WEATHER SCIENCE

SCIENCE KIT

Are you curious about the weather? Then come along! Let's do the experiments in this kit together to learn all about it!

In this guidebook, you will see a lot of things that you already recognize. But there are so many things left to discover about them! The pictures will guide us in doing our experiments and projects. And whenever you see a Try It box, you will see more ideas for other exciting experiments.

Inside the kit, you will also find a color Knowledge Wheel. You can quiz yourself with it to see if you remember all the things that you discovered while doing your experiments.

And now, let's begin!

little labs™

Thames & Kosmos®

Instructions for Parents, Adults, and Children

Caution! Individual parts of this kit are designed with sharp points, corners, or edges. There is a danger of injury. We reserve the right to make technical changes. Keep the experiment kit out of the reach of small children.

Dear Parents and Adults,

This experiment kit is designed for children ages 5 and up. For each experiment, first ask your child the question at the beginning of the experiment. Then present the various pictures to him or her as possible answers. In this way, your child can start to develop ideas about how to explain everyday experiences. Next, your child can follow the pictures to do the experiment mostly by him or herself, to test his or her ideas. That will let your child discover firsthand the answer to the question posed at the beginning. Finally, read your child the answer summary at the end of the experiment to confirm or correct his or her own conclusions.

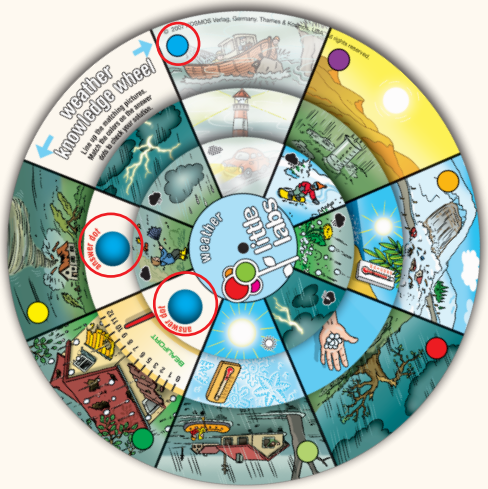
Because the curiosity and powers of comprehension of children at this age are often more fully developed than their manual skills, your assistance will sometimes be needed. Support your little researchers when they need it. If an experiment doesn't work correctly, encourage your child to try it again.

✚ Please be sure to provide the children with any extra materials not contained in the box. These are designed with a red plus sign.

Spanish language instructions are available online at: www.thamesandkosmos.com/littlelabs

Knowledge Wheel Instructions:

Place the three disks on top of one another, ordered according to their size, and secure them together with the supplied brass fastener. Line up the matching weather pictures! Use the two answer dots to check the result. They have to be the same color as the dot on the outermost disk. You can see an example of a solution here:



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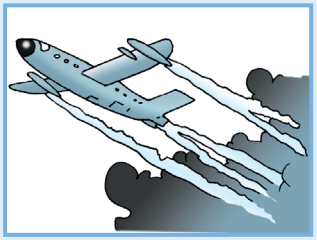
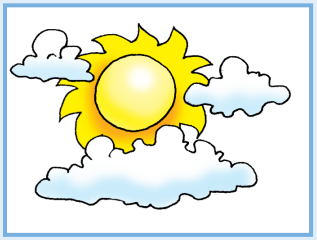
Translation: David Gamon
Editing, layout and production: Ted McGuire. Additional Graphics: Dan Freitas

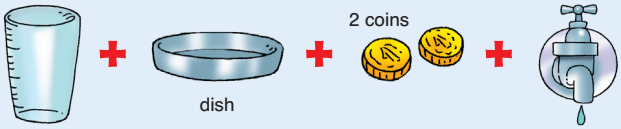
Experiment 1: Who makes the weather?





Or do you have other ideas?

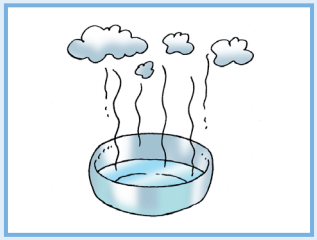
Figure it out like this:



Answer:

You marked the water level in the measuring cup. After two to three hours in the sun, the air became warm and expanded. It needed more space, and pushed the water out of the cup down into the bowl. So when the sun shines, it not only warms the surface of the Earth, but the air as well. As you determined in your experiment, the air expands in the process. Wherever the sun isn't shining, the air maintains its temperature. In that way, we get different masses of air. In order to even out this difference, the air starts to flow; Wind is created. So the sun is a major cause of the weather.

Experiment 2: Where did the water go?



