ACTIVITY 2

WHAT CLOTHES SHOULD I WEAR IN THE RAIN?

EXPERIMENT OBJECTIVES AND CONTENT

In this activity, students learn to identify whether fabrics are waterproof or not.

ESSENTIAL KNOWLEDGE

- Classification of objects according to their properties and characteristics
- Permeability and impermeability

SUGGESTED MATERIALS

Scientific equipment:
- Graduated cylinders
- Dropper
- Proscope digital USB microscope
- Binocular magnifiers
- Stopwatches

Perishable non-scientific materials:
- Water

Household materials:
- Samples of fabrics of different colors and textures (cotton, denim, wool, vinyl, polyester, rubber, leather, spandex, nylon, etc.)
- Plastic containers
- Plastic tubs
- Bottles of waterproofing

School supplies:
- Elastic bands
- Scissors

CONTEXT: SITUATIONAL PROBLEM OR RESEARCH QUESTION

You wake up in the morning and notice it's raining. Since you don't want to get wet on your way to school, you decide to choose clothes that will protect you from the rain. What clothes do you choose? Why?

SUGGESTED PREPARATORY ACTIVITIES (INTRODUCTION)

The teacher invites the students to talk about which clothes they wear depending on the weather and their activities. They then focus on rain garments. What color are they? Are they flexible or stiff? Are they reflective or matte? Are they thick or thin? The students then set out to discover which clothes will protect them from rain.

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 pour water on yellow and red fabrics, water will not go through them, but if I pour water on black or blue fabrics, water will pass through them. I predict this because my raincoat is yellow and it doesn't let water through.

Example 2
I predict that if I spray waterproofing on fabric, water will not pass through. I predict this because my dad sprays this product on his leather vest every fall to protect it from the rain.

Example 3
I predict that fabrics which feel thicker will prevent water from passing through, while thinner fabrics will let water through. I predict this because when I wear my polar fleece, I don't get wet, but when I only wear a shirt, water goes through it.

Example 4
I predict that of the fabrics I look at through the microscope, those with holes will let water pass through. I predict this because my big wool sweater has holes and if I wear it in the rain I get all wet.

WORK PLAN AND EXPERIMENTATION

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

Example A
The students place a piece of fabric on a table or above a container and pour a small amount of water on it. After waiting a few seconds, they look below the fabric to see if the table is wet or if there is water in the container. They redo the experiment with a certain number of fabrics with different or similar colors, then compare the results.

Note: The students can use a stopwatch to compare the permeability of various fabrics over the same amount of time exposed to water.

RECORD ALL YOUR IDEAS AND OBSERVATIONS IN YOUR EXPERIMENT WORKBOOK.

Example B
The students lay a piece of cotton fabric on a table, cut it into two equal parts, then spray a thin coat of waterproofing on one of the two pieces. They next pour water on the two pieces of fabric and observe the results. They repeat the experiment with other types of fabric and compare the results.

Example C
The students stretch a piece of cloth over the mouth of a glass, fix it there with an elastic band and pour water on the fabric. They observe whether or not the water passes through and drips into the glass. They repeat the experiment with various fabrics of differing thickness and compare their results.

Example D
The students look at different pieces of fabric through a magnifying glass or microscope and compare the weave of the fabrics. By pouring a little water on fabrics with small holes and on fabrics without holes, they observe whether or not water passes through.

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

- Amount of water poured (a minimum amount is necessary, otherwise the fabric may simply absorb the water.)
- Waiting time (hence the utility of a stopwatch)
- Number of times water has been poured on a piece of fabric
- Pressure placed on fabric with fingers
- Tension of fabric (If it is highly stretched over the glass, it will probably let more water through.)
- Amount of waterproofing sprayed on the fabric

DISCUSSION: SUGGESTED INTEGRATION ACTIVITIES (CONSOLIDATION)

The teacher reviews the activity with the entire class: Were all the students able to verify their hypotheses? Do they think their experiments were a success? Why? The students make two piles of fabric, those that keep rain out and those that do not. The teacher helps them find similarities and differences between the permeable and impermeable fabrics. Grade two students could add the names of the fabrics on the labels of their rain gear and compare these to the results of their experiments.

SUGGESTED ACTIVITIES FOR APPLYING KNOWLEDGE (APPLICATION)

The students can continue their thought process by investigating garments that protect best against wind or cold. They could also investigate what animals do when it rains: does water really "roll right off a duck's back"? Why do ducks never look as though they are wet?

SCIENTIFIC CONCEPTUAL CONTENT

Permeability and impermeability
A material is said to be permeable when it lets liquids (such as water) or gasses (such as air) pass through it. Inversely, a material is said to be impermeable when liquids cannot pass through it.

Textiles
Most plant-based fabrics (hemp, cotton, linen, jute, raffia, sisal, etc.) and animal-based fabrics (wool, hair, silk, etc.) are permeable since they are woven, which means these fabrics have holes of various sizes. Artificial textiles (acetate, rayon, viscose, etc.) and synthetic textiles (nylon, Tergal, etc.) have varying degrees of permeability.

Impermeable materials
Other materials, such as rubber and vinyl, are extremely impermeable (e.g., boots, coats). There are also synthetic coatings (polyurethane, PVC) that reproduce the chemical and physical characteristics of materials that repel water. Saturating permeable fabrics, such as those used in snowsuits, rain boots and winter boots, with these coatings can render them impermeable.

CULTURAL REFERENCES

Effects

Initiate a thought process on the uses of impermeable fabrics and their impacts on people's living conditions. In addition to keeping us dry, some fabrics can protect against heat and fire (e.g., firefighters' clothing, which often uses asbestos), while others protect against the cold (e.g., astronauts' spacesuits). Some garments reduce chaffing (e.g., leather jackets and pants for motorcyclists or horseback riders), while still others can stop bullets (bullet-proof vests).

Technology

Some porous or fibrous materials are impermeable to liquid water, but may allow water vapor to pass through them under minimal pressure. This is especially true of fibers in "breathable waterproof" sports garments: liquid water does not go through toward the body, but water vapor can easily escape (e.g., Gore-Tex fabric).

FOR MORE CULTURAL REFERENCES, VISIT THE ÉCLAIRS DE SCIENCES WEBSITE:

www.eclairsdesciences.qc.ca

REFERENCES

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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

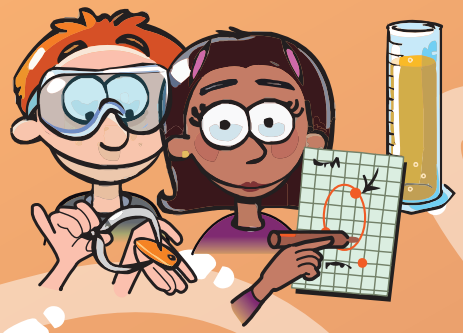
- **Situation problem** or
- **Discovery question** or
- **Need to be fulfilled**
- **Question related to the operation of an object** (how does it work?)

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



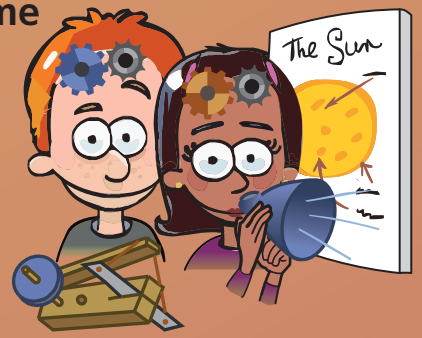
My equipment:
- I observe and handle the equipment.
- How could this equipment be useful to me?
- I choose my equipment and my materials.

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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