



ACTIVITY 5

HOW CAN I CREATE MY OWN WEATHER FORECAST?



EXPERIMENT OBJECTIVES AND CONTENT

In this activity, students discover how to manipulate and make certain meteorological instruments while familiarizing themselves with the language of this discipline.

This activity can be divided into two parts:

- 1) Use of measuring instruments, gathering data, observation, analysis, and forecasting meteorological phenomena;
- 2) Making measuring instruments



ESSENTIAL KNOWLEDGE

Matter:

- Transformation of matter: natural phenomena

Systems and interaction:

- Meteorological systems and climates
- Technologies related to the atmosphere

Techniques and instrumentation:

- Use of simple observational instruments
- Use of simple measuring instruments
- Design and manufacture of measuring instruments and prototypes

Appropriate language:

- Terminology related to an understanding of the Earth and the universe
- Conventions and types of representations
- Drawings, sketches



SUGGESTED MATERIALS

Scientific equipment:

- Thermometers, rain gauges, hygrometers
- Barometers, anemometers, weather vane
- Binoculars
- Droppers
- Beaufort scale
- Cloud chart

Perishable non-scientific materials:

- Food coloring
- Water

Household materials:

- Rubbing alcohol, straws
- Needles, thread bobbins
- Party balloons
- Condiment bottles or jars
- Empty canning jars (clean with no lids)

School supplies:

- Pencils, scissors, adhesive tape
- Elastic bands, large pieces of cardboard

Note: It is not necessary to have all the meteorological instruments listed here on hand to do the activity.



CONTEXT: SITUATIONAL PROBLEM OR RESEARCH QUESTION

To celebrate the end of the school year, the whole class is going to have a big party in a park near the school. However, the meteorologists are on strike so there is no weather forecast and it is impossible to find out whether it will be nice outside or not on the day of the party. So the class decides to create its own weather forecast so they can plan when to have the party.





SUGGESTED PREPARATORY ACTIVITIES (INTRODUCTION)

The teacher leads a discussion on the importance of weather forecasts in our everyday lives and asks the students to listen to a weather forecast or read one in the newspaper. The students identify the primary components of a weather forecast.



INITIAL IDEAS AND HYPOTHESES

Here are a few examples of hypotheses the students might formulate based on their initial ideas:

Example 1

I predict that I can predict the weather by observing conditions in nature. I predict this because my uncle often tells me that nature can tell us a lot of things. He told me that when the sun is dark orange at sunset it's a sign that the next day will be very hot.

Example 2

I predict that if I carefully build my own meteorological instruments, I can tell what the weather will be like. I predict this because I know that real meteorologists made the prototypes of the instruments they use today. I think I can do the same thing if I work diligently.

Example 3

I predict that if I look at how air pressure changes, I will be able to tell if it is going to rain or not. I predict this because they talk about air pressure all the time in weather forecasts.



WORK PLAN AND EXPERIMENTATION

It is suggested that the students write the data they collect each day of the week on a piece of cardboard. It is important to record the exact time of day the data are collected. To obtain the most reliable data possible, it would be a good idea to identify the times of the day when the students should systematically take readings for temperature, wind, humidity and other components of a weather forecast. Here are a few examples of experiments the students can carry out to verify their hypotheses:

OBSERVATION OF ENVIRONMENT

Example A

The students look at the clouds with the naked eye or with binoculars for a week in order to become familiar with their shapes, colors, movements and altitudes. Next, they predict what the clouds indicate. They record their observations, compare them with a cloud chart and evaluate if their forecasts are accurate or wrong. The students must justify each proposal.

Example B

The students observe the wind. They design their own wind scale and integrate the ideas of each team member into a uniform whole that resembles the Beaufort Scale. They record their observations each day at one or more specific times. It is important to indicate the time when the observations were made, how they were made and the methods used to make them.

RECORD ALL YOUR IDEAS AND OBSERVATIONS IN YOUR EXPERIMENT WORKBOOK.



**Example C**

The students observe different signs in their environment. For example, they look at the leaves on the trees: if they turn over when it is windy, it's a sign of rain. Or they examine the behavior of birds, since when it rains, they fly close to the ground.