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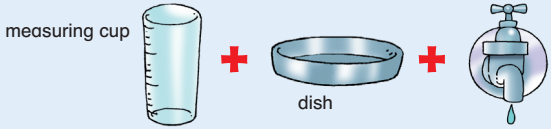
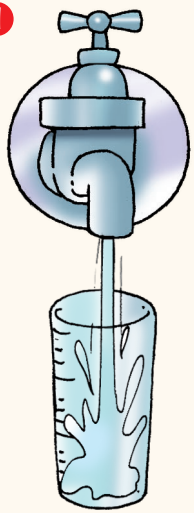


1



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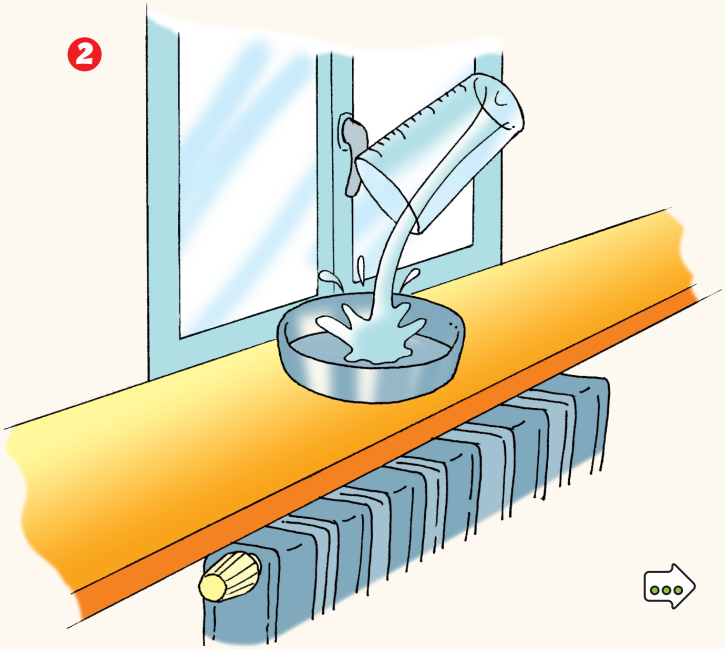
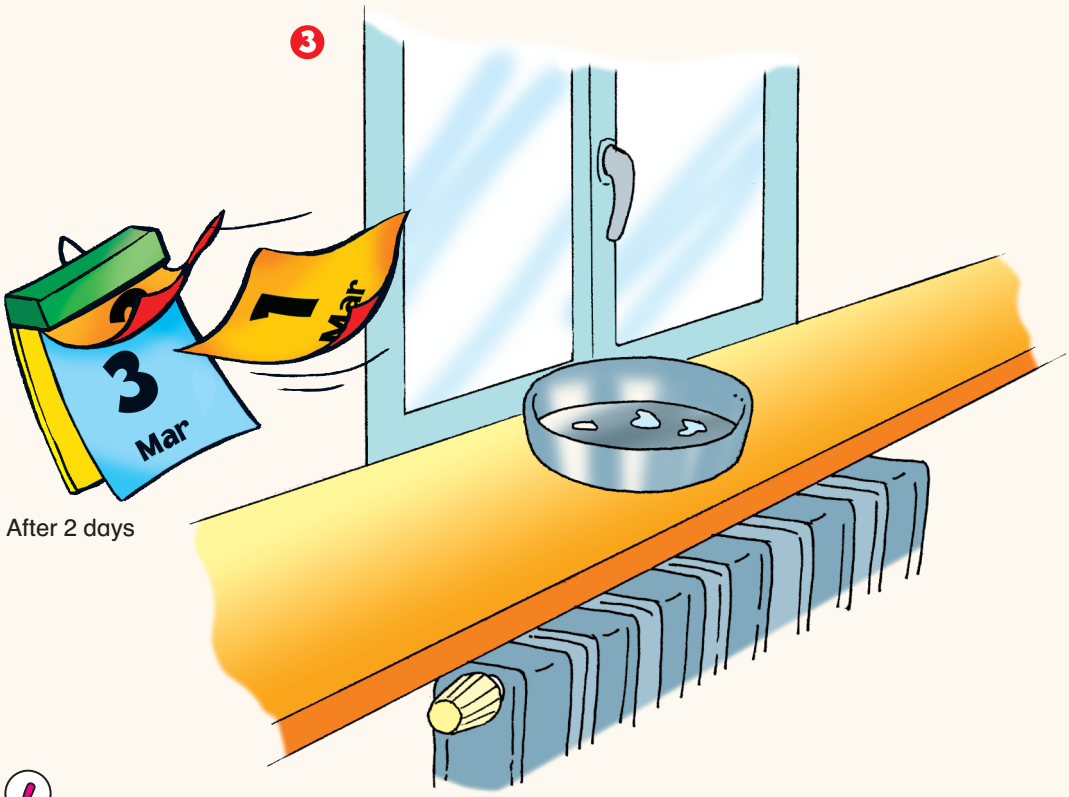


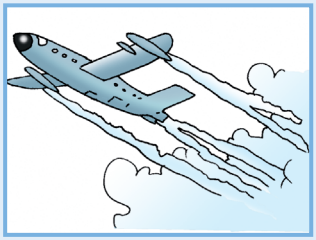


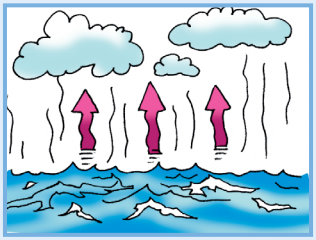
After 2 days

Answer:

Water consists of many tiny particles. They are not permanently attached to each other, but can come apart and be taken up by the air. Then, the water becomes distributed in very fine particles in the air. This is what happens in your experiment. The water has evaporated. In the sunshine, this happens very quickly, because warm air can absorb more of the tiny water particles than cold air can.

