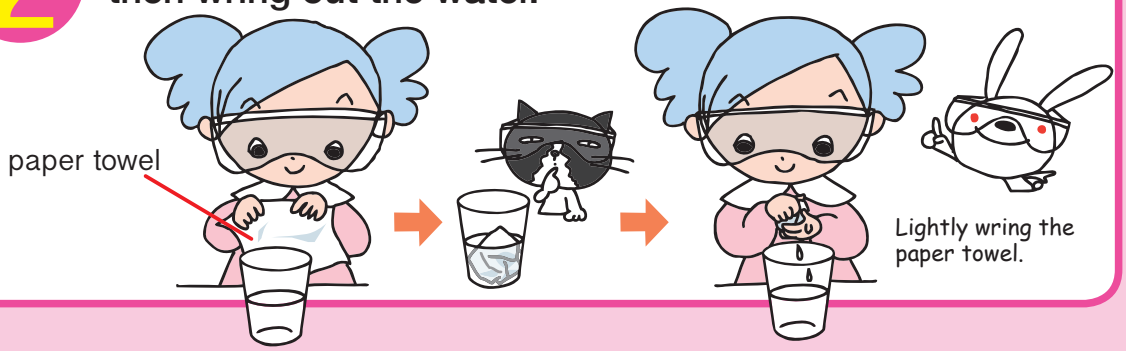


Experiment Method

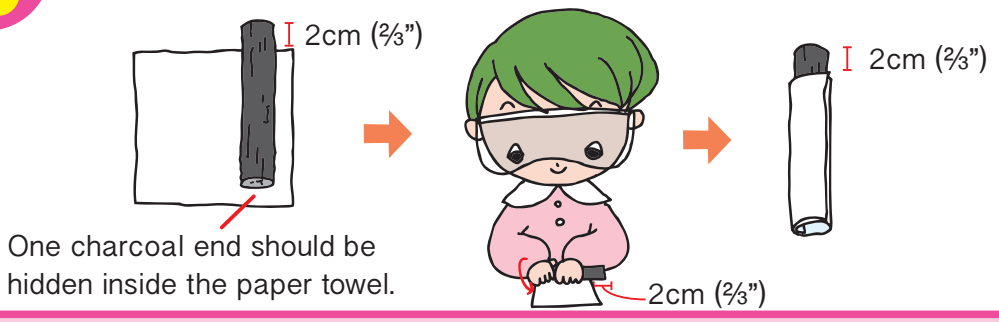
1 Pour 2 spoonfuls of salt into a half-filled cup of water.



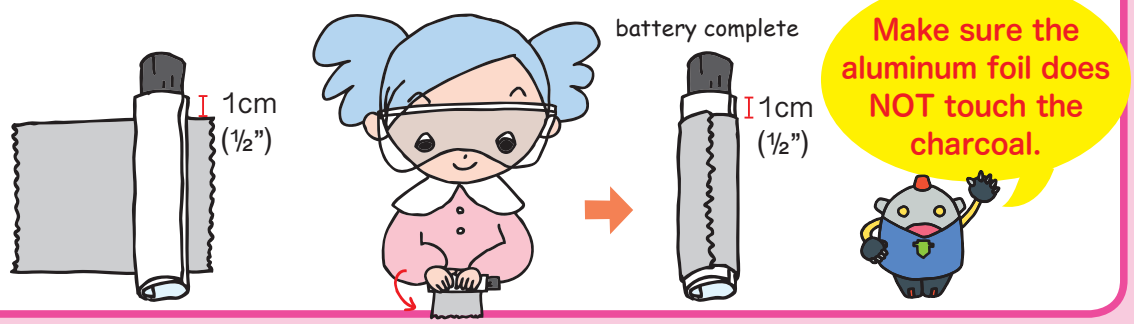
2 Soak a sheet of paper towel in the water of Step 1, and then wring out the water.



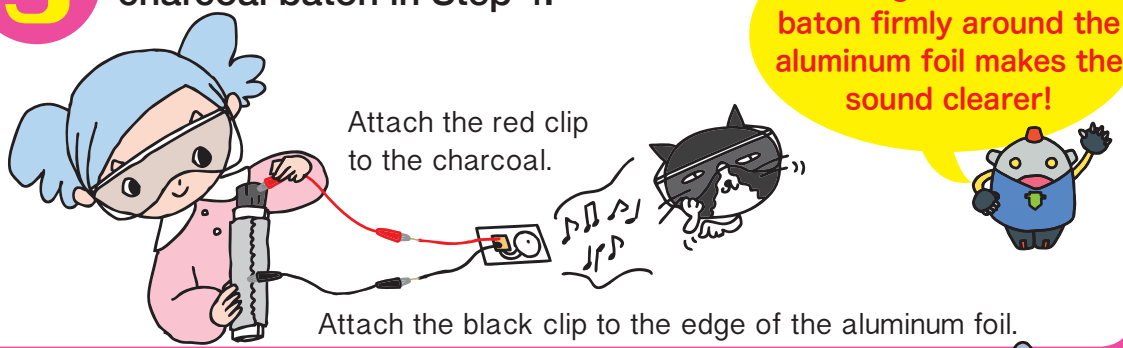
3 Leaving a margin of about 2cm (⅔in) on one side, roll the paper towel around a piece of charcoal.



4 Leaving about 1cm (½in) of paper towel exposed at the top, wrap the charcoal in aluminum foil, and grab the whole baton firmly.



5 Connect the conductive wire to the charcoal baton in Step 4.



What's Happening?

Inserting paper towel soaked in salt water between the charcoal and aluminum foil creates a battery from which electricity flows; enough to power an electronic IC melody chip. → See P.30

Experiment 4

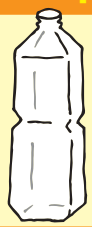
Why are Sunsets Red?

Date: (Day)_____,(Month)_____

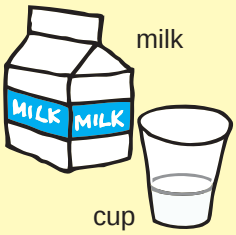
Simulate a sunset inside a plastic bottle!

What to Prepare

water



plastic bottle (2L)(68fl.oz)

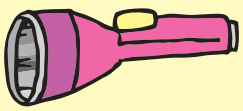


milk

cup

dropper

flashlight (miniature light bulb type)



4

Experiment Method

1 Fill a plastic bottle nearly full with water, then using a dropper, squeeze about 25 drops of milk inside.

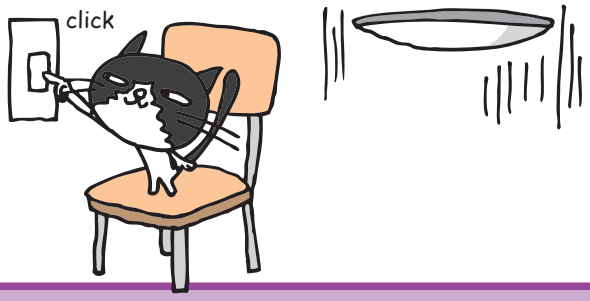
plastic bottle (2L)(68fl.oz)

2 Cap the bottle and then vigorously shake the water-milk mixture.

Tightly cap the bottle.

Shake well.

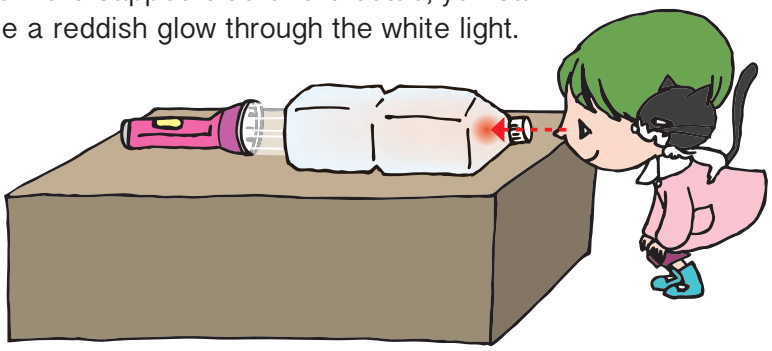
3 Turn off the room lights.



4 Lay the bottle down on its side, and then light it from the bottom with the flashlight.

5 Go around to the cap side of the bottle and peer toward the light from the flashlight through the bottle.

From the capped side of the bottle, you can see a reddish glow through the white light.



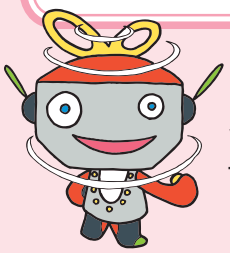
What's Happening?

Air contains many floating particles. In this experiment, milk substitutes as those particles to recreate an atmospheric layer. The white light of the flashlight acts as a substitute for sunlight. Casting the light of the flashlight through the milk-added water in the bottle makes the white light glow reddish in the same way that a sunset appears red when light passes through air particles. → See P.32

Experiment 5

The Mysterious Pendulum

Date: (Day)_____,(Month)_____

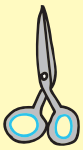


See coins swinging magically from strings!

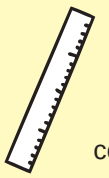
What to Prepare

6 coins (identical type)

string

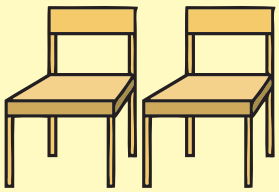


scissors



ruler

cellophane tape

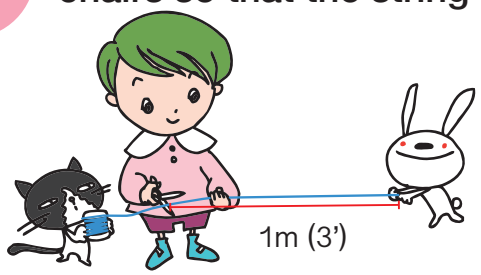


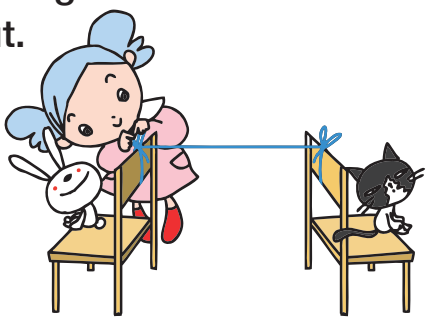
2 chairs of equal height

5

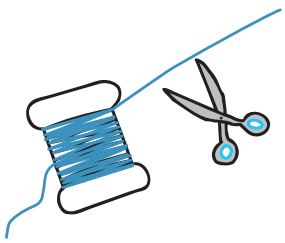
Experiment Method

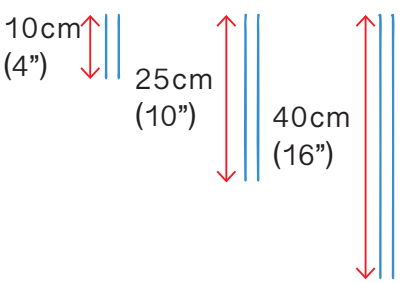
1 Cut a 1-meter (3ft) length of string and tie it to two chairs so that the string is taut.



