FREEK VONK™
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BRESSER

WEATHER STATION

Art. No. 9820200

EN **Experiments**

EN Experiments

Experiment 1

Measuring wind speed

We cannot see the wind, but we often see what it is doing or what it has done. To measure wind speed, we use an instrument called an anemometer.

Materials:

• 1 wind speed meter (Anemometer)

Steps:

1. Assemble the wind speed meter.

2. Turn on the meter, switch to wind speed measurement mode and select the unit you want to use:

- m/s: Meters per second

- km/h: Kilometers per hour

- mph: Miles per hour

- knots: Nautical Miles per hour

3. You may erase the previously recorded maximum wind speed data first. Press [AVG/MAX] until the maximum data is shown and press [ON/OFF/CLR] to clear this old data. Change back to normal mode by pressing [AVG/MAX] again.

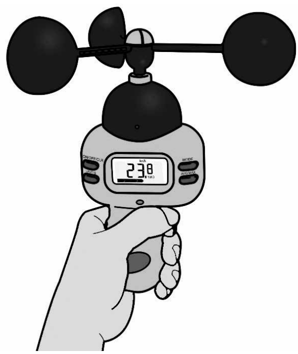
4. Take the meter outside and hold it up, at arm's length while the cups rotate in the wind. Lower the instrument and note the reading. You can recall the average and maximum wind speed by pressing the [AVG/MAX] button.

Explanation:

The wind speed meter is equipped with wind cups. They spin almost like a windmill when the wind blows. The stronger the wind blows, the faster these rotations are. Along with the wind cups, a shaft rotates, which is connected to a slot wheel. The electronic circuitry measures the speed of the wheel and calculates the wind speed.

Note:

- Hold the wind speed meter up high so that your body will not block the wind and affect the readings.
- The bar on the bottom of the display is the Beaufort Scale, which was devised in 1805 by a British sailor named Francis Beaufort. The scale was used to estimate the force of the wind without the use of any instruments. It divides wind speeds into 12 categories, each of which describes the physical effect of the wind.



The Beaufort Scale

Force	Wind speed (km/h)	Description	Effects
0	<1	Calm	Smoke rises vertically
1	1-5	Light air	Wind direction shown by smoke-drift
2	6-11	Light breeze	Wind felt on face; leaves rustle; weather vanes move
3	12-19	Gentle breeze	Leaves and small twigs move, light weight flags extend
4	20-28	Moderate breeze	Small branches move, raises dust, leaves and paper
5	29-38	Fresh breeze	Small trees sway
6	39-49	Strong breeze	Large tree branches move, telephone wires "whistle", umbrellas are difficult to control
7	50-61	Near gale	Large trees sway, becoming difficult to walk
8	62-74	Gale	Twigs break off trees, walking is difficult
9	75-88	Strong gale	Slight damage occurs to buildings, roof tiles fly off
10	89-102	Storm	Trees uprooted, considerable damage to house (rarely experienced)
11	103-117	Violent storm	Very rarely experienced; extensive widespread damage
12	118+	Cyclone/ Hurricane	Extreme destruction; devastation

Experiment 2

Measuring wind direction using a wind vane

From which direction is the wind blowing? The wind vane is one of the oldest weather tools. It is used for measuring wind direction.

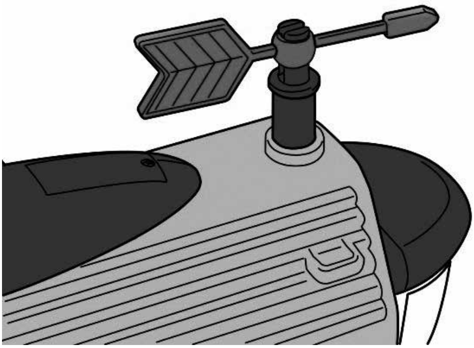
Materials:

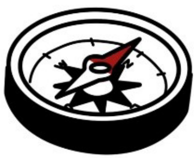
• 1 wind vane

• 1 compass

Steps:

1. Set the wind vane (with the carrying case) in a high place. Make sure it does not tilt or wobble. Always make sure nothing blocks the wind. Otherwise, the results would be inaccurate.
2. The wind vane’s arrow spins and points in the direction from which the wind comes. So, if it points south, the wind is a south wind. Use the compass to determine the wind direction. The red pointer always points north. Align the compass so that the red arrow points to the 'N' on the compass scale. Compare the direction of the arrow on the wind vane with the compass and read the corresponding direction on the compass scale.





Explanation:

The part of the vane that turns into the wind is usually shaped like an arrow. The other end is wide so it will catch the smallest breeze. The breeze turns the arrow until it catches both sides of the wide end equally. The wind vane helps meteorologists to track, among other things, the movement of storm clouds.

Experiment 3

Measuring temperature using a thermometer

Materials:

• 1 thermometer (not included)

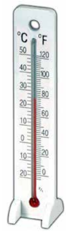
• 1 notepad

Observe your thermometer:

Look at your thermometer, which is a small tube with a small bulb at the bottom. In the middle you see a thin red line. It rises higher when it is hotter. When it gets cold, the line drops. The liquid inside is colored alcohol, which expands when heated and shrinks when cooled. The scale on both sides of the thermometer indicates the temperature using different units. On one side is the Fahrenheit scale (°F), which is used mostly in the United States, on the other side is the Celsius scale (°C) which is mostly used in the rest of the world.

Temperature:

Temperature is a measure of how warm or cold something is. A thermometer is a device that measures the temperature of things. You can use a thermometer to measure the temperature inside or outside your house, inside the refrigerator or even your body temperature if you are sick. Temperature is one of the most important elements of weather because it controls or influences other elements like humidity, clouds, rain and wind.



