anko

Cloud & Rain Maker
Instruction Manual

8+ years

Activities to learn:
The Water Cycle and Evaporation
Artificial Clouds
Artificial Rain
Understanding pH
Rain pH Measurement
Snowflakes under a Magnifier
Clouds and Weather
Weather Symbols and Weather Maps
Lightning and static electricity
How far away is the storm?

KEYCODE: 43-149-216

MADE IN CHINA

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Drawings in the manual are for visual purposes only. Actual product may vary slightly.
The manufacturer reserves the right to change any specification or feature without prior notice.

IMPORTANT! PLEASE READ CAREFULLY BEFORE USE AND KEEP FOR FUTURE REFERENCE.

WEATHER SCIENCE
RAIN & CLOUD MAKER

⚠ WARNING! CHOKING HAZARD

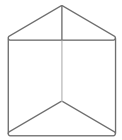
– Small parts. Not for children under 3 years.

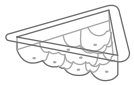
WARNING! Not Suitable For Children Under 36 Months Due to Small Parts. Choking hazard. Use with care and only under supervision of an adult. Always keep packaging for future reference and safety reasons.

Advice for Supervising Adults

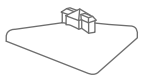
This experiment kit is only intended for use by children over the age of 8 years. The instructions should enable adults to assess the experiment's suitability for the child concerned. Before starting the experiments, read through the instruction manual together with your child and discuss the safety information. Check to make sure the kit has been assembled correctly, and assist your children with the experiments.

PACKAGE CONTENTS

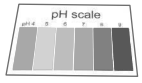

1 triangular container


1 rain lid

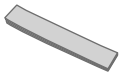

1 ice lid


1 plaster molded castle with island


1 bottle of food colouring



pH scale


1 set of pH paper


3X magnifier


1 pipette

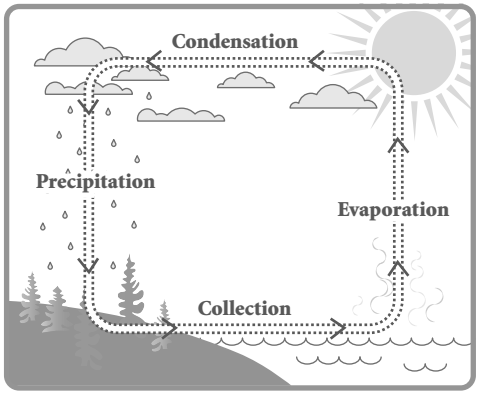
IMPORTANT: YOU MAY ALSO NEED: a jug of steaming hot water, a stirring spoon.

Please read all the instructions to help you understand all the procedures before you start. If there is anything you don't understand or are not sure about, please ask an adult such as one of your parents/relatives or a schoolteacher. Using this kit, you will need adult supervision at all times. An adult should always assist with hot/boiling water.

ACTIVITIES INSTRUCTIONS:

ACTIVITY 1

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 in oceans, lakes and rivers into a gas, called water vapor, in a process 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.

Material:
- Two chalk sticks (not included)
- A water puddle pool

Steps:
1. Find a place where water puddle pools are always formed after the rain.

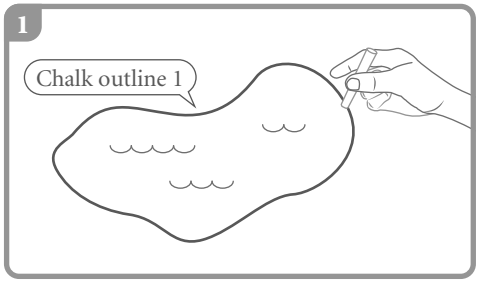
2. After a rainy day, look for a puddle pool. With your chalk, trace an outline around the puddle pool and wait.

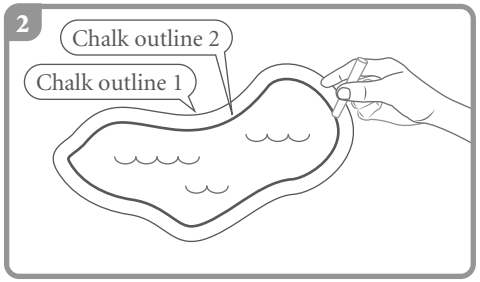
3. Four or five hours later, return to see your puddle pool. Trace a second outline. Use a different colour chalk if you have it.