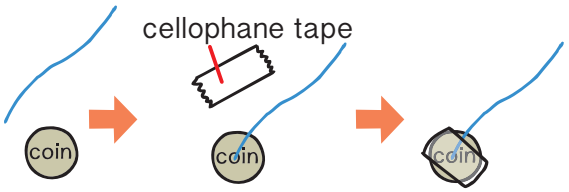


2 Cut 3 pairs of string lengths at 10cm (4in), 25cm (10") and 40cm (16").

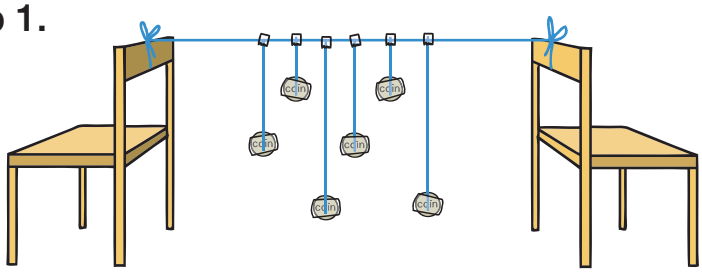




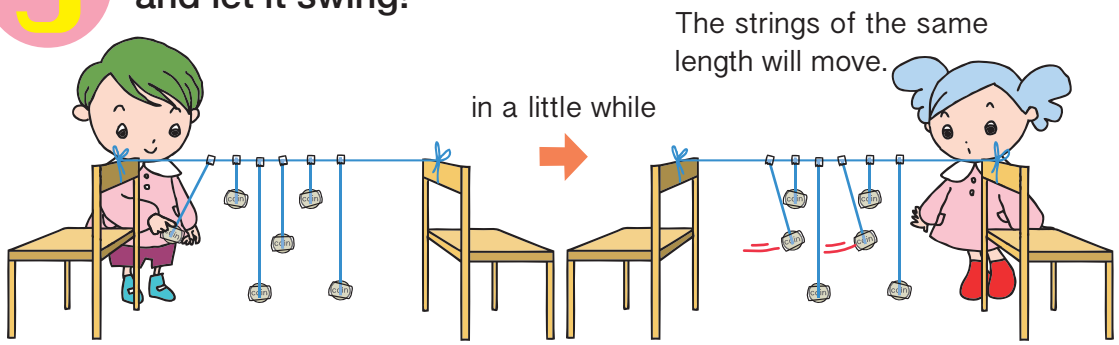
3 Tape the coins to one end of each piece of string.



4 Tape the other end of each string about 5cm (2in) apart from each other to the string between the chairs from Step 1.



5 When the coins are still, pull back on one of the coins and let it swing!



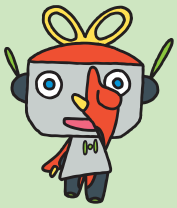
What's Happening?

Coins attached to strings, when set into motion, will go back and forth in the same places. This is called a pendulum effect. The movement of a pendulum is regular. The longer the string, the slower the pendulum movement. The shorter the string, the faster the pendulum movement. When setting in large motion one of the 6 coins, other coins on identical lengths of string also start moving. This phenomenon is called "resonance." → See P.34

Experiment 6

Rising Ball, Sinking Ball

Date: (Day)_____,(Month)_____



What happens to ping-pong and steel balls by shaking rice?

What to Prepare

ping-pong ball

steel ball

rice

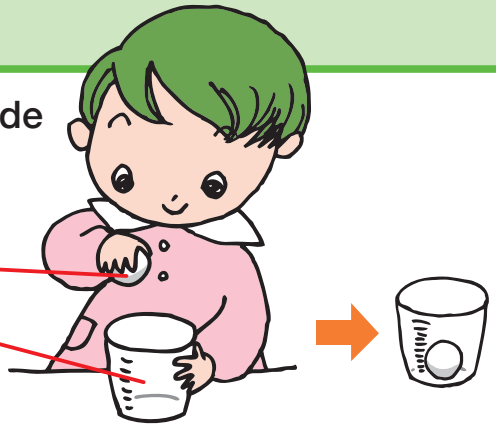
measuring cup

electric toothbrush

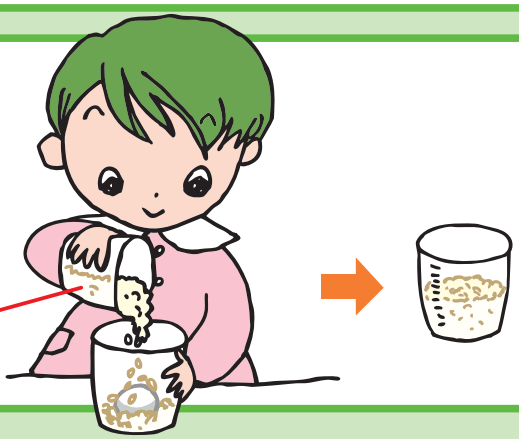
Experiment Method

Experiment 1

1 Put a ping-pong ball inside a measuring cup.



2 Fill the measuring cup with rice so that it covers the ping-pong ball.



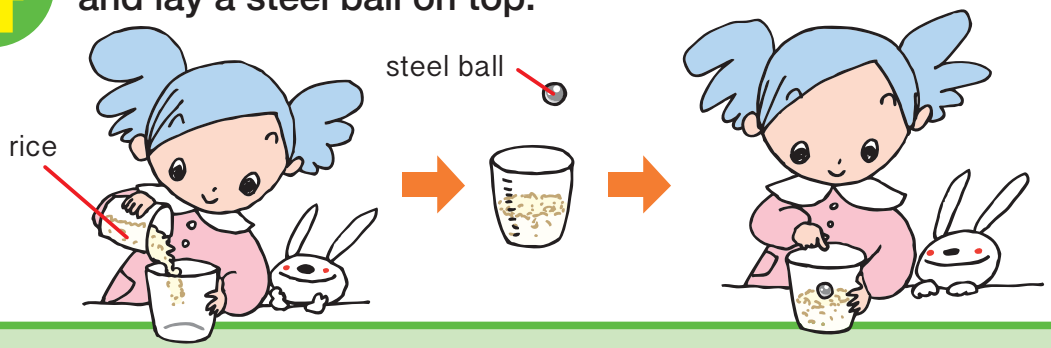
3

Place the backside of an electric toothbrush against the side of the measuring cup, and turn the brush on.

Experiment 2

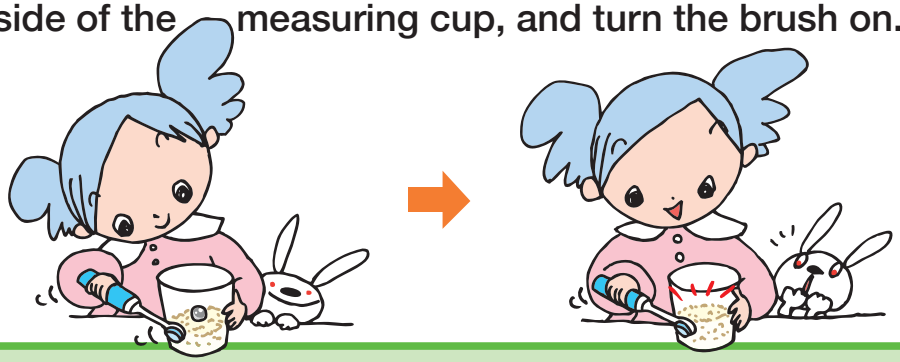
4

Fill the measuring cup about halfway with rice, and lay a steel ball on top.



5

Place the backside of the electric toothbrush against the side of the measuring cup, and turn the brush on.



What's Happening?

When the electric toothbrush vibrates the measuring cup, the rice inside shakes and acts like a liquid. As a result, anything lighter than rice will rise to the top, while anything heavier will sink to the bottom.

→ See P.36

Experiment 7

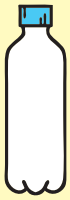
The Up and Down Fish

Date: (Day)_____,(Month)_____

Make a plastic fish rise and fall in a bottle!

What to Prepare

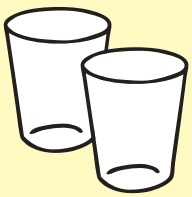
water



plastic soda bottle (500ml)(17fl.oz)

fish-shaped plastic soy sauce container

steel nut



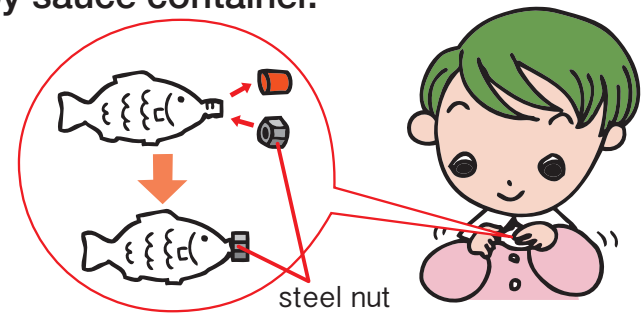
2 cups

paint

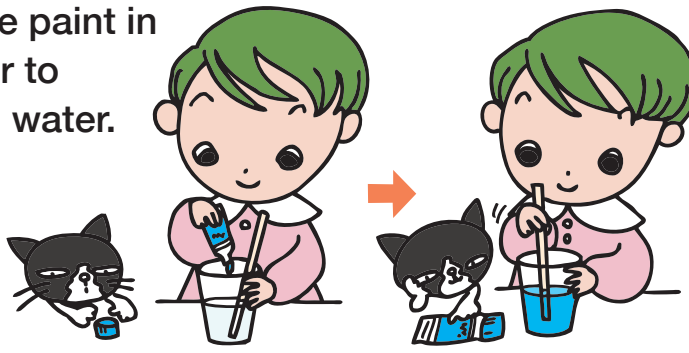
disposable chopsticks

Experiment Method

1 Attach the steel nut to the mouth of the fish-shaped plastic soy sauce container.



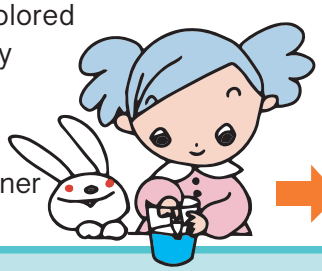
2 Dissolve some paint in a cup of water to make colored water.



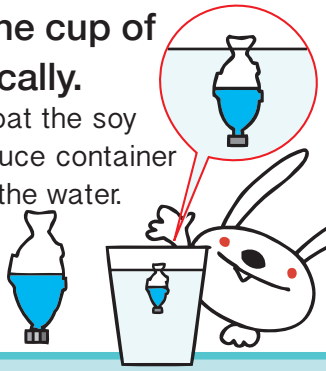
3 Suck up some of the colored water into the soy sauce container, and place it in the cup of water so that it floats vertically.

Suck up some colored water into the soy sauce container.

You can use the soy sauce container like a dropper.

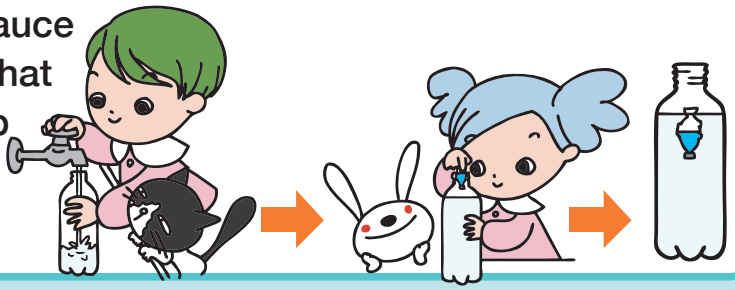


Float the soy sauce container in the water.



Try to float it so that the tail of the fish-shaped soy sauce container is sticking out of the water.

4 Fill the plastic soda bottle with water and insert the fish-shaped soy sauce container so that it floats on top of the water.



5 Put the cap on the plastic soda bottle, and with both hands, firmly squeeze the sides of the bottle, then let go.

Grab the sides firmly and squeeze.

Now release your hands.

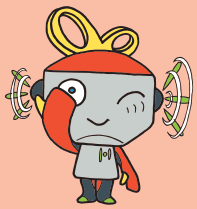
What's Happening?

Firmly squeezing the sides of the plastic bottle raises water pressure inside the bottle. Water rushes into the soy sauce container that's in the bottle compressing any air inside the container. As a result, the container becomes heavier and sinks. Letting go of the plastic soda bottle causes water pressure to return, forcing the container to float back up. This experiment demonstrates use of water pressure and buoyancy. → See P.38

Experiment 8

The Hovering Ball

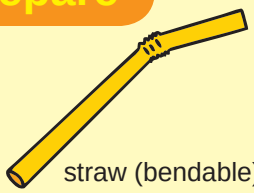
Date: (Day)_____,(Month)_____



Use a straw to make a formed styrol ball float in midair!

