

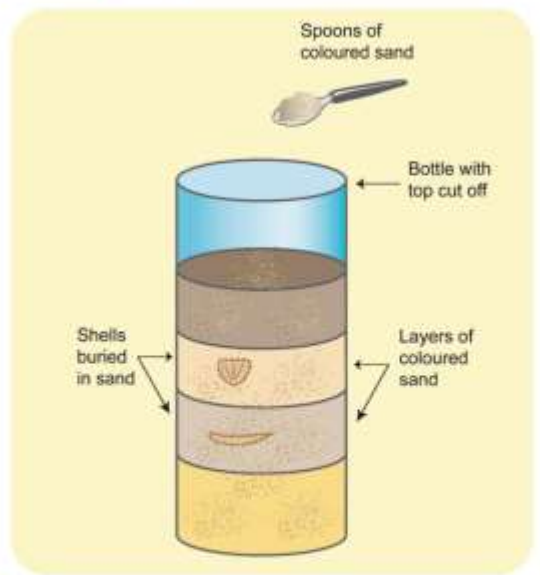
Teaching the Dynamic Earth

Rock circus

ESEU KS1 workshop material



Earth science for years 1/2





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ESEU Primary Workshops

The rock circus

Earth Science for KS1, Years 1/2

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Summary

Try a series of 'hands-on' activities that involve identifying, sorting and classifying a range of things 'found in the ground'. Through the circus activities, focus first on minerals, then fossils, then rocks, before applying your identification skills to the 'Found in the ground' activity to distinguish all three. Then use this experience to build your own sedimentary rock and to identify natural materials in and around the school.

Earth Science Education Unit workshops

These workshops have been devised for teachers and trainee teachers. They are intended to provide participants with a range of activities that can be used in the classroom, whilst helping them to develop the skills for using the activities in an engaging and motivating way that will enthuse and educate their pupils, whilst developing their critical thinking skills. The workshops should also develop the background Earth science knowledge and understanding of the teachers involved.

The workshop format may be transposed directly into a classroom, but often this is not appropriate. Similarly, individual activities, and the worksheets on which these are based, may be transferable directly into a classroom situation, but will often require modification for the classes and situations in which they are used, during which suitable risk assessments are undertaken.

Workshop outcomes

The workshop and its activities provide the following outcomes:

- insights into how minerals, rocks, fossils and other things 'found in the ground' can be sorted, classified and identified most effectively;
- the use of evidence to distinguish fossils from non-fossils;
- an opportunity to explore the vicinity of the school for the natural materials found there;
- an opportunity to investigate sedimentary rock formation processes;
- the potential to use Earth materials for a wide range of cross-curricular and creative activities;
- practical activities that develop skills of exploration, discussion, argumentation and creativity;
- guidance on how the elements of Earth science in the curriculum can be taught most effectively.

Starter: Pirates and buried treasure

Topic: This activity involves identifying, describing and grouping a selection of objects, including Earth-related objects, into various categories.

Activity:

'Treasure' is hidden in a sand tray. The treasure can be coloured minerals, fossils, rocks, metal e.g. coins, jewellery, wood, plastic, glass - anything you have available that is 'interesting' but some of which 'Earth-related'. The 'pirates' find the treasure, describe and sort it in a variety of ways. The sorted treasure is then stored in 'treasure chests'. The uses of all the objects in the treasure chests is then discussed.



Buried treasure (Elizabeth Devon)

Pupil learning outcomes Pupils can:

- describe the materials by visual appearance or by touch based on their physical properties;
- identify and name the various objects
- distinguish between the objects and the material from which they are made
- sort into groups by identifying properties of the materials;
- give explanations of why they have sorted the materials in a particular way;
- suggest uses for all the different objects.

Curriculum references:

England	Scotland	Wales	Northern Ireland
<p>Science: KS1 Years 1 and 2 Working scientifically</p> <ul style="list-style-type: none"> • asking simple questions and recognising that they can be answered in different ways • observing closely • identifying • using their observations and ideas to suggest answers to questions <p>Pupils in years 1 and 2 should explore the world around them. They should experience different types of scientific enquiries, including practical activities. They should use simple features to compare objects, materials and, with help, decide how to sort and group them, and, with guidance, they should begin to notice patterns and relationships. They should ask people questions. They should use simple measurements and equipment (for example, hand lenses) to gather data and talk about what they have found out and how they found it out. With help, they should record and communicate their findings in a range of ways and begin to use simple scientific language</p> <p>Year 1 Everyday Materials</p> <ul style="list-style-type: none"> • distinguish between an object and the material from which it is made • identify and name a variety of everyday materials, including wood, plastic, glass, metal and rock • describe the simple physical properties of a variety of everyday materials • compare and group together a variety of everyday materials on the basis of their simple physical properties <p>Year 2 Uses of everyday materials</p> <ul style="list-style-type: none"> • identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock for particular uses 	<p>Sciences: Materials Early</p> <p>Through creative play, I explore different materials and can share my reasoning for selecting materials for different purposes.</p> <p>SCN 0-15a</p>	<p>Knowledge and understanding of the world Foundation phase Development of skills</p> <p>The following skills are essential to this Area of Learning and can also be developed across the curriculum.</p> <ul style="list-style-type: none"> • Observing • Comparing • Classifying • Exploring and experimenting • Listening • Making decisions • Reflecting • Describing • Sorting and grouping • Asking/ answering questions • Thinking • Solving problems • Recording • Communicating 	<p>The world around us Foundation stage</p> <p>As pupils progress through the Foundation Stage they should be enabled to:</p> <ul style="list-style-type: none"> • show curiosity about the living things, places, objects and materials in the environment; • identify similarities and differences between living things, places, objects and materials; • understand that different materials behave in different ways, have different properties and can be used for different purposes

Age range of pupils: 5 - 7

Time needed to complete activity: 15 minutes

The story for teachers:

Pupils can group the treasure into many categories e.g. type (if minerals, coins, etc are used), colour, texture, shininess, preference etc. Any sorting method that works is a good method.

The pupils are then asked to explain the sorting methods they have chosen and why they have placed different items in different categories.

It can be explained that all the materials ultimately come from the Earth - minerals and rocks directly, the metals in the coins, ingredients such as silica in glass and so on. Once the objects are grouped their uses can be discussed.

The activity can fit into any teaching scheme where grouping of objects is required but it can also be included in literacy and numeracy programmes.

Lead in ideas

- Discuss with the pupils what they know about pirates and what pirates might keep in their treasure chests.
- Teacher and pupils could dress up as pirates and start the activity by reading a suitable story.
- Discuss how the treasure came to be buried in the sand? Did the pirates have to hide it quickly and then could not come back for it? Were they caught?

Following up the activity:

The 'Sensory treasure hunt'

The sand tray could have a simple grid over it so that the locations of the specimens could be recorded. Different methods of recording the locations could be discussed (e.g. drawing a 'plan' on paper, photograph).

The 'treasure chests' could be labelled when they contain their treasures.

Suggest that sorting might be done in other ways, e.g. one item might be placed in a different category – why?

Source:

Combination and adaptation of dinosaur/sand activity by Peter Kennett and sorting of minerals activity by Paul Grant. Additional ideas contributed by Charlotte Aimison, Anne Collins, Phil Critchlow, Elizabeth Devon, Paul Grant, Sarah Harrison, Roger Mitchell, Cally Oldershaw, Geoff Selby-Sly, Peter Woods and Niki Whitburn.

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Preparation and set-up time:

15 minutes or longer if special 'treasure chests' are to be made

Resource list:

- tray for sand approximately 420mm x 300mm (e.g. Gratnell™ tray)
- dry washed sand
- 'treasure chests' (any containers approximately 150mm x 90mm) - these could be gift boxes or made from cardboard
- optional dressing up clothes (pirates)
- 'treasure' including a variety of mineral samples (e.g. coloured quartz and other semi-precious gemstones), rough and smooth pebbles, small fossils, shiny coins, pieces of costume jewellery, coloured glass, wooden or plastic objects (with no sharp edges) etc.

Risk assessment:

Potentially Hazardous Activity	Who/What may be Harmed?	Hazard Rating (A)	Likelihood (B)	Risk (AxB)	Further Action Required?
Found in the Ground	No significant hazard				No

Hazard Rating (A):

- 1 = Insignificant effect
- 2 = Minor Injury
- 3 = Major Injury
- 4 = Severe Injury
- 5 = Death

Likelihood of occurrence (B):

- 1 = Little or no likelihood
- 2 = Unlikely
- 3 = Occasional
- 4 = Probable
- 5 = Inevitable

Risk Priority (AxB):

- 12-25 = High risk – take immediate action
- 6-11 = Medium risk – take action as soon as possible
- Less than 6 = Low risk – plan future actions where required

ESEU activity guide sheet:

Pirates and buried treasure

This activity involves identifying, describing and grouping a selection of objects, including Earth-related objects, into various categories.

'Treasure' is hidden in a sand tray. The treasure can be coloured minerals, fossils, rocks, metal e.g. coins, jewellery, wood, plastic, glass - anything you have available that is 'interesting' but some of which 'Earth-related'. The 'pirates' find the treasure, describe and sort it in a variety of ways. The sorted treasure is then stored in 'treasure chests'. The uses of all the objects in the treasure chests is then discussed.



Buried treasure (*Elizabeth Devon*)

Circus activity 1: Fossil or not?

Topic: A discussion about what is a fossil and what is not; this is a practical activity with pictures (see later) and/or specimens to help you to discuss what is a fossil and what is not.

Activity:

Give the pupils these definitions:

A fossil: is any preserved sign of past life, more than 10,000 years old;

A body fossil: is the remains of the body of an animal or plant, or the imprint or cast of it;

A trace fossil: indicates that an animal or plant was there, but is not a body fossil; it includes footprints, burrows, signs of roots, tooth marks, etc.

Ask the pupils:

- Now you know what fossils are, can you put the pictures and/or specimens into three groups and label them: (1) Body fossil (2) Trace fossil (3) Not a fossil.

(You may like to give the pupils pre-prepared labels.)



Example pictures of 'Fossil or not?'

