Activities for learning about rocks and soil

Identifying rocks

You will need a collection of rock specimens. Keys for the main rock groups, with illustrations, are given on the next two pages.

Suggested activities

1 For each of the rock samples, describe what you see and sketch the rock.

2 How would you describe the rock's colour? Is there more than one colour in the rock?

3 Can you see crystals in the rock? Are they in contact with each other or are they cemented together?

4 How hard is the rock? Does it crumble? Can you scratch it with a nail?

5 Does it fizz when acid (vinegar) is added to it?

6 Is there any banding? Can you describe it?

7 Are there any fossils, rock fragments or minerals?

Figure 1 Measuring the mass of a rock sample

Measuring density of rocks

- The density of an object is the amount of mass it has in a given volume. This is measured in g cm^{-3} or kg m^{-3}.
- Different rock groups have well-defined ranges of density. This is controlled by the types of minerals they contain and the way they were formed. Rocks with high-density minerals will generally have higher whole-rock densities. Also, a rock that has been formed under great pressure will often be very compact and this will increase its density.
- The density of a rock is a measure of how compact it is. The more mass it has in a given volume the greater its density. This can be modelled in the classroom or playground by marking out an area and asking different numbers of children to enter it. The more children that enter the area the denser the material. NB: You may like to mention the difference between area and volume.

Table 1 Typical density ranges for common rock types

Rock type	Typical density range (g cm^{-3})	Examples
Igneous	2.6–3.4	basalt, gabbro, rhyolite, granite, obsidian
Metamorphic	2.5–3.0	slate, schist, gneiss, marble
Sedimentary	2.1–2.8	sandstone, limestone, mudstone, conglomerate

How to find out the density of a rock

1 The density of any object can be found by using the equation:

density (g cm^{-3}) = mass (g) ÷ volume (cm^3).

2 The mass of the rock sample can be measured using a balance (Figure 1). It is reasonable to round the mass to 1 decimal place.

3 The volume of the rock sample can be obtained by a displacement experiment (Figure 2). Children measure out a known volume of water (or coloured water) into a measuring cylinder (initial volume). They then carefully place the rock sample into the measuring cylinder and measure the new volume (final volume). The volume of the rock is the difference:

volume of the rock (cm^3) = final volume (cm^3) – initial volume (cm^3).

4 In Figure 2, the volume of a limestone fragment was measured. The final volume was 171 cm^3 and the initial volume was 151 cm^3:

volume of the limestone = 171 – 151 = 25 cm^3.

5 The mass of the limestone was 57.5 g.

Therefore, density of the limestone = 57.5 ÷ 25 = 2.3 g cm^{-3}.

6 To provide some indication of the values expected, Table 2 provides the values obtained in this experiment for three rock types.

Table 2 Calculated density values for rock types in this experiment

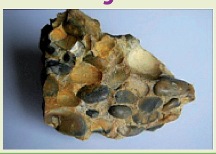
Rock type	Mass (g)	Volume (cm^3)	Density (g cm^{-3})
Limestone	57.5	25	2.3
Sandstone	48.2	19	2.5
Granite	60.8	20	3.0

Figure 2 Finding the volume of a rock sample

Identifying differe

Sedimentary rock key

Does it contain fragments of rounded rocks cemented together?
- yes → Conglomerate
- no → **Can grains be seen?**
  - yes → Sandstone
  - no → **Does it react with acid (vinegar)?**
    - no → Mudstone
    - yes → **Does it contain fossils?**
      - no → Fossiliferous limestone
      - yes → Massive limestone

Use the key to identify the rock		
Sedimentary rock	**Description**	**Name**
A 		
B 		
C 		
D 		
E 		

Igneous r

Are the crystals di
- yes → **EXTRUSIVE Does the rock look like glass?**
  - yes → Obsidian
  - no → **Is the rock black?**
    - yes → Basalt

Use the key to identify the roc	
Igneous rock	**D**
A 	
B 	
C 	
D 	
E 	

ent types of rock

...ock key

...fficult to see?

no → INTRUSIVE Is the rock black and white?

- yes → Gabbro
- no → Granite

...k

no → Rhyolite

...ck		
	...escription	Name

Metamorphic rock key

Are the crystals in bands or layers?

- yes → Are the crystals visible?
  - no → Slate
  - yes → Are the crystals in black and white bands?
    - no → Schist
    - yes → Gneiss
- no → Marble

Use the key to identify the rock			
Metamorphic rock		Description	Name
A			
B			
C			
D			

SCIENCE SWAP SHOP

Rocks and soils pull-out

Activities for investigating soil

For safety reasons, use compost:

- Alkaline chalky soil can be made by adding a small amount of baking powder to the compost.
- Peat can be used for the acidic soil or you can add a small amount of citric acid to compost (1 tsp to 2 litre tub full of soil).
- Compost can be used by itself for neutral soil.