What to Prepare

scissors



straw (bendable)

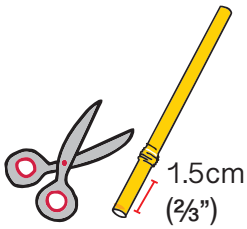
formed styrol ball

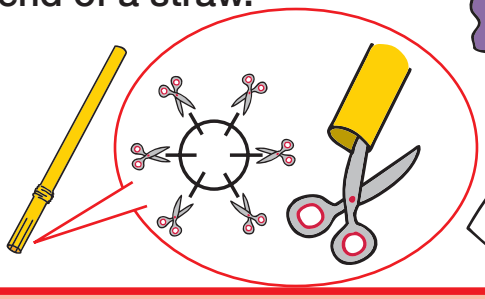
string

cellophane tape

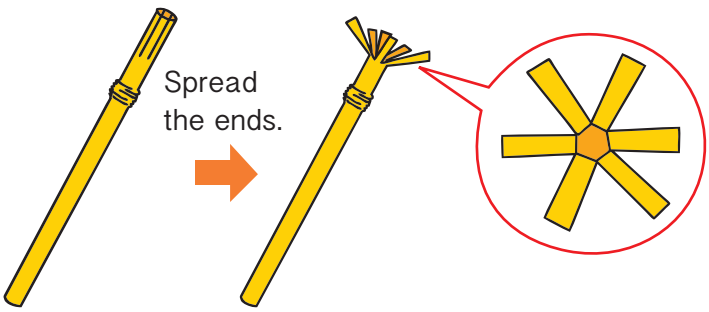
Experiment Method

1 Make 6 incisions about 1.5cm (⅔in) in length into the end of a straw.

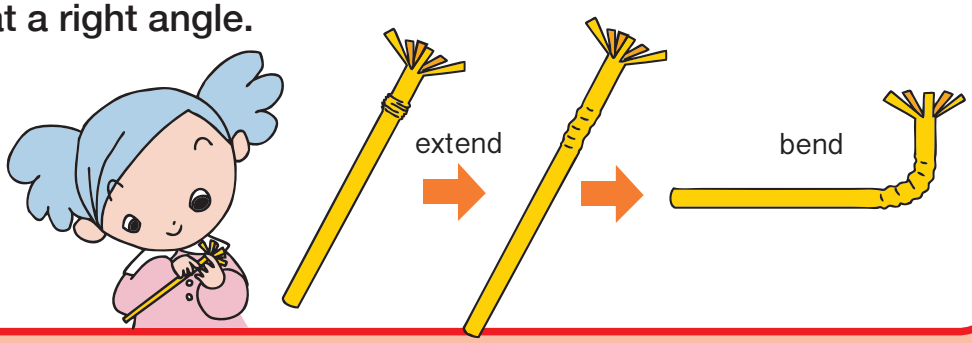




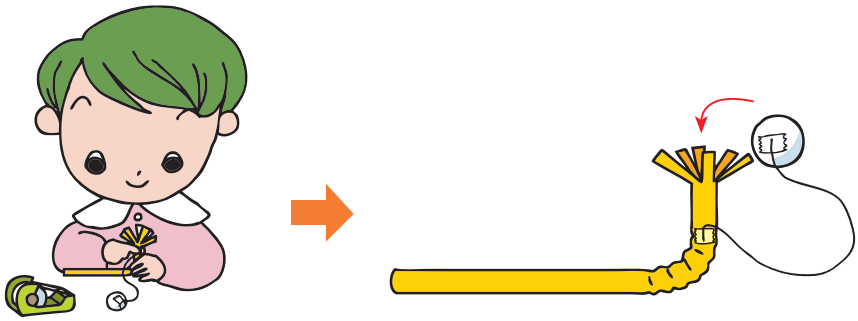
2 Spread out the frayed ends of the straw.



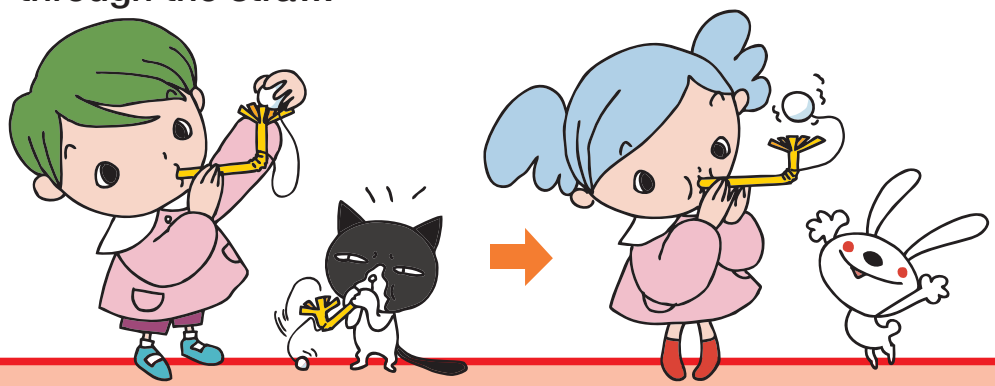
3 Extend the straw fully and then bend one end upwards at a right angle.



4 Attach the formed styrol ball to the straw using string and cellophane tape.



5 Place the ball on the frayed end of the straw and blow through the straw.



What's Happening?

When blowing the ball up through the straw, the ball floats in the air, moving not only up and down, but also side to side. Even if the straw is angled, the ball will keep floating above the end. Once you get used to it, try altering the strength of your breath. → See P.40

Experiment 9

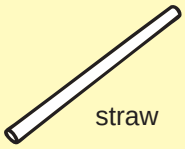
Launch a Balloon Rocket!

Date: (Day)_____,(Month)_____

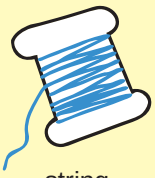
Use the force of escaping air to launch a balloon rocket!

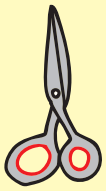
What to Prepare


balloon


straw


cellophane tape

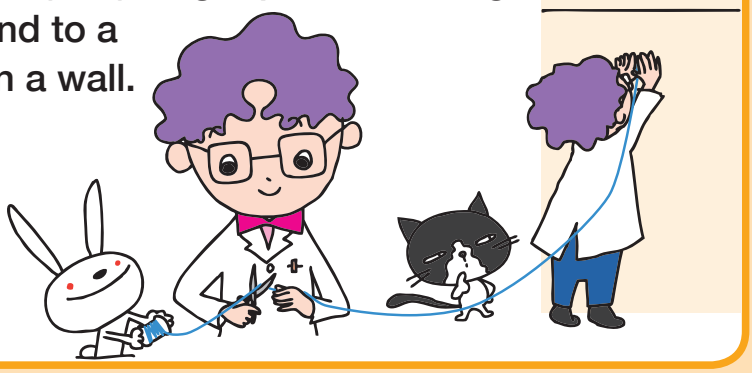

string


scissors

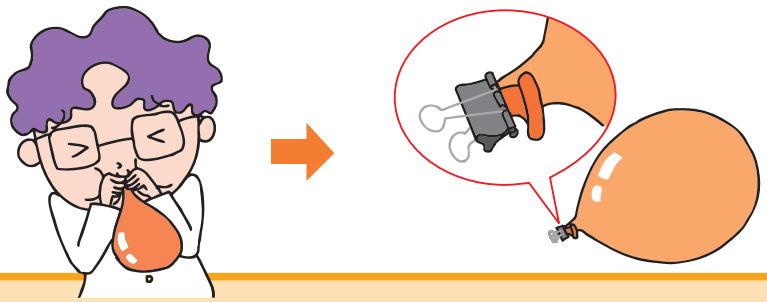

double clip

Experiment Method

1 Cut off a 3-meter (10ft) length piece of string, and tape one end to a high position on a wall.

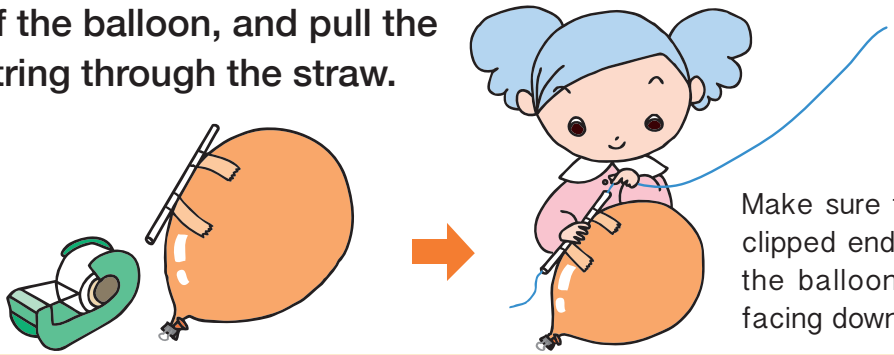


2 Inflate a balloon and then clip the end shut using a double clip so that air doesn't escape.



3

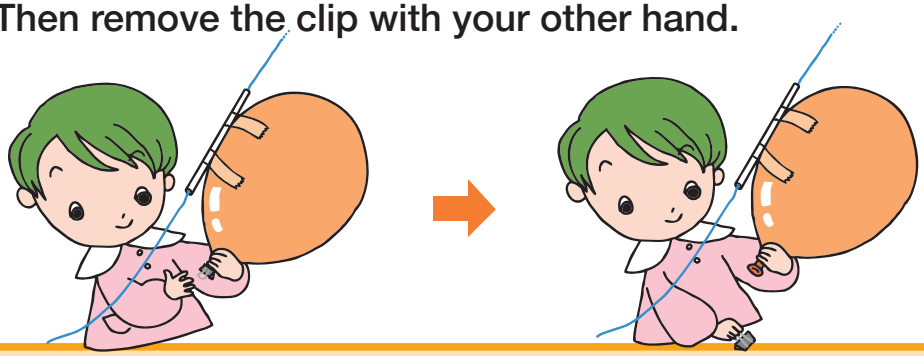
On one side of the balloon, tape a straw up the length of the balloon, and pull the string through the straw.



Make sure the clipped end of the balloon is facing down.

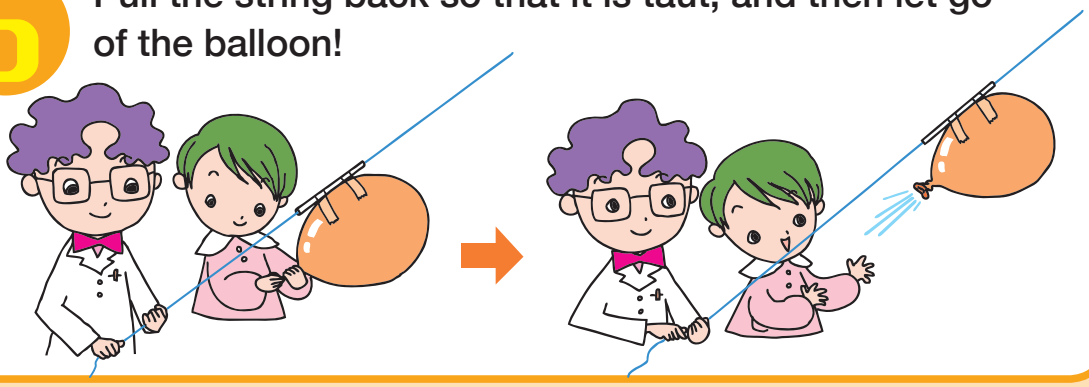
4

Grab the end of the balloon above the clip with your hand and press firmly to prevent air from escaping. Then remove the clip with your other hand.



5

Pull the string back so that it is taut, and then let go of the balloon!



What's Happening?

When you release the balloon, you're allowing air to escape from inside the balloon with great force. Using the principle of action and reaction, the balloon will move in the opposite direction of the released air, and speed along the string to the other end. → See P.42

Experiment 10

Make a Superball!

Date: (Day)_____,(Month)_____

Create your original superball with laundry starch and salt!