- Which of the following are fossils?
 - 4000 year-old footprints like ours;
 - a squirrel killed on the road;
 - 3500 million year-old cell filaments;
 - a petrified tree stump;
 - the trail of a trilobite in 530 million year-old rocks;
 - 'tree-like', dendritic mineral growths;
 - a beach pebble with holes bored by marine organisms;
 - a human shape preserved in volcanic ash at Pompeii;
 - a piece of dinosaur skin?

Pupil learning outcomes: Pupils can:

- distinguish between what is and what is not a fossil;
- discuss the criteria for making that decision.

Curriculum references:

England	Scotland	Wales	Northern Ireland
<p>Science: KS1 Years 1 and 2 Working scientifically</p> <ul style="list-style-type: none"> • asking simple questions and recognising that they can be answered in different ways • observing closely, using simple equipment • performing simple tests • identifying and classifying • using their observations and ideas to suggest answers to questions <p>Year 1 Everyday materials</p> <ul style="list-style-type: none"> • identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock 	<p>Science: Biodiversity and independence First</p> <p>I can distinguish between living and non-living things. I can sort living things into groups and explain my decisions.</p> <p>SCN 1-01a</p>	<p>Knowledge and understanding of the world Foundation phase</p> <p>Development of skills</p> <p>The following skills are essential to this Area of Learning and can also be developed across the curriculum.</p> <ul style="list-style-type: none"> • Observing 	<p>The world around us Foundation stage Strand 1: interdependence</p> <p>How living things rely on each other within the natural world;</p> <ul style="list-style-type: none"> • about the variety of living things

<p>Year 2 Living things and their habitats</p> <ul style="list-style-type: none"> • explore and compare the differences between things that are living, dead, and things that have never been alive <p>Lower KS2 Years 3 and 4 Working scientifically</p> <ul style="list-style-type: none"> • asking relevant questions and using different types of scientific enquiries to answer them • making systematic and careful observations • gathering, recording, classifying and presenting data in a variety of ways to help in answering questions • recording findings using simple scientific language, drawings, labelled diagrams, • reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions • using results to draw simple conclusions, make predictions for new values, suggest • improvements and raise further questions • identifying differences, similarities or changes related to simple scientific ideas and processes • using straightforward scientific evidence to answer questions or to support their findings <p>Year 3 Rocks</p> <ul style="list-style-type: none"> • describe in simple terms how fossils are formed when things that have lived are trapped within rock <p>Upper KS2 Years 5 and 6 Year 6 Evolution and inheritance</p> <ul style="list-style-type: none"> • recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago 	<p>Second I can identify and classify examples of living things, past and present, to help me appreciate their diversity. I can relate physical and behavioural characteristics to their survival or extinction. SCN 2-01a</p>	<ul style="list-style-type: none"> • Comparing • Classifying • Listening • Making decisions • Reflecting • Describing • Sorting and grouping • Asking/ answering questions • Recording • Communicating 	<p>As pupils progress through the Foundation Stage they should be enabled to:</p> <ul style="list-style-type: none"> • show curiosity about the living things, places, objects and materials in the environment; • identify similarities and differences between living things, places, objects and materials.
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Age range of pupils: 5 - 16 years

Time needed to complete activity: 20 minutes

The story for teachers:

The fossil record is evidence for evolution. In order to study it, we need to understand what a fossil actually is. Pupils may think that only the bones and teeth of animals can be fossilised, and that fossils have to be preserved in rock.

- What is a fossil? A fossil is any preserved evidence of life, usually regarded as more than 10,000 years old (the start of the Holocene Epoch – although some palaeontologists disagree about this age-related definition). Fossils consisting of the organisms themselves, or of isolated body parts, are known as body fossils. Fossils which preserve evidence of behaviour (such as footprints, burrows and droppings) but not body parts, are known as trace fossils. Some rocks that contain fossils are unconsolidated, such as some clays and sands. The fossil record is evidence for evolution.

The pictures show the following:-

- fossil bone (body fossil)
- hazelnuts (not a fossil – not old enough)
- fossilised wood (body fossil)
- fossil shell (body fossil)
- desiccation cracks (not a fossil – evidence of a dry environment but not evidence of life)
- fossil tooth (body fossil)
- dinosaur footprint (trace fossil)
- insects in amber (body fossil).

- Which of the following are fossils?

○ 4000 year-old footprints like ours as found in mud north of Liverpool, UK	not old enough to be a trace fossil
○ a squirrel killed on the road	not a fossil, not old enough
○ 3500 million year old cell filaments	body fossil
○ a petrified tree stump	body fossil
○ the trail of a trilobite in 530 million year-old rocks	trace fossil
○ 'tree-like', dendritic mineral growths	not a fossil – not produced by life
○ a beach pebble with holes bored by marine organisms	probably not a fossil, unless the boring took place more than 10,000 years ago, in which case the boring is a trace fossil
○ a human shape preserved in volcanic ash at Pompeii	not old enough to be a fossil – Vesuvius erupted, burying Pompeii, in AD79
○ a piece of dinosaur skin	body fossil

By organising objects into groups pupils are establishing a pattern. Recognising that some objects are not fossils, even though they appear to be, involves cognitive conflict. Discussion about the activity is metacognition. The ability to say something about the environment of the animal or plant when it was alive is bridging.

This activity fits well into teaching schemes with lessons about the development of life on Earth and with sorting objects into groups.

Lead in ideas: With some specimens and photographs discuss the pupils' knowledge about fossils and the fossilisation process.

Following up the activity:

Consider what would be the best way for you to leave a sign of your life for the future? For it to be classified as a fossil, it would have to last for more than 10,000 years!

See Earthlearningidea 'Dead and buried - how could I become fossilised?'

Source: Earth Science Education Unit - www.earthscienceeducation.com
2005 Dead and Buried? Teaching KS4 Biology.

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Preparation and set-up time: 10 minutes

Resource list:

Pictures of the following (supplied - you may wish to replace some with your own specimens)

- fossil bone
- hazelnuts (if you provide these, be sure they are shelled – due to possible nut allergies)
- fossilised wood
- fossil shell
- desiccation cracks
- fossil tooth
- dinosaur footprint
- insects in amber

Include more specimens or pictures of your own, such as:

- egg-shaped pebble (not a fossil – not organic)
- modern tooth (not a fossil – not old enough)
- coprolite (fossil droppings; trace fossil)
- fossil leaf (body fossil)
- fossil burrows (trace fossil)
- three sheets of paper, or card, labelled 'body fossil', 'trace fossil' and 'not a fossil' on which to group the pictures or specimens, (optional – given on page 14)
- definition cards with the following definitions, (optional – given on page 14)

Risk assessment:

Potentially Hazardous Activity	Who/What may be Harmed?	Hazard Rating (A)	Likelihood (B)	Risk (AxB)	Further Action Required?
Fossil or not	No significant hazard	-	-	-	No

Hazard Rating (A):

- 1 = Insignificant effect
- 2 = Minor Injury
- 3 = Major Injury
- 4 = Severe Injury
- 5 = Death

Likelihood of occurrence (B):

- 1 = Little or no likelihood
- 2 = Unlikely
- 3 = Occasional
- 4 = Probable
- 5 = Inevitable

Risk Priority (AxB):

- 12-25 = High risk – take immediate action
- 6-11 = Medium risk – take action as soon as possible
- Less than 6 = Low risk – plan future actions where required



Fossil bone - Ichthyosaur vertebra Photo: P.Kennett



Some hazelnuts Photo: P.Kennett



Fossil wood Photo: P.Kennett



Fossil shell Photo: P.Kennett



Desiccation cracks Photo: P.Kennett



Fossil shark tooth Photo: P.Kennett



Cast of fossil footprint of hind foot of iguanodon
Photo: P. Murphy, Leeds University



Insects in amber Photo: E. Devor

Sorting sheets (Fossil or not?)

A body fossil:

A trace fossil:

Not a fossil

Definition Cards (Fossil or not?)

A fossil:

is any preserved sign of past life more than 10,000 years old

A trace fossil:

- indicates that an animal or plant was there, but is not a body fossil;
- it includes footprints, burrows, signs of roots, tooth marks, etc.

A body fossil:

is the remains of the body of an animal or plant, or the imprint or cast of it

ESEU activity guide sheet:

Fossil or not?

A discussion about what is a fossil and what is not; this is a practical activity with pictures (see later) and/or specimens to help you to discuss what is a fossil and what is not.

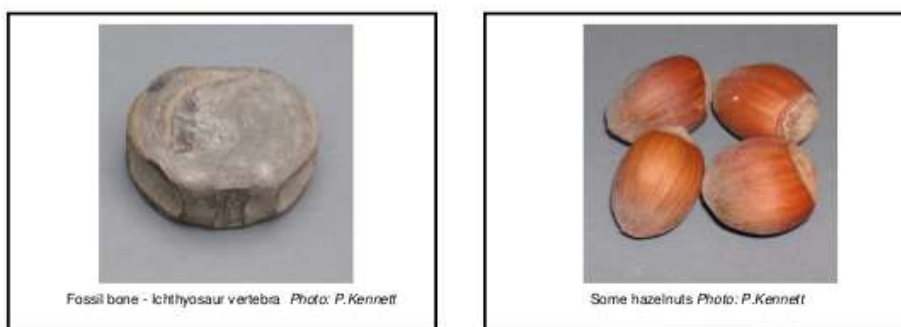
Give the pupils these definitions:

- A fossil: is any preserved sign of past life, more than 10,000 years old;
- A body fossil: is the remains of the body of an animal or plant, or the imprint or cast of it
- A trace fossil: indicates that an animal or plant was there, but is not a body fossil; it includes footprints, burrows, signs of roots, tooth marks, etc.

Ask the pupils:

Now you know what fossils are, can you put the pictures and/or specimens into three groups and label them: (1) Body fossil (2) Trace fossil (3) Not a fossil.

(You may like to give the pupils pre-prepared labels.)



Example pictures of 'Fossil or not?'

Then consider, which of the following are fossils?

- 4000 year-old footprints like ours;
- a squirrel killed on the road;
- 3500 million year-old cell filaments;
- a petrified tree stump;
- the trail of a trilobite in 530 million year-old rocks;
- 'tree-like', dendritic mineral growths;
- a beach pebble with holes bored by marine organisms;
- a human shape preserved in volcanic ash at Pompeii;
- a piece of dinosaur skin?

