ACTIVITY 4

WHAT HAPPENS TO THE LEAVES WHEN THEY FALL TO THE GROUND?

EXPERIMENT OBJECTIVES AND CONTENT

In this activity, students learn about the conditions necessary for the decomposition of leaves.

! THIS ACTIVITY TAKES PLACE OVER SEVERAL WEEKS OR EVEN MONTHS. IT IS IMPORTANT TO LEAVE THE CONTAINERS OUTSIDE.

ESSENTIAL KNOWLEDGE

Matter:
- Characteristics of living things: metabolism of plants (death)
- Organization of living things: anatomy of plants

Systems and interaction:
- Interaction between living organisms and their environment
- Environmental technologies (composting)

Appropriate language:
- Terminology related to an understanding of living things

SUGGESTED MATERIALS

Perishable non-scientific materials:
- Freshly fallen leaves (green or yellow)
- Leaves that have been on the ground for a while (damp or dry)
- Soil taken from the woods.

Household materials:
- Plastic tubs or containers with lids (about 4 liters)
- Watering cans
- Several meters of plastic tape or string
- Sticks or broom handles.

CONTEXT: SITUATIONAL PROBLEM OR RESEARCH QUESTION

Have you ever taken a walk in the woods or a forest? What season? Were there dead leaves on the ground? Do you remember what these leaves looked like? Do the leaves that fall to the ground remain like that for long? How can we know if they change form?

SUGGESTED PREPARATORY ACTIVITIES (INTRODUCTION)

In the fall, students could jump in a pile of dead leaves then observe the leaves on the surface and at the bottom of the pile. They could also ask the school maintenance staff or the city workers who pick up leaves (from the school yard or the sidewalks) what they do with them.

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 if I put leaves in a closed container, they will not decompose. I believe this because the leaves in the schoolyard are blown around and get wet, while leaves in a closed container are protected from the wind and rain.

Example 2
I predict that if I put brown leaves in a container, they will decompose, but not green or yellow leaves. I believe this because brown leaves are mixed with soil in the forest, while the yellow leaves are on top of the ground.

Example 3
I predict that if I mix dead leaves up with soil, they will decompose faster than leaves by themselves. I believe this because blackened leaves are the same color and smell just like soil.

Example 4
I predict that if I cut leaves up into tiny pieces, they will decompose faster than whole leaves. I think this because when they are smaller, they mix more easily with the soil in the forest.

Example 5
I predict that leaves will only decompose if I put them in the snow. I believe this because the leaves disappear under the snow in winter.

WORK PLAN AND EXPERIMENTATION

Here are a few examples of experiments the students can carry out to verify their hypotheses:

Example A
Students place dead leaves in a sealed container outside and gather a pile of leaves in a corner of the school yard. It is preferable to rope off the pile of leaves in the schoolyard with rope or plastic tape so that they are not disturbed by other students. Once a week, the students observe (at the surface and bottom of the container), describe (color, condition and odor) and compare the two samples of leaves.

RECORD ALL YOUR IDEAS AND OBSERVATIONS IN YOUR EXPERIMENT WORKBOOK.

Example B
The students fill one container with freshly fallen leaves and another with dead leaves (already brown). They decide whether to close the containers or leave them open. Once a week, the students observe (at the surface and bottom of the containers), describe (color, condition and odor) and compare the two samples of leaves.

Example C
The students fill a container with forest soil and leaves (either dried out or freshly fallen, or a mixture), and another container with leaves but no soil. They decide whether to close the containers or leave them open. Once a week, the students observe (at the surface and bottom of the containers), describe (color, condition and odor) and compare the two samples.

Example D
The students cut up leaves (either fresh or dried) and place them in a container (with or without soil). For comparative purposes, it would be useful to also have a container of uncut leaves. It should also be taken into consideration that closing the containers could affect the results. Once a week, the students observe (at the surface and bottom of the containers), describe (color, condition and odor) and compare the two samples.

Example E
Students amuse themselves collecting some snow to cover the dead leaves. For comparative purposes, it would be useful to also have a container of leaves without any snow. Once the snow has melted (on the surface and at the bottom of the container), the students compare the two samples.