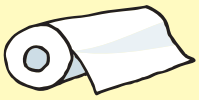
What to Prepare

laundry starch (containing poly-vinyl alcohol, PVA)

salt

plastic cup

spoon



paper towels

disposable chopsticks

Experiment Method

1 Pour about 2cm (⅔in) of laundry starch into a cup.

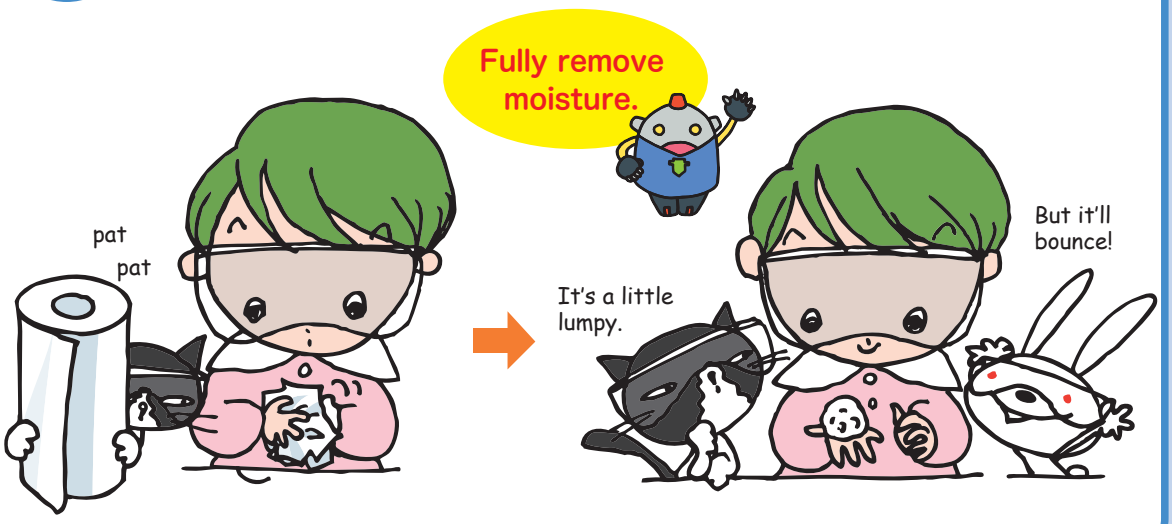
If you want to add color to your superball, here's where you can add a little bit of paint and mix well.

Attention!
Make sure to use laundry starch containing PVA.

2 Add salt, a little at a time, while mixing it in with chopsticks.

3 Keep repeating Step 2 until the contents of the cup hardens.

4 Once the mixture hardens into a clump, remove it and pat it with a paper towel to absorb any moisture.



What's Happening?

Mixing salt well with laundry starch hardens the poly-vinyl alcohol (PVA) contained in the starch. Rolling the clump of starch into a ball and removing moisture produces a very bouncy ball like a superball.

→ See P.44

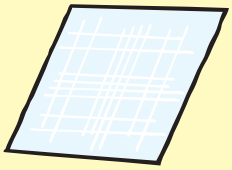
Experiment 11

Split the Light Fantastic!

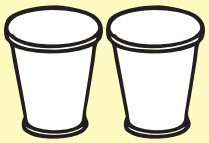
Date: (Day)_____,(Month)_____

Use a spectroscopy sheet to separate light into colors!

What to Prepare



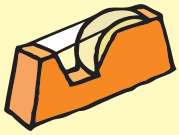
spectroscopy sheet



2 paper cups

scissors

ballpoint pen

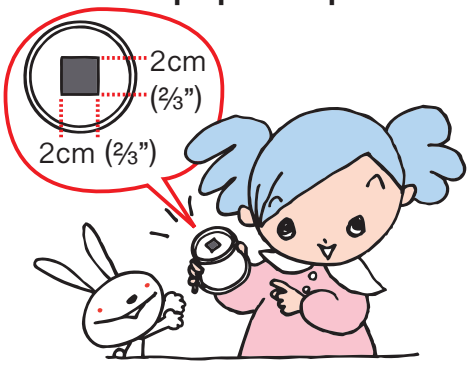


cellophane tape

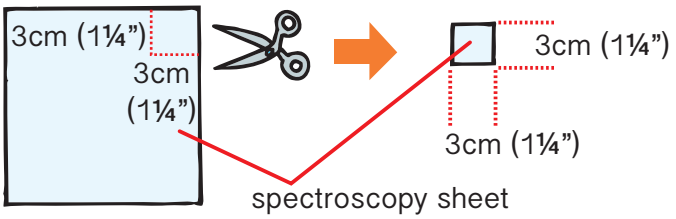
Experiment Method

1 Cut out a section from the bottom of a paper cup.

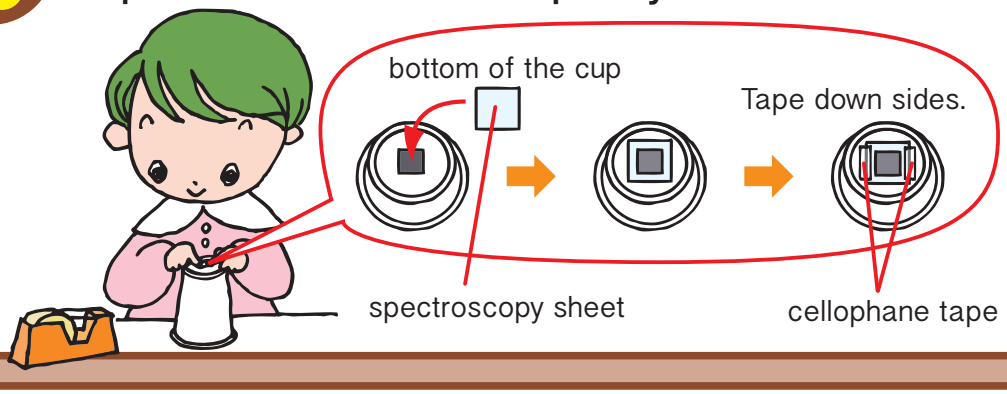
Attention! Have adults do the cutting, okay?



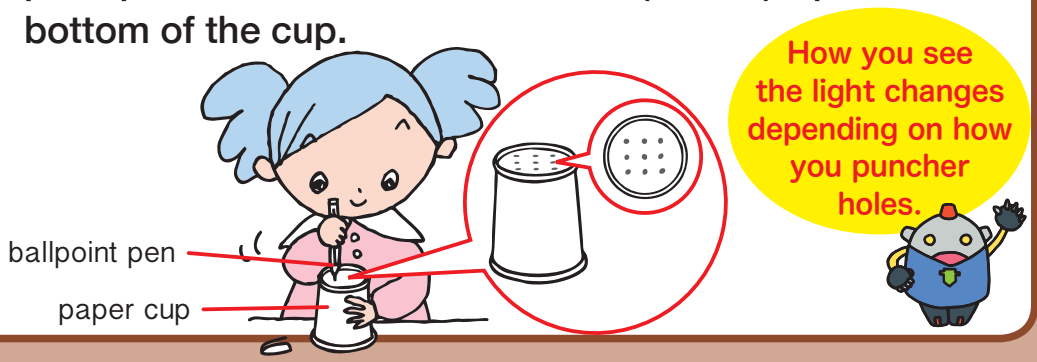
2 Cut out a 3cm x 3cm (1¼in × 1¼in) square piece from a spectroscopy sheet.



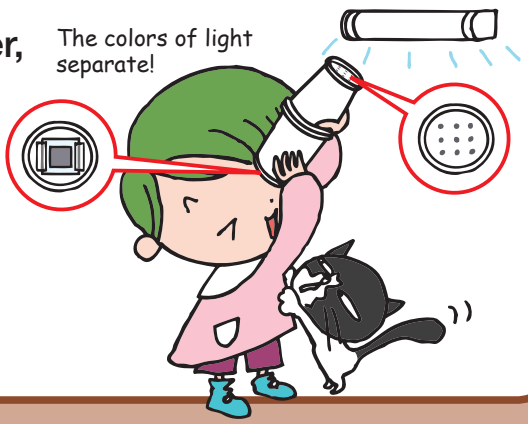
3 Tape the spectroscopy sheet square over the hole in the cup so that the hole is completely covered.



4 With the other paper cup, and using the tip of a ballpoint pen, puncture holes about 1mm (1/20in) apart in the bottom of the cup.



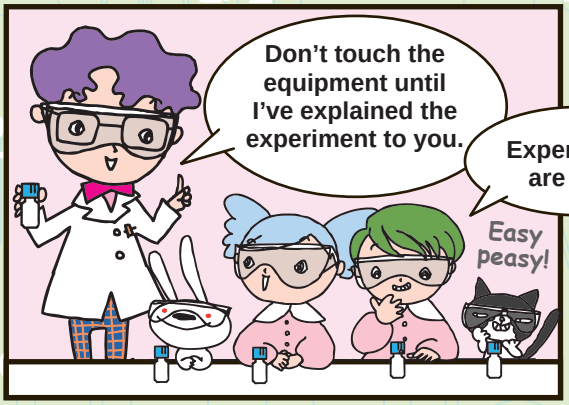
5 Hold the two cups together, top to top, and peer through the spectroscopy sheet side at a light.

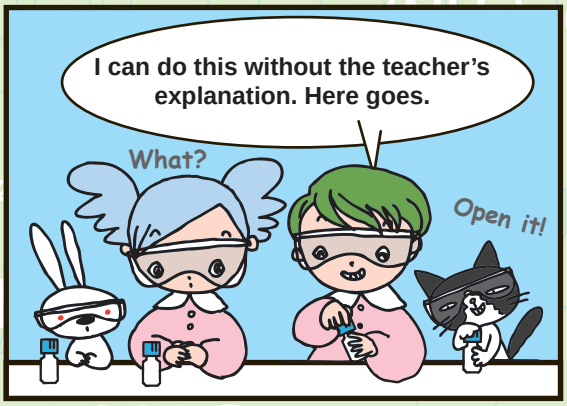


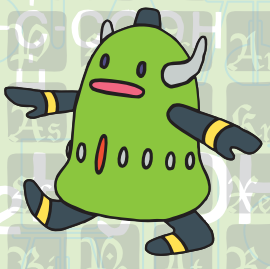
What's Happening?

A spectroscopy sheets separates light into colors. While light is emitted from a fluorescent bulb, but actually, a number of colors combine to make the light appear white. Looking through a spectroscopy sheet lets you to see the light's various colors. → See P.45

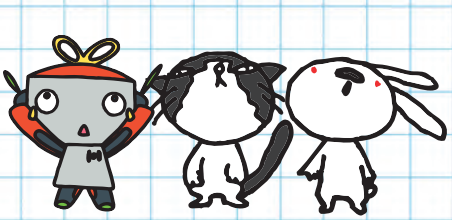
Let's do an experiment!

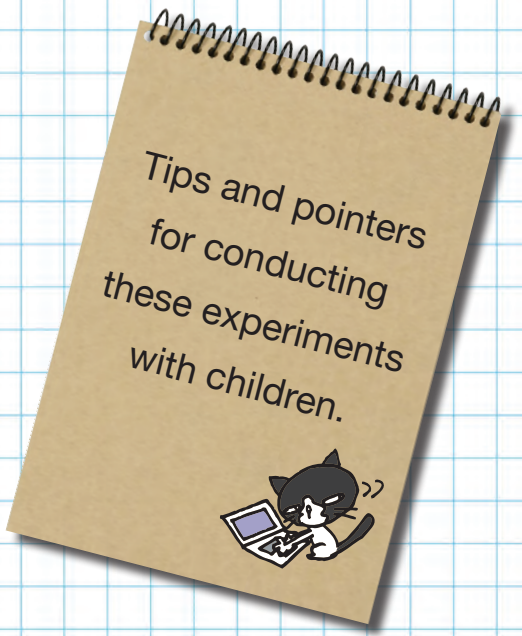


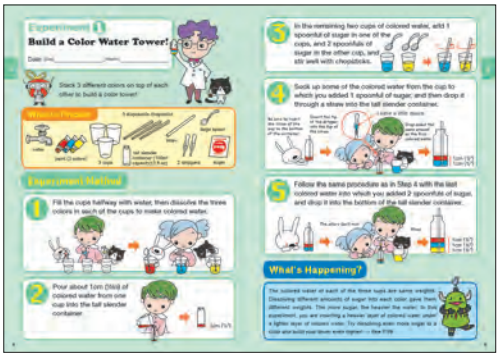




User Guide for Guardians and Instructors







Experiment 1
Build a Color Water Tower!

Stack 3 different colors on top of each other to build a color tower!

Tips for a Successful Experiment

To ensure the success of this experiment, make sure that the straw is at the bottom of the slender container when injecting the second and third colors into the liquid. If the straw separates from the bottom of the container, the colors will mix.