Experiment 3: Where do clouds come from?





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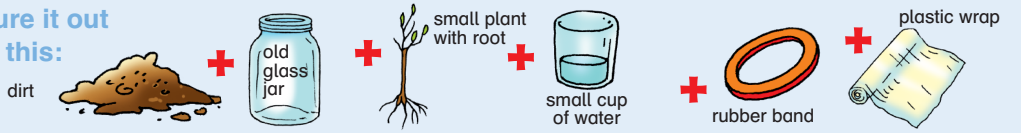


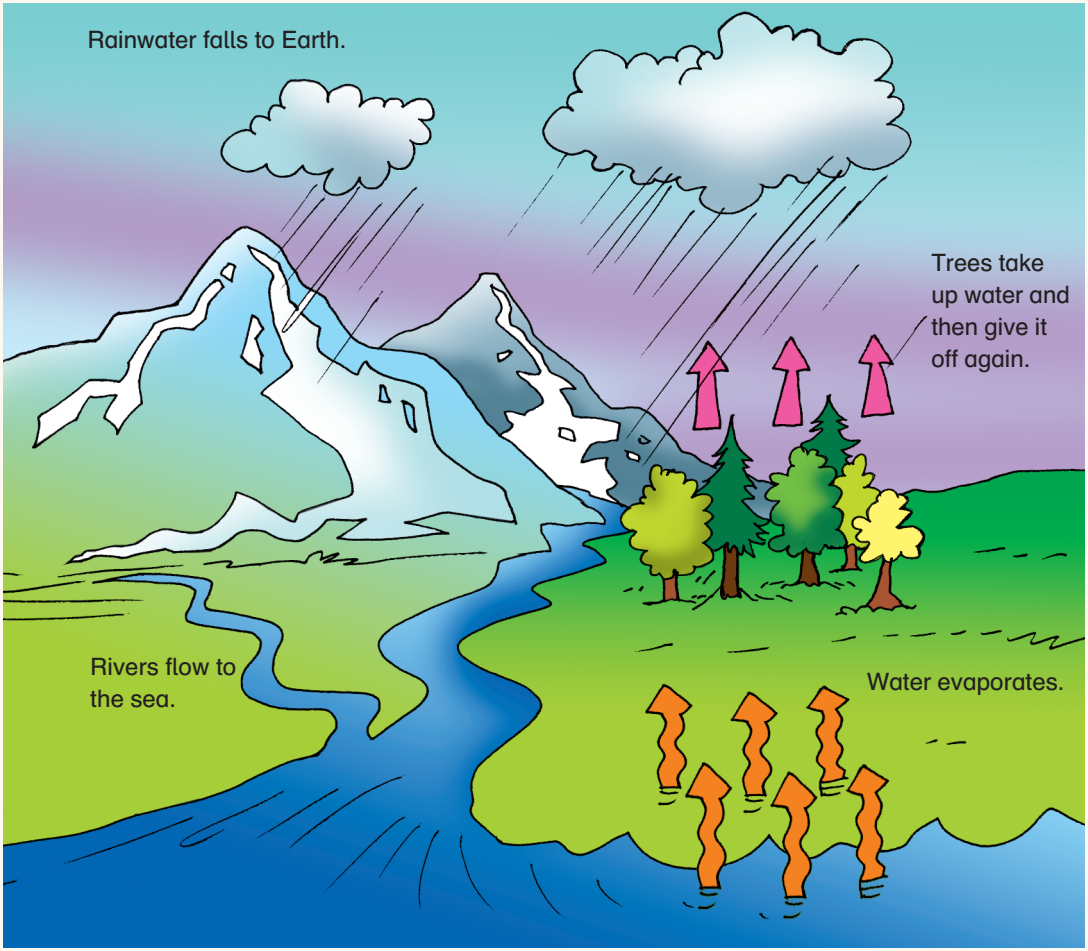
1

2

3

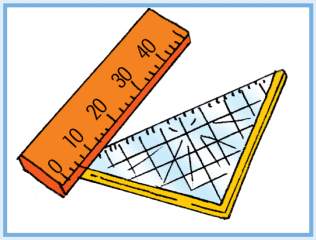
Answer:

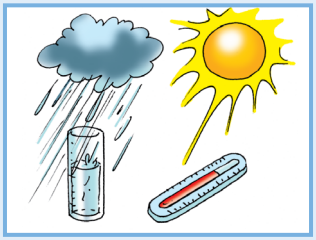
You have created a miniature world. The water forms droplets on the plastic wrap, which fall back down to the Earth again.



