
# Chemistry: All About You

## Module 6. Hands on activities: Water experiments

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## MODULE 6. HANDS ON ACTIVITIES: WATER EXPERIMENTS

In this section we propose a number of hands-on activities in chemistry to increase students' knowledge of chemistry concepts and scientific processes. The experiments proposed have been developed in the context of the Global Experiment of the International Year of Chemistry – http://water.chemistry2011.org/web/iyc. The International Year of Chemistry (IYC 2011) is an initiative of IUPAC, the International Union of Pure and Applied Chemistry, and UNESCO, the United Nations Educational, Scientific and Cultural Organization.

The Global Experiment of the International Year of Chemistry, an initiative of the IUPAC Committee on Chemistry Education, has been developed to appeal to students from primary school to senior high school. The activities that make up the experiment will help students appreciate the role of chemistry in issues of water quality and purification. At the same time, students will contribute to an online global map, reporting on their investigations of water quality and water treatment.

The activities proposed cover important topics and conceptual understanding in science and also provide a variety of opportunities to learn important experimental and data gathering skills. They consist of classroom and laboratory activities to be carried out by the teacher and his/her students.

The Global Experiment of the International Year of Chemistry proposes experiments to test the properties of water, filtration materials and purification of water using a solar still.

In these teacher guidelines, we provide teachers with a selection of two examples of experiments on water that can be included in a lesson plan in combination with the video "*Chemistry: All About You*". The experiments have been selected by the Young EPCA Think Tank as the best hands-on activities from the Global Experiment of the International Year of Chemistry to link with the video "*Chemistry: All About You*".

You can find more lab activities on salinity and acidity of water on the website of the Global Experiment of the International Year of Chemistry:

http://water.chemistry2011.org/web/iyc/experiments

## 1. FILTRATION

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| **Experiment purpose** | To filter water from a natural local source. |
| **Link** | http://chemistry2011.org |
| **Pedagogical objectives** | Students will use household materials to build a water filtration unit. |
| **Time needed** | 50 minutes |
| **Materials** | • 2 litres of “dirty” natural water<br>• 3 litres of clean water<br>• 1 two-litre plastic soft drink bottle with its cap<br>• 2 two-litre plastic soft drink bottles, one with its bottom cut off to use as a funnel and one with the top cut off to use for sedimentation.<br>• 1 large beaker (with a volume of 500 ml, or 2 cups)<br>• 2 tablespoons of alum<br>• 1½ cups fine sand<br>• 1½ cups coarse sand<br>• 1 cup small pebbles<br>• 1 coffee filter<br>• 1 rubber band<br>• 1 large spoon<br>• A clock with a second hand or a stopwatch |
| **Procedure** | • Pour dirty swamp/river/reservoir water into the two litres bottle with a cap.<br>• Place the cap on the bottle and vigorously shake the bottle for 30 seconds. Continue the aeration process by pouring the water into another bottle or the beaker, then pouring the water back and forth between them about 10 times. Once aerated, gases have escaped (any bubbles should be gone). Pour your aerated water into the bottle with its top cut off.<br>• Add two tablespoons of alum to the aerated water. Slowly stir the mixture for 5 minutes.<br>• Allow the water to stand undisturbed in the container. Observe the water at five-minute intervals for a total of 20 minutes.<br>• Construct a filter from the bottle with its bottom cut off as follows: |