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

- Outside temperature
- Moisture in the container (i.e., if the container is open to the rain, if the soil is wet or dry)
- Aeration of the container (i.e., whether it is open or closed)
- The state of the leaves at the beginning of the experiment (dry or damp)
- The presence of small worms, animal droppings, or micro-organisms (bacteria, moulds) in the soil

DISCUSSION: SUGGESTED INTEGRATION ACTIVITIES (CONSOLIDATION)

By pooling their results, the students will be better able to answer the initial question: what happens to fallen leaves? Did the students find any answers? Did they have any particular difficulties carrying out their experiments? The students could prepare a chronology and record the leaves' state at each observation.

SUGGESTED ACTIVITIES FOR APPLYING KNOWLEDGE (APPLICATION)

Students could conduct more involved research on composting and extend the experiment for several months to make compost for the school's flower beds at the end of the school year. They could collect perishable plant matter (fruit and vegetable peels) from the school cooks and put them in a real compost bin. They could even make a worm composting bin to use inside, since this technique is odorless. It might also be interesting to organize a guided tour of an "éco-quartier" or Montréal's Saint-Michel Environmental Complex.

SCIENTIFIC CONCEPTUAL CONTENT

Decomposition

Leaves disappear because they are gradually digested by micro-organisms (bacteria and mould), fungi and insects. As they slowly decompose, the leaves turn brown. Moisture, air and heat are not directly responsible for the leaves' disappearance, but they do provide micro-organisms with a favorable environment to feed and develop.

Humus

Humus, or "topsoil," is the end result of the slow decomposition of leaves. Humus makes up the uppermost layer of soil. It is generally brown or dark-brown in color. Its color and odor vary depending on the location (forest, plain, farm field, etc.) and type of plant. It is very rich, slightly acidic, well aerated and retains water very well. It is thus a favorable growth medium for many plants and trees. In fact, gardeners and farmers use humus for their plants and crops.

Composting

Composting is the controlled fermentation that recycles waste products such as dead leaves and kitchen scraps into fertile soil. Bacteria rapidly decompose materials given sufficient oxygen. The process releases a great deal of heat (e.g., steaming manure). Then anaerobic (without oxygen) fermentation, done primarily by fungi, takes over to transform the fresh compost into ready-to-use soil. Bad odors are often associated with this stage.

Can I make my own compost?

Composting for your own garden is easy thanks to home-made or commercial composters. The type of composter you choose will depend on how much material you have to compost or the size of your garden. Obtaining mature compost is a slow process that can take from three months to three years. Instructions on making your own compost are readily available in garden centers, in books and on the Internet.

CULTURAL REFERENCES

Impacts

Organic agriculture is based on respect for the environment, and especially for biological cycles. The natural formation of topsoil is thus emphasized for organic crops. Topsoil provides all the nutrients and water plants need to grow. Intensive tilling of farmland leads to the loss of topsoil, primarily by increasing soil erosion (water is not absorbed by the soil and runs off). Farmers must then add fertilizers to make the soil more fertile and regularly water their crops.

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

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Conception
L'île du savoir (CRÉ de Montréal)

A project of

Produced by

Major financial partners

PROCESS OF ACTIVE DISCOVERY

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

Context related to everyday life

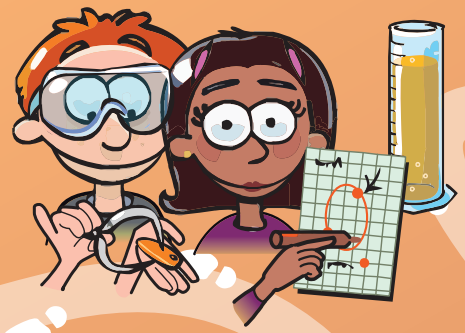
- **Situation problem** or
- **Discovery question** or
- **Need to be fulfilled**
- **Question related to the operation of an object** (how does it work?)

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



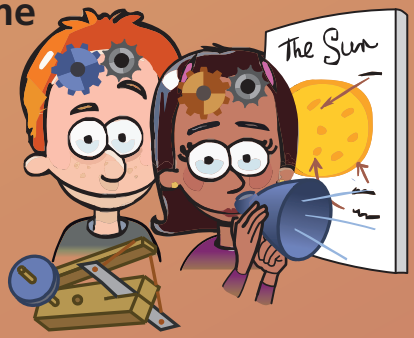
My equipment:
- I observe and handle the equipment.
- How could this equipment be useful to me?
- I choose my equipment and my materials.

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?

New question?

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

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