KS2 Circus Activity: Will My Rock Hold Water?

Topic addressed
This activity investigates the porosity/permeability of rocks.

National curriculum references

Science KS2	Sc3 1d	to describe and group rocks and soils on the basis of their characteristics, including appearance, texture and permeability
Science Scheme of Work	Unit 3D	Rocks and soils

Pupil practical or teacher demonstration
Pupil practical.

Time needed to complete the activity
20 minutes.

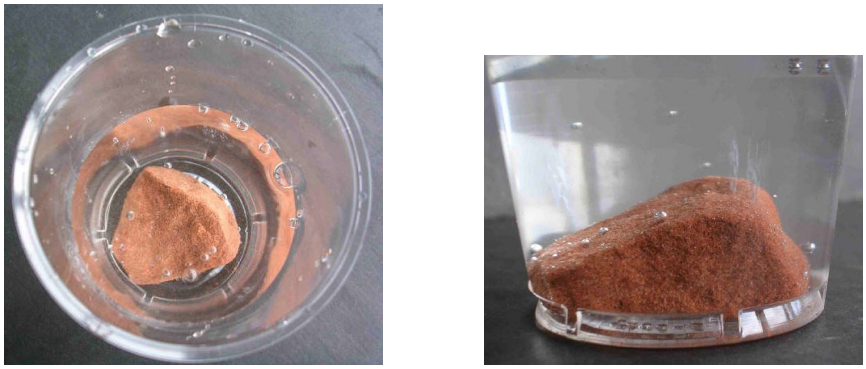
Preparation and set-up time
5 minutes.

Resource list
- Samples of granite, permeable sandstone and others such as: shelly limestone, chalk, slate, marble – the same specimens as used in the KS2 Circus Activities 'A Rocky Look, Touch and Tell?' and 'Found in the Ground'. Samples should be 2cm in diameter, or larger
- Plastic container/beaker of water to put the rocks in, preferably transparent
- *If pupil groups are doing this activity, it is useful for them to have enough sets so they can work in groups of three*

Activity

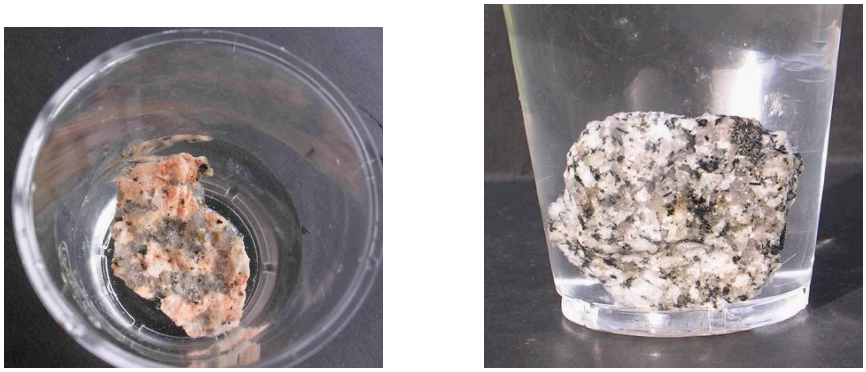
A <u>Bubbling Rocks</u>

- Take one sample of a permeable sedimentary rock (eg sandstone) and one of an igneous rock (eg. granite) both with clearly visible grains.
- Watch for bubbles as you put both of these into a container of water at the same time.
- Watch closely to see where the bubbles come from on each of the samples.
- Describe what you have seen.



(top view) (side view)

Figure 4: Sandstone 'bubbling' in a plastic beaker (Peter Kennett)



(top view) (side view)

Figure 5: Granite not 'bubbling' in a plastic beaker (Peter Kennett)

B **Sorting the Rocks**

Put the rest of the rock samples into a container of water at the same time and watch for bubbles.

- What is the order of the rocks, from the most to the least 'bubbly'?
- Ask questions, e.g. How do we use a 'bubbly' (permeable) rock like sandstone?
- How do we use a non-'bubbly' (impermeable, waterproof) rock like slate?

Results expected

The bubbly rocks have spaces between the grains that can hold air and water and that air and water can flow through – so they are porous (they have spaces between the grains) and permeable (liquids and gases can flow through them). This activity shows which rocks are porous/permeable and which rocks don't allow air and water to flow through and so are impermeable. Pupils do not need to know the scientific definition of the terms 'porosity' or 'porous', which is the percentage of pore space in a sample, but they do need to know about permeability; that fluids can flow through some rocks and not others (although they don't need to know the terminology - that permeability is the rate of flow of a fluid through a substance).

In the permeable rocks, bubbles rise from the top. This is because the air 'hidden' in the pore spaces in the rock is less dense than the water and so rises through the connected pores. Atmospheric pressure on the surface of the water then pushes water into the spaces left behind – so water flows into the bottom of these permeable rock samples as air rises from the top.

In the 'non-bubbly' (non-porous, impermeable) rocks, bubbles can sometimes be seen on the surface that come from trapped air in near surface cracks – but the bubbles do not grow or rise as they do in the 'bubbly' rocks with interconnected pore spaces.

The permeability of the rock samples is likely to be – permeable - sandstone, chalk; impermeable – clay, slate, marble, granite. This may vary according to the samples, e.g. some sandstones may have a mixture of grain sizes and may have poor permeability. Some sedimentary rocks that were once permeable but have become well cemented (natural cement has filled the pore spaces between the grains 'gluing' the rock together) may now be impermeable. Fine-grained sedimentary rocks, like clay, although having gaps between the grains (and so being porous), like sandstone, have gaps that are so small that water can't flow through, so they are impermeable.

Permeable sandstone underground can store water (or oil and gas).
Impermeable slate can be used on roofs of buildings to keep the water out. Impermeable rocks can also be used as facing stones on buildings or gravestones, and nice-looking ones (eg. granite) are used for kitchen work surfaces.

Pupil learning outcomes
Pupils can:
- test to see whether a rock is permeable or not;
- test rock permeability and sort out rocks according to their permeability;
- know that some rocks can contain air or water and others cannot;
- apply their knowledge to real world situations.

Ideas for leading into the activity
The 'Found in the ground' and 'Look, touch and tell' ESEU KS2 Years 3 and 4 activities – sorting, describing and grouping rocks according to their appearance and texture.

Ideas for following up the activity
- Investigate the natural building materials around the school – are they permeable or impermeable?
- Where are rocks found locally? – are they permeable or impermeable?
- Discuss the uses of the rock samples with pupils (see below for ideas).

Extension ideas for the more able or faster pupils
List several uses for each of the rock samples, e.g:
- sandstone – sand from sandstone is used in the building industry; sandstone is an underground reservoir rock because it is porous and permeable and so can hold water, oil or gas; tough sandstones are often good building stones;
- clay is impermeable and can be used to line reservoirs to stop the water leaking away; clay is also used in pottery and paper making;
- chalk is used in farming to make fields more fertile (it neutralises acid soils) and is used in cement-making. It is also a porous and permeable rock that can hold underground water supplies;
- slates are used on roofs to keep water out because slate is impermeable;
- marble and granite are both decorative stones used for buildings, sculpture.

Some of the more able may be able to time for how long a rock 'bubbling' continues. These results could then be recorded on a simple graph.

The rocks could be weighed when dry and then again after they have been immersed in water. Experimentation is necessary here, as some may need to be submerged overnight/weekend to make a significant difference. They also may need to be left on a window sill or radiator to dry out to ensure they are dry for next time.

Source of activity
Earthlearningidea 'Modelling for rocks. What's hidden inside – and why?' devised by Chris King – www.earthlearningidea.com.