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Time and temperature:

We know that the time factors influence how hot or cold it is. The time of the year and the time of the day have influence over the temperature.

- Temperature variation between day and night: It refers to the periodic and regular change of temperature within a day. The temperature is usually at maximum around 2 o'clock in the afternoon when we receive the strongest sunlight and at minimum around sunrise in the early morning, when the heat stored in the ground from the day before is dissipated.
- Seasonal temperature change: It refers to the periodic and regular change of temperature at different times of the year. The temperature is highest during summer time when the earth is closer to the sun. During wintertime the temperature is the lowest when the earth is further away from the sun and the sunlight is weaker.

Measure and record the temperature:

Use the supplied thermometer and measure the outdoor temperature. Take readings at different times of the day and at different months. Try to complete the table below. This will give you a rather exact idea of the range of temperature of your area.

Month/Hour	**3:00**	**6:00**	**9:00**	**12:00**	**15:00**	**18:00**	**21:00**	**24:00**
January								
March								
May								
July								
September								
November								

Experiment 4

Exploring lightning and static electricity

Thunderstorms are terrifying and yet beautiful to watch. When warm, humid air rises and cools, the water vapor condenses into a cloud. When the conditions are right, it gradually develops into a thundercloud with more and more water vapor. Thunderstorms are created in the giant cumulonimbus clouds. Flashes of lightning may fill the sky and sometimes we hear a booming sound wave called thunder.

Lightning

Lightning is a huge discharge of electricity and is one of the most unpredictable forces of nature. It can strike from minor or major storms and can hit a target 10 or even 25 miles away from the parent cloud. When ice and water particles collide in a cloud, they are charged with static electricity. Lighter particles tend to be positively charged and end up near the top of the cloud, while negatively charged particles are near the bottom of the cloud. In time, this charge becomes so great that electricity jumps to the ground or to the other clouds, creating great sparks of lightning. The lightning heats up the air to a high temperature and produces a powerful explosion we hear as thunder.

Materials:

- 1 cotton cloth, towel or blanket. The material needs to be clean and dry.

- Dry air. This experiment works best when the humidity is low, like during wintertime. Turning the furnace up a few degrees will help dry the air further.

Steps:

1. Turn off all the lights and give your eyes some time to adjust to the darkness.
2. Sit on the floor or bed. Place the cloth on your back. Make a fist and hold your hand at a distance of approximately 15 cm from your face, directly in front of your chin.

3. Quickly move the cloth over your head with your other hand. Make sure it rubs well on your hair.

4. Draw the cloth close to your fist until it is approximately 10 cm above your fist. Make sure the fist doesn't touch your arm.

5. If you're doing it correctly, spectacular little blue/purple sparks will jump off your knuckles into the cloth. The faster you pull the cloth, the longer and more frequent the sparks will be.

Explanation:

The small sparks occur because something similar to a thunderstorm is happening. When you rub the cloth over your hair, you transfer tiny invisible energy particles, which we call electrons, from your hair to the cloth. This makes the cloth negatively charged and your hair positively charged, which creates a high electrical voltage between your body and the cloth. This electrical voltage can cause electrons to want to jump back from the cloth to your body in order to balance the difference in charge. If you hold the cloth to your fist, and the difference in charge is very large, a small spark or flash can occur balancing out the difference in charge.

Experiment 5

Determining how far away a storm is

Materials:

- 1 wristwatch / stopwatch (not included)
- 1 notepad

Steps:

1. Have your stopwatch or a wristwatch ready.
2. When you see a flash of lightning, start the stopwatch or note the time on the wristwatch.
3. Count the number of seconds until you hear the thunder.
4. For every 3 seconds the storm is 1 kilometer away. So, divide the number of seconds you counted by 3 to get the distance in kilometers. For example, if you hear the thunder after 9 seconds, the storm is 9 / 3 = 3 km away.

Explanation:

Light travels much faster than sound. The lightning and thunder are always happening at the same time, but light reaches you instantly, while the sound takes longer. Sometimes you may see a flash of lightning without hearing thunder. This is because the lightning occurs too far away to be heard. But when you see lightning and hear thunder at the same time, it means that the thunderstorm is very close, so LOOK OUT!

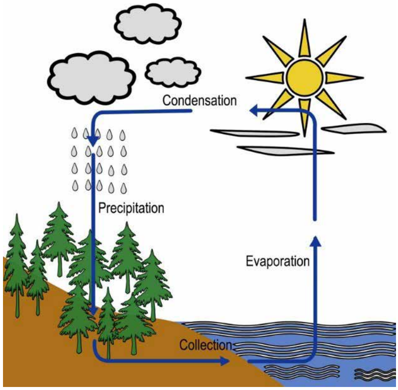
Experiment 6

Understanding the Water Cycle and evaporation

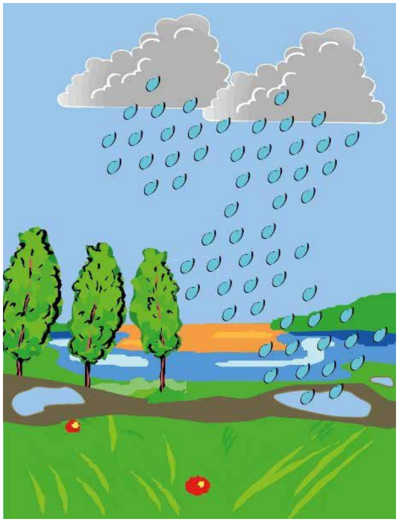
The earth has a limited amount of water. Water keeps going around and around in a continuous process called the "Water Cycle".

