MISSION 01

Fantastik'eau

I love water. I take care of it!

CRYSTAL CLEAR

CYCLE 3

C.I.EAU Centre d'interprétation de l'eau

Québec

MISSION
01

Fantastik'eau

I love water. I take care of it!

CRYSTAL CLEAR

IWB
ACTIVITY ALSO AVAILABLE IN INTERACTIVE WHITEBOARD FORMAT!
cieau.org/fantastikeau

TEACHER'S GUIDE
CYCLE 3

CIEAU
Centre d'interprétation de l'eau

Québec

MISSION 01: CRYSTAL CLEAR

GOAL OF THE ACTIVITY

Build a water filter to "fix" a section of the drinking water treatment plant.

DURATION

45 MINUTES

CONNECTIONS WITH THE CURRICULUM OF THE QEP

MATHEMATICS:

- Fractions, percentages

SCIENCE AND TECHNOLOGY:

- Technological design
- Using simple measuring instruments
- Measuring quantities

CRYSTAL CLEARWATER: There are 995 municipal drinking water treatment facilities in Québec, which get their water from surface or groundwater sources, and 7 000 certified water treatment operators—people like me!

JÉRÉMIE: The plate will be used to support the plastic glass. The size of the hole in the plate must be slightly smaller than the opening of the glass in order for the rim of the glass to be able to rest on the plate.

WALTER : Check out the filter I made! You can show it to your students if they need some inspiration.

I used a coffee filter, some cat litter, gravel, cotton balls, and a strainer. I lose a lot of water when filtering ... your students can surely do better!

MATERIALS FOR EACH TEAM OF 2–3 STUDENTS

- 1 large nail, 1 pushpin or a sharp screwdriver (!)
- 2 glasses made of clear, flexible plastic that each hold 250 millilitres of liquid
- 1 paper or aluminum plate with a six centimetres diameter hole in the middle (diameter of the base of the 250 millilitres glass)
- Earth and leaves to cloud the water that will be filtered by the water filter. The water must be brown, but not muddy, in order for the students to see a difference.
  - e.g. 1 cup (250 millilitres) of water + 1 tablespoon of earth, leaves, branches or debris, as desired.
- Students' choice of the following to filter (B) :
  - A paper coffee filter
  - Sifted sand
  - Gravel or aquarium gravel
  - Funnels or strainers
  - Cotton balls
  - Sponges
  - Cat litter (non-clumping)
  - Cardboard, paper
  - Whatever you find in the recycling bin, whether or not it works!
- 1 measuring cup (A)
- Scissors and a pencil
- Water and a bin or tray to hold the water
- A time measuring device (clock, watch, stopwatch)

WARNING

It is recommended to have an adult use a drill, a hole puncher or another tool to pierce a hole.

BACKGROUND

Still half asleep, Conscious Charlie trudges towards the shower, with a towel around his neck. Wasteful Wally dashes past him and slams the shower door shut.

He opens the faucet of the shower ... but hardly any water comes out! Outraged, Wasteful Wally is eventually joined by Conscious Charlie. Together, they open the faucet, look inside the showerhead, and listen for the sound of water in the wall. It's no use: the water still won't run!

Our two companions head to the source of the problem: the drinking water treatment plant. They are welcomed by Crystal Clearwater, who tells them the problem is caused by the filters. Normally, they are changed one by one, every 25 to 30 years. Exceptionally, they must now be changed all at the same time! That explains why Mini-Town's water flow has been significantly reduced. If only a team of people could build new filters, the water flow could be restored much sooner!

THIS IS A JOB FOR
THE FANTASTIK'EAU CREW!

Cycle 3

MISSION 01

BUILDING A BASIC WATER FILTER

INSTRUCTIONS FOR CYCLE 3 ELEMENTARY STUDENTS

1. YOUR TASK

Build a filter that clarifies water and also allows it to flow well.

2. INVESTIGATING AND IDENTIFYING POSSIBLE SOLUTIONS

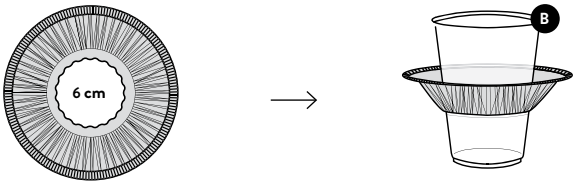
Guide your students' hypotheses towards absorbent materials AND mention that sand and gravel are often used in filters. Ask your students to advance hypotheses. Let them illustrate the plans for their filters, then tell them to get to work! Each team must create a prototype (step 3). The results are then shared to determine which ones work best. Lastly, the students calculate the gains they have achieved (step 4).

