

In Search of Solutions

This resource can be downloaded from <https://rsc.li/3oy2Dfc>

Water for survival: student sheet

Learning objectives:

1. Observe that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution.
2. Use knowledge of solids, liquids, and gases to decide how mixtures might be separated, including through filtering, sieving, and evaporating.

Introduction

You are on a survival course, your group has been left in the wilds for a few days with only a limited amount of water and food. It is a scorching hot summer's day. Early evening you discover that the person carrying the water has drunk it all and there is only powdered potatoes or packet soup to eat. Clearly, in order to eat and drink tonight you must obtain some water. Luckily you come across a muddy pond next to a rubbish tip. Fortunately, you also notice old bits of laboratory equipment in the rubbish tip. There is a wood fire beside the pond with charcoal in it.

Your task

Obtain some pure water in order to prepare a meal and to have water to drink the following day. You must also find a way of showing that the water is pure.

Equipment & materials

Eye protection.

General

- Glass beakers (100, 250, 400 cm³), large plastic trays, test tubes, boiling tubes, test tube holders, conical flasks & bungs to fit them with a glass through tube (or side-arm flasks or side-arm boiling tubes), straight & bent glass tubing, rubber tubing (5 cm & 30 cm lengths), funnels, filter papers, plastic sieves, glass droppers, evaporating basins, thermometers, paper towels.
- Bunsen burners, tripods, gauzes, heat-resistant mats, clampstands.
- Charcoal.

Per group

- Water sample from 'muddy pond'.

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Water for survival: teacher notes

Planning

Time	100 minutes (this time can be split into a 30 minute planning lesson where students have all the apparatus available to look at, and a 70 minute practical session).
Group size	2-4.
Curriculum links	Filtration, distillation, temperature.

Possible approaches

Fits in well with classwork on evaporation and condensation. Some help on cooling steam may be necessary. Pond contents could be varied, for example oil could be added to the water. More advice on how to use these resources can be found here: <https://rsc.li/3ApCfaq>

Information for technicians

To prepare the 'muddy water sample' you will need to mix:

- tap water (400 cm³)
- soil (about half a handful)
- green ink to colour noticeably
- salt (4 g)

Health & safety notes

This is an open-ended problem solving activity, so the guidance given here is necessarily incomplete. Teachers need to be particularly vigilant, and a higher degree of supervision is needed than in activities which have more closed outcomes. Students must be encouraged to take a responsible attitude towards safety, both their own and that of others. In planning an activity students should always include safety as a factor to be considered. Plans should be checked by the teacher before implementing them.

Read our [standard health & safety guidance](#) and carry out a risk assessment before running any live practical. Refer to [SSERC/CLEAPSS](#) Hazcards and recipe sheets.

Check students' apparatus before they start heating. Remind students that if their water boils too vigorously they are to turn down the flame. Small blue flame only required.

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To avoid the (remote) possibility of infection from soil organisms, it is preferable to heat the soil in an oven first to sterilise it. (In case there is a temptation to taste the water in advance). If using compost, be careful it is not too dry to avoid the possibility of inhaling fungal spores.

Eye protection is advisable when boiling liquids.

Warn students that tasting it is NOT an acceptable way of showing the water is pure.

Write-up and assessment

Suggested write-up

Student to write a diary entry for day 1 of the survival course (as part of the survival course assessment procedure).

Evaluation of task

These are suggestions only:

1. Firstly, judge against criteria for success (see introduction for ideas).
2. That some purification was achieved.
3. Does method take into account soluble impurities as well as insoluble impurities?
4. Some tests done on water (visual + boiling point + others).
5. Distillation.

Extension work

Learners analyse the pond water sample to determine the contents. Find some ideas for tests they could perform here:

- Identifying ions practical video for 14-16 year olds: <https://rsc.li/39W8kv1>