This cycle is made up of a few main parts:

- Evaporation (and transpiration)
- Condensation
- Precipitation
- Collection



The sun's heat transforms the water collected in oceans, lakes and rivers into a gas. This gas is called water vapor and the process is called evaporation. In the atmosphere, the water vapor gets cold and changes back into droplets of liquid water, forming clouds. This is called condensation. When the water is too heavy to be held in the clouds, it falls back to the ground as precipitation - dew, rain, sleet or snow.

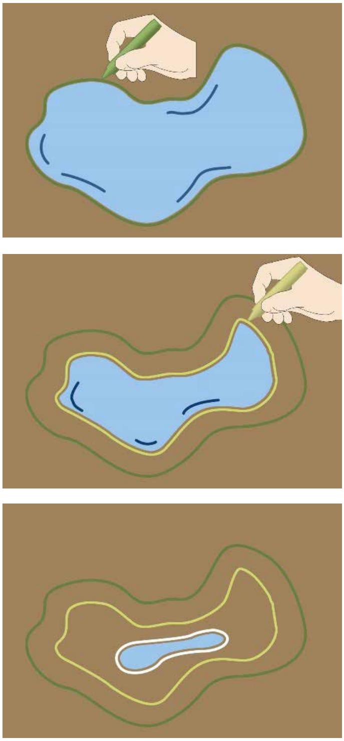


Materials:

- 2 chalk sticks
- Puddles

Steps:

1. Find a place where puddles are usually formed after the rain.
2. After a rainy day, look for a puddle. Use your chalk to trace the edges of the puddle and wait.
3. Return to look at your puddle when four or five hours have passed. Trace the edges of the puddle as it appears now. If you have a piece of chalk with a different color, use it.
4. Compare the chalk outlines. If you wish, you can wait to draw another one when more time has passed.
5. Try this Experiment under different weather conditions: with the sun shining, cloudy or windy weather … When will the puddle dry the fastest?



Explanation:

The puddle decreases as water evaporates. It is the intensity of the heat of the sun that determines the speed of evaporation. So, if the weather is hot after the rain, the puddles disappear very quickly. However, if it remains wet and cold, the puddles stay longer.

Experiment 7

Determining the pH

What is pH?

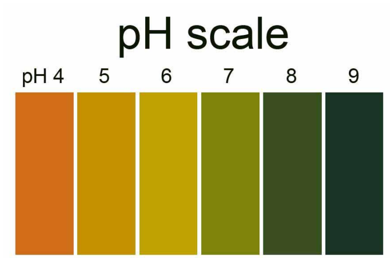
pH, which stands for potential of Hydrogen, is the value which indicates if a substance is an acid or a base.

The pH can go from 1 to 14:

- Substances which have a pH lower than 7 are acids (the pH 1 being the strongest acid).
- Substances which have a pH equal to 7 are neutral.
- Substances which have a pH higher than 7 are bases/alkaline (the pH 14 being the strongest base/alkaline).

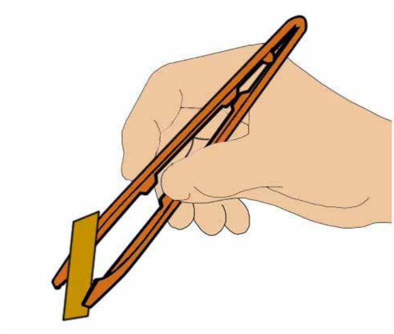
Materials:

- pH paper
- 1 pH scale
- 1 pair of tweezers
- Tap water

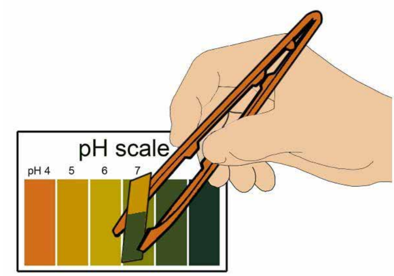


Steps:

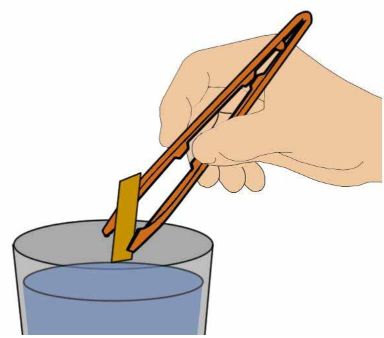
1. Study the pH scale, the supplied pH scale goes from 4 to 9. Locate the color corresponding to each pH value.
2. The pH paper changes color when we put it in contact with a basic or acidic substance. Always hold the pH paper with the tweezers, because even the moisture of your fingers can make it change color.



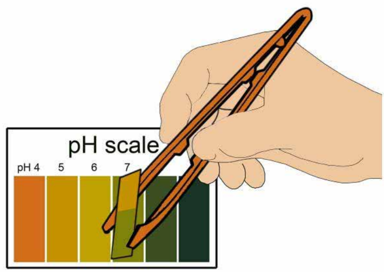
3. By comparing the color of paper pH on a pH scale, you can determine the pH of the substance you are testing.



4. You can check the pH of different substances, but start with the tap water of your house. Cut out small pieces of pH paper. Do not forget to always use the tweezers! Soak the pH paper in water.



5. Note the color change. Find the new color of the pH paper on the pH scale. The number that corresponds to this color is the tap water's pH.



Explanation:

pH paper is a special kind of paper that changes its color when you dip it into a liquid. The new color shows whether the liquid is acidic, basic, or neutral. The pH value of water should be neutral (7).

Experiment 8

Air pollution and determining the pH of rain

Pollution is caused by the emission of undesirable substances to the atmosphere, the earth, rivers and seas. Pollution harms or endangers our lives, and also badly affects the lives of animals and plants.

