

Year 7

Lesson 9

Solutes and solubility

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Learning Objectives

Students will be able to:

- Understand that substances can be suspended or dissolved in water and that water treatment involves the removal of these materials
- Undertake investigations that mimic aspects of the water treatment process, including distillation and filtration
- Identify materials that should not be disposed of via drains or sinks.

Learning outcomes

Subject	Strand & Content Descriptors
Science	<p>Science Understanding</p> <ul style="list-style-type: none">• Water is an important resource that cycles through the environment (ACSSU222)• Mixtures, including solutions, contain a combination of pure substances that can be separated using a range of techniques (ACSSU112) <p>Science as a Human Endeavour</p> <ul style="list-style-type: none">• Science knowledge can develop through collaboration and connecting ideas across the disciplines of science (ACSHE223)• Science and technology contribute to finding solutions to a range of contemporary issues; these solutions may impact on other areas of society and involve ethical considerations (ACSHE120)• Science understanding influences the development of practices in areas of human activity such as industry, agriculture and marine and terrestrial resource management (ACSHE121) <p>Science Inquiry Skills</p> <ul style="list-style-type: none">• Identify questions and problems that can be investigated scientifically and make predictions based on scientific knowledge (ACSIS124)• Communicate ideas, findings and solutions to problems using scientific language and representations using digital technologies as appropriate (ACSIS133)

Important Questions

- Why water is called the universal solvent?
- What is the difference between a solvent and a solute?
- How are substances that are suspended in water removed?
- How are substances that are dissolved in water removed?



Lesson Plan

Water is sometimes called the universal solvent as more substances dissolve in water than any other chemical. Substances that don't dissolve in water may be held in suspension.

Substances that dissolve or are suspended in water may be naturally derived – such as soil in a dam catchment, or be generated from households or industry, for example soap, oil and dirt. Regardless of the source, water needs to be treated before it is distributed and after it is used. This lesson provides some practical insight into the processes used to ensure the quality of water supplies is maintained.

Suspended or dissolved?

The following activities can be undertaken in small groups. Following the explanation of the experiment procedure, students should record predictions and their reasons for these predictions. During the experiment they should complete an observation log as shown below.

1. Instruct each group to fill each container with water to about ¾ of the volume.
2. To one container add 3 tablespoons of jelly crystals; to the other jar add 3 tablespoons of soil.
3. Place lids on containers and record initial observations (e.g. colour of water; visible materials).
4. Shake the containers vigorously for 1 minute and record observations.
5. Place the containers, undisturbed on a flat surface, and record observations after 5 and then 10 minutes.

The jelly crystals have dissolved (the water acting as a solvent has dissolved the crystals – termed a solute and produced a solution). The soil has been suspended; particles may be visible and 'held' in the water column; heavier particles may have settled to the bottom of the jar.

Students may suggest substances derived from water catchments or household activities and whether these dissolve or remain suspended. The experiment could be repeated with a range of substances including, oil, soap, or tissue paper.

Sample	Time	Record observation (what changes did you see?)
Sample 1 – Jelly Crystals	1. (record time)	
	2. (record time)	
	3. (record time)	
	4. (record time)	
Sample 2 - Soil	1. (record time)	
	2. (record time)	
	3. (record time)	
	4. (record time)	

Removing suspended substances from water may be achieved through a number of processes including clarification, filtration and flocculation.





Filtration: used to remove suspended substances from water.

Observing Sample 2, students suggest techniques to remove suspended matter from the sample. (Some of the material will have settled out, some will still be in suspension).

Students design and construct a simple filter (see resource requirements) and test its effectiveness at removing suspended solids. (Keep a control sample of dirty water to compare with filtered samples)

Students record the effectiveness of their filter and identify practices that achieved or hindered filter effectiveness (e.g. water volume or speed; filter material permeability) and make suggestions on improving the effectiveness of the filter.

Discuss whether the water is now clean? Consider how dissolved substances could be removed.

Removing dissolved substances from water may be achieved through a number of processes including chemical reactions, use of biological organisms to remove nutrients (for example bacteria can be used at wastewater treatment plants to remove nitrogen and phosphorous derived from detergent), ultra-filtration and distillation. This activity provides instruction for an activity that models distillation.

Distillation

Observing Sample 1 students suggest techniques to remove dissolved matter from the sample.

Construct a simple distillation device (see Resource Requirements)

1. Using a microwave or stove heat Sample 1
2. While sample 1 is heating attach one end of the aquarium tube to the funnel spout and secure.
3. Wrap the remaining tube around the bottle of frozen water and place the end of the tube in a collection container.
4. Pour the heated Sample 1 solution into a container with an opening the same diameter as the top of the funnel 5. Invert the funnel onto the container and fix or seal.
5. Students observe and record observations using appropriate scientific terminology.

Resource Requirements

Suspended or dissolved?	Filtration	Distillation
2 clear jars (or similar with lids) Jelly crystals Soil (preferably clay based) Water	Plastic funnels Filter material (e.g. dishcloths, filter papers; sand; fine gravel) Collection containers	Plastic funnel Container (opening same size as funnel diameter) Aquarium tubing Bottle of frozen water Collection container



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Additional Activities

Visit a water treatment or waste water treatment plant in your region.

Research the impact of incorrect materials being flushed down drains or toilets; produce a brochure, poster or short video to discourage these practices.