Lesson 2

ROCK PROPERTIES

Learning intentions

1. Be able to make comparisons between materials on the basis of investigation and measurement of properties.
2. Recognise a 'fair test' and be able to talk about the variables that need to be controlled.
3. Be able to read the scale on a spring balance accurately.
4. Understand the meaning of the terms permeable and impermeable.
5. Be able to relate knowledge of properties of materials to their everyday use.

Resources

- One set of rocks for every group to include samples of granite, basalt, sandstone, slate, shale and limestone
- Magnifying glass (x5) per child, or one between two children
- A large clear plastic aquarium (per group)
- A plastic net bag, such as the type used to hold oranges (per group)
- A spring balance (per group) If not available then a pan top balance is acceptable
- Marbles or ball bearings
- Dienes 1 cm^3 cubes

Introduction

Remind pupils of the previous lesson and how we were thinking about the characteristics/properties of rocks. Ask if anyone can remember the names of the five rocks we identified using the key. Explain that today we are going to look further at the properties of our rocks.

Hold up a sample of granite (the speckled rock) and a piece of sandstone (red/brown grainy rock) and ask the children to remind me of the differences between the ways the grains are attached/connected in each sample; interlocking grains in the granite, loosely connected grains in the sandstone.

Ask the children to predict what will happen to the masses of the rocks when they are placed in water. If necessary give them three options, i.e. the rocks could (1) stay the same weight (2) get heavier or (3) become lighter. Can the children explain their predictions?

Pupils often predict that the red/brown rock will get heavier, but the speckled rock will stay the same. When asked why they have made these predictions, they may answer that water will get into the red/brown rock and make it heavier, but that it won't get into the speckled rock.

Introduce the terms **permeable** and **impermeable** in a simple way, i.e. permeable rocks are those which allow fluids to move through them, while impermeable rocks will not allow fluids to move through them and explain that today the pupils are going to test the permeability of a selection of rocks.

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Development

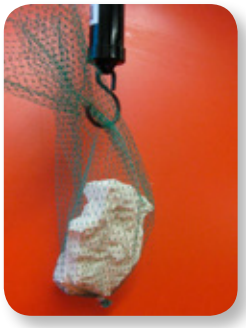
Point out that when scientists have theories/ideas about how the world works, they have to test out these ideas. Part of a scientist's job therefore is to design experiments to help them test their predictions. These tests must be 'fair tests'. Give the pupils in their groups a few minutes to come up with ideas about how they might test the permeability of their rock samples and focus particularly on how they could do this fairly, i.e. the only variable that changes is the type of rock being tested, all other variables/conditions are kept the same. For example the rocks must be left in water for the same period of time and weighed using the same pan balance/spring balance. Discuss why this is important. In theory, the actual rock samples should be the same size and shape, but this is not always possible in practice.

Point out that scientists also meticulously record their results and ask what the pupils think they need to record in this case, i.e. the weight of each rock sample before and then after being in the water and the change in mass for those rocks that prove to be permeable. A table format could be provided for recording purposes, such as the one shown below.

Type of rock	Weight before being put in water	Weight after being put in water	Change in weight
Granite			
Sandstone			
Basalt			
Slate			

Group activity

Divide the pupils into small groups of four or five providing each group with a clear plastic aquarium, containing enough water so that rocks can be fully submerged and samples of granite, basalt, slate and if possible two different types of sandstone. Also give each group a spring balance (if not available then a pan top balance is acceptable) and a plastic net bag, such as the type used to hold oranges. Explain how to weigh the rock samples by placing them in the net bag and attaching the bag onto the hook at the end of the spring balance. *Make sure pupils can read the scale accurately before beginning the activity.*



Lesson 2 *continued*

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Allow groups to carry out the task and remind them that good scientists are always observing closely what happens during an experiment, so they should also record anything unusual they notice, e.g. bubbles should be seen escaping from the surface of the sandstones. Ask the pupils how long they think they should leave the rocks in the water before reweighing them. Pupils may suggest leaving the rocks until any 'bubbling' ceases. Why could the bubbling be significant? This could mean leaving the rocks in water overnight in order to see a significant difference (probably advisable) or at the very least from the beginning of the school day until the afternoon. Remove the rocks and dry off any surplus water, reweighing them and recording any changes in weight.

Plenary

Discuss results (the granite, basalt and slate are impermeable so no difference in weight should have occurred, while the sandstones are permeable and therefore should register a gain in weight) and explain that the 'bubbly' rocks have spaces between the grains that can hold air and that water can move through these spaces that are known as pores. When these rocks are placed in water, the air escapes, bubbles are seen rising from the upper surface of the rock and water moves into the spaces left by the escaping air. The impermeable rocks on the other hand have no spaces between the grains and so do not allow air or water to flow through them.

This can be nicely illustrated by filling two containers one with marbles, or small ball bearings, and one with Dienes 1 cm^3 cubes stacked neatly in rows. What happens when water is added to each container?

Finally draw pupils' attention to the fact that **the properties of materials relate to their everyday use**. For example, 'Why is slate used for roofing?' It is a layered rock which can be split easily between the layers and it is also impermeable. 'Why is granite used for kitchen work tops rather than sandstone?' Granite is a very hard rock which can be polished and it is also impermeable. Sandstone is permeable and grains easily come loose from its surface.

Ask the pupils how knowledge of a rock's properties might help scientists (geologists) to know where to look for reserves of oil, natural gas or water stored in rocks underground. See Extension activities.

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Extension activities

- Find out about **aquifers**, (permeable rocks, which have a store of water held underground i.e. groundwater), and how we can tap into this groundwater supply. How much of our water in the UK (especially Northern Ireland) and Ireland comes from groundwater sources, rather than from surface held water sources like rivers and reservoirs? Can we pollute groundwater sources? How might this happen? A useful website is www.onegeology.org/extra/kids/water.html

It is also possible to create your own aquifer in a cup and use it to show how groundwater can easily become contaminated by adding red food colouring and watching it seep into your home made aquifer (see www.youtube.com/watch?v=kNrNJ23V-CU) and for a more complicated version try www.epa.gov/ogwdw/kids/flash/flash_aquifer.html

- Present the children with the following problem – you need to find the hardest possible rocks to build a bridge. Can you place a collection of rocks in order of hardness – from hardest to softest? What could you use as hardness testers? Children may suggest using a fingernail, an iron nail or a coin. Discuss difficulty of carrying this test out fairly because of the problem of keeping the pressure exerted the same in every case. An alternative would be to ask the children if they can devise a strategy for systematically testing which rocks will make a scratch on all the others perhaps recording in a table format as shown below. In this case, the order of hardness would be granite, slate and then sandstone.

	Sandstone scratched by	Slate scratched by	Granite scratched by
Sandstone	/	no	no
Slate	yes	/	no
Granite	yes	yes	/