Acid rain is caused by chemical changes, which occur in the atmosphere and are produced by air pollution. Under the action of these chemical changes, certain gases become acidic. Acid rain is very harmful to the environment. It damages everything over a period of time because it causes the living things in the environment to die. Acid rain affects life in water as well as life on land. It is almost worse in water than on land because fish need the water to breathe. When the water gets polluted, then the fish get sick and end up dying.

However, rainwater is always slightly acidic. Normal rainwater has a pH of 5.6. It is only when the pH of the rain drops below 5.6 that it is considered acid rain.

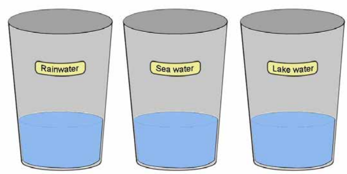
Materials:

- pH paper
- 1 pH scale
- Plastic cups
- 1 pair of tweezers
- 1 pipette
- Different types of water

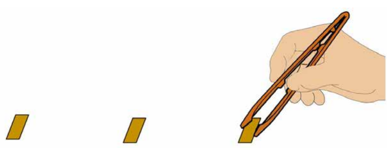
WARNING:

Risk of burns from hot water! Only perform this task under adult supervision.

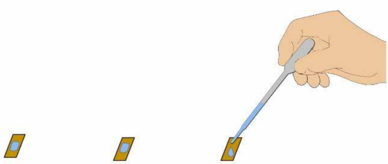
Steps:



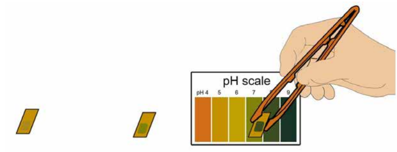
1. Gather as many water samples as possible: tap water, rainwater, water from an aquarium, a lake, a river, the sea.
2. Pour each sample in a cup and label the cups.
3. Take pH paper using the tweezers. Cut it into small pieces and place one of these pieces next to each cup.



4. Add a few drops of each water sample on the pH paper using a pipette. Wash and dry the pipette every time before picking up the next water sample.



5. Wait a few minutes and compare the colors to the pH scale. Determine the pH value of each sample using the colors.



6. You can also test the pH of the two other water forms, like an ice cube and vapor. Pay attention not to get burnt by the hot vapor.

Explanation:

If the pH of rainwater is 5, it is considered acid rain. Acid rain is dangerous. Therefore, if the pH of rainwater is below 5, the water is not viable.

Experiment 9

Building a hygrometer

Humidity refers to the concentration of water vapor in the air. Measuring the humidity helps meteorologists forecast the weather. A relative humidity of 100 percent is when the air has as much water vapor as it can hold at a particular temperature, and mists or fogs form. When the air is very humid, the chance of raining is higher. In hot and humid weather, we feel uncomfortable because perspiration on our skin does not evaporate as quickly, hampering our body's effort to cool down.

Meteorologists use a device called a hygrometer to measure humidity. One type of hygrometer is the wet-and-dry bulb thermometer, which contains two different thermometers.

Materials:

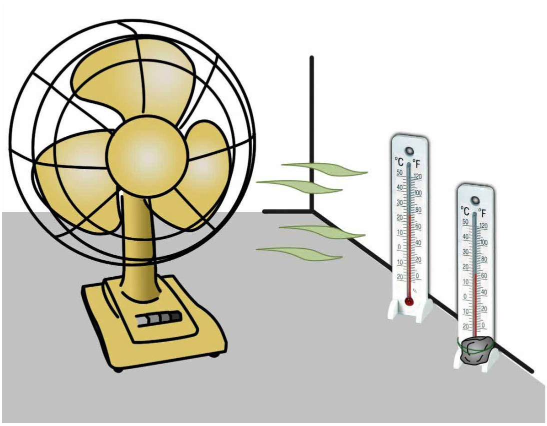
- 2 thermometers (not included)
- 1 cotton ball or small piece of cotton
- Tap water
- 1 relative humidity table
- 1 fan

	dry bulb minus wet bulb									
dry bulb °C	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
10	88	77	66	55	44	34	24	15	6	
11	89	78	67	56	46	36	27	18	9	
12	89	78	68	58	48	39	29	21	12	
13	89	79	69	59	50	41	32	22	15	7
14	90	79	70	60	51	42	34	25	18	10
15	90	81	71	61	53	44	36	27	20	13
16	90	81	71	63	54	46	38	30	23	15
17	90	81	72	64	55	47	40	32	25	18
18	91	82	73	65	57	49	41	34	27	20
19	91	82	74	65	58	50	43	36	29	22
20	91	83	74	67	59	53	46	39	32	26
21	91	83	75	67	60	53	46	39	32	26
22	91	83	76	68	61	54	47	40	34	28
23	92	84	76	69	62	55	48	42	36	30
24	92	84	77	69	62	56	49	43	37	31
25	92	84	77	70	63	57	50	44	39	33

Relative humidity table

Steps:

1. Use a rubber band to tie a thoroughly wet cotton ball to the bulb of one thermometer. This is the wet thermometer.
2. Place the wet and dry thermometers side by side against the wall or one side of a box. You can use a piece of tape to secure them so they will not fall.
3. Turn on the fan and blow on the thermometers until the temperature readings stop falling. This may take several minutes.
4. Write down the temperature on both thermometers, for example 19 °C and 15 °C
5. Subtract the temperature on the wet thermometer from that of the dry one, e.g. 19 °C - 15 °C = 4 °C.
6. Look in the provided Relative Humidity Table for the temperature of the dry thermometer in the far left column, e.g. 19, and the difference of the two temperatures at the top row, e.g. 4. Look where the row with the dry temperature and the column with the temperature difference meet in the table. This number is the relative humidity in % (see highlights in the example table: 65%).