CRYSTAL CLEARWATER:
If your students have difficulty building a filter, a standard model can be made by putting a paper filter in the bottom of the glass, then adding sand and gravel. But first, invite them to explore the materials, to choose the medium (or media) they intend to use to filter the water, and to explain their choices.

3. DESIGNING THE PROTOTYPE

- Your students will use a 250 millilitres B glass in which they will punch six holes using a pushpin or a sharp screwdriver. !
- Next, your students will enlarge the holes using a large nail. You can also make the holes in advance if you prefer, or use a funnel. !
- Lastly, your students will choose the medium (or media) they will use to filter the water.

Note: the chosen medium (or media) must all fit into the glass!



WARNING

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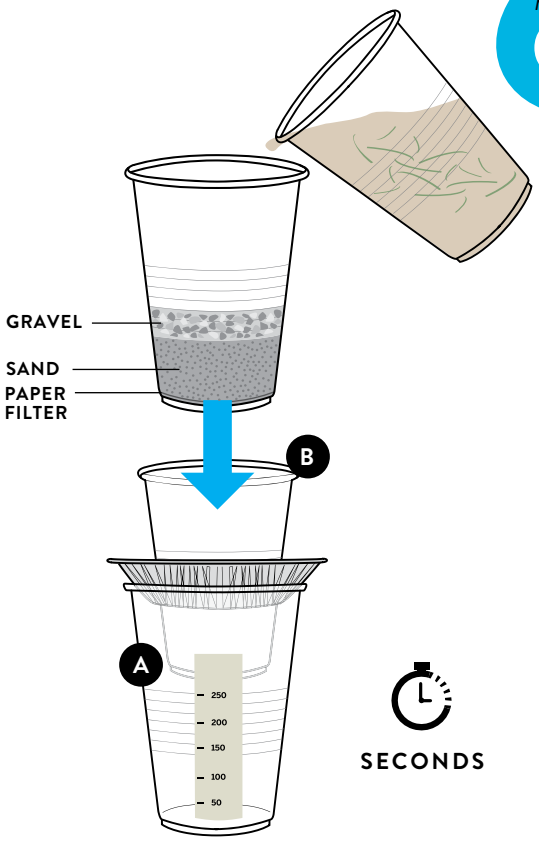


JÉRÉMIE:
A similar design will be used in Mission 02! You can use a clear plastic glass to allow your students to see how the filtering media are superimposed in the glass.

4. OBSERVATIONS : CALCULATING THE VOLUME OF WATER LOST

Up until now, everything could be done without getting wet! At this stage, we add the use of water. You can do the filtration tests in a plastic bin or tray, or ask the teams to proceed one at a time in the sink to avoid spills.

Alternatively, you can make a hole with a six centimetres diameter (or with the same diameter as the glass) in a thick paper plate, insert your glass with the filter, and place everything on a measuring cup A. Afterwards, all you need to do is stir and pour the cloudy water over the filter. Your students can also simply hold the glass over a measuring cup.

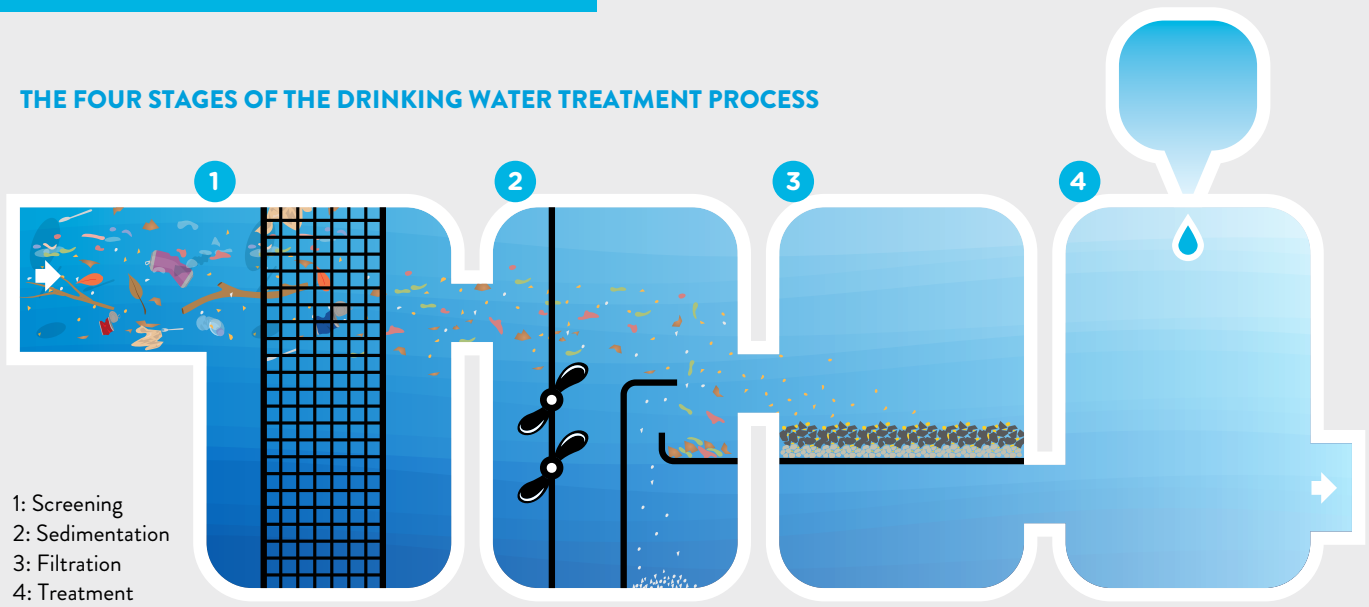
Ask your students to calculate the volume of water lost during the filtration (see the student workbook).