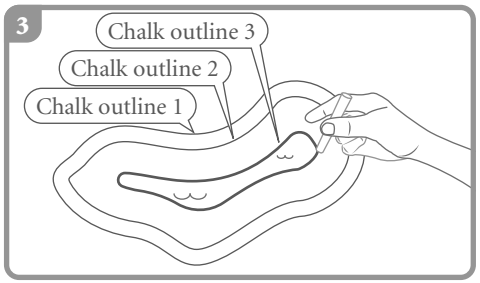
4. Compare the two marks. If you wish, you can wait to trace another outline a little later.

5. Try this activity under different weather conditions: bright sunshine, cloudy, windy weather... When will the puddle pool dry most quickly?

Explanations:
The puddle pool decreases as water evaporates. It is the intensity of the heat of the sun that determines the speed of evaporation. If it is hot after the rain, the puddle pools disappear very quickly, but if it remains wet and cold, the puddle pools remain longer.







ACTIVITY 2

Artificial Cloud

Make your own cloud! Learn how clouds work.

Materials:
- Triangular container
- Ice lid
- Plaster molded castle with island
- Hot water
- Ice cubes
- Salt

** This activity must be performed under the supervision of an adult.

Steps:
1. Place the plaster castle with island into the container and pour some very hot water in, up to the middle of the plaster island level. With the help of an adult, carefully pour the water.

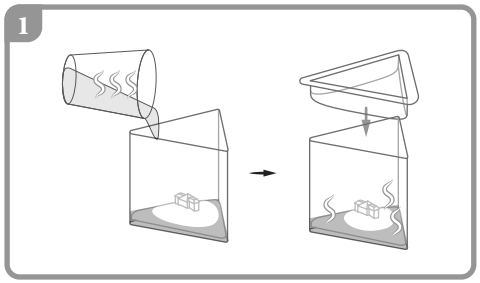
2. Use the ice lid to completely cover the container opening.

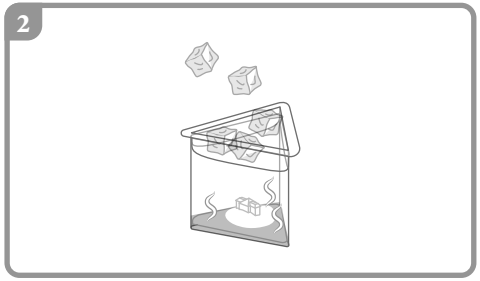
3. Put some ice cubes on the lid and add some salt.

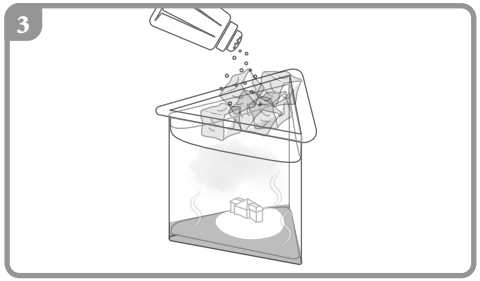
4. Wait and watch. In about 15 minutes you will see cloud and mist form between the lid and water inside the container.
(If the cloud effect is hard to see, ask an adult to help by lighting a match. Open the lid and put the lit match in the container for a few seconds, remove and blow out the flame. Place the lid back on. The smoke will help show the cloud more clearly).

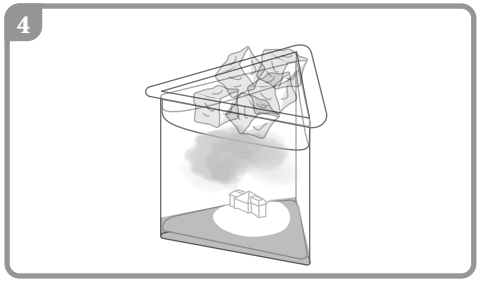
Explanations:

The ice with the salt makes the lid very cold while some of the hot water turns into vapour inside the jar. The cold lid causes the warm water vapour to condense and form cloud and mist. This is the same thing that happens in the atmosphere as warm, moist air rises and meets colder temperatures high in the atmosphere.









ACTIVITY 3

Artificial Rain

Make it rain! Learn how rain works.