		dry bulb minus wet bulb									
dry bulb	**°C**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	10	88	77	66	55	44	34	24	15	6	
	11	89	78	67	56	46	36	27	18	9	
	12	89	78	68	58	48	39	29	21	12	
	13	89	79	69	59	50	41	32	22	15	7
	14	90	79	70	60	51	42	34	25	18	10
	15	90	81	71	61	53	44	36	27	20	13
	16	90	81	71	63	54	46	38	30	23	15
	17	90	81	72	64	55	47	40	32	25	18
	18	91	82	73	65	57	49	41	34	27	20
	19	91	82	74	65	58	50	43	36	29	22
	20	91	83	74	67	59	53	46	39	32	26
	21	91	83	75	67	60	53	46	39	32	26
	22	91	83	76	68	61	54	47	40	34	28
	23	92	84	76	69	62	55	48	42	36	30
	24	92	84	77	69	62	56	49	43	37	31
	25	92	84	77	70	63	57	50	44	39	33

Relative humidity table

Experiment 10

Setting up the barometer

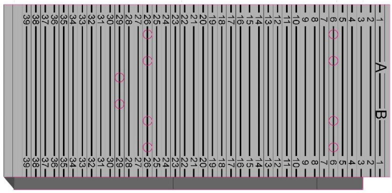
Atmospheric pressure or air pressure corresponds to the weight of air. Measuring atmospheric pressure is very useful in predicting the weather. We use a barometer to measure the air pressure. Here is how to make your own.

Materials:

• 1 balloon
• 1 plastic tube
• 5 pieces of bag ties
• 1 rubber ring
• 1 stopper
• 1 pressure scale card
• 1 pipette
• 1 cup
• Food coloring
• Water

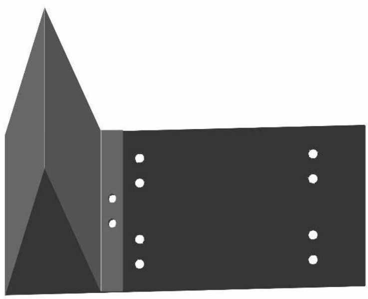
Steps:

1. Prepare the pressure scale card.

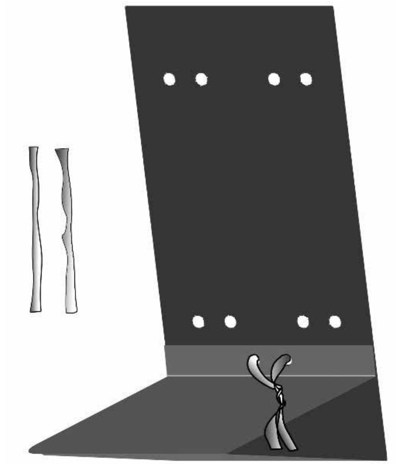


1. Lay it flat on a table, with the printed side faced down as indicated below.

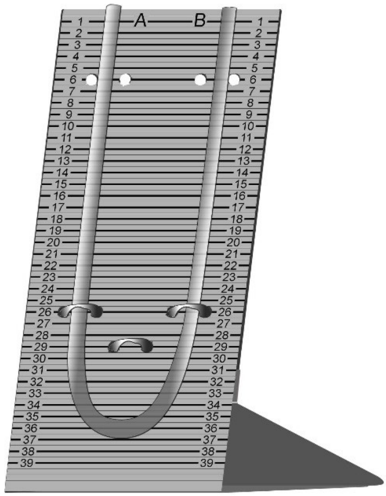
3. Fold the left side towards the middle, until the holes on the left panel intersect with those near the middle of the cardboard.



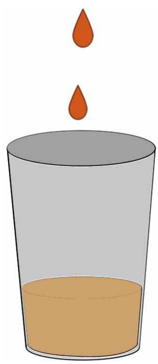
4. Insert a bag tie through the overlapping holes, make a loop and twist the ends so that the cardboard shape is secured.



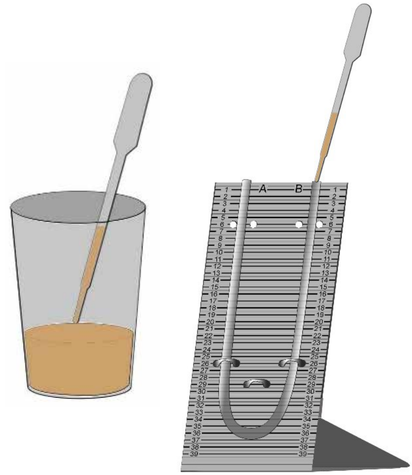
5. Fix the plastic tube in position using two bag ties



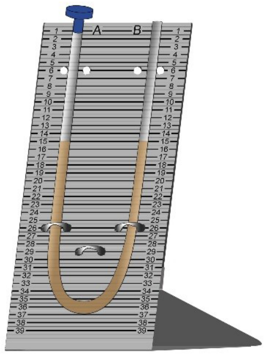
6. Fill the cup with some water, add a few drops of food coloring and stir with a spoon until they are mixed.



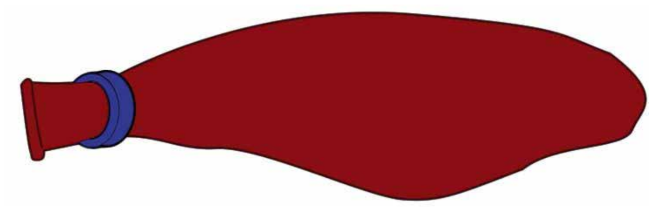
7. Use the pipette to add the colored water into the plastic tube until it is half-full.