CONCLUSIONS

How did it go? What could your students do to improve their prototypes?

THE FANTASTIK'EAU CREW'S EXPLANATIONS

THE FOUR STAGES OF THE DRINKING WATER TREATMENT PROCESS



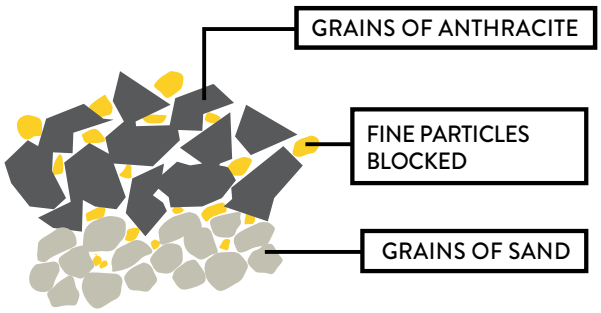
1: Screening
2: Sedimentation
3: Filtration
4: Treatment

WHAT IS HAPPENING AND WHY IS IT IMPORTANT?

Great job! Thanks to you, water is now flowing freely once again. The way your filter works is very similar to some of the stages that take place at the drinking water treatment plant. First, to clarify the water coming in from the source, the largest solids are removed from it. This stage is called screening (1). If these larger solids were not removed, they could damage or block the filter used at a later stage in the process. In your own mission, this step could be done using a strainer, for instance.

Once the water is in the treatment plant, it is left to stand until the largest particles of suspended matter fall to the bottom. This stage is called sedimentation (2). Notice how the water on top gradually becomes clearer.

Lastly, the smallest particles remaining in the water are filtered (3), which can be done using sand, like in your experiment! Several water treatment plants have an additional layer in their filters, which is made of larger grains of anthracite (a sedimentary rock which is part of the coal family). Anthracite holds in the larger particles and prevents the sand from clogging too quickly. In drinking water treatment plants, the bottoms of the filters retain the grains of sand from the filter medium while letting the water flow. This is the equivalent of the coffee filter in your project!



CRYSTAL CLEARWATER:
Important: your students cannot drink this water! At a water treatment plant, there is a fourth stage, which consists of treating the water using chemicals like ozone—yes, that same gas found high up in the sky's ozone layer. When the water leaves the treatment plant, a small amount of chlorine is also added to it. That's right, the same disinfectant found in swimming pools! Don't worry: once the water reaches your home, it hardly contains any more chlorine. It is totally fit for consumption.