The water evaporates, the fine droplets in the air precipitate on the plastic wrap, and they can then fall back to the ground of your miniature world. You can see these fine droplets in the air outside as clouds in the sky.

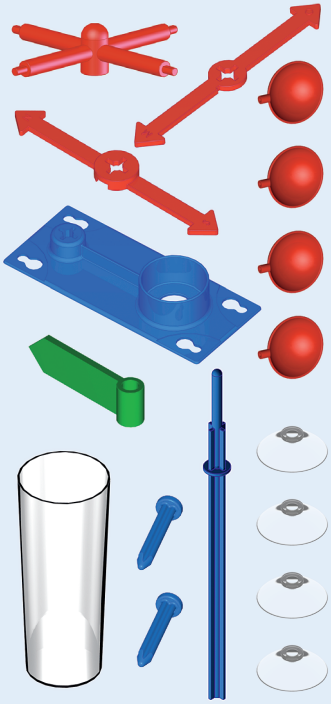
Experiment 4: How do I measure the “weather?” ... the wind and the rain?

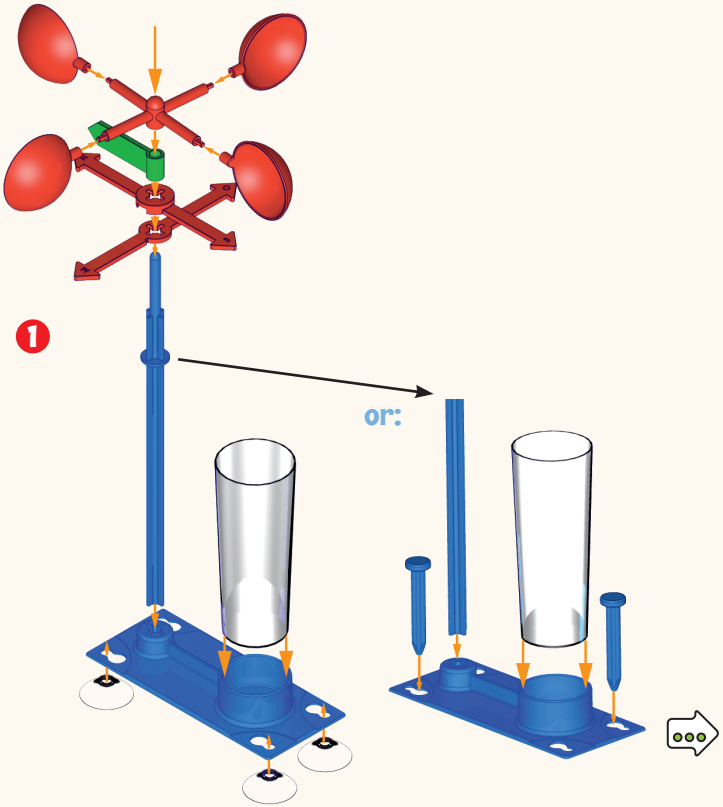




Or do you have other ideas?

Figure it out like this:





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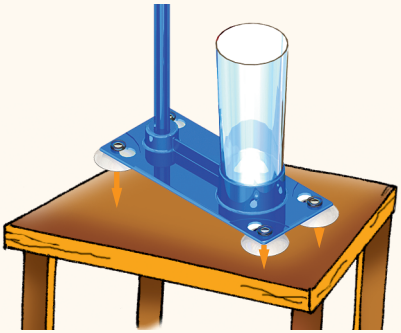

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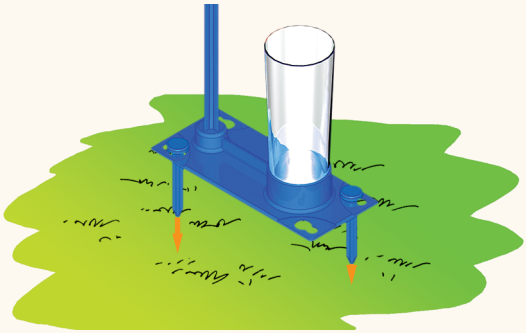


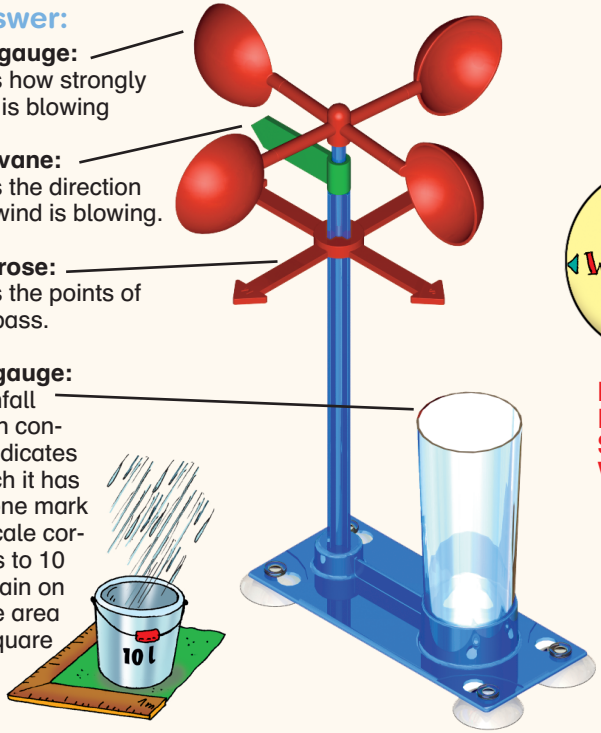
Answer:

