



# WATER FILTRATION - AGE 10-14



## WATER FILTRATION - LESSON PLAN:

### **Curriculum Area:**

Science – Water purification including osmosis, pure and impure substances

### **Activity:**

For learners in small groups to carry out water filtration exercise to highlight the importance of clean water and how it can be achieved compared to the equipment used in HMS Oardacious.

### **Learning Objectives:**

Learners will:

- Understand that the RN has talented and highly qualified sailors and marines employed in a wide range of roles at sea and ashore.
- Understand the different ways of making potable water through 2 and 3 step processes.
- Work effectively as a group to solve problems and test their hypothesis by planning and conducting an experiment.
- Review and evaluate their results using appropriate scientific vocabulary.

### **Previous Skills:**

Learners will need to be able to work effectively in small groups, sharing ideas and tasks within the activity. Learners will need previous experience of the process of osmosis.

### **Resources:**

- One 2-litre plastic bottle for each student or small group of students. These should be pre-cut in half by an adult in a Primary setting.
- Filtration materials, such as: Napkins, Gravel, Sand, Cotton Balls, Clay (examples, not exhaustive)
- Materials to be used as “pollution,” such as: Soil, Litter (bits of plastic, small objects like paperclips, etc.), Food scraps (i.e. orange peels, egg shells, lettuce, etc.), Bits of leaves or grass, Food colouring, Cooking oil, Glitter (examples, not exhaustive)
- Cups or containers for mixing the “polluted water.”
- Towels or napkins for clean-up
- Worksheet – Water Filtration Experiment (one for each student or small group of students)

### **Introduction/Background:**

Although Earth is covered with water (over 70% of Earth’s surface), only about 3% of the water on our planet is not salt water. Of this tiny amount of freshwater, much is locked up in ice and glaciers. Of the remainder, less and less is available to humans because of rising populations and increased pollution. Everyone on Earth must share the same water continuously cycling through, and we are all connected by watersheds. Almost everyone in the Western World is used to having clean water anytime, at the turn of a tap. Most of the world’s people are not so lucky and must obtain water from a variety of sources. Many of



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these water sources contain pollution of some form, whether it is bacteria and microorganisms, chemicals, toxins, waste, litter, or other substances and materials.

When a Royal Navy submarine deploys for up to 9 months, freshwater availability is a vital factor in the vessel's ability to remain on task anywhere in the world. State of the art submarines have in-built filtration systems to turn the surrounding saltwater in to fresh water for human consumption. Just like when they are onboard their submarine, the rowers on the HMS Oardacious Atlantic Rowing Challenge will be surrounded by water but will not be able to drink it.

With space at a premium on the vessel and each team member expected to drink approximately 6 litres of water a day to maintain their high energy output, a solution to create their own drinking water had to be found.

### **Different types of water purification:**

The process used by the HMS Oardacious crew is called Reverse Osmosis, in this process sea water is forced through a series of semi permeable membranes which will remove the salt and other impurities from the water. This water is then sterilised using chlorine tablets.

### **Review of the Science:**

In the UK, water resources include lakes, rivers, aquifers and reservoirs.

An aquifer is an underground layer of permeable rock, gravel or sand that is soaked with water, while a reservoir is usually an artificial lake, made by building a dam to accumulate and save river water in the valley behind.

### **Filtering the water:**

Solids in the water, such as leaves and soil, must be removed. The water is sprayed onto specially-prepared layers of sand and gravel called filter beds.

Different-sized insoluble solids are removed as the water trickles through the filter beds. These are cleaned every so often by pumping clean water backwards through the filter.

The water is then passed into a sedimentation tank. Aluminium sulphate is added to clump tiny particles together to make larger particles, which settle out more easily. The water is then passed through a fine filter, such as carbon granules, to remove very small particles. The water is then sterilised with either exposure to Ozone gas or UV light.

### **Challenge:**

1. Break students into small groups and pass out Worksheet #1 – Water Filter Procedure (one for each student, or one for each lab group) and Worksheet #2 – Water Filter Lab Worksheet (one for each student). Distribute lab supplies to each station (2-liter soda bottle pre-cut in half, filtration materials, "pollution" materials).
2. Have students think about the types of pollution they discussed in the first activity. How could they represent these with the materials provided?
3. Have each group follow the procedure outlined in Worksheet – Water Filtration Experiment



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## **Discussion / Results:**

1. Students imagine again that they have no running water and no water treatment facilities, and they must collect water from sources near their homes. What might this water look like, taste like, smell like, etc. Would they like to use this water for drinking, cleaning, cooking, etc.?
2. Based on the water filter activity, how would they design a water filter to clean the water they would be using?
  - a. What pollutants would they need to filter out?
  - b. What materials would they use to filter each kind of pollutant?
  - c. Are there any pollutants that they were not able to filter out with their hand-made filters?
  - d. Even if the water looked clean, is it possible that the water was still undrinkable?
  - e. How might they remove contaminants from the water that cannot be filtered out?
  - f. Would they feel safe and comfortable using and drinking the water after using a homemade filter? Would they get sick?
3. Think about microscopic organisms that are too tiny to see and possibly too small to filter. Also, think about contaminants that are dissolved in the water and thus would be difficult to filter. How do water treatment plants and sanitation facilities solve this problem? (Ex. they use chemical cleaners to treat the water.)
4. Remind your students that, although most people in the UK generally have reliable access to clean water, many people around the world are not so lucky and must collect and clean their own water. In addition, conditions such as drought, pollution, increased population and unequal distribution of natural resources threaten Earth's water supply. This makes it necessary for each of us to conserve water and find ways to reduce our daily water usage.

**Conclusion:** What was the best filtration material?

## **Extension Activities:**

- **Research water filtration types used in your local area.**