USE OF METEOROLOGICAL INSTRUMENTS**Example D**

The students use real meteorological instruments or make a Stevenson screen (see scientific content) in which to house their instruments and obtain more accurate data. Each day at a specific time, they take readings and record their observations. They then create graphs in order to make forecasts.

Note: A relatively expensive experiment, this activity could be a project for the cycle or the whole school. It is important to choose a good location for the screen so that it does not get vandalized.

**DESIGNING AND MAKING
METEOROLOGICAL INSTRUMENTS****Example E**

The students design a thermometer by inserting a long thin glass tube or straw into a glass bottle containing a colored liquid (preferably alcohol). Then they fix the tube into the neck of the bottle with modeling clay so that the bottle's opening is closed. The students calibrate their instrument by referring to a real thermometer or by developing a relative scale. It is suggested to compare the prototype with a professional instrument to assess the accuracy of the calibration and operation of the instrument made in class.

Example F

The students take a canning jar without a lid and stretch a piece of party balloon over the opening, which they hold in place with an elastic band. They place one end of the straw in the middle of the balloon and use adhesive tape to affix it horizontally across the jar, and they affix a needle to the other end. They then glue a large piece of cardboard to the back of the jar. Opposite the point of the needle, the students draw a horizontal line, which will be the "0" level of their barometric scale. This line must be drawn quite quickly, while the pressure is the same inside and outside the jar. As the atmospheric pressure changes, the needle will point above or below the line. If the needle points below the line, it indicates low air pressure, since the air pressure inside the jar is greater than it is outside. Generally speaking, this is a sign that precipitation is coming. If the needle points above the "0" level, the pressure inside the jar is less than it is outside, which indicates high atmospheric pressure and, in general, the coming of nice weather. It is important to remember that patience and regular measurements are required to note slight variations in atmospheric pressure.

EXPERIMENTAL FACTORS

To ensure scientific rigor, the students should evaluate the experimental factors that might influence the experimental results.

- Seasonal variations
- Calibration of instruments
- Location instrument is set up
- Accuracy of measuring scale
- Amount of water evaporated
- Color of objects located near instrument (albedo effect)





DISCUSSION: SUGGESTED INTEGRATION ACTIVITIES (CONSOLIDATION)

The teacher asks the students to write a report of their experiment. Were they able to determine a date for the end of the year party? To synthesize the information, the teacher has the students create a chart representing the data collected (climatograph). The students could also present the results of their experiments in the form of small televised information spots. It is also important that the teacher review the basic concepts covered throughout the activity.



SUGGESTED ACTIVITIES FOR APPLYING KNOWLEDGE (APPLICATION)

After the activity, the teacher could organize a visit to a real meteorological station. A meteorologist could also come to class and talk about his or her work. As enrichment, the students could do research on the different climates found on Earth.



SCIENTIFIC CONCEPTUAL CONTENT

Celsius scale

Temperature measurement scale based on the freezing point (0°C) and boiling point (100°C) of water.

Stevenson screen

White box located 1.20 meters off the ground that allows air to flow around it but protects the instruments it houses from the Sun's rays and precipitation. Ideally, it is made out of wood.

Anemometer (wind gage)

Instrument used to measure wind speed.

Barometer

Instrument used to measure atmospheric pressure.

Wind vane

Instrument used to indicate wind direction.

Rain gauge

Instrument used to measure the amount of precipitation that falls at a given location over a specific period of time.

Thermometer

Instrument used to measure temperature.

Hygrometer

Instrument used to measure the degree of humidity in the air (human hair can be used to make a hair hygrometer, since hair length varies according to humidity).

Cloud classification

Clouds can be classified according to several factors: appearance, altitude, genus, species or variety.

Albedo effect

White surfaces reflect the Sun's energy (high albedo), while dark surfaces absorb it (low albedo), which increases temperature.





Meteorology

Meteorology is the science that studies atmospheric processes and phenomena in order to predict the weather.

Meteorological event

Exceptional meteorological conditions that are not always observable, including, among others, strong winds, heavy rains, hail, heavy snow fall, blizzards, violent thunderstorms, and tornadoes.

Photoperiod

Length of day, i.e., the time during the day when the sun is shining, from sunrise to sunset.

Precipitation

All forms of liquid or solid water in the atmosphere that fall to Earth's surface as, for example, rain, snow or hail.