1. Wind gauge:
Indicates how strongly the wind is blowing

2. Wind vane:
Indicates the direction that the wind is blowing.

3. Wind rose:
Indicates the points of the compass.

4. Rain gauge:
The "rainfall collection container" indicates how much it has rained (one mark on the scale corresponds to 10 liters of rain on a surface area of one square meter).

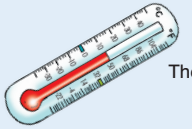


This memory aid will help you! The letters have to be placed in order, one after the other, in a clockwise direction.

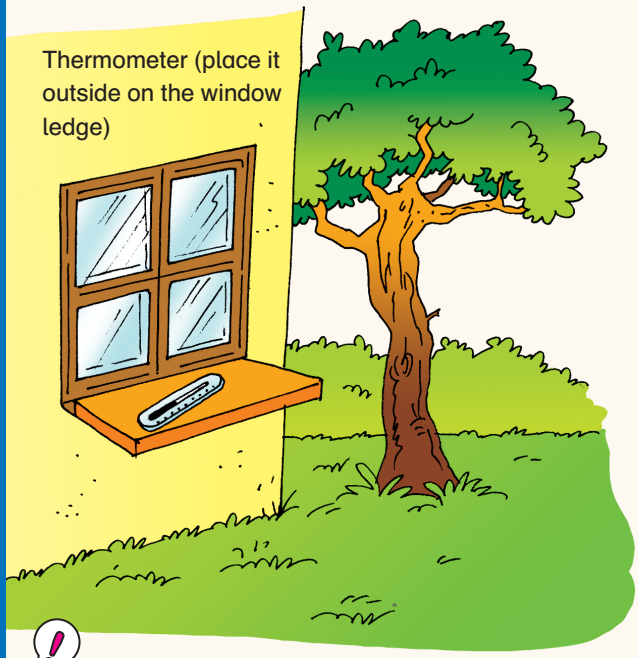
N – North —> Never
E – East —> Eat
S – South —> Sour
W – West —> Watermelon

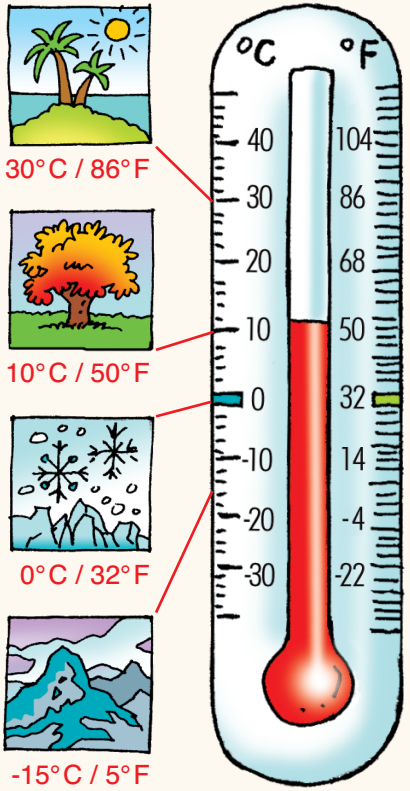
Experiment 5: How do I measure the “weather?” … the temperature?

Figure it out like this:



Thermometer

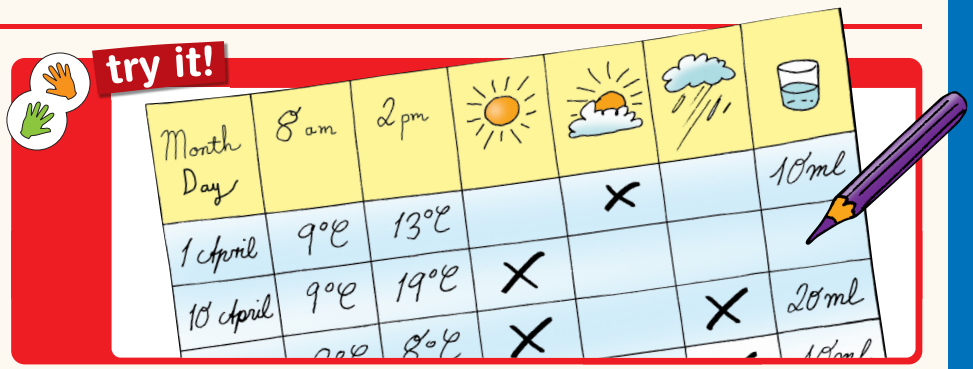




Answer:

The thermometer measures the temperature of the air. There is a red liquid in the thermometer’s glass tube. It expands when it is warm and that makes it require more space. So the red column rises. When it is cold, the liquid contracts and the red column goes down.
The °C (degrees Celsius) unit is used in this manual and in most of the world, although °F (degrees Fahrenheit) is still commonly used in the USA. 0 °C = 32 °F.

try it!