DIVING DEEPER: THE WATER CYCLE

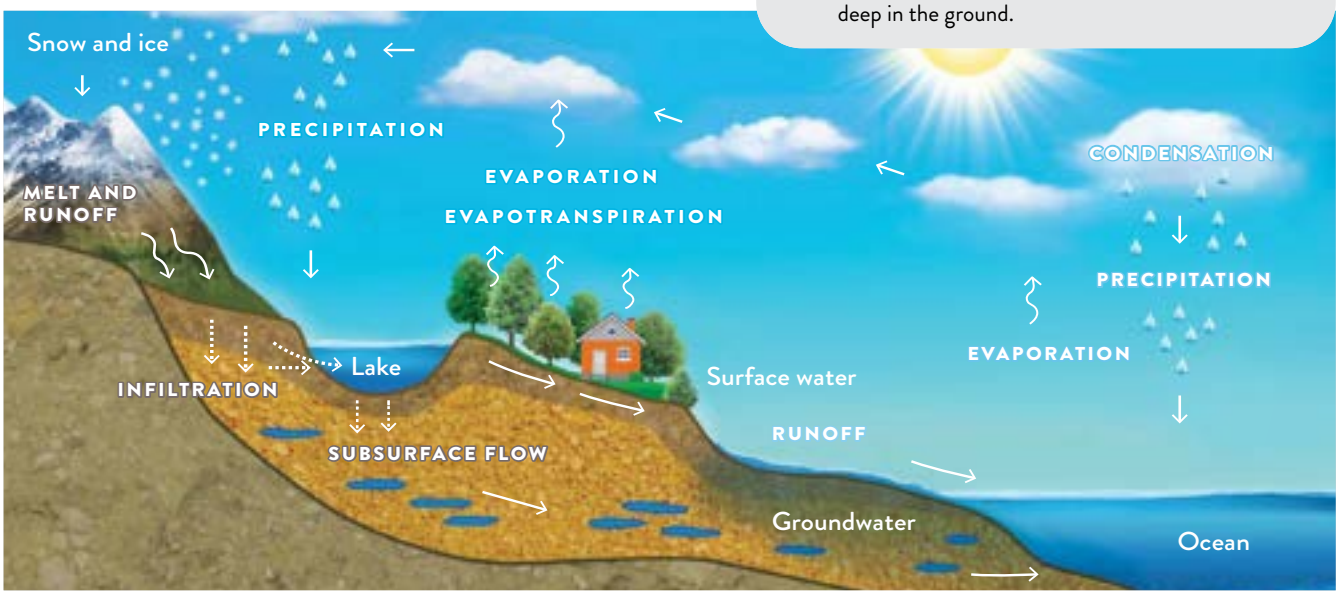
JÉRÉMIE:
While Wasteful Wally and Conscious Charlie go back home to finally take their showers, explore how water makes its way to their homes—and yours—by doing The Water Tower activity (mission 04) !

AQUA-MARY:
Water is purified by humans—and also by nature!

CRYSTAL CLEARWATER: Yes, like the filters in a drinking water treatment plant, the soil filters part of the rainwater until it reaches the water tables, which contain valuable drinking water reserves that are deep in the ground.

During the **EVAPORATION** stage, the water from streams, lakes and oceans is exposed to the sun, which makes it evaporate. Transpiration refers to all the water that is rejected by plants, as well as animals and humans (through sweat, for instance). Both processes are combined in the word evapotranspiration!

CONDENSATION, is when fine droplets of water vapour found in the air (in the form of clouds, for example) agglomerate to form drops of water.



PRECIPITATION is how water appears after condensation. This is what creates rain, snow, and hail.

RUNOFF is simply when water flows on the ground. For example, water may flow from the top of a mountain down to a plain, then reach the streams, rivers, lakes, and oceans. Along the way, the water will come into contact with certain substances (e.g. salt), which it will dissolve and carry with it.

INFILTRATION is when the water penetrates the soil, either by travelling through the soil or through natural cracks in rocks. This is how the water reaches the water tables, which are underground water reserves. Surface water (e.g. the water from a lake) and glacier water are also water reserves.

The **WATER TABLE** is the underground area where water that infiltrates the soil moves more slowly than on the surface. Water leaves the water table when a passage, such as a well, allows it to come outside.

The water **FLOWS** towards the ocean, through the rivers and lakes, or through the soil. And then the cycle starts all over again...

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CRYSTAL CLEAR

STUDENT WORKBOOK
CYCLE 3

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BACKGROUND

Still half asleep, Conscious Charlie trudges towards the shower, with a towel around his neck. Wasteful Wally dashes past him and slams the shower door shut.

He opens the faucet of the shower … but nothing comes out! Outraged, Wasteful Wally is eventually joined by Conscious Charlie. Together, they open the faucet, look inside the shower head, and listen for the sound of water in the wall. It's no use: the water just won't run!

Our two companions head to the source of the problem: the drinking water treatment plant. They are welcomed by Crystal Clearwater, who tells them the problem is caused by the filters. Normally, they are changed one by one, every 25 to 30 years. Exceptionally, they must now be changed all at the same time! That explains why Mini-Town's water flow has been significantly reduced. If only a team of people could build new filters, the water flow could be restored much sooner!

