MODULE III

Lesson Plan 4

Summary

Lesson title

Water Treatment – Homemade Filter

Duration	90 minutes.
Proposed student's age range	12 - 14

Lesson summary

Water treatment is essential to ensure access to clean and safe water, a vital necessity for human health and the environment. This lesson introduces students to the concept of water treatment by creating a homemade filter. This activity will explore the water purification process and the importance of different filtration methods, connecting to global issues of access to clean water and sustainability.

Learning outcomes

Purpose/Learning Objective

- Understand the basic process of water treatment.
- Learn how to build a homemade water filter.
- Identify the importance of filtration and other water purification methods.
- Relate access to clean water to sustainability and public health issues.

Intersecting objectives

- Encourage teamwork and collaboration.
- Develop critical thinking and problem-solving skills.
- Promote awareness about responsible water use and environmental impact.

Connection to SDGs

- This theme is aligned with SDG 6 "Ensure availability and sustainable management of water and sanitation for all" - Target 6.1: "By 2030, achieve universal and equitable access to affordable drinking water for all".

Implementation

Facilitation

- Make sure you have all materials ready before class.
- Divide students into small groups to encourage teamwork.
- Provide a brief theoretical introduction to water treatment.
- Guide students through the filter-building process, offering assistance and supervision.
- Encourage students to observe and record the results of their experiment.

Resources required

- Empty plastic bottles (2 per group).
- Fine sand.
- Gravel.
- Activated charcoal.
- Cotton.
- Coffee filters.
- Dirty water (can be prepared with soil and tap water).
- Scissors and knives (objects to cut the plastic).
- Containers to collect the filtered water.

Ideas for follow-up

- Research and design other homemade water purification methods, such as boiling or using water purification tablets.
- Study real-life cases from regions facing challenges in accessing drinking water and discuss possible solutions.
- Research projects on the effects of contaminated water on public health.

Source / Materials & class preparation

- Introduction to water treatment with a brief explanation based on these sources: Source 1 and Source 2.
- Educational videos to facilitate student understanding: Video 1 and Video 2.
- Examples of homemade water filters are attached in the Annexes section for printing or displaying on a screen.
- Videos of building the model to guide students: Video 1, Video 2 and Video 3.

Lesson Outline

Timing	Instructions step-by-step
10 minutes	Explain the purpose of water treatment and the importance of having access to clean and safe water. Use Source 1 and Source 2 to give a brief theoretical introduction to water purification methods. Show the educational videos (Video 1 / Video 2) to illustrate the water treatment process visually and prepare students for the hands-on activity.
5 minutes	Divide the students into groups and explain the water filter activity (Annexes Section).
5 minutes	Prepare the cloudy water and distribute the material.
25 minutes	Filter Construction (Video 1 / Video 2 / Video 3): 1. Bottle Cutting: Each group cuts a plastic bottle in half. The top will serve as the funnel, and the bottom will serve as the base. 2. Funnel Preparation: Place a coffee filter at the bottom of the funnel to prevent filter materials from passing into the filtered water. 3. Filter Layers: Fill the funnel with layers of the following materials in this order: a. Cotton on the bottom. b. Activated carbon. c. Fine sand. d. Gravel on top. 4. System Assembly: Place the funnel (top of the bottle) into the base (bottom of the bottle).
5 minutes	Initial test of filter performance: 1. First Filtration: Each group pours the dirty water into the funnel and observes how it passes through the different layers of the filter. 2. Observations: Students record their initial observations about the clarity of the filtered water compared to the dirty water.
15 minutes	Collecting feedback and possible filter improvements: 1. Discussing Improvements: Discuss possible improvements to the filter design with students. They can adjust the amount of each material or add additional layers if necessary. 2. Implementing Improvements: Groups adjust their filters based on the discussions and prepare the filter for a second test.
5 minutes	Final Test of Filter Performance:

	1. Second Filtration: Perform a second test with the dirty water using the improved filters. 2. Comparison of Results: Compare the results of the first and second filtration and note any improvement in the clarity of the filtered water.
10 minutes	Presentation of the project by each group and discussion. Each group presents its filter and explains the construction process, the improvements made, and the results obtained.
10 minutes	Reflection and evaluation of learning (Annex Section).

Formative assessment

- Class observations and oral questions during the model creation to check whether the cycle phases are clear.
- Evaluation of the models and group presentations, in which a brief discussion is held between the other groups to highlight the strong points of the model of the classmates who are presenting.
- Use of the reinforcement activities attached in the Annexes section.

Feedback

Net Promoter Score (NPS) is a widely used metric to gauge the loyalty and satisfaction of customers or, in an educational context, students. It measures the likelihood of the students recommending the lesson or course to others. Here is how you can describe and implement NPS:

Develop the NPS Question:

- Primary Question: "On a scale of 0 to 10, how likely are you to recommend this lesson to other students?"
- Follow-up Questions: "Why did you choose that score?" and "How can we improve this lesson?"

Collecting Responses:

A template for collecting feedback using paper surveys is shown in the Annexes.

- Digital Surveys: Use online tools like Google Forms, SurveyMonkey, or Typeform to distribute the NPS questions to students.
- Paper Surveys: Hand out paper questionnaires at the end of the lesson for students to fill out.
- Interactive Applications: Utilize interactive apps like Quizziz, Mentimeter, or Kahoot! to gather real-time responses.

