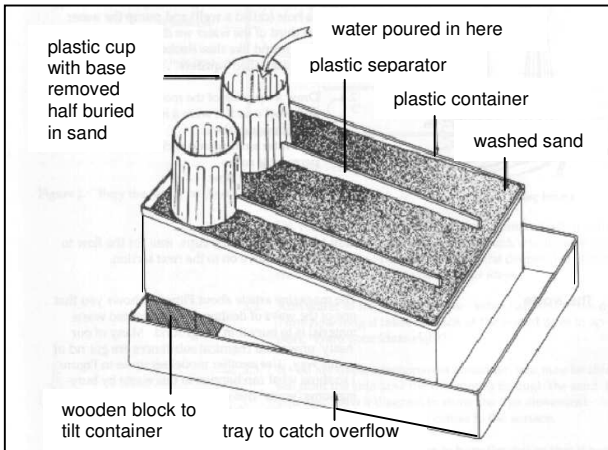


From rain to spring: water from the ground

Demonstrating how water flows through the ground – and how it can be used and polluted

Underground water flow

Show how rain becomes groundwater that flows through the ground and then comes out in springs by setting up a model like this.



Pour water to fill the two cups. Soon you will see through the sides of the plastic container that the sand becomes wet and the water begins to flow 'downhill'. Ask the pupils where the water is likely to come to the surface as you continue to 'top up' the cups with water. Depending on how deeply buried the cups are, the water will appear somewhere near the cups or at the lower end of the container – in each case, the water appears as a 'spring', like in the photo. Eventually the water overflows the container into the tray beneath.



A natural spring in Death Valley, California, USA.

From Earth Science World Image Bank - Photo ID: h4uu4k © Marli Miller, University of Oregon.

Water wells

Ask the pupils, if they wanted to get the water out of the 'ground' before it reached the 'spring', what they could do? The answer would be to dig or drill a well somewhere above the spring and pump out the water. Show this by digging a hole with a spoon - that will soon fill with water.



A hand dug well, Obelai, Uganda

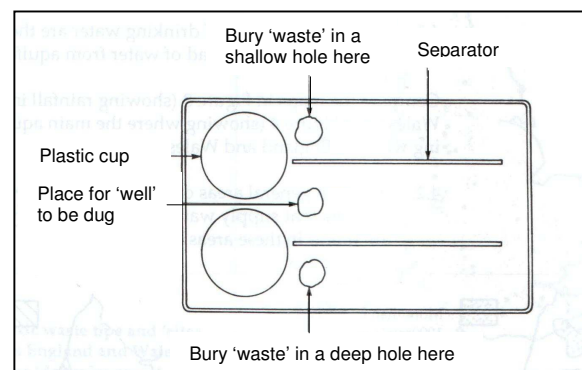
© Teso Development Trust.
www.teso.org.uk
45 Sandhurst Avenue,
Stourbridge, West Midlands DY9 0XL.

Ask the pupils what in the model represents:

- the hills
- the rain
- a spring
- a well or borehole

Toxic waste

To show how waste can pollute groundwater – set up this beforehand (before adding the water). Bury 'waste' (some paper dipped in ink or something similar) at shallow and deep depths in the model, as below. Tell the pupils that waste containing toxic chemicals has been buried, at two different depths.



Ask them from which depth the waste is likely to appear first, polluting the 'spring'. After predicting, the pupils usually watch very carefully as you add the water, to find out which is right. Depending on how the model is set up, the 'waste' can appear first from either of the two places. The key point is that, no matter how deeply the waste is buried, it will always reach the surface, causing pollution, unless it is buried in leak-proof containers or impermeable rocks.

(Note: You could do this as a 'thought experiment' without actually burying the 'waste' – avoiding having to wash the sand before the next demonstration).

The back up

Title: From rain to spring: water from the ground

Subtitle: Demonstrating how water flows through the ground – and how it can be used and polluted

Topic: A demonstration of groundwater flow, springs, wells and problems of toxic waste disposal

Age range of pupils: 10 – 18 years

Time needed to complete activity: 15 mins

Pupil learning outcomes: Pupils can use the model to describe:

- how water that falls as rain can eventually flow out of the ground in springs;
- how underground water can be tapped through wells;
- how toxic waste can pollute groundwater.

Context: The model demonstrates how groundwater flows and forms aquifers (permeable rocks containing underground water supplies). In the model, the upper part with the cups represents the 'hills'; water poured into the cups represents 'rain'; the water emerges from the 'ground' in a 'spring'. The 'spring' is usually found at the lower end of the container, where the downward flowing water reaches the impermeable edge of the container and flows upwards to the 'ground surface' – as in many natural springs formed where flowing water meets an impermeable barrier.

To get to the water before it flows out of the spring, you need to dig or drill a hole or 'well'.

Unsealed toxic waste buried at any depth in rocks that have groundwater flowing through them, will eventually pollute the groundwater and groundwater supplies.

Following up the activity:

Try explaining what is happening using the Earthlearningidea activities '*Modelling for rocks : what's hidden inside and why*', published on 1st December 2007 and '*The space within: the porosity of rocks*', to be published on 30th June 2008.

Underlying principles:

- Water from rain flows 'downhill' through interconnected pore spaces in permeable rocks.
- It comes out of the rocks where the rocks meet the surface or where impermeable underground barriers cause the water to 'pond up'.
- Water emerges from rocks at springs or in marshes or bogs.
- As water flows through permeable rocks it becomes filtered, so that underground water supplies are often cleaner than surface water supplies. However, it can become polluted naturally or by buried waste.

Thinking skill development:

- Pupils see a pattern of water flow (construction)
- They encounter cognitive conflict as they try to predict where 'springs' will emerge and where 'waste' might flow out.
- Discussions around their predictions involve metacognition
- Application of the model to real world situations involves bridging.

Resource list:

- rectangular plastic container (eg. 30 cm x 20 cm), preferably translucent or transparent – smaller or larger containers can also be used
- plastic tray to catch overflow
- washed sand to fill rectangular container up to near the top
- two plastic coffee cups with the bases cut out
- blocks, to raise one end of the container
- two plastic separators for the container (cut from the lid?)
- water in a separate container
- spoon to excavate 'well' or to bury 'waste'
- 'waste' – paper (eg. toilet paper) dipped into ink, or coffee/tea

(Note: If you do bury 'waste' you will need to wash out the sand before it is used in the next demonstration.)

Useful links: A more complex model than described above can be found at:

<http://www.beg.utexas.edu/education/aquitank/tank01.htm>

Source: Earth Science Teachers Association (1992) *Science of the Earth 11 – 14, Water overground and underground: WG2 Out of sight- out of mind?* GeoSupplies, Sheffield.

© Earthlearningidea team. The Earthlearningidea team seeks to produce a teaching idea every week, at minimal cost, with minimal resources, for teacher educators and teachers of Earth science through school-level geography or science, with an online discussion around every idea in order to develop a global support network. 'Earthlearningidea' has little funding and is produced largely by voluntary effort.

Copyright is waived for original material contained in this activity if it is required for use within the laboratory or classroom. Copyright material contained herein from other publishers rests with them. Any organisation wishing to use this material should contact the Earthlearningidea team.

Every effort has been made to locate and contact copyright holders of materials included in this activity in order to obtain their permission. Please contact us if, however, you believe your copyright is being infringed: we welcome any information that will help us to update our records.

If you have any difficulty with the readability of these documents, please contact the Earthlearningidea team for further help.

Contact the Earthlearningidea team at: info@earthlearningidea.com