Temperature

In meteorology, temperature is how hot or cold the air is. Temperature is measured using a thermometer and expressed in degrees Celsius (°C) or degrees Fahrenheit (°F).



CULTURAL REFERENCES

Paleoclimatology

The study of climates that existed on Earth tens or hundreds of millions of years ago. It helps us understand the mechanisms by which climates change and design models for future trends. In order to understand past climates, paleoclimatologists study air bubbles, pollen grains and fossil plant fragments trapped in ice caps or sediments.

History

The study of climate has always been important to humans. Understanding how meteorological systems change over time has led to major discoveries and helped protect countless lives. Agriculture and ocean voyages are examples of situations where the study of meteorological conditions has been extremely important. Today, meteorologists are trying to further their understanding of atmospheric conditions and their variations in order to better comprehend and predict climatic changes—such as increases in violent meteorological events or desertification—that could be dangerous for humans and other forms of life on Earth.

People

Anders Celsius (1701-1744), a Swedish astronomer, invented the Celsius scale used to measure temperature. The Italian physicist Evangelista Torricelli (1608-1647) discovered the existence of atmospheric pressure and invented the mercury barometer.

Technology

For the last few decades, radar has been used to take atmospheric readings. Weather balloons (or sounding balloons) can measure air temperature, pressure and humidity at altitudes of up to 30 km. Doppler radar is used to evaluate the direction of clouds, winds and rain drops.

**FOR MORE CULTURAL REFERENCES,
VISIT THE ÉCLAIRS DE SCIENCES WEBSITE:
www.eclairsdesciences.qc.ca**





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Conception

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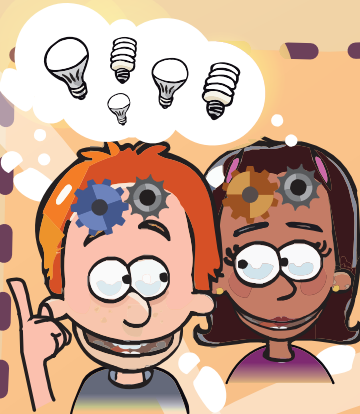
PROCESS OF ACTIVE DISCOVERY

GENERAL LEARNING PROCESS IN SCIENCE AND TECHNOLOGY (IN ELEMENTARY SCHOOL)

Context related to everyday life



- Situation problem or
- Discovery question or
- Need to be fulfilled
- Question related to the operation of an object (how does it work?)



Initial ideas and hypothesis

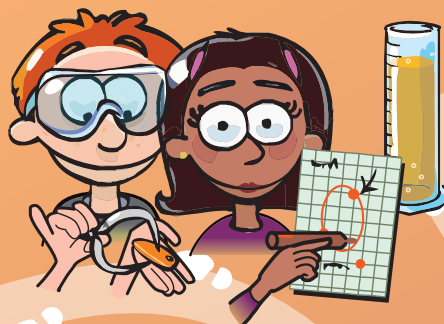
My initial ideas:

- I share my own ideas.

My hypothesis:

- I predict that... I think that because...
- I imagine my prototype.
- I think it works like this...

Planning and carrying out



My equipment:

- I observe and handle the equipment.
- How could this equipment be useful to me?
- I choose my equipment and my materials.

Carrying out my process:

- What will the steps be?
- What precautions should I take?

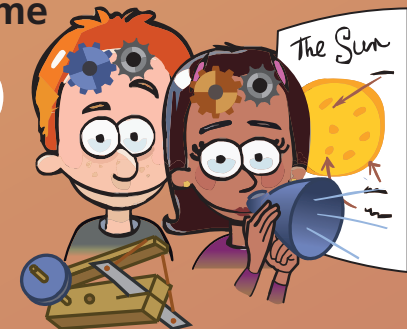
My actions:

- I carry out the steps of my protocol.
- I note or draw what I observe, what I do and what I discover.

My results:

- What is my answer to the problem, question or need?

Outcome



My outcome:

- Do my results confirm my hypothesis or not?
- Are my results similar to those of the other teams?
- Can the other teams' results help me to find answers to my problem, my question or my initial need?
- What could I communicate concerning my discoveries?

What I learned:

- What do I retain from this activity?
- What could I communicate concerning my results or my discoveries?

New question?