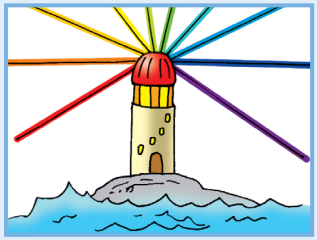


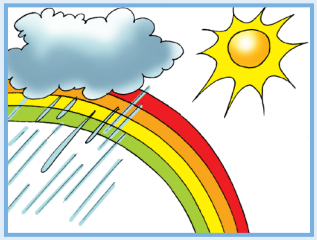
Month Day	8 am	2 pm				
1 April	9°C	13°C		X		10 ml
10 April	9°C	19°C	X			
			X		X	20 ml
	8°C		X			

Template:

Month Day	8 am	2 pm				

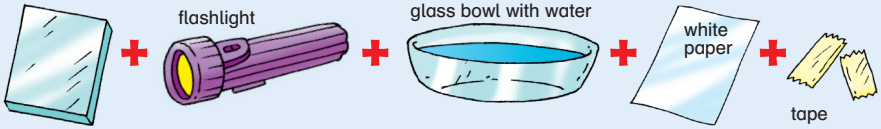
Experiment 6: What creates a rainbow?

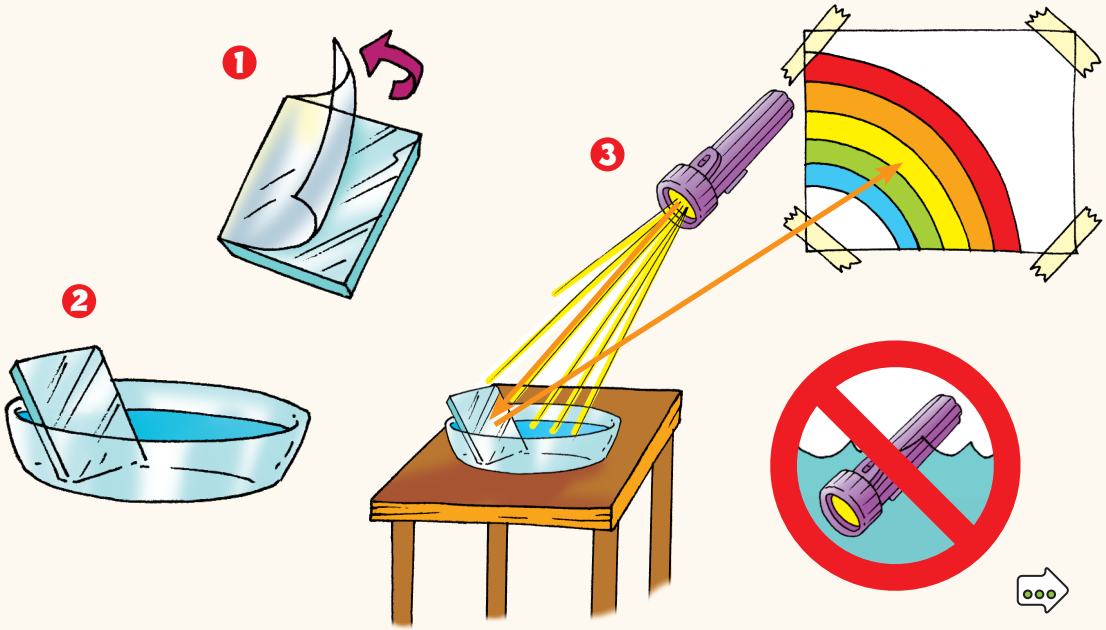




Or do you have other ideas?

Figure it out like this:





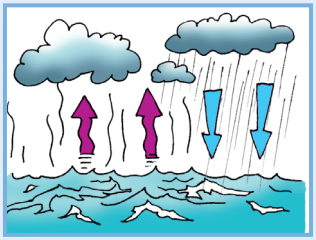
Answer:

Sunlight is made of a mixture of many colors of light. All the colors together appear to us as white light. But when the sun shines through water, each color in the mix behaves differently. The light becomes separated into its individual colors; it becomes broken or refracted.

try it!

If you use the garden hose to shoot a fine spray of water in the direction of the sun on a sunny day, you can create a rainbow.

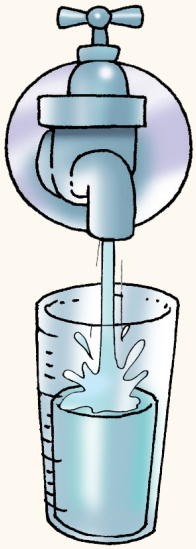
Experiment 7: Where do drops of water come from?



Or do you have other ideas?