Circus activity 2: Rock explorer

Topic: As 'rock explorers' pupils investigate a variety of rocks and sort them into groups.

Activity:

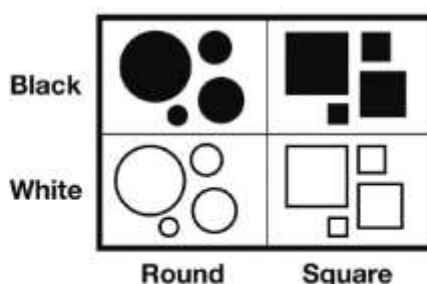
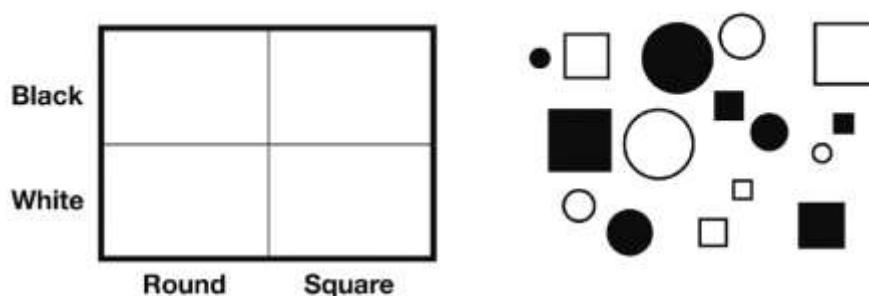
Introduce the pupils to their roles as 'Rock explorers'. Rock explorers are Earth scientists who are scientists who study rocks and soils. Introduce the pupils to the rock explorers 'tool kit' using rock and fossil samples, magnifier, rock ID books, posters, clipboards and pencils. The pupils are then asked to investigate a variety of assorted rock samples using the 'toolkit'.

This activity introduces the children to different ways of sorting stones and allows them to develop their ideas of groups of stones by extending the family of their special stone. This leads on to the idea that Earth scientists also put rocks into groups like families.

In groups of three or four the children discuss and sort their stones according to their own ideas. Allow the children the opportunity to decide on their own classification before making any suggestions. The children can put the different groups of stones on different pieces on paper and write what the group is e.g. white stones.

As a lead into classification for Early Years and Primary, a simple introduction is to use a range of sweets such as Haribo™ and get pupils to "classify" the sweets and say why they chose these groups.

To extend the sorting activity, try making a diagram like the one below with two of the classification criteria. The diagram is completed by placing the objects in the box that would describe their shape and shading, for example:



© diagram by ESEU

This simple classification system can be extended by using a diagram like the above but with the criteria:

- 'black' and 'not black'
- 'round' and 'not round'

Pupil learning outcomes: Pupils can:

- sort rocks into groups using a range of criteria e.g. shape, size, colour, weight.
- create their own forms of classification.
- make a family of stones out of similar types.

Curriculum references:

England	Scotland	Wales	Northern Ireland
<p>Science: KS1 Working scientifically</p> <ul style="list-style-type: none"> observing closely, using simple equipment identifying and classifying <p>Everyday materials Year 1</p> <ul style="list-style-type: none"> identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock describe the simple physical properties of a variety of everyday materials <p>Year 2</p> <ul style="list-style-type: none"> identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses <p>Pupils might work scientifically by: comparing the uses of everyday materials in and around the school with materials found in other places (at home, the journey to school, on visits, and in stories, rhymes and songs); observing closely, identifying and classifying the uses of different materials, and recording their observations.</p> <p>Science: Lower KS2 Years 3 and 4 Working scientifically</p> <ul style="list-style-type: none"> making systematic and careful observations using straightforward scientific evidence to answer questions or to support their findings <p>Year 3 Rocks</p> <ul style="list-style-type: none"> compare and group together different kinds of rocks on the basis of their appearance and simple physical properties <p>Linked with work in geography, pupils should explore different kinds of rocks, including those in the local environment Pupils might work scientifically by: observing rocks, including those used in buildings and gravestones, and exploring how and why they might have changed over time; using a hand lens or microscope to help them to identify and classify rocks according to whether they have grains or crystals, and whether they have fossils in them. Pupils might research and discuss the different kinds of living things whose fossils are found in sedimentary rock and explore how fossils are formed.</p>	<p>Sciences: Early level Biological systems I can identify my senses and use them to explore the world around me. SCN 0-12a</p> <p>Materials Through creative play, I explore different materials and can share my reasoning for selecting materials for different purposes. SCN 0-15a</p> <p>Social Sciences Early level People, past events and societies I am aware that different types of evidence can help me to find out about the past. SOC 0-01a</p> <p>People, place and environment I explore and discover the interesting features of my local environment to develop an awareness of the world around me. SOC 0-07a</p>	<p>Knowledge and understanding of the world Foundation phase Development of skills The following skills are essential to this Area of Learning and can also be developed across the curriculum.</p> <ul style="list-style-type: none"> Observing Comparing Classifying Enquiring Exploring and experimenting Listening Making decisions Predicting and testing Reflecting Describing Sorting and grouping Asking/ answering questions Investigating Thinking Solving problems Recording Communicating 	<p>The world around us Strand 3: Place Foundation stage What is in my world?:</p> <ul style="list-style-type: none"> to recognise the different materials used every day. <p>Key stage 1 Features of the immediate world and comparisons between places:</p> <ul style="list-style-type: none"> about materials in the natural and built environment (G); (H); about the properties of everyday materials and their uses (S&T)

Age range of pupils: 5 – 8 years

Time needed to complete activity: 30 minutes.

The story for teachers:

Through this suite of activities (the ‘Rock explorer’ activity described above and the ‘Family Stone’ and other activities listed below), pupils are introduced, through a variety of cross-curricular and creative approaches, to how rocks can be investigated, discussed and used.

Lead in ideas:

Ask the pupils to describe what they think a ‘rock explorer’ might be like. Use their ideas at the end of the activity to introduce them to the thought that they have been working as a ‘rock explorer’ so a rock explorer is actually just like them.

Following up the activity:

The pupils will have sorted and classified the rocks and stones collected according to, for example colour, shape, size, weight etc. as well as developing their own classification criteria.
Make a class list of all the different ways the children have found to sort their stones. Then introduce them to some of the wide range of rock activities below.

Family Stone

Through the ‘rock explorer’ activity the pupils will have created their own Family Stone (stones with similar characteristics), building up names/ characters within the family with their own description and personality (e.g. Mr and Mrs Smooth, Mr and Mrs Sparkle).
Create a community containing all of the families and characters devised by the children.

Creative rockers

Pupils:

- explore/observe carvings within the local community and/or use a range of different sources, create carvings using different materials e.g. soap, wax, clay;
- explore and create a range of texts or works of art which have been inspired by different landscapes;
- explore and create a range of rock-related instruments which produce different sounds.

Enterprise rocks

Pupils decide on an appropriate way of celebrating and sharing their learning in an enterprising way (e.g. rock gardens, outdoor mosaics, jewellery, painted stones etc.).

Stone stories

Pupils create stories about the members of Family Stone (e.g. a day in the life of Mr Lumpy, the Adventures of Mike Schist!).

Rock album

Pupils create a photo album of Family Stone with captions which give information about the members of the family.

Rock art

Pupils decide on the most appropriate way to create a visual representation of the members of Family Stone (e.g. drawing, painting, collage etc.).

Rock gallery

Pupils decide on an attractive and engaging way to display rocks and stones collected, including for example informative captions, questions, etc.

Rocks at home

Pupils explore around their home to discover and collect different rocks/stones using technology to record their observations.

Rock phonics

Use the naming of members of Family Stone to reinforce phonics e.g. Rhona Rough, Larry Lumpy.

Rock uses

Pupils:

- invite/visit those members of the community who work with rocks/stones to/in their establishment to discover how they use materials;
- investigate the range of ways in which clay has been used over time and in different places; pupils use this information to produce an artefact using clay;
- investigate how rocks and stones have been used in art e.g. aboriginal rock art, Andy Goldsworthy the sculptor; create rock sculptures in school grounds or local green space;
- investigate the ways in which stones have been and are used for jewellery and fashion;
- investigate the ways in which stones have been and are used for leisure.

Rock writer

Pupils explore the possibilities for making marks on different stones/rocks using a variety of materials.

Rock world

Pupils create an environment for Family Stone to live in e.g. meadow, seashore, and mountain. This could include designing and making clothes, home and mini-landscape e.g. in a box or in the school grounds.

Rock science

Pupils take part in a discussion about the different types of jobs scientists carry out, in particular recognising that an Earth scientist is a scientist asking scientific questions. Discuss the local landscape and what job an Earth scientist might do in the local region. How could Earth scientists help local and national communities?

Pupils also:

- research and discuss the scientific job of an Earth scientist;
- research and discover how Earth scientists create families of stones e.g. igneous, sedimentary and metamorphic rocks;
- explore and discuss the properties of rock families;
- prepare a presentation to share this information.

Source: The Earth Science Education Unit, – originally published in the ESEU's 'Scotland Rocks!' workshop booklet.