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DO THIS ACTIVITY WITH JÉRÉMIE

Watch the short video featuring Jérémie, and do the activity with him! All of the Fantastik'eau content and videos are available on the C.I.EAU's website at:

www.cieau.org/fantastikeau

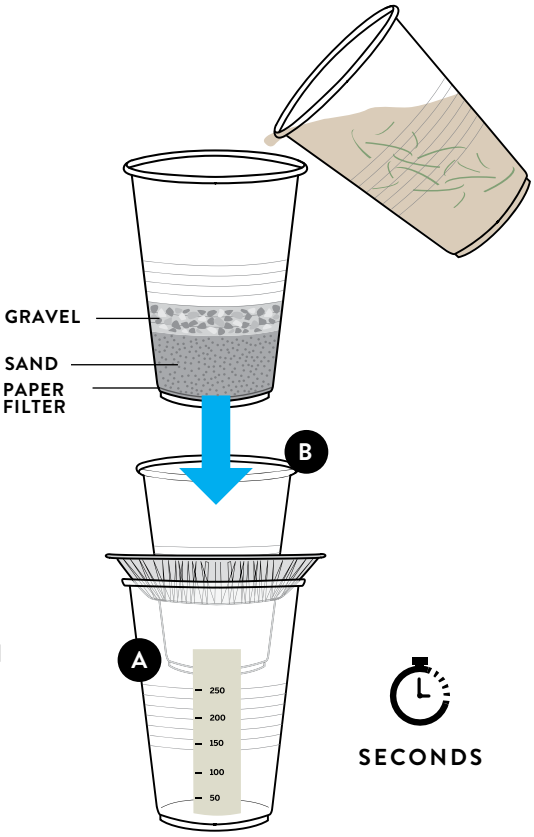
MISSION 01

YOUR TASK

Build a filter that clarifies water and also allows it to flow well.

CHOOSING THE MATERIALS, FILTERING MEDIA AND SOLUTION

Which materials and filtering media seem useful to filter water? Why?



Important: After going through the filter, the water will be clearer than when it is poured, but **it will not be drinkable.** At a water treatment plant, the water goes through additional stages to become drinkable!

DESIGNING AND TESTING THE PROTOTYPE
BUILDING A FILTER FOR THE CLOUDY WATER

- Pierce six holes under the 250 millilitres glass using a pushpin. !
- Enlarge the holes using a large nail. !
- Use the materials at your disposal to build the best filter possible.
  Important: all of your materials and filtering media must fit into your glass. The goal is to have a filter that gives you the clearest water possible, while also filtering as much water as possible.
- When you are ready, pour some murky water over your filter, and use the measuring cup to determine how much water went through your filter. Don't forget to measure the time as the water is passing through the filter.

DIAGRAM OF YOUR FILTER

WARNING

It is recommended to have an adult use a drill, a hole puncher or another tool to pierce a hole.

OBSERVATIONS: CALCULATING THE PERCENTAGE OF WATER FILTERED

What percentage of water did you filter with your device? To find the answer, **use the following equation**:

% of water filtered = volume of water filtered ÷ 150 ml of cloudy water X 100 =

_____

CONCLUSIONS

Does your prototype work well? How could you improve your filter? _____

_____

TEST YOUR SKILLS!

At what speed (flow rate) is water filtered using your device?

Use the following equation: Flow rate of your filter (ml/second) = volume of water / time = _____

How much time would it take you to filter 5 L of water? _____

STUDENT EVALUATION GRID—MISSION 1: COMPETENCY 1 IN SCIENCE AND TECHNOLOGY

Name : _____ Group : _____ Date : _____

	Exceeds expectations (4-5)	Meets expectations (3)	Does not meet expectations (0-2)
Diagram of the filter			
Building the prototype and following the directions of the task.			
Reporting the results			
Calculating the proportion of water filtered			
Conclusions			

EXCERPT FROM:

Fantastik'eau! I love water, I care for it! :
The Fantastik'eau educational package: Complete Guide, 2nd edition

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CREDITS

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The full list of people who contributed to the project (employees, volunteers, contract workers) is displayed on the C.I.EAU's website.

Collaboration—education: Virus 1334, Le Récit
Graphic design: Virus 1334
Illustrations: Simon Says Design

The following is a list of books, websites, pages, and publications dealing directly with the subjects covered in the Fantastik'eau educational package.

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All links associated with the references in this webography were functional on November 24, 2021.

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Centre d'interprétation de l'eau (C.I.EAU) www.cieau.org

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www.envirocompetences.org/media/publications/RapportEnviroComptences-tudesurlamaindoeuvredanslesecteureau-VF.pdf

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CIEAU.ORG

SPECIAL THANKS

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