Materials:
- Triangular container
- Rain lid
- Plaster molded castle with island
- Water
- A cup
- Pipette
- Food colouring

Other materials you will need:
- some tissue/ toilet paper

Steps:
1. Place the plaster castle with island into the container and pour some water in, up to the middle of the plaster island level.

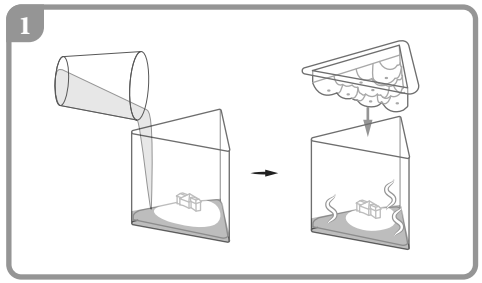
2. Use the rain lid to completely cover the container opening.

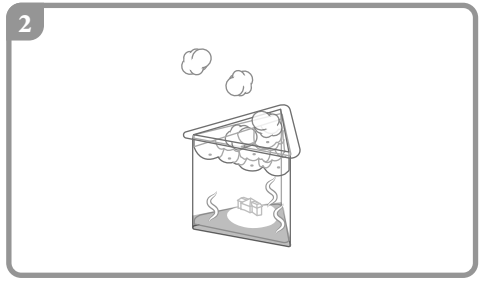
3. Tear and rub some tissue/ toilet paper balls, put it on the lid. Add a few drops of food colouring in a cup of water and mix. Add coloured water slowly on the lid using the pipette.

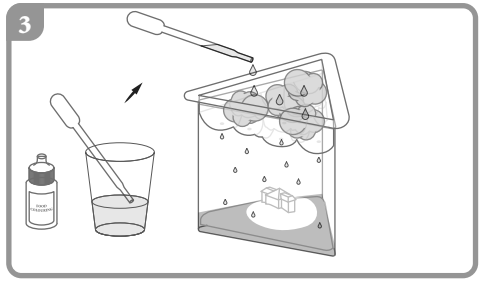
4. After some time, you will see “rain” falling from the small holes of the lid to the water inside the container.

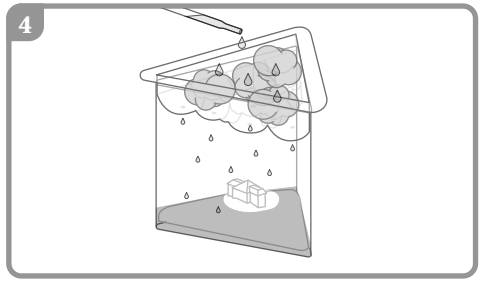
Explanations:

After ACTIVITY 2, the ice lid causes the warm water vapour to condense and form water droplets like those in ACTIVITY 3. This is the same thing that happens in the atmosphere as warm, moist air rises and meets colder temperatures high in the atmosphere. Water vapour condenses and forms precipitation that falls to the Earth as rain, sleet, hail, or snow.









ACTIVITY 4

Understand 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 (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 (pH 14 being the strongest base/alkaline)

Material:
- pH paper
- pH scale
- Tweezers/ any clips (not included)
- Tap water

Steps:
1. Study the pH scale, the supplied pH scale goes from 4 to 9. Locate the colour corresponding to each pH value.

2. The pH paper changes colour when we put it in contact with a base or acid substance. Always hold the pH paper with the tweezers, because even the moisture of your fingers can make it change colour.

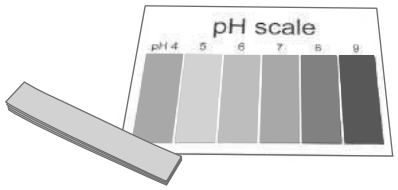
3. By comparing the colour of pH paper on a pH scale, you can determine the pH of the substance you are testing.

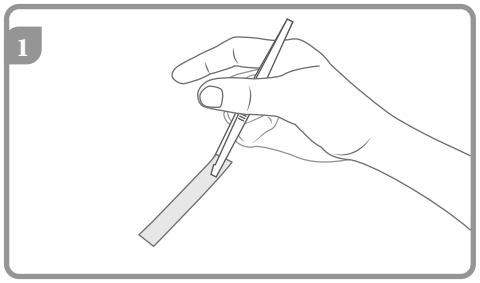
4. Check the pH of the substances you want, but start with tap water. Cut out small pieces of pH paper, do not forget to always use the tweezers! Soak the pH paper in water.