Figure it out like this:

1



2

3

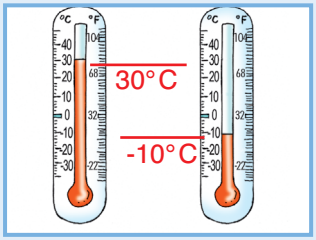
Answer:

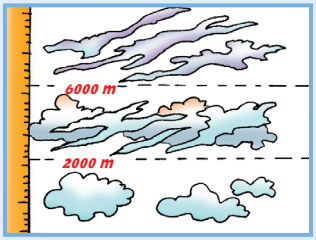
In Experiment 2, you noticed that warm air can absorb more water than cold air. In this experiment, the icy water cools the air in the cup so much that the air has to get rid of the water again. Little water droplets form on the wall of the cup; the water from the air condenses.

try it!

You can see the same thing happen after you take a shower or a bath. Lots of little water drops form on the cold mirror, so you can draw on it!

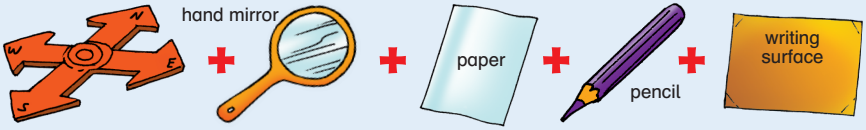
Experiment 8: Why are there different kinds of clouds?

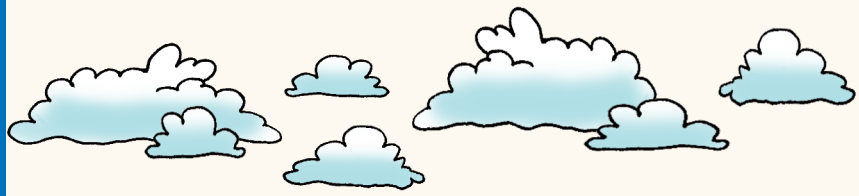


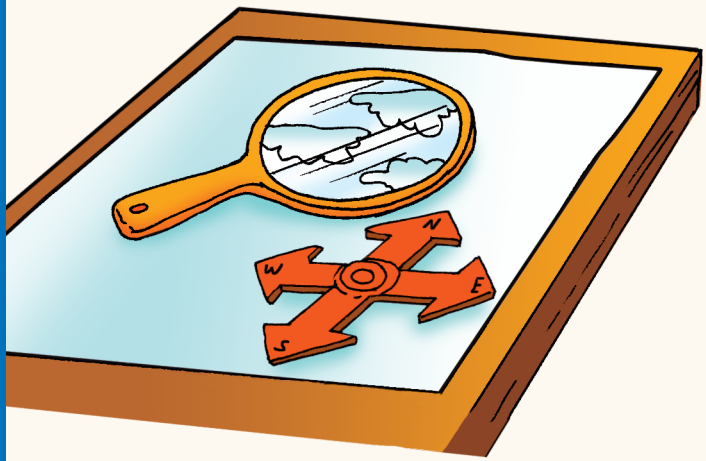


Or do you have other ideas?

Figure it out like this:







Use the hand mirror to watch the clouds moving across the sky. Then, you can also mark the points of the compass and see the direction in which the clouds are moving. Watch the clouds on different days and draw them.

Answer:

Clouds look different depending on their altitude and water content. Wind plays a role in shaping clouds, too.

1. Cumulus clouds:

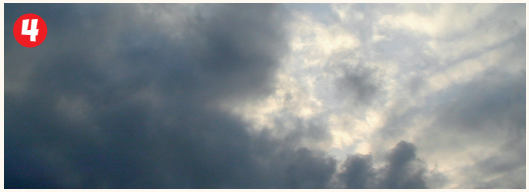
These look like little pieces of cotton wool and are too small to bring rain.

2. Cumulonimbus clouds:

These are tall, dense clouds that can bring heavy rain showers and thunderstorms.

3. Stratus clouds:

These are flat, low altitude clouds that can bring drizzle or fog.



4. Altostratus clouds:

These clouds are like a thick gray sheet, high in the sky. Wind is needed to create these.

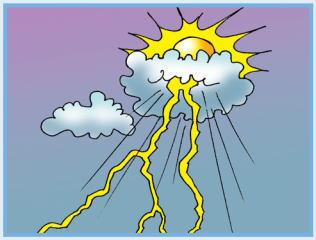
5. Cirrus clouds:

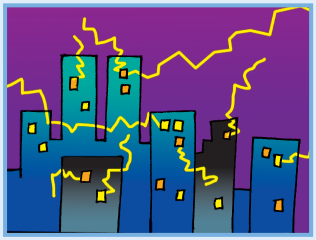
These thin, wispy clouds form at very high altitudes.

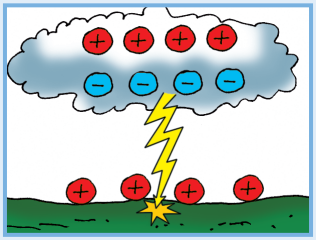
6. Airplane contrails:

Water from jet engines is converted into fine ice crystals that you can see.

