3. Reservoirs

1.5 hours

Investigating the absorbency and the porous nature of different materials which could be used to store natural gas in the reservoir.

OBJECTIVES

- To understand that reservoirs store liquids/gases.
- To understand porosity and that rock can be porous.
- To carry out a fair test, changing one factor.
- To measure a volume by reading a scale.

RESOURCES

(Per group of 4 children unless otherwise stated)

- Green and brown floral foam (oasis)
- Pumice (size of soap bar)
- Sponge (size of soap bar)
- Cork (size of soap bar, if available)
- Cup of sand
- Pop sock
- Shallow bowl or tray/ margarine tub
- 250ml measuring cylinder
- Timer
- Pair of disposable gloves
- Funnel
- Activity sheet 6

Safety note

Floral foam may cause irritation to the skin so disposable gloves should be worn when handling.

For teacher demonstration:

- Large jar or small mixing bowl
- Marbles (enough to fill jar)
- Cup full of sand
- 500ml water

Note: Rock collections containing samples such as sandstone, marble, granite, flint, or gritstone, can also be used. More time will be required to observe measurable amounts of absorbed water.

ADVANCE PREPARATION

Due to inhalation risk from the floral foam, this should be cut prior to the lesson.

INTRODUCING THE ACTIVITY

Using the display made in Activity 1, the children discuss what the reservoir does. Ask the children if they have seen and/or can describe a reservoir. Children may be aware of reservoirs through studying the water cycle, visiting one, or from news reports during periods of drought.

Ask the children to create a description of a reservoir which can be used to explain the appropriate area of their display.

Introduce the children to the idea that the undersea reservoir, where the natural gas is stored, is made from rock. Tell the children that the natural gas is stored as a compressed (squeezed) gas.

Ask the children if they can think of any solids that will store liquids, reminding them of how we mop up spilled water, etc. Create a list of 'solids' that will hold liquids, e.g. paper towels, dish cloths, etc. Show the children the cork, sponge, floral foam, etc. and ask them to plan a test to find out whether any of them will hold liquids. Other materials of the children's choice can be included in their investigations.

MAIN ACTIVITY

The children are given the task to plan and carry out an investigation to find out which is the most porous material to store water. This can be carried out as a fair test by considering the size of the material, the amount of water, and the time allowed for absorption. For example; the children measure and pour 250ml of water into a shallow bowl, tray or margarine tub. The material being tested is put into the water and left for 5 minutes. The amount of water absorbed is calculated by measuring the amount of water remaining in the bowl or tray and subtracting it from the original quantity used. Activity sheet 6 can be used to record results and prompt discussion. The experiment could be extended over a longer period of time, over lunch time or overnight, to see if this makes any significant difference to the amount absorbed.

PLENARY

The children should be given the opportunity to report their findings. Each group investigates a different material; jigsawing can be used for the children to share their findings, e.g. all the Communications Officers, Resource Managers, etc. They then return to their own groups and compare information. This is a good way of checking shared information and for further discussion to take place. During these discussions, they could be asked to consider the following questions:

- What do the results show us?
- How could the investigation be improved?
- Which material would they recommend?

TEACHER DEMONSTRATION

Show how much an apparently 'full' container can hold to develop an understanding of the porous nature of different materials. Start with an empty container and ask if it is full. Add marbles followed by sand, then water. Ask the children at each stage if the container is full. The children should observe that the sand fills spaces between the marbles, and the water fills even smaller spaces between the grains of sand. Explain that many materials, either naturally occurring or manmade, have small spaces between the particles. These spaces can be used to hold other materials or used as a filter.

Remind the children of the gas leaving the bottle of fizzy drink in the previous activity. The level of drink did not go down because the particles of gas were between the particles of water.

BACKGROUND INFORMATION

Water is used in this activity, as it is easier to handle than gas.

The two different kinds of floral foam behave in different ways. Brown foam is manufactured to hold dried or artificial flowers so does not need to absorb water, whereas green foam is manufactured to hold fresh flowers so must be able to absorb water to keep the plants alive for as long as possible.

Natural gas is a mixture of hydrocarbons (molecules that contain only carbon and hydrogen) that exist naturally in rocks beneath the surface of the earth. It is widely used as a heating source, for power generation, and as starting materials in industrial processes. For a gas reservoir to form, the 'source rock' containing the organic matter needs to be covered by a porous rock (the reservoir rock) for the gas to accumulate in, and then a non porous layer (the cap rock) that traps the gas thousands of feet below the earth's surface. This gas is at very high pressure as it is squashed by the weight of the thousands of metres of rock above the reservoir.

The natural gas is extracted for use by drilling wells into the reservoir to pipe the gas to the surface. Once the gas has been extracted, and the reservoir depleted, a small number of reservoirs are converted into storage facilities. Here gas from other fields is pumped back into the reservoir at times of low user demand so that it can be re-extracted when demand is high. Storage facilities have large numbers of wells so they can extract large quantities of gas very rapidly to meet peak demand requirements when there is insufficient production available from producing fields.

For further information and activities on how reservoirs are found and used, visit www.roughguidetogas.org.uk.

AMBASSADOR ROLE

An ambassador could introduce this activity, and work with the class throughout. During the plenary they could add to the discussion by explaining the similarities and differences between this process and what industry does in practice to measure porosity.

If available, take rock cores into the classroom to show the children. Explain how the cores are obtained, what they are made from, and why they are taken from the seabed.