Experiment Explanation

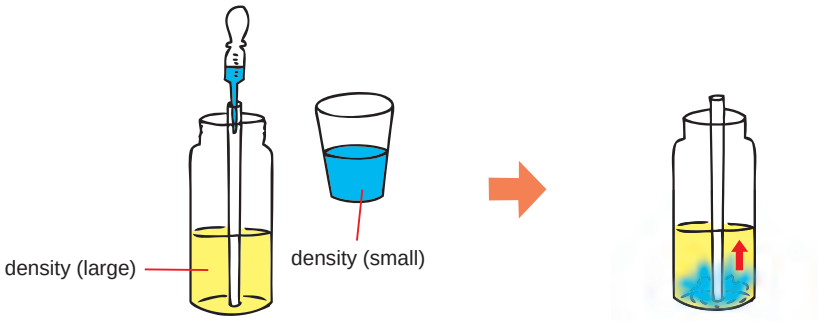
This experiment involves dissolving differing volumes of sugar in identical volumes of water. To be accurate, the added sugar does increase volume slightly, but not to a consequential degree. As a result, one can say that the more sugar that is dissolved, the heavier (denser) the liquid becomes per unit volume.

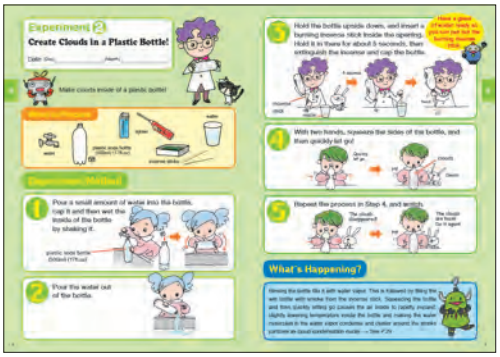
Water of differing colors can be stacked on top of each other by using a straw to inject colored water of greater density under colored water of lesser density. While it is possible to do the reverse and stack colored water of lesser density atop colored water of greater density, this requires greater concentration and precision, and can easily result in the colors mixing.

Sugar is used for this experiment because of its easy solubility, but the same experiment can be conducted using other ingredients, such as salt.

Bonus Experiment : Comparing Different Densities

Inject some colored water of high density (water containing a lot of dissolved sugar) into the slender container first. Then using the straw, inject a different colored water of low density (less sugar) underneath the first layer of colored water. The less dense colored water will quickly rise upward. This demonstrates density differences and why colored water of higher density should go below colored water of lesser density.





Experiment 2
Create Clouds in a Plastic Bottle!

Make clouds inside of a plastic bottle!

Tips for a Successful Experiment

Because this experiment calls for raising pressure inside the bottle by partially collapsing it with one's hands, the bottle that contained a carbonated drink is recommended as it can withstand stronger pressure.

Rinsing the bottle first with water fills it with water vapor, which will contribute to cloud condensation later. Therefore, rinse the bottle well with water.

The experiment calls for inserting a lit incense stick in order to facilitate cloud formation inside the bottle. Smoke particles form the nuclei around which water vapor droplets can stick.

Experiment Explanation

The inside of the bottle is moist after being rinsed and is full of water vapor. When the volume of gas increase rapidly, the temperature decreases. Capping the bottle, and squeezing the sides with two hands will reduce volume. Then releasing one's hands will cause the volume of gas contained in the water vapor to rapidly increase. As a result, temperature inside the bottle drops, and the water vapor cools. Then many small water droplets form around smoke particles acting as condensation nuclei. This creates clouds inside the bottle.

Demonstration Experiment

Use other items to create many more clouds.

This experiment can also be performed with tools that increase the pressure in the bottle (such as decarbonating prevention goods). After increasing pressure inside the bottle, any sudden release of air will result in a rapid increase of air volume inside and accompanying drops in temperature. Many more clouds can be formed than when doing the experiment by squeezing and releasing both hands on the sides of the bottle. You can purchase such items at DIY stores.

What to Prepare plastic soda bottle, water, incense stick, lighter, tools that increase the pressure in the bottle (such as a decarbonation prevention device)

Experiment Method

❶ Rinse the plastic bottle with water.

❷ Insert a lit incense stick in the bottle for 5 seconds.

❸ Use tools that increase the pressure in the bottle and push air into the bottle to raise pressure inside.

❹ Once the bottle is full of pressure inside, quickly release the air inside.

Experiment 3
Make a Charcoal Battery!

Let's make a charcoal battery and play an IC melody!

Tips for a Successful Experiment

This experiment utilizes what is called binchotan (white) charcoal, which can be purchased in DIY stores.

This battery experiment uses an IC melody chip where electricity flowing from the battery plays music. IC melody chips and conductive wire with clips can be purchased online. If conductive wire with clips is not available, thinly cut strips of aluminum foil can be used as a substitute.

There are four tips for a successful experiment.

1) For the salt water, use a saturated salt solution wherein as much salt as possible has been dissolved. Make the density of salt water large enough so that some salt remains undissolved. A thin salt solution will make it harder to conduct electricity.

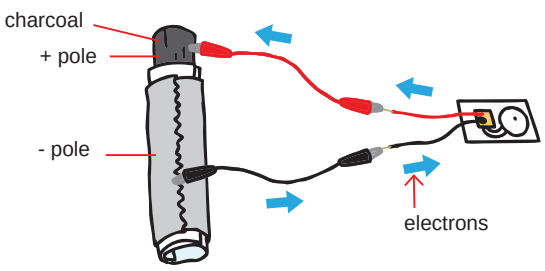
2) When wrapping aluminum foil around the charcoal (already wrapped in paper towel) as shown in Step 4, make sure that the aluminum foil does not directly touch the charcoal itself as this can cause an electric short, and prevent electrical conductivity.

3) When connecting the charcoal battery to the IC melody chip as shown in Step 5, connect the red conductive wire to the charcoal, and the black conductive wire to the aluminum foil. The charcoal battery serves as the + pole (positive terminal), and the aluminum foil serves as the – pole (negative terminal).

4) If the IC chip melody does not play, increase the firmness of your grip on the aluminum foil around the charcoal. The charcoal needs to firmly contact the paper towel, and the paper towel firmly contact the aluminum foil to conduct electricity.

Experiment Explanation

Charcoal contains many tiny pores which adsorb oxygen. Adsorption strength is particularly high with binchotan (white) charcoal, making it well suited as a battery. Aluminum foil is, of course, made from aluminum metal, so when it comes in contact with paper towel soaked in table salt, electrons are easily produced. The electrons pass from aluminum → conductive wire → IC melody chip → conductive wire, and are



adsorbed by oxygen in the charcoal. This flow of electricity powers the IC melody chip and plays music. With this battery, the aluminum that produces electrons (aluminum foil) is the – pole (negative terminal), while the charcoal containing electron-adsorbing oxygen is the + pole (positive terminal). When electrons are emitted from the aluminum foil, the aluminum starts to dissolve. As a result, the aluminum foil after the experiment will be slightly thinner than it was before the experiment.

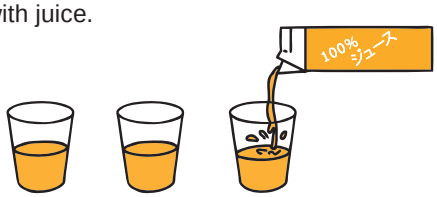
Bonus Experiment : **Make a Juice Battery!**

You can make a battery with fruit juice.

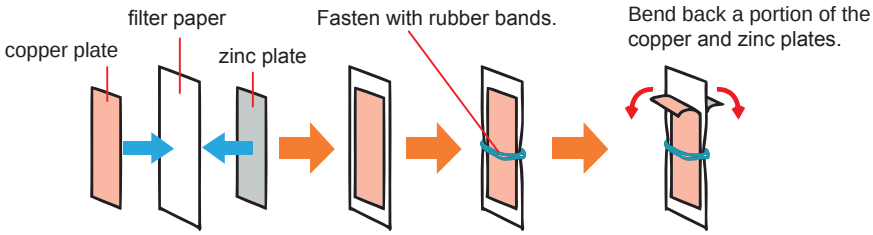
What to Prepare 3 cups, 100% fruit juice, 3 copper plates, 3 zinc plates, filter paper, rubber bands, 4 red and black-divided conductive wires with clips, IC melody chip

Experiment Method

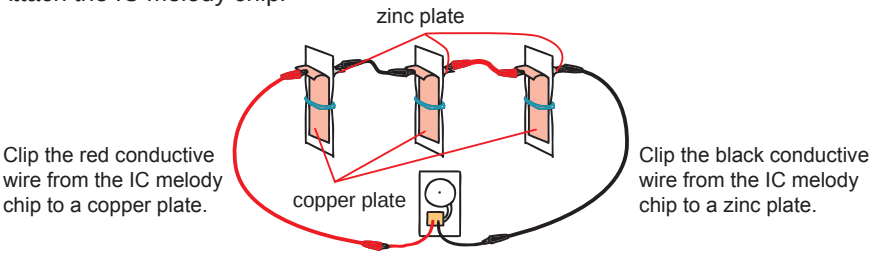
❶ Fill 3 cups halfway with juice.



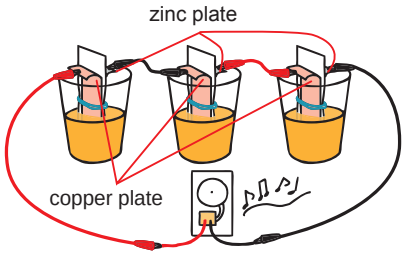
❷ Place filter paper between copper and zinc plates, use rubber bands to make 3 bundled sets, and bend a little of the top edges of the copper and zinc plates outward.

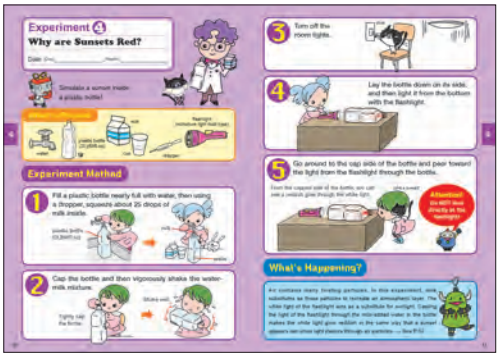


❸ Attach the IC melody chip.



❹ Insert the plates of Step ❸ into the cups of Step ❶.





Experiment 4
Why are Sunsets Red?

Simulate a sunset inside a plastic bottle!

Tips for a Successful Experiment

There are two tips for making this experiment a success.

1) The amount of added milk. Observable redness can differ depending on how much milk there is, and on the type of milk used, or its viscosity. Some prior experimentation with how many drops of milk to add may be necessary to see how red the white light from the flashlight appears. If the amount of milk is small, reddishness will be weak. But if the amount is large, light will have difficulty passing through it, creating a drab reddishness.

2) Use a miniature bulb flashlight, choosing one with as white light as possible. Flashlights that use LED will not work well with this experiment. Some flashlights can produce light with a vibrant red, but conducting the experiment with a flashlight that emits as white a light as possible will enable one to more clearly detect changes to red. It is also recommended to try the experiment using water containing milk, and water not containing milk for comparative purposes. Differences in color can be clearly grasped.

Experiment Explanation

■ Colors of the Sky

In the course of one day, the sky exhibits various colors. Before dawn, the eastern sky is dyed in a red morning glow, but at midday is blue. Then, as the sun begins to set in the west, the sky turns red again before turning black once the sun has disappeared.