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Preparation and set-up time:

15 minutes

Resources:

Per group:

Items to create a 'tool kit' using:

- rock and fossil samples
- magnifier
- rock ID books
- clipboards and pencils
- large sheets of paper and pens

Risk assessment:

Potentially Hazardous Activity	Who/What may be Harmed?	Hazard Rating (A)	Likelihood (B)	Risk (AxB)	Further Action Required?
Rock explorer	Pupils may drop rocks onto their feet	1	1	1	No

Hazard Rating (A):

- 1 = Insignificant effect
 2 = Minor Injury
 3 = Major Injury
 4 = Severe Injury
 5 = Death

Likelihood of occurrence (B):

- 1 = Little or no likelihood
 2 = Unlikely
 3 = Occasional
 4 = Probable
 5 = Inevitable

Risk Priority (AxB):

- 12-25 = High risk – take immediate action
 6-11 = Medium risk – take action as soon as possible
 Less than 6 = Low risk – plan future actions where required

ESEU activity guide sheet:

Rock explorer

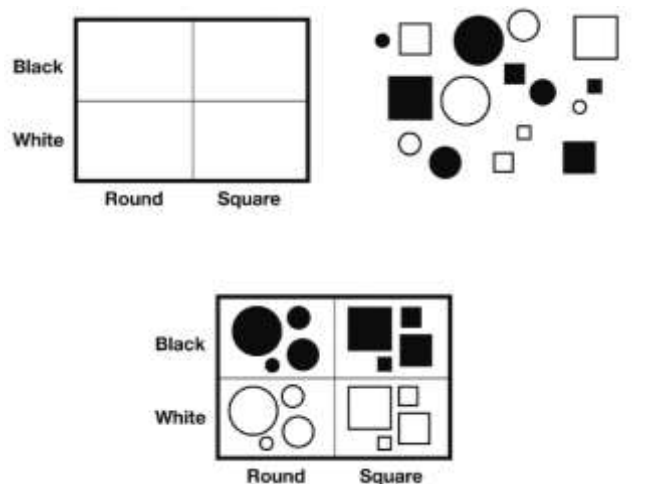
As 'rock explorers', pupils investigate a variety of rocks and sort them into groups.

Introduce the pupils to their roles as 'Rock explorers'. Rock explorers are Earth scientists who are scientists who study rocks and soils. Introduce the pupils to the rock explorers 'tool kit' using rock and fossil samples, magnifier, rock ID books, posters, clipboards and pencils. The pupils are then asked to investigate a variety of assorted rock samples using the 'toolkit'.

This activity introduces the children to different ways of sorting stones and allows them to develop their ideas of groups of stones by extending the family of their special stone. This leads on to the idea that Earth scientists also put rocks into groups like families.

In groups of three or four the children discuss and sort their stones according to their own ideas. Allow the children the opportunity to decide on their own classification before making any suggestions. The children can put the different groups of stones on different pieces on paper and write what the group is e.g. white stones.

To extend the sorting activity, try making a diagram like the one below with two of the classification criteria. The diagram is completed by placing the objects in the box that would describe their shape and shading, for example:



© diagram by ESEU

This simple classification system can be extended by using a diagram like this one but with the criteria:

- 'black' and 'not black'
- 'round' and 'not round'

Circus activity 3: Found in the ground

Topic: This activity involves sorting out things that have been 'Found in the ground' according to criteria the participants choose for themselves. They then sort the things into rocks, minerals, fossils and other objects according to given criteria.

Activity:

A Sort them out

Ask pupils to 'sort out' the samples they have been given (as suggested in the resource list). You could add that the best way of doing this is to have about two or three categories with at least two things in each category and not to have a 'rag-bag' category of 'things that couldn't be fitted into the other groups'. Given this very open-ended request, they can respond in a number of ways. They may sort according to colour, size, shape, 'roughness', 'sparkly-ness/shininess', how heavy they feel, or a combination of these properties. Given that the question was open-ended, any method that works well (i.e. several categories, at least two things in each category and no 'rag bag') is a good response.

It may be useful to give pupils this information on a 'Pupil Success Criteria Card' (see later).

B Talking about the method

Explain that any method that works is fine. But that if we want to talk about the things 'Found in the ground' with others (across the room or across the world), we all need to use the same method of sorting them out. The method used by scientists for these 'Found in the ground' things is to first take out everything that is not rock, fossil or mineral, e.g. wood, bone, manufactured items.

The objects that are left should now be divided into rocks, fossils and minerals

It may be useful to give pupils the definition cards (see later).

C Sort them out scientifically

Given these definitions, ask pupils to sort their objects 'Found in the ground' again, using the 'scientific' criteria.



Rocks, fossils and minerals (*Peter Kennett*)

Pupil learning outcomes Pupils can:

- sort out things 'Found in the ground' effectively, using their own criteria;
- understand effective and less-effective methods of 'sorting thing out';
- distinguish between a rock and a mineral;
- identify a fossil;

Curriculum references:

England	Scotland	Wales	Northern Ireland
<p>Science: Lower KS 2 Years 3 and 4 Working scientifically</p> <ul style="list-style-type: none"> making systematic and careful observations using straightforward scientific evidence to answer questions or to support their findings <p>Year 3 Rocks</p> <ul style="list-style-type: none"> compare and group together different kinds of rocks on the basis of their appearance and simple physical properties describe in simple terms how fossils are formed when things that have lived are trapped within rock <p>Linked with work in geography, pupils should explore different kinds of rocks, including those in the local environment</p> <p>Pupils might work scientifically by: observing rocks, including those used in buildings and gravestones, and exploring how and why they might have changed over time; using a hand lens or microscope to help them to identify and classify rocks according to whether they have grains or crystals, and whether they have fossils in them. Pupils might research and discuss the different kinds of living things whose fossils are found in sedimentary rock and explore how fossils are formed.</p>	<p>Sciences: Materials Second</p> <p>Having explored the substances that make up Earth's surface, I can compare some of their characteristics and uses. SCN 2-17a</p>	<p>Knowledge and understanding of the world Foundation phase</p> <p>Development of skills The following skills are essential to this Area of Learning and can also be developed across the curriculum.</p> <ul style="list-style-type: none"> Observing Comparing Classifying Exploring and experimenting Listening Making decisions Describing Sorting and grouping Sequencing Asking/ answering questions Thinking Solving problems Recording Communicating 	<p>The world around us Foundation stage As pupils progress through the Foundation Stage they should be enabled to:</p> <ul style="list-style-type: none"> show curiosity about the living things, places, objects and materials in the environment; identify similarities and differences between living things, places, objects and materials; understand that different materials behave in different ways, have different properties and can be used for different purposes.

Age range of pupils: 7 – 14 years

Time needed to complete activity: 15 minutes

The story for teachers:

Pupils should be able to remove from the objects all specimens that are not rocks, minerals or fossils. They will need to use the definition cards to divide their remaining specimens into rock, fossil and mineral

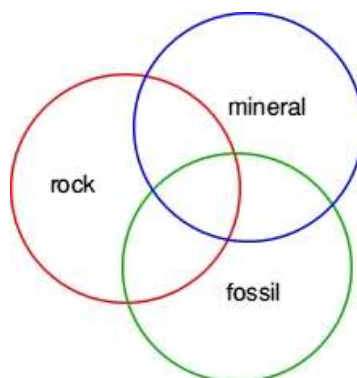
- rock - natural and made of 'bits' called grains
- fossil - any preserved sign of past life more than 10,000 years old.
- mineral - a naturally occurring chemical with the same properties all the way through;

More formal definitions:

- rocks are made of minerals, fragments of older rocks, or fossils. Most rocks contain a variety of minerals, but some, like limestone, can contain lots of grains of just one mineral.
- fossils include 'body fossils' such as a shell, the replaced shell, or the imprint of the body and 'trace fossils' (traces left by organisms) such as footprints or worm burrows;
- minerals, therefore, are natural inorganic elements or chemical compounds that have a definite atomic structure and therefore fixed physical properties (that can sometimes vary between known limits) including common minerals like quartz, calcite, haematite and halite;

Using the definition cards, pupils should be able to group rocks, minerals and fossils separately.

However, some pupils will say that a rock containing a fossil is a rock and others will say it is a fossil. Both are correct. It is a good idea to set up a Venn diagram with three overlapping circles as shown below. Specimens that fit in two categories can then be put inside two rings.



This activity fits any teaching scheme which involves grouping of objects and observational and descriptive skills.

A pattern develops as the objects are grouped scientifically and discussion about the groups involves metacognition. Cognitive conflict is caused when a specimen fits into two categories.

Lead in ideas:

Ask pupils the initial question – ‘Why do we sort things out?’ – the answer is so that patterns in things can be investigated more effectively or so that we can develop systems for storing and finding things. Once objects are grouped, or classified, they can be discussed with and understood by scientists everywhere.

Following up the activity:

Additional ‘difficult’ samples can be added, e.g. a broken brick, a piece of concrete, a piece of wood.

Source:

‘Found in the Ground’ a ‘Science of the Earth’ activity, published by the Earth Science Teachers’ Association and written by Peter Kennett.

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Preparation and set-up time:

Enough time to get out and organise the samples.

Resource list:

- samples of granite, permeable sandstone and other samples such as: shelly limestone, chalk, slate; specimens should be 2cm in diameter, or larger - see photo
- some fossils
- some minerals
- some objects, like, piece of brick, wood, large rusty nail
- ‘Pupil success criteria’ card (next page)
- Definition cards (next page)

Note: If pupil groups are doing this activity, it is useful for them to have enough sets so they can work in groups of three.

Risk assessment:

Potentially Hazardous Activity	Who/What may be Harmed?	Hazard Rating (A)	Likelihood (B)	Risk (AxB)	Further Action Required?
Found in the Ground	No significant hazard	-	-	-	No

Hazard Rating (A):

- 1 = Insignificant effect
- 2 = Minor Injury
- 3 = Major Injury
- 4 = Severe Injury
- 5 = Death

Likelihood of occurrence (B):

- 1 = Little or no likelihood
- 2 = Unlikely
- 3 = Occasional
- 4 = Probable
- 5 = Inevitable

Risk Priority (AxB):

- 12-25 = High risk – take immediate action
- 6-11 = Medium risk – take action as soon as possible
- Less than 6 = Low risk – plan future actions where required

Pupil success criteria card (Found in the ground)

Sort them out

To do this in the best way, you will:

- 1) group the samples into about two or three 'categories' with at least two things in each 'category';
- 2) not have a group which is made of, 'things that couldn't be fitted into the other groups';
- 3) make your choices based on the properties of the samples.

Definition cards (Found in the ground)**Rock**

natural and made of 'bits' called grains

Non-rock

may or may not be natural and are usually not formed of 'bits'

Mineral

natural chemicals with the same properties all the way through

Fossil

any preserved sign of past life more than 10,000 years old

ESEU activity guide sheet:

Found in the ground

This activity involves sorting out things that have been 'Found in the ground' according to criteria the participants choose for themselves. They then sort the things into rocks, minerals, fossils and other objects according to given criteria.