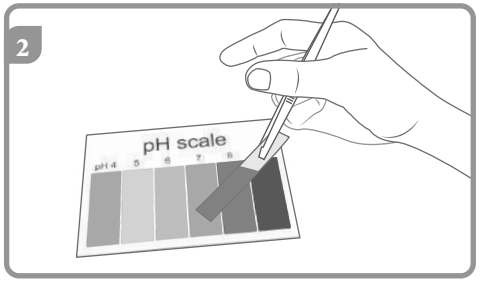
5. Note the colour changes. Compare the colour obtained with the colours of the pH scale.

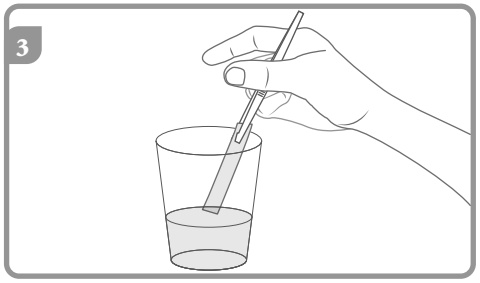
Explanation:

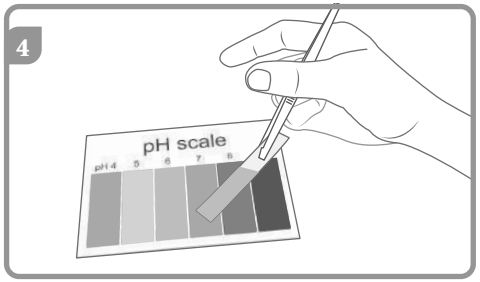
The pH of water should be neutral (7).











ACTIVITY 5

Rain pH Measurement

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

All rainwater contains some level of acidity. Normal rainwater has a pH of 5.6. When the pH level of rainwater goes below 5.6, it is considered as acid rain. Acid rain is caused by chemical changes which occur in the atmosphere, and are produced by the air pollution. Under the action of these chemical changes, certain gases become acidic. Acid rain is very harmful to the environment. Acid rain damages everything over a period of time because it makes the living things in the environment die. Acid rain affects the lives in the water as well as the lives 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.

Material:
- pH Paper
- pH scale
- a pipette
- different types of water

Other materials you will need:
- plastic cups
- tweezers/ any clips

Steps:
1. Gather as many water samples as possible: tap water, rainwater, aquarium water, a lake, a river, the sea.

2. Pour each sample in a pot/ cup and label them.

3. Take pH paper with the tweezers. Cut it into small pieces and place one of these pieces next to each pot.

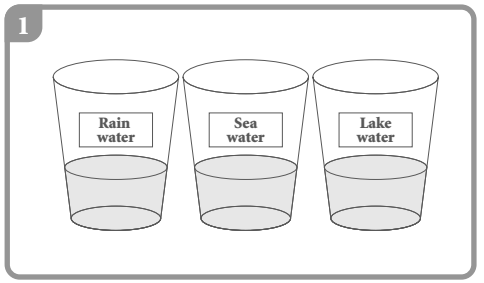
4. Add a few drops of each water sample onto the pH paper using a pipette. Wash and dry the pipette before picking up different water samples.

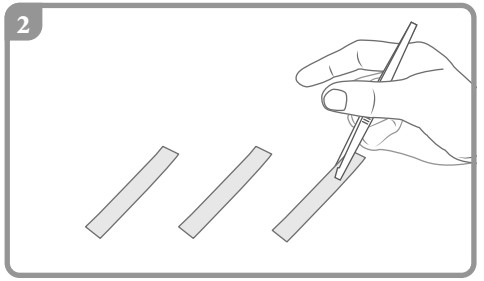
5. Wait a few minutes and compare the colours with the scale. Find the pH of each sample.

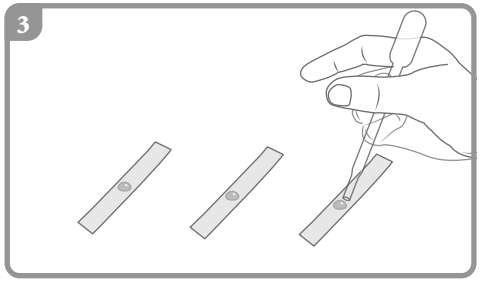
6. You can also test the pH of the two other water forms, like an ice cube and vapour. Pay attention not to get burnt by the hot vapour.