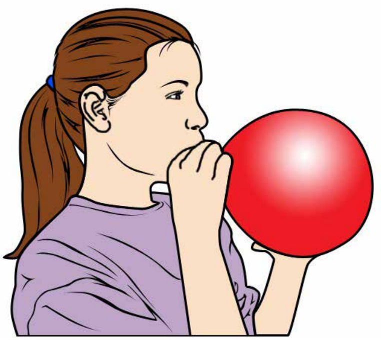
8. Put a stopper to one end of the plastic tube.

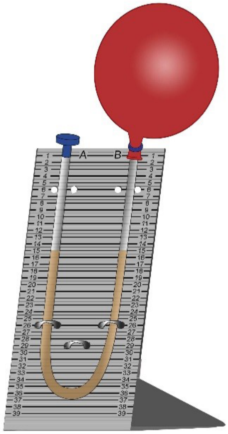


9. Slide the rubber band over the balloon as shown in the picture.



10. Blow the balloon up and quickly attach it to the open end of the plastic tube. Place the rubber ring around the tube to prevent the air from escaping.





11. Fix both ends of the plastic tube on the cardboard with two more bag ties. Now the barometer is ready. Record the level of the water on the left (A) and on the right (B).

Explanation:

Due to the change of the atmospheric pressure, the water level in the tube should change from one day to the next. Atmospheric pressure is the weight of air pressing on every part of your body, and everything around you. We can measure air pressure and predict a storm.

Experiment 11

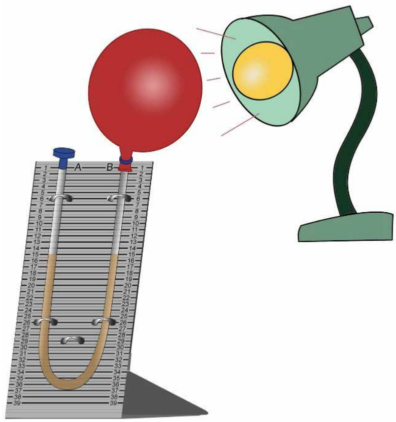
Using the barometer

Check and record the water level of column B (under the balloon) for several days. This should be especially interesting when the weather changes from good to bad or vice versa. Try to find a relation between the weather and the water level readings.

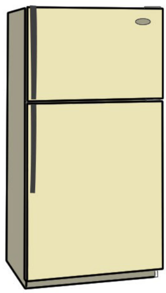
The water level of the barometer changes when the air pressure changes. When the weather is fine, the air pressure is higher. However, when a storm is coming, the air pressure drops. When the pressure increases, the air leaves the balloon and goes into the tube. Thus, the water is pushed towards the stopper and the water level under the balloon falls. Conversely, when the pressure decreases, the air enters the balloon and the water follows the same direction, making the water level under the balloon rise. You can simulate the change of air pressure by trying the Experiment below.

Steps:

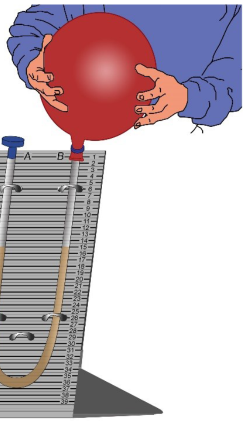
1. Place your barometer close to a light bulb for at least half an hour. Record the water level and compare it with your previous records.



2. Place your barometer inside a refrigerator for about 15 minutes. Record the water levels.



3. Simulate a large increase in air pressure by pressing the balloon with your hands. Note and record the results again.



Explanation:

Air pressure varies according to many factors, such as air temperature and air density (how tightly its particles are packed together). The molecules of cold air move slower and stay closer together than the molecules of warm air. Dense cold air contains many molecules and puts a greater force on the earth’s surface. We usually do not feel the effect of air pressure on us because our body is used to it, unless there is a fast change of air pressure. For example, when we take a lift to go to the top floor of a tall building or when we are on a landing airplane, we can certainly feel the pressure inside our ears.

Experiment 12

Watching snowflakes under a magnifying glass

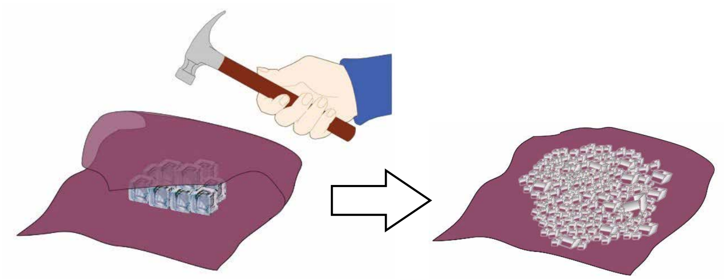
Materials:

- 1 magnifying glass
- 1 cup
- 1 spoon
- 1 large piece of cloth
- 1 hammer
- Some ice cubes
- Some salt
- 1 desk lamp

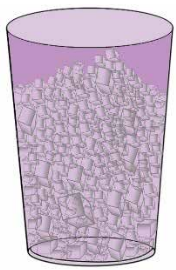
WARNING:
Risk of injury from hammer! Only perform this task under adult supervision.

Steps:

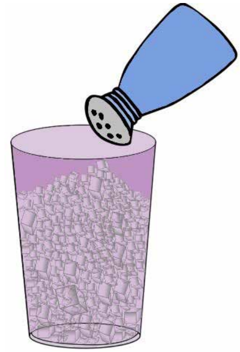
1. Put some ice cubes on a large piece of cloth. Warp the ice within the cloth and use a hammer to crush the ice into small pieces. Be careful when using the hammer and make sure you don't hit any body parts with it.