A Sort them out

Ask pupils to 'sort out' the samples they have been given (as suggested in the resource list). You could add that the best way of doing this is to have about two or three categories with at least two things in each category and not to have a 'rag-bag' category of 'things that couldn't be fitted into the other groups'. Given this very open-ended request, they can respond in a number of ways. They may sort according to colour, size, shape, 'roughness', 'sparkly-ness/shininess', how heavy they feel, or a combination of these properties. Given that the question was open-ended, any method that works well (i.e. several categories, at least two things in each category and no 'rag bag') is a good response.

It may be useful to give pupils this information on a 'Pupil Success Criteria Card'



Rocks, fossils and minerals (*Peter Kennett*)

B Talking about the method

Explain that any method that works is fine. But that if we want to talk about the things 'Found in the ground' with others (across the room or across the world), we all need to use the same method of sorting them out. The method used by scientists for these 'Found in the ground' things is to first take out everything that is not rock, fossil or mineral, e.g. wood, bone, manufactured items.

The objects that are left should now be divided into rocks, fossils and minerals

It may be useful to give pupils the definition cards.

C Sort them out scientifically

Given these definitions, ask pupils to sort their objects 'Found in the ground' again, using the 'scientific' criteria.

Circus activity 4: Rock builder

Topic: An activity to simulate the formation of fossiliferous sedimentary rocks using a variety of sediments and shells in a plastic bottle, with filler acting as cement to 'glue' the grains together.

Activity:

Through this activity, pupils simulate how sediments become sedimentary rocks by being compacted and cemented, and how fossils can be formed in sedimentary rock. The activity needs to 'dry' for a few days before the class comes back to it.

Explain that we can investigate the formation of sedimentary rocks by setting up and carrying out an experiment which simulates this process.

Show the pupils the dry sand and pebbles. Explain that mud, silt, sand, pebbles and boulders are called sediment.

Rub a piece of soft sandstone with a file and study the grains produced. Discuss how sandstone might be made of 'stuck-together sand', and how the presence of sandstone might have meant that parts of the UK were once covered by sand.

Say that we are going to try and turn sand into sandstone.

Get everyone to get a handful of damp sand. Ask them to try and squeeze it really hard to turn it into rock like the sandstone. *Did anyone manage to do this?*

Ask what else they might need to get it to stick. *A. Some kind of glue or natural cement.*

Explain that sedimentary rocks are made over millions of years from loose material being squeezed and stuck together.

Ask them where they might see sedimentary rock today e.g. buried beneath the ground, in cliffs, road cuttings, in building stones and gravestones.

Ask what would happen to a shellfish (e.g. mussel, oyster, clam), or a fish, or even a cola can, that was buried in sand for millions of years. *A. The hard bits might be left behind as a fossil.*

Then carry out the simulation. This can be done without the filler powder, when the children will see coloured layers of sand and have fun. If done this way then sand layers will have to remain in the clear bottle/pot. However, if you want layers to solidify, to form a more rock-like structure then the filler should be used.

Follow these instructions:

1. Put some sand in one of the tubs or bowls and add water to ensure it is fully wet
2. Put more sand in the other tub or bowl, add some powder paint or food colouring to colour the sand and then add water to ensure it is fully wet
3. Put about three spoons of the wet sand into another tub or bowl, add about one spoon of powdered filler and stir until fully mixed; repeat in another tub or bowl with the coloured sand

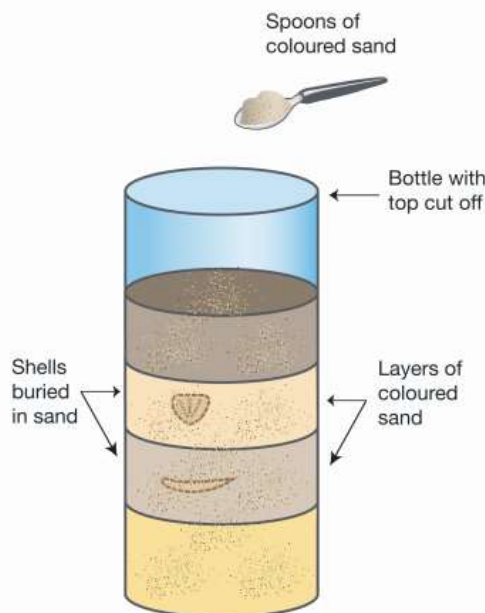


'Mix it all up in a tub/bowl' © ESEU

4. Smear some petroleum jelly on both sides of each shell using your fingers (it makes it easier to lift them out at the end of the activity) - then wash your hands.

5. Use the spoon to fill the 500 ml plastic bottle with alternate layers of the different coloured sands, putting the shells into different layers. If you place the shells at the edge you will be able to see them through the side of the bottle.
6. After each layer has been added, press it down to compact the sand.
7. Write down predictions for what will happen when your layered 'rock' is left in the bottle for a few days:
 - What will the filler powder do that you couldn't do just by squeezing?
 - What will happen to the sand in the bottle after a few days?
 - What will happen to the shells after a few days?

Keep your predictions safe so you can see if you were right later.



'Layered sand' © ESEU

Leave your layered rock to harden in the bottle for a few days; the plastic bottle can then be cut away.

Were the predictions correct?

You can prise out some of the shells at the edge and look at the imprint as well as the 'fossil' itself.

Pupil learning outcomes: Pupils can:

- use the term 'sediment' as the general name given to mud, silt, sand, pebbles and boulders;
- describe how sediments become sedimentary rocks by being compacted and cemented;
- describe how sedimentary rocks may contain fossils.

Curriculum references:

England	Scotland	Wales	Northern Ireland
<p>Science: KS1 Working scientifically</p> <ul style="list-style-type: none"> • asking simple questions and recognising that they can be answered in different ways • observing closely, using simple equipment • performing simple tests • using their observations and ideas to suggest answers to questions <p>Everyday materials Year 1</p> <ul style="list-style-type: none"> • distinguish between an object and the material from which it is made • identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock • describe the simple physical properties of a variety of everyday materials <p>Pupils should explore, name, discuss and raise and</p>	<p>Sciences: Early level Forces, electricity and waves</p> <p>Through everyday experiences and play with a variety of toys and other objects, I can recognise simple types of forces and describe their effects. SCN 0-07a</p> <p>Materials</p> <p>Through creative play, I explore different materials and can share my reasoning for selecting materials for different purposes. SCN 0-15a</p>	<p>Knowledge and understanding of the world Foundation phase</p> <p>Development of skills</p> <p>The following skills are essential to this Area of Learning and can also be developed across the curriculum.</p> <ul style="list-style-type: none"> • Observing • Exploring and experimenting 	<p>The world around us Foundation stage</p> <p>What is in my world?</p> <ul style="list-style-type: none"> • to recognise the different materials used every day; <p>KS1</p> <p>Features of the immediate world and comparisons between places;</p>

<p>answer questions about everyday materials so that they become familiar with the names of materials and properties</p> <p>Year 2</p> <ul style="list-style-type: none"> identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching. <p>Lower KS2 Years 3 and 4 Working scientifically</p> <ul style="list-style-type: none"> asking relevant questions and using different types of scientific enquiries to answer them setting up simple practical enquiries, comparative and fair tests gathering, recording, classifying and presenting data in a variety of ways to help in answering questions reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions using straightforward scientific evidence to answer questions or to support their findings. <p>Rocks</p> <ul style="list-style-type: none"> compare and group together different kinds of rocks on the basis of their appearance and simple physical properties describe in simple terms how fossils are formed when things that have lived are trapped within rock <p>Linked with work in geography, pupils should explore different kinds of rocks and soils, including those in the local environment. Pupils might work scientifically by: observing rocks, including those used in buildings and gravestones, and exploring how and why they might have changed over time; using a hand lens or microscope to help them to identify and classify rocks according to whether they have grains or crystals, and whether they have fossils in them. Pupils might research and discuss the different kinds of living things whose fossils are found in sedimentary rock and explore how fossils are formed.</p>	<p>First level Forces, electricity and waves Forces, electricity and waves By investigating forces on toys and other objects, I can predict the effect on the shape or motion of objects. SCN 1-07a</p> <p>Materials Through exploring properties and sources of materials, I can choose appropriate materials to solve practical challenges. SCN 1-15a</p> <p>Social studies Early level People, past events and societies I am aware that different types of evidence can help me to find out about the past. SOC 0-01a</p> <p>I am aware that different types of evidence can help me to find out about the world around me. SOC 0-15a</p> <p>First level People place and environment I can describe and recreate the characteristics of my local environment by exploring the features of the landscape. SOC 1-07</p>	<ul style="list-style-type: none"> Listening Making decisions Predicting and testing Describing Sequencing Asking/ answering questions Investigating Communicating 	<ul style="list-style-type: none"> about materials in the natural and built environment (G); (H); about the properties of everyday materials and their uses (S&T)
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Age range of pupils: 5 – 11 years

Time needed to complete activity: 30 minutes on the activity day; 15 minutes on follow-up day.

The story for teachers:

As sediments become buried, they are compressed by the overlying sediment and water is squeezed out. Compression by the overlying sediment alone can transform mud into mudstone or shale, however, it cannot change coarser grained sediments into rocks. Pebbles, sand, silt and lime sand must be ‘cemented’ as well as compressed if they are to be changed into conglomerate, sandstone, siltstone and limestone, respectively. The natural cement is deposited as crystals in the spaces between the grains (pore spaces) by circulating fluids – and these ‘glue’ the rock together.

This activity simulates both compression (pupils are asked to press down each layer after it has been added) and cementation, when the filler which (being Plaster of Paris) hardens over time, like natural cement.

Lead in ideas:

Discuss why we need to simulate sedimentary processes and why some processes cannot be investigated in ‘real life’ conditions.

Following up the activity:

Ask pupils to describe, using observation and touching, what has happened to the sand that they tried to squeeze really hard to turn it into a rock compared to the damp sand they put into the bottle. *A. The sand in the bottle became hard, solid and dry.*

What caused this? *A. The sand was compacted (by being pressed into the bottle) and cemented by the filler powder.*

Pupils should break apart their rock to reveal the shell 'fossils' and their imprints (moulds). What might have happened to the fossil if more pressure had been used to make the rock? *A. It may have become flattened, crushed and broken up.*

How do we get fossils out of real rocks? *A. Chip away at them with a sharp hammer or chisel.*

Explore the idea of a simulation in science. Why did we have to investigate sedimentary rocks this way? Why not go out and watch them being formed? Is it right to collect fossils using a hammer/chisel (a discussion about conservation)?