The white light of the Sun is a mixture of 7 colors of light of different wavelengths. Those 7 colors of light in order of shortest to longest wavelengths are: violet, indigo, blue, green, yellow, orange, red. The particular traits of each color of light have an effect on the color of the sky.

violet indigo blue green yellow orange red

easily scattered (short wavelengths) ← → not easily scattered (long wavelengths)

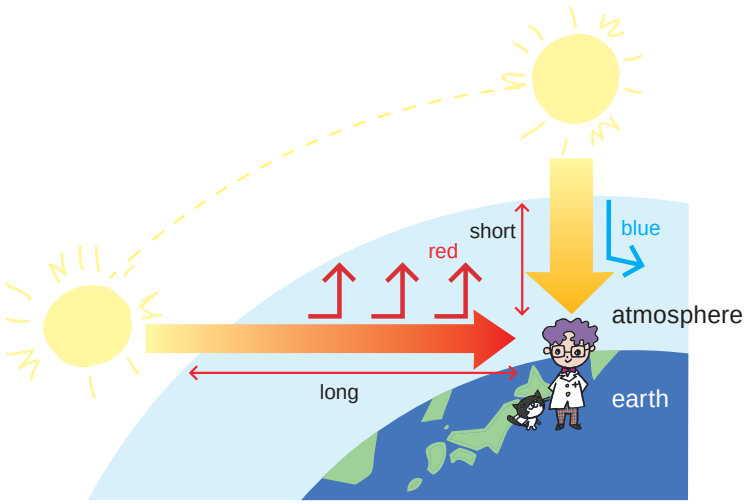
■ The scattering of light

When the white light of the Sun covers the Earth and passes through its atmospheric layers, it gets scattered by particles and floating dust in the air. This scattering rate differs depending on the wavelength (color) of light. Shorter wavelength light scatters easily while longer wavelength light does not.

During the day when the Sun is directly overhead, the distance the light travels through the atmosphere is relatively short, so scattering is minimal. But in the morning or at dusk, that distance grows longer, leading to more scattering of light.

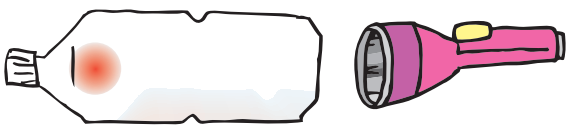
■ Why is the sky blue?

During the day, because the distance that light travels from the Sun through the atmosphere is shorter, light of short wavelength, or blue, gets scattered across the sky. That's what makes the sky appear blue. Light that does not get scattered hits our eyes as sunlight, making the Sun appear yellow. The same principle can be observed in the experiment. Nearest to the flashlight, you can see a slightly bluish color.



■ Why are sunsets red?

At sunrise and sunset, the distance that light travels from the Sun through the atmosphere is relatively longer, making longer wavelength light that is more difficult to scatter in the day visible to our eyes as red. The shorter wavelengths of blue do not reach very far as a portion of red light is scattered instead.



Demonstration Experiment

A scattering experiment using laser light.

What to Prepare laser pointer, dry ice, hot water about 70-98°C (158-208°F)

Experiment Method

❶ Place dry ice in hot water. Smoke will billow up.

❷ Turn off the lights and make the room dark.

❸ Turn on the laser pointer and point it at the smoke.

Attention! NEVER look directly at a laser light source with the naked eye.

Pointing the laser at the wall will show you a visible point of light on the wall, but the ray of light going from the laser pointer to the wall is not visible. Shining the laser pointer through a dry ice cloud, however, scatters the light and makes the path of the light observable.

Experiment 5
The Mysterious Pendulum

See coins swinging magically from strings!

Tips for a Successful Experiment

If in Step 2 of the experiment, the coins will still swing together if string lengths vary slightly, so cut strings to be at least 10cm (4in) different in length from each other.

In Step 4 of the experiment, taping the strings too far apart from each other may prevent the transference of kinetic motion, so keep the gap between the strings at about 5cm (2in). Note also that the swinging won't be conveyed immediately. Allow some time for the motion transference to begin.

Experiment Explanation

The time it takes for a weight dangling on a string to swing back and forth once is called an "oscillation." The number of back and forth swings of a pendulum over a certain unit of time is referred to as "frequency."

The Italian physicist and astronomer, Galileo Galilei (1564-1642) found that if the strings of a pendulum are set at a fixed length, the time it takes for them to swing back and forth (frequency) will be identical. This is called "isochronous pendulum." Galileo discovered this principle upon entering the Pisa Cathedral and noticing that a hanging lamp would take the same amount of time for one oscillation when swinging wildly or calmly. In short, the oscillation was constant regardless of the amplitude of pendulum swing. If two strings are the same length, they'll have identical oscillations. Moreover, the weight of the object at the bottom of the pendulum has no influence on the oscillation time. Pendulum clocks make use of this principle.

This experiment calls for three pairs of string lengths of 10cm (4in), 25cm (10in) and 40cm (16in) each to be made. The oscillation of one pendulum (coin dangling from string) will create enough vibration to cause all the pendulums to

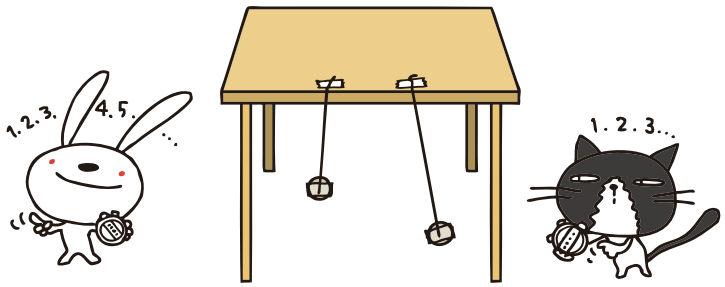
MEMO

sway slightly. But wait a moment, and any pendulum on a string of the same length as the first will begin to mimic its oscillation exactly. String length determines the oscillation. The swinging motion from one pendulum gets transmitted to the other string of the same length (of identical oscillation), and grows larger. This phenomenon of another pendulum beginning to swing in unison with the first is called “resonance”.

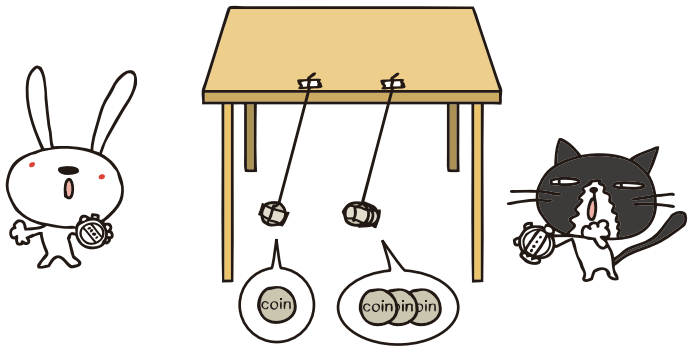
Bonus Experiment 1 : How many times does the pendulum swing?

Try counting how many times the pendulums swing in 1 minute.

❶ Change the string length.

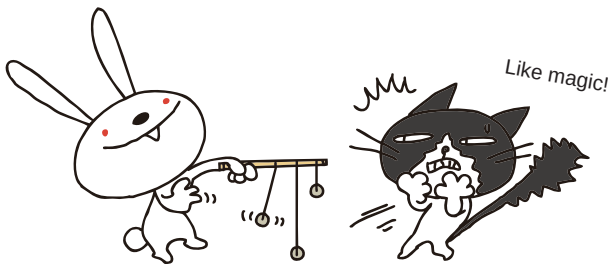


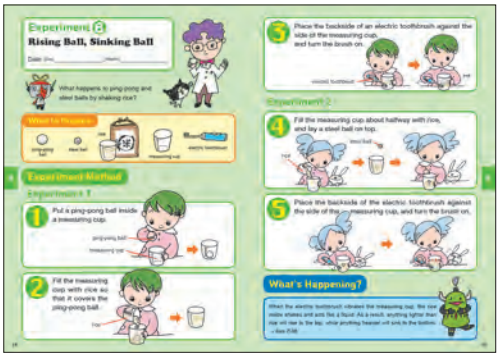
❷ Change the weight (by adding coins).



Bonus Experiment 2 : Move the Pendulum You Want

By changing and adjusting how you move the chopstick, you can set into motion whichever pendulum you like.





Experiment 6
Rising Ball, Sinking Ball

What happens to ping-pong and steel balls in shaking rice?

MEMO

Tips for a Successful Experiment

To ensure the success of this experiment, make sure to vibrate the rice inside the cup well. Use a small cup so that all of the rice contained will vibrate. If you are using a ping-pong ball, a rice measuring cup is the perfect size for this experiment.

In Experiment 1, adding a relatively small amount of rice will quickly cause the ping-pong ball to rise. As a guide, fill the cup just enough to hide the ping-pong ball.

Placing the back of an electric toothbrush (turned on) will vibrate the rice, but it is a good idea to check first what part of the toothbrush vibrates the most.

Experiment Explanation

Placing the electric toothbrush against the side of the cup will cause the rice inside to begin vibrating. Observe this vibration. Once the rice begins to shake, the entire container will start to behave like a liquid. This is called a “liquefaction phenomenon.” When liquefaction occurs, the low density (specific gravity) ping-pong ball will start to rise, while the high density (specific gravity) steel ball will submerge.

■ Ancient Technology : Panning for Gold

Gold is a precious metal that exists as a simple substance, and has a much denser (specific gravity) than other types of ore found in the natural world. Many tourist attractions featuring gold mines give visitors a chance to pan for gold using a special plate (or panning dish) into which gold dust, sand and water is poured and then shaken. By doing this, the heavier density gold dust sinks to the bottom of the pan. If you remove the sand at the top, only the gold dust remains in the plate. This age-old technique is called “gravity concentration.” The tip to accumulating a lot of gold dust by panning is to shake the pan vigorously to stimulate the liquefaction of the plate’s contents.

■ Earthquakes and the Liquefaction Phenomenon

When a large earthquake strikes, shaking regions where the soil is sandy with high levels of groundwater, liquefaction can occur. In such instances, the soft ground foundation sinks, or subsides, potentially causing buildings to lean or collapse.

In ground such as this, particles such as sand gather together to support the foundation, with water filling in the spaces (Fig.1). If there is an earthquake, the particles break apart from each other, allowing water to become more evenly distributed between them. As a result, the entire area becomes like a liquid. This is the liquefaction phenomenon (Fig. 2). When this situation occurs, buildings with their high density can sink or lean. Once the earthquake subsides, sand particles sink and gather together again, separating from the water, but causing the foundation to drop or sink (Fig. 3)

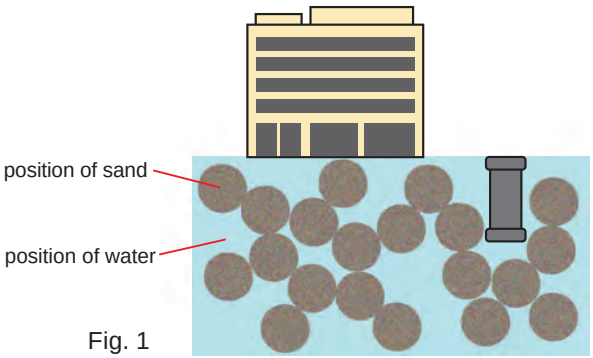


Fig. 1

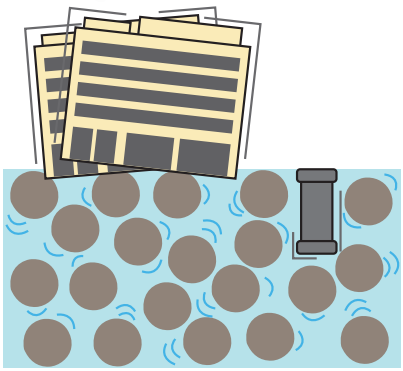


Fig. 2

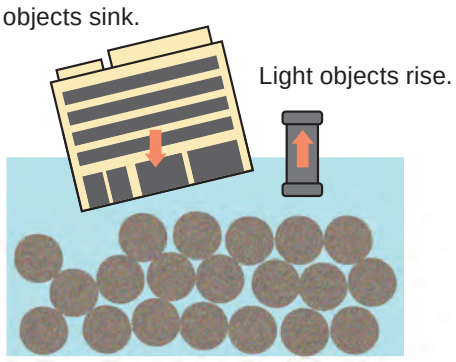


Fig. 3

Experiment 7
The Up and Down Fish

Make a plastic fish rise and fall in a plastic bottle!

Tips for a Successful Experiment

There are four tips for making this experiment a success.

1) The size of the soy sauce container matters. Use one small enough to be inserted through the mouth of a plastic drink bottle. A fish-shaped container is used here, but feel free to use other containers.

2) The size of the nut also matters. Prior to the experiment, make sure the nut is of the bore size that will fit snugly around the mouth of the soy sauce container.