Classifying Responses:

- Promoters (Score 9-10): Students who are highly satisfied and likely to recommend the lesson.
- Passives (Score 7-8): Students who are satisfied but not enthusiastic; could switch their opinion easily.
- Detractors (Score 0-6): Students who are dissatisfied and unlikely to recommend the lesson; may provide constructive criticism.

Calculating the NPS:

- Formula: NPS = % of Promoters - % of Detractors.
- Interpreting the Score: NPS ranges from -100 to +100. A positive score (above 0) is generally good, and a score above 50 is excellent.

Analysing and Using Feedback:

- Review additional comments to understand the reasons behind the scores.
- Identify patterns and specific areas for improvement from detractors and passives.
- Use positive feedback from promoters to reinforce successful aspects of the lesson.

Annexes

Water resource maps for printing or displaying on a screen:

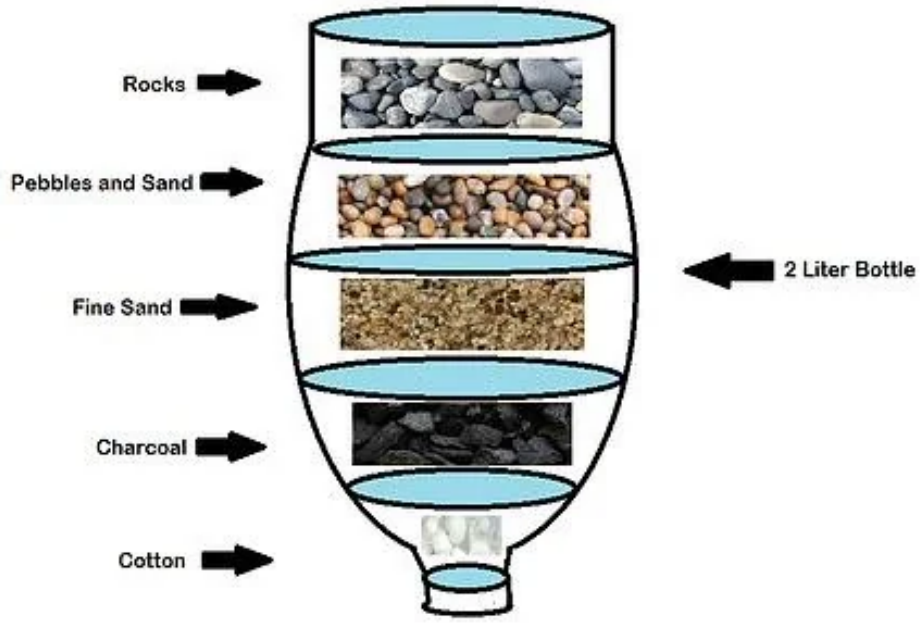


Figure 3.4.1: Support figure. Source: Bell Museum, University of Minnesota. Enlace: https://www.bellmuseum.umn.edu/activities-for-kids/exoplanet-exploration-grades-7-8/filter-your-water-experiment/

Reinforcement activities to assess whether students have learned what was explained:

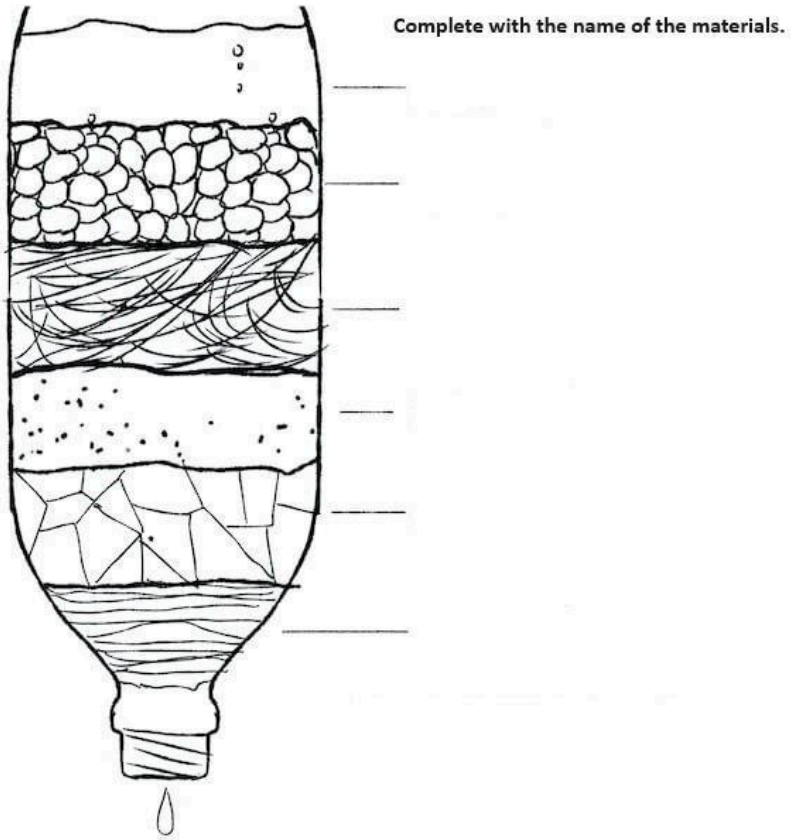


Figure 3.4.2: Support figure. Source: own creation.

QUESTIONNAIRE TO COLLECT FEEDBACK ON THE LESSON

On a scale of 0 to 10, how likely are you to recommend this lesson to other students?

0	1	2	3	4	5	6	7	8	9	10

Not likely at all — Extremely likely

Why did you choose that score?

How can we improve this lesson?