Observation

1 Place a small quantity of soil onto a piece of white paper (Figure 1).

2 Carefully observe the sample with the naked eye. Record/sketch your observations.

3 Use a magnifying glass to observe the sample more closely. Record/sketch what you see (Figure 2).

4 Repeat this with your next sample.

5 Once you have finished your observations try to group the samples into similar groups. State what characteristics you have chosen when deciding which group a soil belongs to.

Porosity

1 Place 10 g of soil into a filter funnel fitted with a filter paper.

2 Place a 10 ml measuring cylinder underneath the filter funnel.

3 Pour 10 ml of water onto the soil.

4 After 5 minutes record the volume of water that has entered the measuring cylinder. *[Keep the filtrate for the next investigation.]*

5 Repeat steps **1** to **4** with your next sample.

Which sample had the greatest porosity? Is this a good thing or bad thing for a farmer who wants to grow plants in this type of soil?

How acidic or alkaline is the soil?

1 First make your pH indicator:

– Using scissors, cut a hand-sized amount of red cabbage into small pieces and place this into a small (150 ml) beaker.

– Add enough water to cover the cabbage and stir until the water becomes a deep-blue colour (Figure 3).

– Red cabbage indicator turns **red** in acids, **blue** in neutral conditions and **green** in alkaline.

2 To test the pH (acidity or alkalinity) of the filtrates use a pipette to add 3–4 drops of your red cabbage indicator to each sample (Figure 4). Record the colour change.

3 Record the pH values in a table.

Do soils have the same or different pH values? How might this affect the types of plants that grow in these soils?

Figure 1 Children carefully observing their soil sample and recording what they see

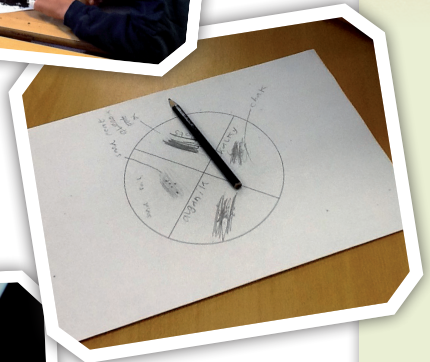


Figure 2 (right) Recording what can be seen under the microscope

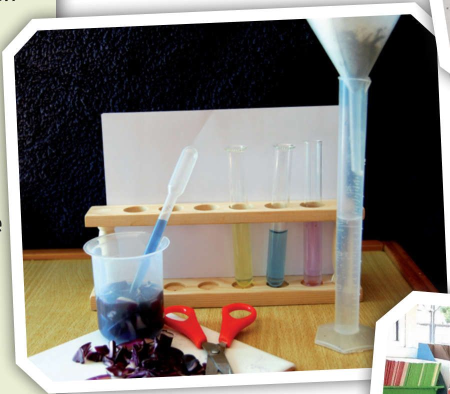


Figure 3 Making red cabbage pH indicator

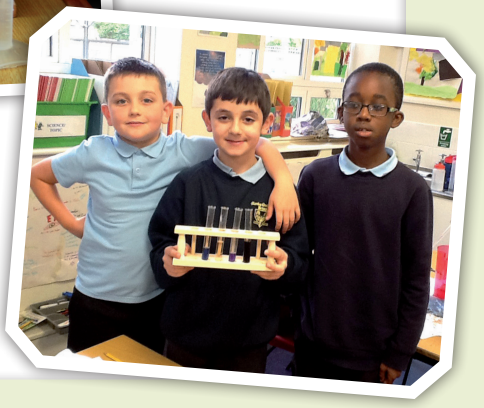


Figure 4 Displaying the pH range of the filtrate samples

These ideas were brought to you by **Andy Markwick**, a STEM consultant with over 34 years teaching experience. He is a teacher trainer and MA supervisor for UCL Institute of Education and a CPD leader for STEM Learning. Email: andy.markwick@yahoo.co.uk (www.stemconsultancy.co.uk).

Need some help with identifying the rocks?

Sedimentary rocks:
A Conglomerate; B Sandstone; C Fossiliferous limestone; D Massive limestone; E Mudstone.

Igneous rocks:
A Basalt; B Granite; C Rhyolite; D Gabbro; E Obsidian.

Metamorphic rocks:
A Slate; B Marble; C Gneiss; D Schist.