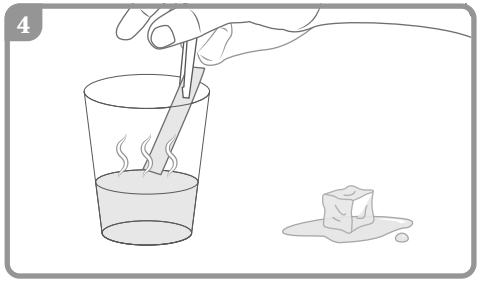
Explanations:

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









ACTIVITY 6

Snowflakes under a Magnifier

Materials:
- A magnifying glass
- Triangular container
- A pipette/ spoon

Other materials you will need:
- A large piece of cloth
- A hammer
- Some ice cubes
- Some salt
- A desk lamp

** This activity must be performed under the supervision of an adult.

Steps:
1. Put some ice cubes on a large piece of cloth. Wrap the ice within the cloth and use a hammer to crush the ice into small pieces.

2. Fill the triangular container up to about 3/4 full with the crushed ice.

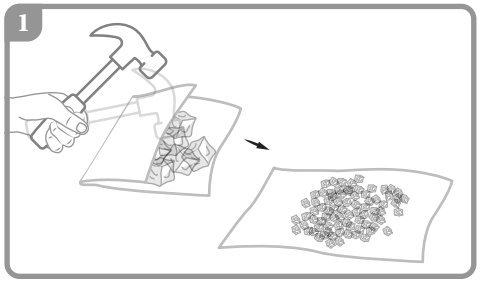
3. Add salt into the triangular container until almost full, the ice should start to melt.

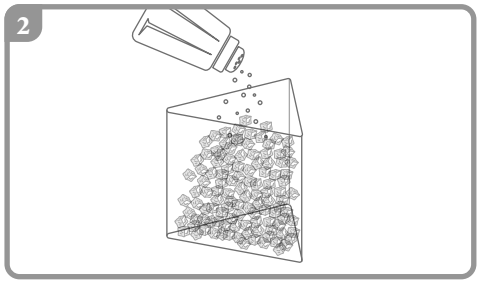
4. Stir the ice and salt mixture very rapidly with a pipette or spoon for at least 15 minutes.

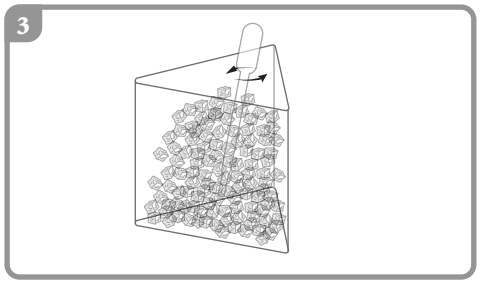
5. There should be some dew on the outside of the triangular container at first, observe what is produced if you wait a few minutes longer. They become crystals of ice. Examine carefully with a magnifying glass. You can see the crystal structure more clearly if you place the cup near a desk lamp.

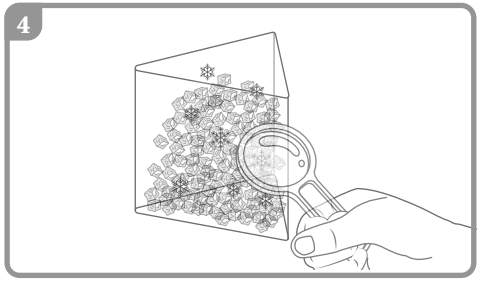
Explanations:

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









ACTIVITY 7

Clouds and Weather

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. Clouds can help you predict 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 19km 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, and often accompany rain.

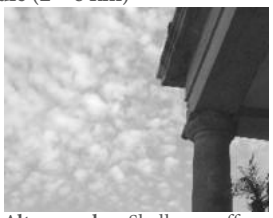
High (Above 6km)

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: Middle level grey sheet, thinner layer allows sun to appear as through ground glass.

Low (Below 2 km)

Cumulus: clouds looks 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.