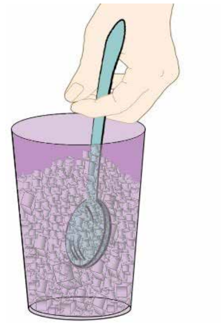
2. Fill a cup up to about 3/4 full with the crushed ice.



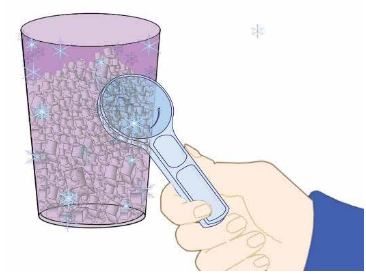
3. Add salt into the cup until it is almost full. The ice should start to melt.



4. Stir the ice and salt mixture very rapidly with a spoon for at least 15 minutes.



5. There should be some dew on the outside of the cup at first, observe what occurs if you wait a few minutes longer. Ice crystals should be forming. Examine carefully with a magnifying glass. You can see the crystal structure more clearly, if you place the cup near a desk lamp.



Explanation:

As the cup cools, the moisture in the air condenses on the cool surface. As the cup becomes colder, the water on the surface of the cup freezes causing the formation of ice crystals.

Experiment 13

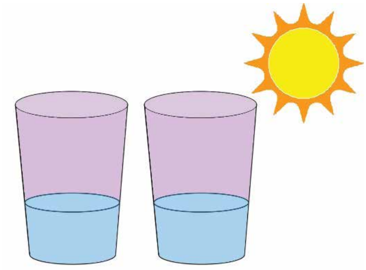
Exploring the greenhouse effect

Materials:

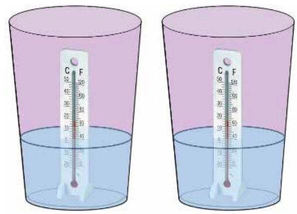
- 2 cups
- 1 rubber band
- 2 thermometers (not included)
- 1 plastic bag

Steps:

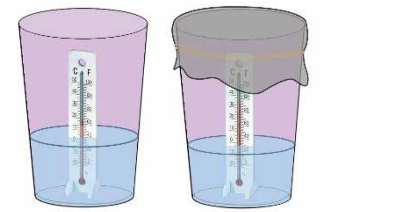
1. Fill both cups with the same amount of cold water and place them under the sun.



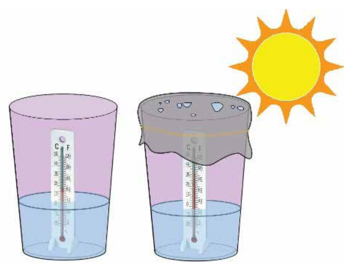
2. Put a thermometer inside each cup. The readings on both thermometers should be the same.



3. Cover one of the cups with a plastic bag and secure it with a rubber band as shown in the picture.



4. Leave both cups in the sun for one hour and record the temperatures. What do you notice? Are they the same or different? How can this difference be explained? Also, observe that there is some steam condensation forming under the plastic cover.



Explanation:

Greenhouse effect results from air pollution mainly due to carbon dioxide. The gas is produced when car engines are running. In fact, carbon dioxide is formed when we burn fuels such as coal and oil. This gas builds up in the atmosphere and creates a layer, which traps the sun's heat like a greenhouse. As more and more carbon dioxide builds up in the atmosphere, this "greenhouse effect" warms the climate and dissolves the ice in the polar region. In this Experiment, the plastic bag acts as the layer of carbon dioxide in the atmosphere.

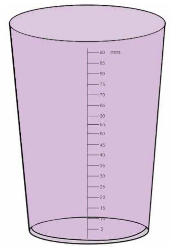
Experiment 14

Measuring rainfall using a rain gauge

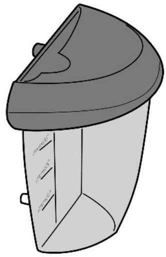
How much rainfall do you get where you live? Use the rain gauge to measure the amount.

Materials:

- 1 cup with scale or the rain gauge from the weather station case



Cup with scale



Rain gauge from weather station case

Steps:

1. When you see clouds in the sky and a storm is coming, set up the rain gauge in an open area away from trees or buildings, which may affect the amount of rain that falls into the rain gauge. Make sure the rain gauge is stable and will not be easily tripped over. You can put some small rocks around it but they should not block the opening of the rain gauge.
2. When the rain stops, record how much rain (mm) is collected. Take the reading at eye level to avoid error. Compare your result with the weather report on radio or TV.

Explanation:

Meteorologists use a similar rain gauge at many weather stations around the world. If it is very rainy where you live, this project will keep you busy. If however you live in a dry area like the desert region, it may take a long time to collect any rain.

Experiment 15

Creating artificial rain

Make it rain! Learn how rain works.

Materials:

- 1 large container with a large opening, such as a 1 liter glass jar or mayonnaise jar
- Hot water
- Some ice cubes
- Some salt
- A metal cover or a small plate to hold ice cubes

WARNING:
Risk of burns from hot water! Only perform this task under adult supervision.

Steps:

1. Please ask an adult for help with this Experiment. Pour very hot water into the glass jar until the water level is about 5 cm high. Pay attention and be very careful when pouring the water.