You may want to conduct a much larger fair test investigation around the excitement that fossils often generate as suggested below.

Using this activity as a base, pupils could design, carry out and report on a series of fair tests to find out what the best sedimentary rocks for preserving fossil imprints might be like.

Variables that could be explored include:

- the amount of filler powder (simulating natural cement);
- the amount of time it is left for;
- the amount of compaction (by putting heavy weights on top);
- the amount of water;
- the size of the sediments (sand comes in different "grades" and you could also offer small pebbles, or mixtures of sand and pebbles, or different layers of sands and pebbles);
- fossils are much more common in some UK rocks than others – why is this? (*A. More organisms lived in some areas than in others, the conditions for preservation were better in some areas than in others, igneous rocks never contain fossils (Pompeii is very exceptional) and metamorphic rocks rarely do.*)

There is potential for a full report on fossil preservation to be written in a meaningful context.

Source: The Earth Science Education Unit – originally published in the ESEU's 'Scotland Rocks!' workshop booklet.

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Preparation and set-up time:

500 ml plastic bottles required to be prepared in advance by cutting the tops off with scissors.
10 minutes.

Resources:

Per class on activity day:

- piece of sandstone
- file
- damp sand
- dry sand (a handful)
- pebbles (a handful)

Per group/pupil on activity day:

- spoon
- 4 x bowl or tub (2 for the sand and coloured sand, 2 for mixing)
- powder paint or food colouring
- 500 ml plastic bottle (with the top cut off)
- shells
- sand
- powdered wall filler (e.g. Polyfilla™)
- petroleum jelly

Per group/pupil on results day:

- scissors
- their simulated rock trials (dried and set)
- their predictions from the activity day

Note that: the Plaster of Paris in powdered fillers (e.g. Polyfilla™) sets with an exothermic reaction and has been known to cause burns when used in large quantities. The amounts being used here are very small and there are, therefore, no recognized hazards in this context.

Risk assessment:

Potentially Hazardous Activity	Who/What may be Harmed?	Hazard Rating (A)	Likelihood (B)	Risk (AxB)	Further Action Required?
Rock builder	Teacher/Pupils by the powdered filler	1	1	1	Be aware that only small quantities of filler should be used – see note above

Hazard Rating (A):

- 1 = Insignificant effect
- 2 = Minor Injury
- 3 = Major Injury
- 4 = Severe Injury
- 5 = Death

Likelihood of occurrence (B):

- 1 = Little or no likelihood
- 2 = Unlikely
- 3 = Occasional
- 4 = Probable
- 5 = Inevitable

Risk Priority (AxB):

- 12-25 = High risk – take immediate action
- 6-11 = Medium risk – take action as soon as possible
- Less than 6 = Low risk – plan future actions where required

ESEU activity guide sheet:

Rock builder

An activity to simulate the formation of fossiliferous sedimentary rocks using a variety of sediments and shells in a plastic bottle, with filler as cement.

Follow these instructions:

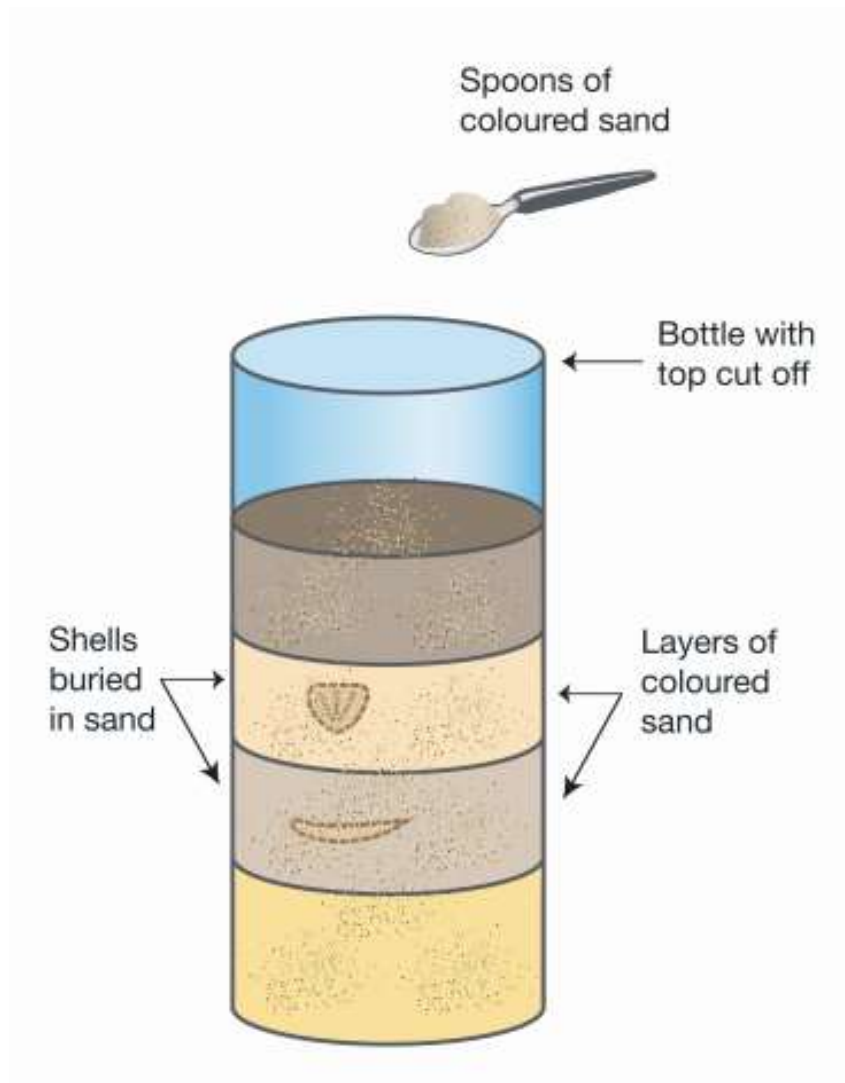
1. Put some sand in one of the tubs or bowls and add water to ensure it is fully wet
2. Put more sand in the other tub or bowl, add some powder paint or food colouring to colour the sand and then add water to ensure it is fully wet
3. Put about three spoons of the wet sand into another tub or bowl, add about one spoon of powdered filler and stir until fully mixed; repeat in another tub or bowl with the coloured sand



'Mix it all up in a tub/bowl' © ESEU

4. Smear some petroleum jelly on both sides of each shell using your fingers (it makes it easier to lift them out at the end of the activity) - then wash your hands.
5. Use the spoon to fill the bottle with alternate layers of the different coloured sands, putting the shells into different layers. If you place the shells at the edge you will be able to see them through the side of the bottle.
6. After each layer has been added, press it down to compact the sand.
7. Write down predictions for what will happen when your layered 'rock' is left in the bottle for a few days:
 - What will the filler powder do that you couldn't do just by squeezing?
 - What will happen to the sand in the bottle after a few days?
 - What will happen to the shells after a few days?

Keep your predictions safe so you can see if you were right later.



'Layered sand' © ESEU

Leave your layered rock to harden in the bottle for a few days; the plastic bottle can then be cut away.

Were the predictions correct?

You can prise out some of the shells at the edge and look at the imprint as well as the 'fossil' itself.

Circus activity 5: Rocks at school and beyond

Topic: A short walk outside to examine the rocks and stones that can be found in the local vicinity.

Activity:

The activity for teachers and pupils is described below – please read it through before you go outside. Then please go outside for a few minutes to see the range of rocks and stones that can be found locally, and consider the educational scope of what you find. Please return to re-join the group later. We will take everybody outside to see what you have found as part of the plenary session.



Around primary school (*Laura Thomson*)

There are rocks and stones all around us whether we live in an urban or rural setting, so this activity takes the children outside, exploring and investigating where rocks and stones can be found.

Take the children out for a walk around the school and in the local vicinity - recording all the places they can see rocks and stones e.g. crags, pebbles, gravel, stone walls, bridges, graveyards. They will also see rocks and stones in the mountains, at the coast or in excavations under the ground they are standing on.

Take photographs and use them to make a wall display (Rock Gallery) or add to a *Talking and Thinking Floorbook™ to record the evidence the children have found. This book clarifies the strategies available to plan effective child-centred experiences.

(*Information on Talking Thinking Floorbooks™ can be found at www.mindstretchers.co.uk)

Pupil learning outcomes: Pupils can:

- find the rocks and stones all around;
- use their senses to find rocks and stones;
- describe how rocks and stones can be used to make structures;
- record their findings using a digital camera.

Curriculum references:

England	Scotland	Wales	Northern Ireland
<p>Science: KS1 Working scientifically</p> <ul style="list-style-type: none"> • observing closely, using simple equipment • identifying and classifying <p>Everyday materials Year 1</p> <ul style="list-style-type: none"> • identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock • describe the simple physical properties of a variety of everyday materials 	<p>Sciences: Biological systems Early</p> <p>I can identify my senses and use them to explore the world around me.</p> <p>SCN 0-12a</p>	<p>Knowledge and understanding of the world Foundation phase Development of skills</p> <p>The following skills are essential to this Area of Learning and can also be developed across the curriculum.</p> <ul style="list-style-type: none"> • Observing 	<p>The world around us Foundation stage Strand 3: place</p> <ul style="list-style-type: none"> • to recognise some basic features of their home (eg window, door, roof, chimney, bedroom); • garage, garden); • to have an awareness of features of the local landscape (eg hill); • to recognise the different materials used every day.