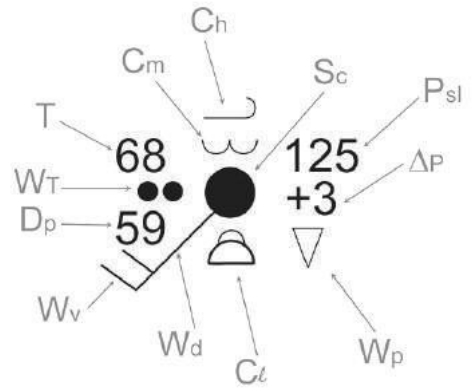
Stratus: Low level layer or mass, grey, uniform base.

Cumulonimbus: Cumulonimbus are thunder clouds. They are the largest clouds of all and more vertically developed, often with an anvil-shaped top, and produce heavy showers.

ACTIVITY 8

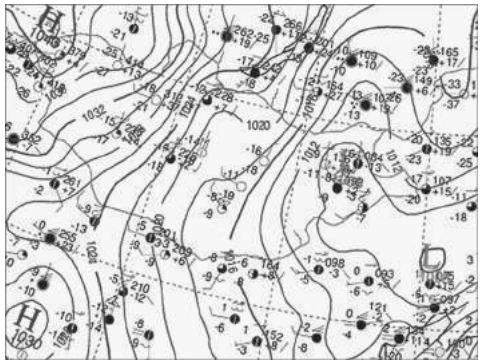
Weather Symbols and Weather Map

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



Components of the observation symbol:

T : temperature in °F/°C
D_p : dew point in °F/°C
W_T : type of weather (see various symbols)
W_d : wind direction
W_v : 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)
C_h : high clouds type (see various symbols)
C_m : type of middle height clouds
C_l : type of low clouds
S_c : sky cover (see various symbols)
P_{sl} : 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)
Δ_p : change in air pressure in the past 3 hours (+ indicates rise, / indicates steady rise)
W_p : weather over past 6 hours



Weather Symbols

Weather Type

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

Wind Strength

- 5 knots (9.3 km/h)
- 10 knots (18.5 km/h)
- 20 knots (37 km/h)
- 50 knots (92.6 km/h)

Cloud Cover

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

High Cloud Types

- Cirrus
- Cirrostratus
- Cirrocumulus

Middle Height Cloud Types

- Altocumulus
- Altostratus

Low Cloud Types

- Stratus
- Stratocumulus
- Cumulus
- Cumulonimbus
- Nimbostratus

ACTIVITY 9

Lightning and Static Electricity

Thunderstorms are terrifying and yet beautiful to watch. When warm, humid air rises and cools, the water vapour condenses into a cloud. When the conditions are right, it gradually develops into a thundercloud with more and more water vapour. Thunderstorms are created in the giant cumulonimbus clouds. Flashes of lightning may fill the sky and sometimes with 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 during major or minor storms and can hit a target up to 40 km 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.

Material:

- 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 heating 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. Sit on the floor or bed. Place the cloth on your back. Make a fist and hold your hand at a distance of approximately 15cm from your face, directly in front of your chin.

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

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

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

ACTIVITY 10

How Far Away is the Storm?

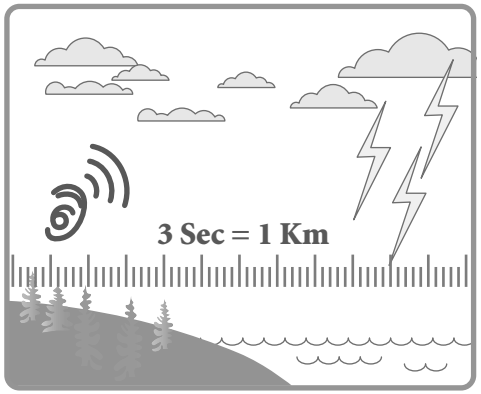
Material:
- Watch/Stopwatch
- A notepad

Steps:
1. Get your stopwatch or wrist watch ready.

2. When you see a flash of lightning, start the stopwatch or note the time on your wrist watch.

3. Count the number of seconds until you hear the thunder.

4. For **every 3 seconds the storm is 1 kilometre** away, divide the number of seconds you count by 3 to get the distance in kilometres. For example, if you hear the thunder after 9 seconds, the storm is 9/3=3 km away.



What's happening?

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