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| **Procedure** | • Pour dirty swamp/river/reservoir water into the two litres bottle with a cap.<br>• Place the cap on the bottle and vigorously shake the bottle for 30 seconds. Continue the aeration process by pouring the water into another bottle or the beaker, then pouring the water back and forth between them about 10 times. Once aerated, gases have escaped (any bubbles should be gone). Pour your aerated water into the bottle with its top cut off.<br>• Add two tablespoons of alum to the aerated water. Slowly stir the mixture for 5 minutes.<br>• Allow the water to stand undisturbed in the container. Observe the water at five-minute intervals for a total of 20 minutes.<br>• Construct a filter from the bottle with its bottom cut off as follows:<br>  ○ Attach the coffee filter to the outside neck of the bottle, using a rubber band. Turn the bottle upside down placing it in a beaker or cut-off bottom of a two litres bottle. Pour a layer of pebbles into the bottle – the filter will prevent the pebbles from falling out of the neck.<br>  ○ Pour the coarse sand on top of the pebbles.<br>  ○ Pour the fine sand on top of the coarse sand.<br>  ○ Clean the filter by slowly and carefully pouring through 3 litres (or more) of clean drinking water. Throw away the water that has passed through the filter.<br>• After a large amount of sediment has settled on the bottom of the bottle of swamp/river/reservoir water, carefully – without disturbing the sediment – pour the top two-thirds of the swamp/river/reservoir water through the filter. Collect the filtered water in the beaker/plastic bottle.<br>• Compare the treated and untreated water. Has treatment changed the appearance and smell of the water? |
| **Outcomes for students** | **Scientific processes**<br>• Observing and comparing the appearance of untreated and treated water.<br>• Recording the scientific data and observations in an appropriate manner.<br>• Interpreting data in terms of environment and nature of the water involved.<br>• Asking scientific questions about water treatment and water in the environment.<br>• Carrying out scientific investigations by selecting and controlling variables.<br><br>**Chemistry and Physics background**<br>• Aeration as a tool in water treatment – the role of oxygen.<br>• Coagulation as a chemical tool to clarify water.<br>• Sedimentation and filtration as physical tools to clarify water |

## 2. SOLAR STILL CHALLENGE

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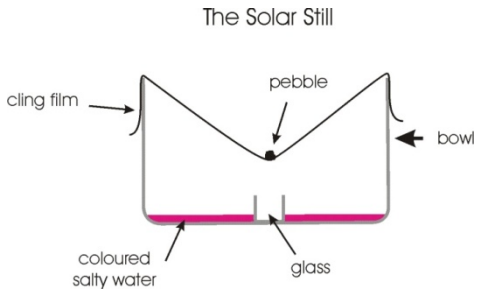
| **Experiment purpose** | To clean water from a local source using a non-conventional unit. |
| **Link** | http://chemistry2011.org |
| **Pedagogical objectives** | Students will build a solar still and find out how it can purify water. |
| **Time needed** | 90 minutes |
| **Materials** | **For building the solar still:**<br>• Large metal or plastic bowl<br>• Small, shallow glass or cup (clean)<br>• Measuring jug or cylinder<br>• Cling film (wider than the bowl)<br>• A pebble<br>• Hot water<br>• Food dye and salt<br>  |
| **Procedure** | • Add a measured volume of hot water (about 1 cm) to the bowl.<br>• Add some food colouring and about a teaspoonful of salt to the water in the bowl.<br>• Take all the equipment out to a sunny, level place.<br>• Place the glass or cup in the middle of the bowl making sure no water splashes into it.<br>• Cover the bowl loosely with cling film, sealing the film to the rim of the bowl.<br>• Place the stone in the middle of the film above the cup.<br>• Leave the still for at least an hour (the longer the better) and then check that there is some water in the cup.<br>• Take the still back indoors, remove the cling film and take out the cup without splashing any water into or out of the cup.<br>• Measure the amount of water in the cup.<br>• Observe the colour of the water in the cup and test it for salt.<br>• Calculate the percentage of the water that was purified:<br>$$\%\ \text{water purified} = \frac{\text{volume collected}}{\text{volume added to still}} \times 100$$ |

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| **Outcomes for students** | **Scientific processes**<br>• Observing and comparing the appearance of untreated and treated water.<br>• Recording the scientific data and observations in an appropriate manner.<br>• Interpreting data in terms of environment and nature of the water involved.<br>• Asking scientific questions about water treatment and water in the environment.<br>• Carrying out scientific investigations by selecting and controlling variables.<br><br>**Chemistry and Physics background**<br>• States of matter and their inter-conversion (evaporation and condensation).<br>• Distillation as a physical tool to clarify water.<br>• The efficiency of a solar still for purifying water. |