2. Use a small plate or flip the lid to cover the jar opening completely.

3. Put some ice cubes on the lid and add some salt.

4. Wait and watch. In about 15 minutes, you will see "rain" falling from the lid to the water inside the jar.

Explanation:

The ice and salt mixture makes the lid very cold while some of the hot water turns into vapor inside the jar. The cold lid causes the warm water vapor to condense and form water droplets. The same thing happens in the atmosphere as warm, moist air rises and meets colder temperatures high in the atmosphere. Water vapor condenses and forms precipitation that falls to the Earth as rain, sleet, hail, or snow.

Experiment 16

Learning about different types of clouds

There are many different types of clouds. Meteorologists classify clouds into three main types: cirrus, cumulus, and stratus. We can also group them according to the altitude of the cloud base. High clouds include cirrus clouds. Altostratus and altocumulus are middle clouds. Stratus are examples of low clouds.

Group			
High **(Above 6 km)**	 **Cirrus:** Typically thin and white in appearance and made up of ice crystals	 **Cirrocumulus:** With small ripples rather like the scale of a fish	 **Cirrostratus:** Sheet-like, high-level clouds composed of ice crystals

Middle **(2 – 6 km)**	 **Altocumulus:** Shallow, puffy or wave-like; composed of water and/or ice	 **Altostratus:** Mid-level grey sheet; thinner layer allows sun to appear as through ground glass	
Low **(Below 2 km)**	 **Cumulus:** Clouds look like floating cotton; they have flat base and distinct outlines; when they are dark and deep, they bring rain	 **Nimbostratus:** dark grey, “wet” looking clouds; they produce light/moderate rain over a large region	 **Stratus:** Low-level layer or mass, grey, uniform base
		**Cumulonimbus:** Cumulonimbus are thunderclouds; they are the largest clouds of all and more vertically developed, often with an anvil-shaped top, and produce heavy showers	

Explanation:

Clouds can help predict the weather. A weather change is often indicated by a change in clouds. Cumulus clouds are the fair weather clouds seen on warm summer days. However, if conditions are right, a cumulus cloud can grow into a towering thunderhead called cumulonimbus. Violent updrafts of wind may lift the top of a storm cloud up to 19 km above the earth.

Cirrus clouds often signal the approach of rain. Since cirrus clouds are so high, they do not appear to move very fast.

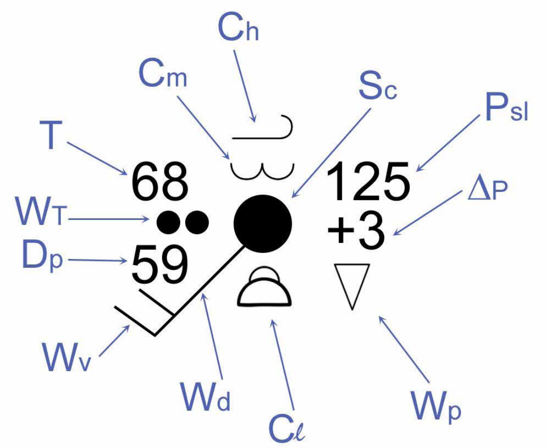
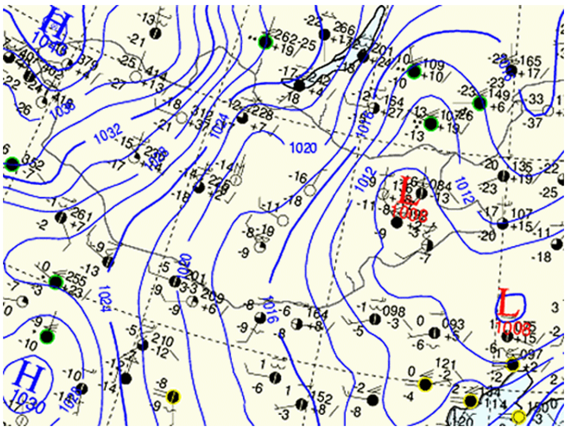
Stratus clouds are low grey clouds (below 2 km) and form when the air is filled with water droplets. They often accompany rain.

Experiment 17

Understanding weather symbols and weather maps

Meteorological observations are noted on a weather map. Circles show where the weather stations are located. Around each circle there are various numbers and symbols that represent the weather conditions being observed there. In order to interpret this data correctly, it is important to understand what types of data the different numbers and symbols represent. This Experiment introduces these reporting symbols:

Components of the observation symbol:

T: temperature in °C / °F **DP:** dew point in °C / °F **WT:** type of weather (see Weather Symbols) **Wd:** wind direction **Wv:** wind strength in knots (1 knot = 1.83 km/h) indicated with short lines, which add up to a given value (20 knots in this example) **Ch:** high clouds type (see Weather Symbols) **Cm:** type of middle height clouds **Cl:** type of low clouds **Sc:** sky cover (see Weather Symbols) **Psl:** air pressure at sea level (in millibars (mb) to the nearest tenth with the leading 9 or 10 omitted; in this case the pressure would be 1012.5 mb) **ΔP:** change in air pressure in the past 3 hours (+ indicates rise, / indicates steady rise) **Wp:** weather over past 6 hours	  **Weather map**

Weather Symbols

Weather Type

- Drizzle
- Rain
- Snow
- Freezing Rain
- Showers
- Hail
- Ice Pellets
- Fog
- Thunderstorm
- Tornado
- Hurricane

Wind Strength

- 5 knots
- 10 knots
- 20 knots
- 50 knots

Cloud Cover

- Clear Sky
- Slightly covered sky
- Cloudy Sky
- Very cloudy Sky
- Overcast

High Clouds Type

- Cirrus
- Cirrostratus
- Cirrocumulus

Middle Height Clouds Type

- Altocumulus
- Altostratus

Low Clouds Type

- Stratus
- Stratocumulus
- Cumulus
- Cumulonimbus
- Nimbostratus

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