3) The amount of colored water in the soy sauce container matters. When the container is floating in the water, the container end (or tail, if fish-shaped) should be slightly exposed out the water surface. Fill the container with the right amount of colored liquid to ensure this. The manner in which the container floats will determine the relationship between the container's weight and buoyancy (Fig.1). If the container is too buoyant, add more colored water (Fig. 2). If the container sinks and is fully submerged, remove some colored water from the container (Fig. 3).

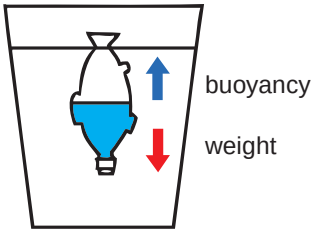


Fig. 1

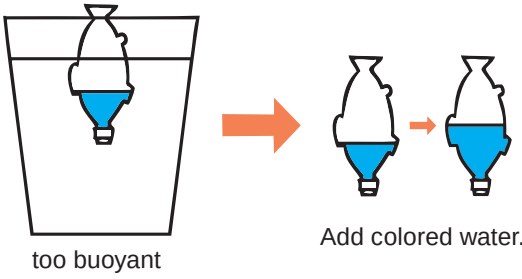


Fig. 2

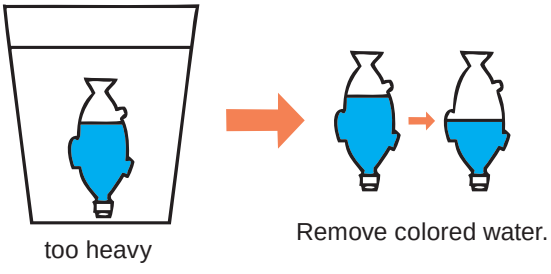


Fig. 3

4) What to do when the soy sauce container is not floating or submerging well. If when the sides of the plastic bottle are firmly squeezed, the container fails to submerge, you may wish to add more colored water to the contents of the container. Conversely, if when releasing the sides of the bottle, the container fails to rise clearly, try reducing the amount of colored water in the container. Adjust the amount of colored water accordingly.

Experiment Explanation

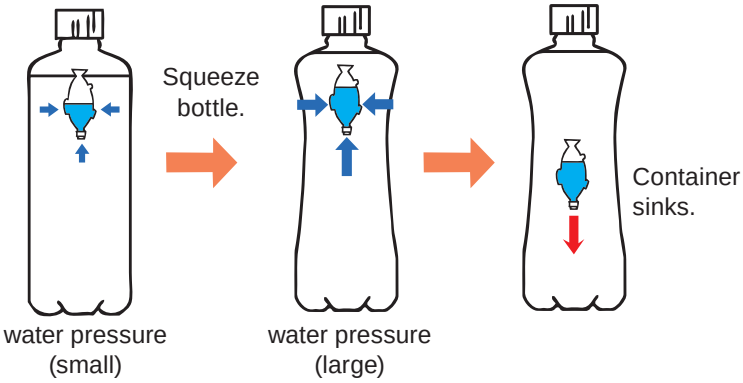
This experiment calls for floating a fish-shaped soy sauce container that is partially filled with colored water inside a plastic bottle so that the tailfin of the container sticks out of the surface. Here, the weight of the colored water in the container is equally balanced with its buoyant strength to maintain this position.

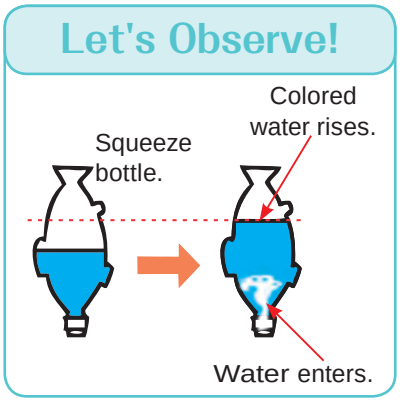
When the container is placed inside the bottle, squeezing the bottle firmly will cause the container to submerge, while releasing the bottle will cause it to float back up. Let's consider the reasons for this occurrence.

■ Why the Container Sinks

Squeezing the plastic bottle firmly raises water pressure inside. As a result, water from the bottle enters the soy sauce container forced in by water pressure, shrinking the amount of air in the container. This makes the container heavier, and so it sinks.

Make sure to observe when the bottle is being squeezed how water enters into the soy sauce container, and how the surface of the colored water inside rises.

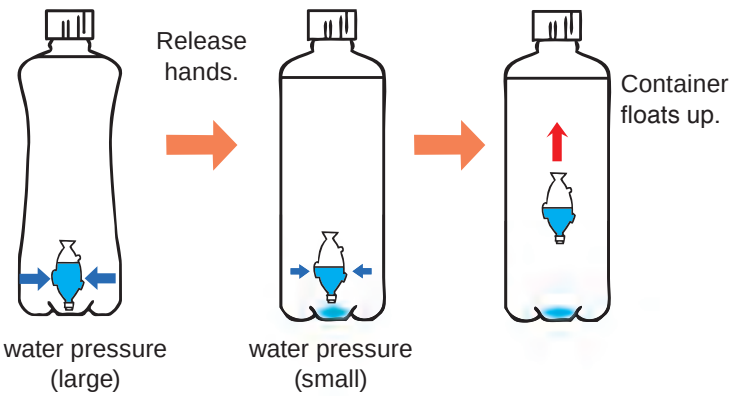


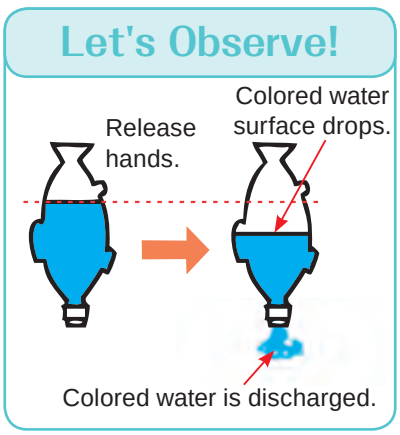


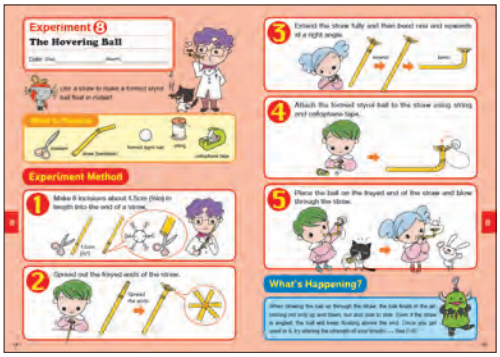
■ Why the Container Rises

Conversely, when releasing your hands from the sides of the plastic bottle, water pressure inside returns to normal. As a result, air trapped inside the soy sauce container expands, discharging colored water from the mouth of the container. In this way, the container recovers its previous weight and floats upward.

When releasing or relaxing one's hands on the sides of the bottle, be sure to observe how the colored water is discharged from the mouth of the soy sauce container, and how the surface of the colored water inside drops.







Experiment 8
The Hovering Ball

Use a straw to make a formed styrol ball float in midair!

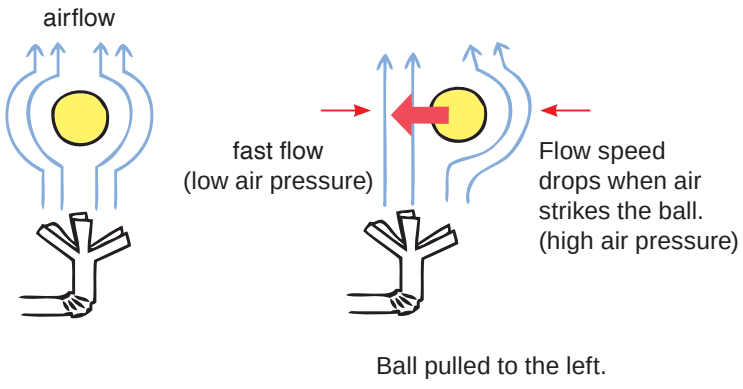
Tips for a Successful Experiment

To ensure the success of this experiment, try using as light a ball as possible. This experiment uses a ball made of formed styrol. Adjusting one's strength of exhaled breath is also important. If you blow too weakly, the ball will not float, but blow too hard and the ball will fly away. Experiment with stronger and weaker exhalations of breath, and practice making the ball float well.

Experiment Explanation

This experiment demonstrates how air pressure and object weight (a ball) can be balanced to make the object float in the air.

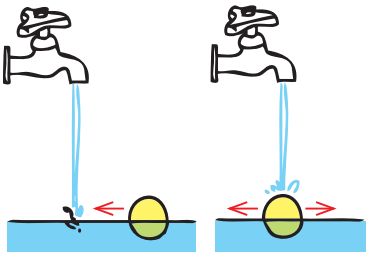
Observe carefully how the ball is floating, and you will notice that it moves from side to side and backwards and forwards in the air. As the figure shows, when airflow is rapid, atmospheric pressure drops, and the ball will be drawn in the direction of the air flow. As a result, even if you angle the straw slightly, the ball will not drop but remain afloat.



MEMO

Bonus Experiment : **Science in the Tub!**

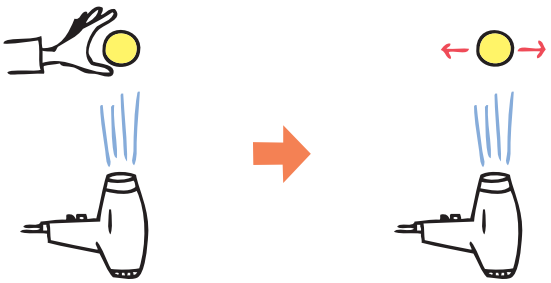
Place a ball on the surface of the water near a running faucet, and it will stay in one place while moving slightly left, right, front and back. This is the same principles as with airflow. If the stream of water is rapid, water pressure drops, and the ball is drawn in the direction of the falling water.



Demonstration Experiment 1

Float a ping-pong ball above a hair dryer.

What to Prepare ping-pong ball, hair dryer

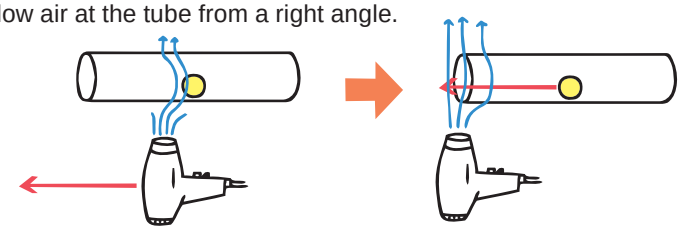


Demonstration Experiment 2

Place a ball in the center of a clear tube. Blow air into one end from a hair dryer, and the ping-pong ball will sail out the other end. But blow air from the hair dryer at direct angle from the tube, and you can pull the ping-pong ball through the tube.

What to Prepare ping-pong ball, hair dryer,
clear tube (about 1m(3ft) length)

Blow air at the tube from a right angle.



Slowly move the hair dryer.

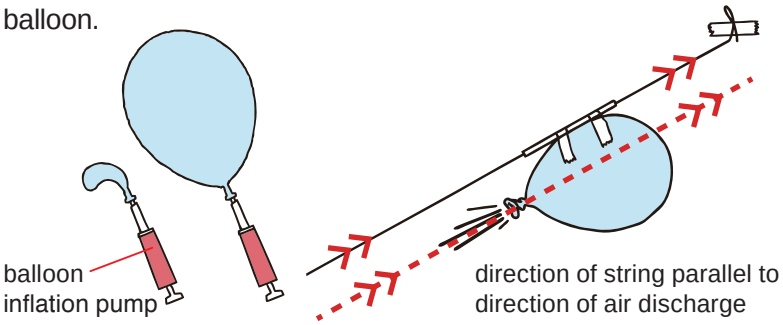
Experiment 9
Launch a Balloon Rocket!

Use the force of escaping air to launch a balloon rocket!