<p>Year 2</p> <ul style="list-style-type: none"> identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses <p>Pupils might work scientifically by: comparing the uses of everyday materials in and around the school with materials found in other places (at home, the journey to school, on visits, and in stories, rhymes and songs); observing closely, identifying and classifying the uses of different materials, and recording their observations.</p> <p>Science: Lower KS2 Years 3 and 4 Working scientifically</p> <ul style="list-style-type: none"> making systematic and careful observations using straightforward scientific evidence to answer questions or to support their findings <p>Year 3 Rocks</p> <ul style="list-style-type: none"> compare and group together different kinds of rocks on the basis of their appearance and simple physical properties <p>Linked with work in geography, pupils should explore different kinds of rocks, including those in the local environment</p> <p>Pupils might work scientifically by: observing rocks, including those used in buildings and gravestones, and exploring how and why they might have changed over time; using a hand lens or microscope to help them to identify and classify rocks according to whether they have grains or crystals, and whether they have fossils in them. Pupils might research and discuss the different kinds of living things whose fossils are found in sedimentary rock and explore how fossils are formed.</p>	<p>Social sciences: People place and environment Early</p> <p>I explore and discover the interesting features of my local environment to develop an awareness of the world around me.</p> <p style="text-align: right;">SOC 0-07a</p> <p>First</p> <p>I can describe and recreate the characteristics of my local environment by exploring the features of the landscape.</p> <p style="text-align: right;">SOC 1-07a</p> <p>Through activities in my local area, I have developed my mental map and sense of place. I can create and use maps of the area.</p> <p style="text-align: right;">SOC 1-14a</p>	<ul style="list-style-type: none"> Comparing Classifying Enquiring Exploring Describing Sorting and grouping Asking/ answering questions Thinking Solving problems Recording Communicating <p>Places and people</p> <ul style="list-style-type: none"> A walk in the local area can be followed by sequencing the journey using photographs, expressing preferences for particular features of the environment and drawing a plan of the local area with symbols to represent particular features. 	<p>As pupils progress through the Foundation Stage they should be enabled to:</p> <ul style="list-style-type: none"> show curiosity about the living things, places, objects and materials in the environment; identify similarities and differences between living things, places, objects and materials; different materials behave in different ways, have different properties and can be used for different purposes; understand that materials can be joined/assembled in different ways; be aware of the local natural and built environment and their place in it. <p>KS1 Strand 3: place</p> <ul style="list-style-type: none"> about materials in the natural and built environment (G); (H); about the properties of everyday materials and their uses (S&T).
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Age range of pupils: 5 – 11 years

Time needed to complete activity: up to an hour

The story for teachers:

You may be surprised by how many different types of natural rock and stone as well as rock-like building materials can be found in the vicinity. This activity should alert you to the possibilities.

Lead in ideas:

- Read ‘Bonting’ by Shirley Hughes (in the Big Alfie Out of Doors Storybook; 2007-09, ISBN 0099 258919, Red Fox Books, Glen Falls, New York).
- Another good book is ‘Everybody Needs a Rock’ by Byrd Baylor, 1985, ISBN 068 971 0518, Aladdin Publishing, New York.
- If you don’t have either of the above books then the teacher could bring in a special stone and tell the children how they found it and why it is special to them.

Source: The Earth Science Education Unit – originally published as ‘Rocks at home’ in the ESEU’s ‘Scotland Rocks!’ workshop booklet.

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Preparation and set-up time:

Enough time to plan and check the route.

Resource list:

- digital camera or any other preferred method of recording

Risk assessment:

Potentially Hazardous Activity	Who/What may be Harmed?	Hazard Rating (A)	Likelihood (B)	Risk (AxB)	Further Action Required?
Walking beyond the school	Teacher/pupils	3	1	3	Check the route beforehand and be alert for issues with crossing roads, traffic, etc.

Hazard Rating (A):

- 1 = Insignificant effect
 2 = Minor Injury
 3 = Major Injury
 4 = Severe Injury
 5 = Death

Likelihood of occurrence (B):

- 1 = Little or no likelihood
 2 = Unlikely
 3 = Occasional
 4 = Probable
 5 = Inevitable

Risk Priority (AxB):

- 12-25 = High risk – take immediate action
 6-11 = Medium risk – take action as soon as possible
 Less than 6 = Low risk – plan future actions where required

ESEU activity guide sheet:

Rocks at school and beyond

A short walk outside to examine the rocks and stones that can be found in the local vicinity.

The activity for teachers and pupils is described below – please read it through before you go outside. Then please go outside for a few minutes to see the range of rocks and stones that can be found locally, and consider the educational scope of what you find. Please return to re-join the group later. We will take everybody outside to see what you have found as part of the plenary session.



Around primary school (*Laura Thomson*)

There are rocks and stones all around us whether we live in an urban or rural setting, so this activity takes the children outside, exploring and investigating where rocks and stones can be found.

Take the children out for a walk around the school and in the local vicinity - recording all the places they can see rocks and stones e.g. crags, pebbles, gravel, stone walls, bridges, graveyards. They will also see rocks and stones in the mountains, at the coast or in excavations under the ground they are standing on.

Take photographs and use them to make a wall display (Rock Gallery) or add to a *Talking and Thinking Floorbook™ to record the evidence the children have found. This book clarifies the strategies available to plan effective child-centred experiences.

Plenary: Sensory treasure hunt

Topic: This activity helps pupils to learn particular properties of a variety of objects.

Activity

Pupils go on a 'treasure hunt', preferably outside, using their senses to find objects with properties similar to the objects in their lucky dip bags. Before they go outside they are shown how to use a hand lens or magnifier correctly.

Set up the activity by putting objects that have the following characteristics into individual lucky dip bags and other examples in the area where the hunt will take place:

- hard – hard rock samples, piece of wood, brick
- soft – lump of clay, paper tissues;
- stretchy - anything elasticated
- stiff - pencil,
- shiny – polished rocks, CD ROM, aluminium foil
- dull – any sample that does not shine;
- rough – rough rock samples, e.g. sandstone, piece of wood, brick
- smooth – polished pebbles, piece of polished metal (with no sharp edges), piece of transparent plastic, plastic lid, piece of slate, paper
- bendy - ruler, piece of wire, paper
- not bendy - anything that will not bend!
- waterproof - umbrella material, slate
- not waterproof - ordinary cloth, mudstone
- absorbent - tissues, kitchen roll
- not absorbent - plastic, polythene
- transparent – transparent plastic;
- opaque – any that you cannot see through

Ask the pupils

To find an object in their lucky dip bag, then find a similar object on their 'treasure hunt'.

For example: If the object in the lucky dip bag is hard and rough (rock sample), they should hunt for something that is hard and rough (piece of wood or rock sample or whatever they can find).



Sensory treasure hunt (*Elizabeth Devon*)

Then they return for another 'lucky dip' followed by a 'treasure hunt'.

All the 'treasure' collected by the pupils is then displayed on a table. The objects are then grouped according to their characteristics. The Property word cards (flash cards see later) may help. It will become apparent that many objects fall into two, or more, categories.

When they have completed their first groupings, ask the pupils to group the objects into those which are naturally occurring and those which are manufactured.

Now ask the pupils questions about the best material to use in particular circumstances e.g. 'What is the best material for an umbrella? ...for lining a dog basket? ...for curtains? ...for a bookshelf? ...for a gymnast's leotard?'

Lastly, ask the pupils if they could change the shape of any of the objects e.g. by squashing, bending twisting stretching?

Pupil learning outcomes

Pupils can:

- use a hand lens or magnifier correctly;
- use appropriate vocabulary to describe materials;
- use senses to explore different materials;
- group materials in many different ways;
- explain that there are many ways to group these objects;
- distinguish between naturally occurring materials and those which are manufactured;
- decide the best material to use in certain circumstances;
- realise that some objects can change shape when squashed, bent, twisted, stretched.

Curriculum references:

England	Scotland	Wales	Northern Ireland
<p>Science: KS1 Years 1 and 2 Working scientifically</p> <ul style="list-style-type: none"> • asking simple questions and recognising that they can be answered in different ways • observing closely • identifying • using their observations and ideas to suggest answers to questions <p>Pupils in years 1 and 2 should explore the world around them They should experience different types of scientific enquiries, including practical activities. They should use simple features to compare objects, materials and, with help, decide how to sort and group them, and, with guidance, they should begin to notice patterns and relationships. They should ask people questions. They should use simple measurements and equipment (for example, hand lenses) to gather data and talk about what they have found out and how they found it out. With help, they should record and communicate their findings in a range of ways and begin to use simple scientific language.</p> <p>Year 1 Everyday materials</p> <ul style="list-style-type: none"> • distinguish between an object and the material from which it is made • identify and name a variety of everyday materials, including wood, plastic, glass, metal and rock • describe the simple physical properties of a variety of everyday materials • compare and group together a variety of everyday materials on the basis of their simple physical properties. <p>Pupils should explore, name, discuss and raise and answer questions about everyday materials so that they become familiar with the names of materials and properties such as: hard/soft; stretchy/stiff; shiny/dull; rough/smooth; bendy/not bendy; waterproof/not waterproof; absorbent/not absorbent; opaque/transparent.</p> <p>Pupils should explore and experiment with a wide variety of materials, not only those listed in the programme of study, but including for example: brick, paper, fabrics, elastic, foil.</p> <p>Pupils might work scientifically by: performing simple tests to explore questions, for example: 'What is the best material for an umbrella? ...for lining a dog basket? ...for curtains? ...for a bookshelf? ...for a gymnast's leotard?'</p> <p>Year 2</p> <ul style="list-style-type: none"> • identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses • find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching 	<p>Sciences: Materials Properties and uses of substances</p> <p>Early Through creative play, I explore different materials and can share my reasoning for selecting materials for different purposes. SCN 0-15a</p> <p>First Through exploring properties and sources of materials, I can choose appropriate materials to solve practical challenges. SCN 1-15a</p>	<p>Knowledge and understanding of the world Foundation phase</p> <p>Development of skills The following skills are essential to this Area of Learning and can also be developed across the curriculum.</p> <ul style="list-style-type: none"> • Observing • Comparing • Classifying • Enquiring • Exploring • Listening • Making decisions • Predicting and testing • Reflecting • Describing • Sorting and grouping • Asking/ answering questions • Investigating • Thinking • Communicating 	<p>The world around us Foundation stage As pupils progress through the Foundation Stage they should be enabled to:</p> <ul style="list-style-type: none"> • show curiosity about the living things, places, objects and materials in the environment; • identify similarities and differences between living things, places, objects and materials; • understand that different materials behave in different ways, have different properties and can be used for different purposes;

Age range of pupils: 5 - 6 years

Time needed to complete activity: 30 minutes

The story for teachers:

This activity has endless potential and can be used in many ways. It is best carried out outside where there is plenty of space but can equally well be enjoyed in the classroom. Pupils can work at their own pace with the faster and more able investigating uses and other properties such as the object's ability or not to change shape. The words fulfil many literacy requirements and pupils can try to apply them to other objects.