Experiment 9: What causes lightning?







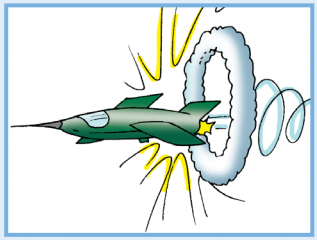
Or do you have other ideas?

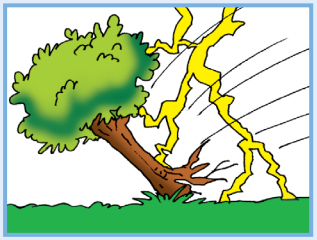
Figure it out like this:

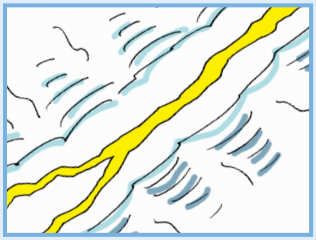
Answer:

Almost any object has positive and negative charges. When you rub it, the drinking straw takes on a lot more negative charges. It becomes electrostatically charged. Then, it wants to have the positive charges of the little pieces of polystyrene (styrofoam), in order to regain a balance. That causes them to be attracted to it. In clouds during a storm, cold and warm air are agitated together. The droplets of water and little ice crystals in the clouds rub against each other and become charged (just like the drinking straw). In order to regain a balance, they have to discharge themselves. That makes lightning.

Experiment 10: What is thunder?

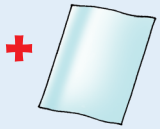


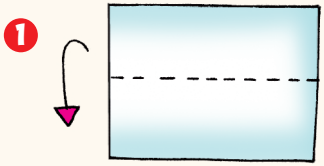


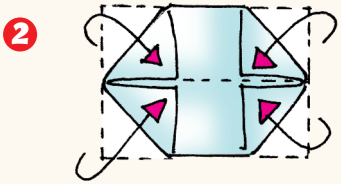


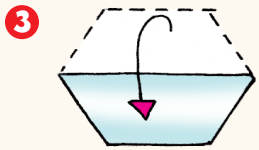
Or do you have other ideas?

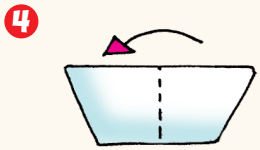
Figure it out like this:

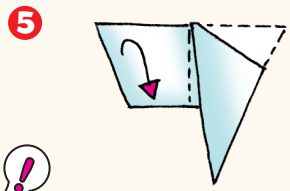


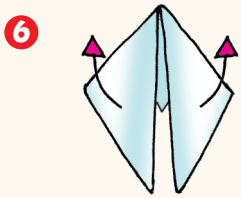


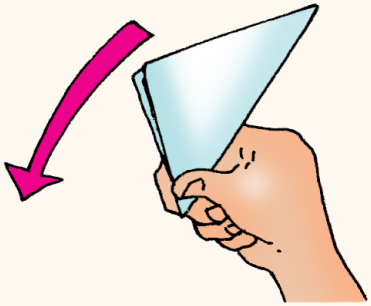












Answer:

When a lightning bolt races to the ground, it heats the air so much that the air abruptly expands. That creates noise, just like your thunder pouch when it snaps open.

How do you measure wind strength?

Wind Table:

Calm

Light air

Light breeze

Gentle breeze

Moderate breeze

Fresh breeze

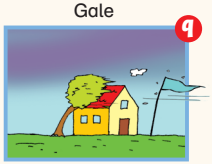
Beaufort (bft)	Name	Description
0	Calm	Smoke rises straight up
1	Light air	Leaves move in the treetops
2	Light breeze	Smoke blows, light movement in the tips of grasses
3	Gentle breeze	Smoke blows quickly, flags, grasses, and the tips of bushes move lightly
4	Moderate breeze	Wind can be felt, tops of trees and bushes move and make a soft rustling sound
5	Fresh breeze	Wind is clearly felt, tops of trees and bushes obviously move with rustling sound
6	Strong breeze	Trees and branches move strongly, waves and white foam form on water's surface
7	Near gale	Trees make whooshing noise, leaves are torn off, water forms whitecaps
8	Gale	Entire trees in motion, twigs break, the wind starts to howl, high waves on the water
9	Severe gale	Thin branches break, the wind howls, strong whitecaps on the water
10	Storm	Trees are uprooted, significant damage occurs
11	Violent storm	Heavy storm damage
12	Hurricane	Catastrophic hurricane damage

Wind strength is measured in Beaufort numbers (bft), named after the British admiral who created this multipart scale in 1806.

Strong breeze

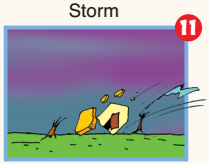
Near gale

Gale

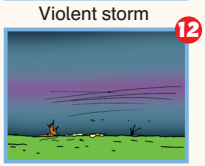


Severe gale

Storm



Violent storm



Hurricane