MEMO

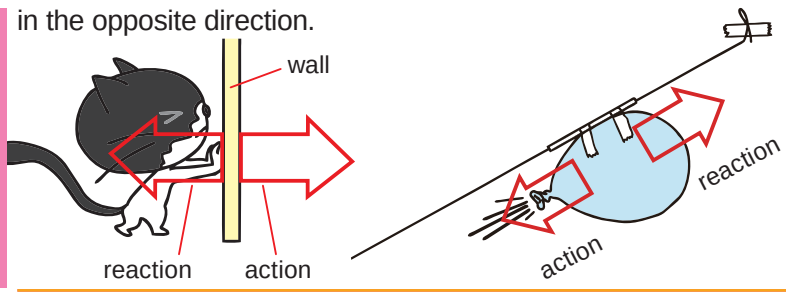
Tips for a Successful Experiment

A balloon attached to a straw glides along a string powered by air escaping from the balloon. There are three tips for making this experiment a success. 1) Inflate the balloon fully. Adults should do this as it may be difficult for young children. Consider also using an inflating pump device. 2) Make sure the string is taut. If the string sags at all, the balloon may stop moving at that point. 3) Make sure that the straw is positioned parallel to the direction of the air escaping from the balloon end. This will maximize the force of the air to propel the balloon.



Experiment Explanation

When you push against a wall, you apply force in the direction that you push. But since the wall doesn't move, you feel as if the wall were pushing back against you. This is called the "action-reaction law", also called "Newton's third law of motion", which states that "for every action, there is an equal and opposite reaction." This experiment shows how air discharged from a balloon in one direction propels the balloon in the opposite direction.



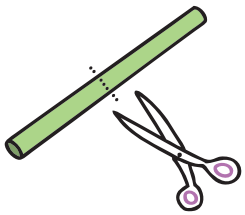
Bonus Experiment : **Launch a Straw Rocket!**

Using the same air force, send a straw flying with a burst of air from a plastic bag, creating a straw rocket.

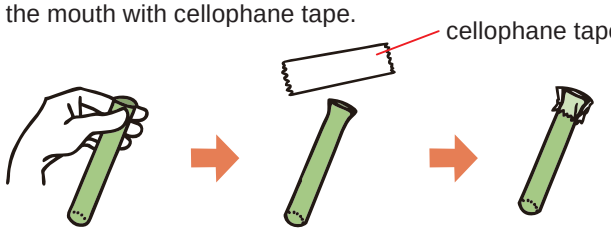
What to Prepare fat straw, slender straw, cellophane tape, plastic bag, scissors

Experiment Method

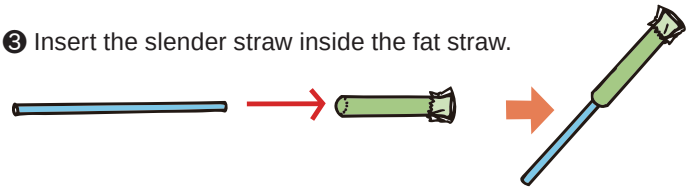
❶ Cut the fat straw in half.



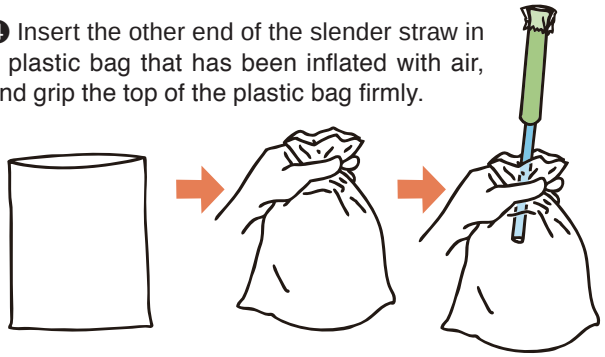
❷ Squash one end of the fat straw and then seal the mouth with cellophane tape.



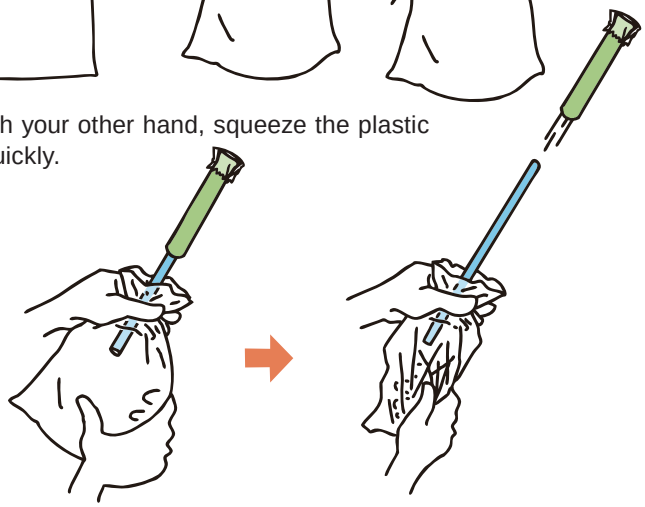
❸ Insert the slender straw inside the fat straw.



❹ Insert the other end of the slender straw in a plastic bag that has been inflated with air, and grip the top of the plastic bag firmly.



❺ With your other hand, squeeze the plastic bag quickly.



Experiment 10
Make a Superball!

Create your original superball with laundry starch and salt!

MEMO

Tips for a Successful Experiment

When adding salt to the laundry starch, add about one-third teaspoonful of salt several times. If there is not enough salt, the ball won't harden. If too much salt is added, the completed superball will have undissolved salt sticking to it. If the latter occurs, brush off the extra salt before playing with the ball. When adding salt to the laundry starch, the substance will be a white liquid. But gradually, a white clump will form separate from the liquid. Once this occurs, remove the white clump and start rolling it in your hands to make it round while squeezing it firmly to remove moisture. The resulting ball will be bumpy in texture, but will be a bouncy superball.

Experiment Explanation

In this experiment, use laundry starch containing PVA (polyvinyl alcohol), which is a highly polymerized compound that has been dissolved in water. Adding salt to this starch and mixing well will prevent the PVA from dissolving in water further, and harden into a clump. This is because salt is more water-soluble than PVA, a phenomenon referred to as "salting out." Removing moisture from the hardening clump produces a superball substance.

■ Salting out is used in making tofu

If you soak soy beans overnight in water, then pulverize them in a mixer, the liquid that is produced from squeezing the mixture is soy milk, while the leftover solid substance is called okara (tofu dregs). Adding nigari brine to the soy milk, curdles the soy milk and hardens it into tofu. With tofu, the protein contained in soy beans dissolves, but mixing in nigari prevents protein dissolution, and deposits it instead. The result is tofu, and it is made using the salting out principle.

Experiment 11
Split the Light Fantastic!

Use a spectroscopy sheet to separate light into colors!

Tips for a Successful Experiment

Make sure that only adults use the scissors or cutter knives in this experiment to prevent accidents.

If the hole made in Step 4 of the experiment are too large, it increases the risk of looking directly into a light source. Conversely, if the holes are too small, light will be more difficult to perceive. Experiment with hole sizes in the preparation stage. Changing the number of holes may also change the appearance of light, so experiment with varying hole number as well.

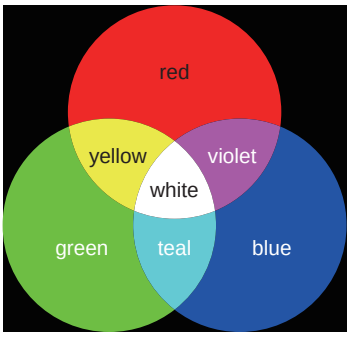
Light from the Sun is very strong, and looking directly at it can damage the eyes. So make sure NOT to gaze directly at the Sun with the naked eye.

Experiment Explanation

Darkening a room, and illuminating a CD or DVD with a flashlight beam will separate the light into various colors. This is because on the surface of a CD or DVD are many imperceptibly thin grooves. Shining a light in this way on the grooves splits the light. A spectroscopy sheet also has thin grooves in a crisscross pattern that are not visible with the naked eye. As a result, looking at light through a spectroscopy sheet will also make visible the separation of light into colors.

■ Three Primary Colors of Light

You can see many colors when illuminating a television screen, computer monitor or LED, but it is the mixture of red, green and yellow light that lets you create every other color. For example, red and blue makes violet, blue and green makes teal, green and red makes yellow. Additionally, red and green mixed with blue turns light white again. Because they can be combined to produce all other colors, red, green and blue are called the “three primary colors of light.”



■ What Makes a 7-Color Rainbow?

After a rainfall, you can often find a rainbow in the sky. In that rainbow, seven different colors are visible because the white sunlight passes through the drops of rain, a process of refraction that splits the light into various colors.

What is "Science Workshops for Kids?"

Science Workshops for Kids are science experiment classes for children to learn about the wonders of science and develop a thirst for learning!

We holds science experiment classes in kindergartens and elementary schools near Group business sites.

1 Who are the teachers?

Our employees visit your school to teach you how to do science experiments.

2 What will we do?

We will select an experiment from "Amazing Discoveries! Science Experiments for Kids" each time and try it with everyone in the class.

3 Will we work in groups?

Yes, we will try various experiments in groups of 4-5 children.

4 What do we need?

We will arrange for all things that are not available in your school. Make sure to wear the protective glasses when using chemicals.

5 What if the experiment does not go well?

Experiments may not go well on the first attempt. But, there no need to worry. Let's try different ways again and again till we succeed.

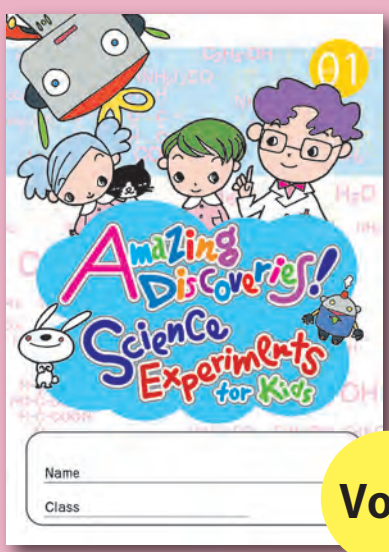
6 Can we try the experiments at home too?

Yes, you can carry out the experiments for which materials are available at home. Do try together with your parents.

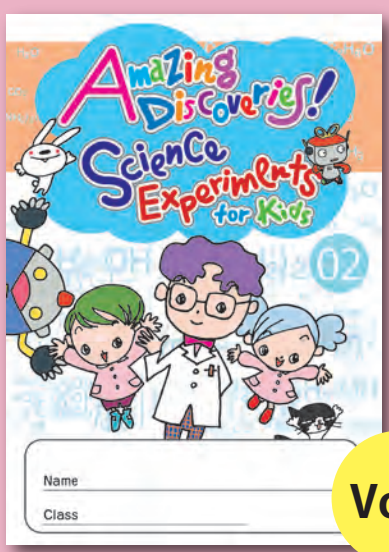
Amazing Discoveries! Science Experiments for Kids

Back Issue Information

Previous issues are available on our website.



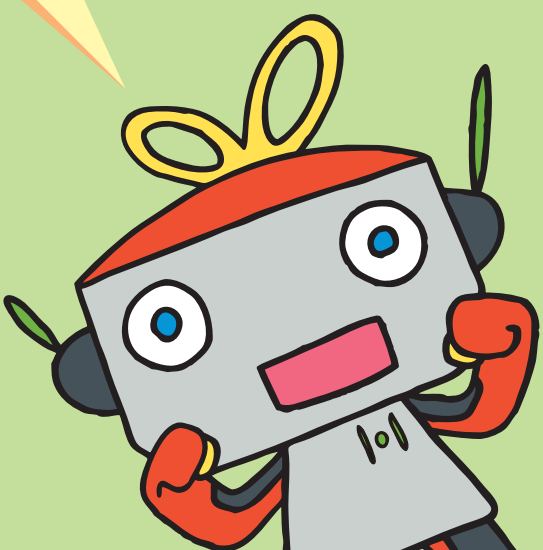
Vol.1



Vol.2

11 different experiments in every issue!

Showa Denko Materials encourages children's curiosity in science



Amazing Discoveries!
Science Experiments for Kids Vol.3

"Science Workshop for Kids"
Educational Material

Supervised by Kazuhiro Miyamoto,
Kaisei Junior & Senior High School, Tokyo, Japan

Illustrations and design by ByuuunWorks

Published by Showa Denko Materials Co.,Ltd.

---

www.mc.showadenko.com