Pupils quickly discover a pattern as they group the objects. Discussion involves metacognition and cognitive conflict is caused when objects fit into two or more groups. Applying the words to objects all around is a bridging skill.

Lead in ideas:

Have similar samples to those in the lucky dip bags ready to show the pupils. Introduce all the words they will need, (maybe use the flash cards), and demonstrate each property with the correct example.

Following up the activity:

Pupils could collect five more objects and bring them back to the table, then sort them into their appropriate groups.

More able pupils could either fill in a pre-prepared groups list and could see how many times each sample occurred in a group or they could be asked to develop their own lists. They could also suggest uses for all the materials and decide which ones could change shape in similar ways.

Source: Activity devised for ESEU's 'Rock and soil circus' workshop by Charlotte Amison, Anne Collins, Phil Critchlow, Elizabeth Devon, Paul Grant, Sarah Harrison, Roger Mitchell, Cally Oldershaw, Geoff Selby-Sly, Peter Woods and Niki Whitburn

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Preparation and set-up time

10 minutes.

Resource list

- 10 lucky dip bags – preferably opaque
- a range of materials e.g. as listed in the 'Activity' section above
- Property word cards – see following

Risk assessment:

Potentially Hazardous Activity	Who/What may be Harmed?	Hazard Rating (A)	Likelihood (B)	Risk (AxB)	Further Action Required?
Sensory Treasure Hunt	No significant hazard	-	-	-	No

Hazard Rating (A):

- 1 = Insignificant effect
- 2 = Minor Injury
- 3 = Major Injury
- 4 = Severe Injury
- 5 = Death

Likelihood of occurrence (B):

- 1 = Little or no likelihood
- 2 = Unlikely
- 3 = Occasional
- 4 = Probable
- 5 = Inevitable

Risk Priority (AxB):

- 12-25 = High risk – take immediate action
- 6-11 = Medium risk – take action as soon as possible
- Less than 6 = Low risk – plan future actions where required

Property word cards (Sensory treasure hunt)

Property
hard

Property
soft

Property
Stretchy

Property
stiff

Property
Shiny

Property
dull

Property
rough

Property
smooth

Property
bendy

Property
not bendy

Property
waterproof

Property
not waterproof

Property
absorbent

Property
not absorbent

Property
transparent

Property
opaque

ESEU activity guide sheet:

Sensory treasure hunt

This activity helps pupils to learn particular properties of a variety of objects.

Pupils go on a 'treasure hunt', preferably outside, using their senses to find objects with properties similar to the objects in their lucky dip bags. Before they go outside they are shown how to use a hand lens or magnifier correctly.

Set up the activity by putting objects that have the following characteristics into individual lucky dip bags and other examples in the area where the hunt will take place:

- hard – hard rock samples, piece of wood, brick
- soft – lump of clay, paper tissues;
- stretchy - anything elasticated
- stiff - pencil,
- shiny – polished rocks, CD ROM, aluminium foil
- dull – any sample that does not shine;
- rough – rough rock samples, e.g. sandstone, piece of wood, brick
- smooth – polished pebbles, piece of polished metal (with no sharp edges), piece of transparent plastic, plastic lid, piece of slate, paper
- bendy - ruler, piece of wire, paper
- not bendy - anything that will not bend!
- waterproof - umbrella material, slate
- not waterproof - ordinary cloth, mudstone
- absorbent - tissues, kitchen roll
- not absorbent - plastic, polythene
- transparent – transparent plastic;
- opaque – any that you cannot see through

Ask the pupils

To find an object in their lucky dip bag, then find a similar object on their 'treasure hunt'.

For example: If the object in the lucky dip bag is hard and rough (rock sample), they should hunt for something that is hard and rough (piece of wood or rock sample or whatever they can find).



Sensory treasure hunt (*Elizabeth Devon*)

Then they return for another ‘lucky dip’ followed by a ‘treasure hunt’.

All the ‘treasure’ collected by the pupils is then displayed on a table. The objects are then grouped according to their characteristics. The Property word cards (flash cards see later) may help. It will become apparent that many objects fall into two, or more, categories.

When they have completed their first groupings, ask the pupils to group the objects into those which are naturally occurring and those which are manufactured.

Now ask the pupils questions about the best material to use in particular circumstances e.g. ‘What is the best material for an umbrella? ...for lining a dog basket? ...for curtains? ...for a bookshelf? ...for a gymnast’s leotard?’

Lastly, ask the pupils if they could change the shape of any of the objects e.g. by squashing, bending twisting stretching?

Resource list

Resource list: Starter: Pirates and buried treasure	Supplied By	
	Facilitator	Institution
One for every group of six pupils/participants:		
• tray for sand approximately 420mm x 300mm (e.g. Gratnell™ tray)	✓	
• dry washed sand	✓	
• treasure chests (any containers approximately 150mm x 90mm) - these could be gift boxes or made from cardboard	✓	
• optional dressing up clothes (pirates)		✓
• treasure, e.g. variety of mineral samples - coloured quartz, rough and smooth pebble, small fossils, shiny coins, pieces of costume jewellery, coloured glass, wooden or plastic objects (with no sharp edges) etc.	✓	

Resource list: Circus activity 1: Fossil or not?	Supplied By	
	Facilitator	Institution
One set of the following:		
Pictures of the following		
<ul style="list-style-type: none"> • fossil bone • hazelnuts • fossilised wood • fossil shell 	<ul style="list-style-type: none"> • desiccation cracks • fossil tooth • dinosaur footprint • insects in amber 	✓
• (optional) more specimens or pictures of fossils or non-fossils		✓
• Sorting sheets (body fossil, trace fossil, not a fossil)	✓	
• Definition cards (a fossil, a body fossil, a trace fossil)	✓	

Resource list: Circus activity 2: Rock explorer	Supplied By	
	Facilitator	Institution
One set of the following: Items to create a 'tool kit' using:		
• rock and fossil samples	✓	
• magnifier	✓	
• rock ID book	✓	
• clipboards and pencils		✓
• large sheets of paper and pens		✓

Resource list: Circus activity 3: Found in the ground	Supplied By	
	Facilitator	Institution
One set of the following:		
• samples of granite, permeable sandstone and other samples such as: shelly limestone, chalk, slate; specimens should be 2cm in diameter, or larger - see photo	✓	
• some fossils	✓	
• some minerals	✓	
• some objects, like, piece of brick, wood, large rusty nail	✓	
• 'Pupil success criteria' card	✓	
• Definition cards (rock, non-rock, mineral, fossil)	✓	

Resource list: Circus activity 4: Rock builder	Supplied By	
	Facilitator	Institution
Per class on activity day:		
• piece of sandstone	✓	
• file	✓	
• damp sand	✓	
• dry sand (a handful)	✓	
• pebbles (a handful)	✓	
Per group/pupil on activity day:		
• spoon	✓	
• 4 x bowl or tub (2 for the sand and coloured sand, 2 for mixing)	✓	
• powder paint or food colouring	✓	
• 500 ml plastic bottle (with the top cut off)	✓	
• shells	✓	
• sand	✓	
• powdered wall filler (e.g. Polyfilla™)	✓	
• petroleum jelly	✓	
Per group/pupil on results day:		
• scissors		✓
• their simulated rock trials (dried and set)		N/A
• their predictions from the activity day		N/A
Note that: the Plaster of Paris in powdered fillers (e.g. Polyfilla™) sets with an exothermic reaction and has been known to cause burns when used in large quantities. The amounts being used here are very small and there are, therefore, no recognized hazards in this context.		

Resource list: Circus activity 5: Rocks at school and beyond	Supplied By	
	Facilitator	Institution
One of the following:		
• (optional) digital camera or any other preferred method of recording		✓

Resource list: Plenary: Sensory treasure hunt	Supplied By			
	Facilitator	Institution		
One for every group of three pupils/participants:				
• lucky dip bag – preferably opaque	✓			
<table border="0" style="width: 100%;"> <tr> <td style="vertical-align: top; width: 50%;"> <ul style="list-style-type: none"> • a range of materials e.g. the following: <ul style="list-style-type: none"> • hard – hard rock samples, piece of wood, brick • soft – lump of clay, paper tissues • stretchy - anything elasticated • stiff - pencil • shiny – polished rocks, CD ROM, aluminium foil • dull – any sample that does not shine • rough – rough rock samples, e.g. sandstone, piece of wood, brick • smooth – polished pebbles, piece of polished metal (with no sharp edges), piece of transparent plastic, plastic lid, piece of slate, paper </td> <td style="vertical-align: top; width: 50%;"> <ul style="list-style-type: none"> • bendy - ruler, piece of wire, paper • not bendy - anything that will not bend! • waterproof - umbrella material, slate • not waterproof - ordinary cloth, mudstone • absorbent - tissues, kitchen roll • not absorbent - plastic, polythene • transparent – transparent plastic; • opaque – any that you cannot see through </td> </tr> </table>	<ul style="list-style-type: none"> • a range of materials e.g. the following: <ul style="list-style-type: none"> • hard – hard rock samples, piece of wood, brick • soft – lump of clay, paper tissues • stretchy - anything elasticated • stiff - pencil • shiny – polished rocks, CD ROM, aluminium foil • dull – any sample that does not shine • rough – rough rock samples, e.g. sandstone, piece of wood, brick • smooth – polished pebbles, piece of polished metal (with no sharp edges), piece of transparent plastic, plastic lid, piece of slate, paper 	<ul style="list-style-type: none"> • bendy - ruler, piece of wire, paper • not bendy - anything that will not bend! • waterproof - umbrella material, slate • not waterproof - ordinary cloth, mudstone • absorbent - tissues, kitchen roll • not absorbent - plastic, polythene • transparent – transparent plastic; • opaque – any that you cannot see through 	✓	
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• Property word cards (hard, soft, stretchy, stiff, etc.)	✓			