ACET Junior Academies'

Scheme of Work for Science

Big Ideas – Materials & Forces

Year 3 – Rocks & Forces

About this unit:

PoS – Rocks & Forces

This unit combines two big ideas because it ties in with History – The Stone Age. Students will look at rocks, investigating their properties – emphasising that they are doing the same as they have done with features of animals, plants, and the properties of materials. We will look how rocks and fossils are formed, with a consideration of the time involved, then move on to look at forces. Forces will be reviewed later in the year, when we are studying magnets. In this unit, we will focus on forces as a push and a pull, and the things we can do to make pushing and pulling easier. It should be noted that 'friction' does not need to be taught as a specific concept here, as it is studied in more detail in Y5. The focus in this Y3 unit is on pushing & pulling forces and their effects.

At the end of the unit, rocks and forces come together as the students consider how Stone Age people moved the enormous rocks to Stonehenge. This is not about how they lifted them into place, but about how they pushed or pulled them along the ground from Wales to Wiltshire. There is an alternative Art activity where students can look at examples of rock-balancing art, and have a go themselves.

Try and get the students to identify and state that something is a 'push force' and a 'pull force' whenever they can, as they will be able to use these terms in many more units as they progress in science.

Students will need to go outside at some point this term and record information for the class year book. This will be looked at in 'Plants'.

Unit structure

This unit is structured around seven science enquiries:

1. Are all rocks the same?
2. Can rocks change over time?
3. Where do rocks come from?
4. What do fossils tell us?
5. Can we identify different forces?
6. Why is moving rocks to Stonehenge a big deal?

7a. Could you move rocks to Stonehenge?

7b. Rock balancing

Links to previous and future National Curriculum units

Y1 – Everyday materials

Y2 – Uses of everyday materials

Geography - Rocks

- Y5 – Properties of materials
- Y5 - Forces

<table>
<tr><th colspan="4">Enquiry 1: Are all rocks the same?</th></tr>
<tr><th>Links to previous learning</th><th>Scientific skills</th><th>Assessment criteria</th><th>Curricular links</th></tr>
<tr><td rowspan="3">Y1 – Everyday materials</td><td>EA – Identifying, grouping and classifying

Asking questions
Observing and measuring</td><td rowspan="3">Can your children:
- Identify features of rocks
- Describe differences between rocks</td><td rowspan="3">Horizontal:

Vertical:
Y5 – Properties of materials</td></tr>
<tr><td>Key concepts:</td></tr>
<tr><td>Different rocks have different features.
Rocks are made from crystals that we can see through hand lenses</td></tr>
<tr><th colspan="2">Key terms</th><th colspan="2">Common misconceptions</th></tr>
<tr><td colspan="2">Rock, hard, scratch, brittle, crumbly, texture, colour, heavy, light</td><td colspan="2">Hard and strong are different. Hard – how easy it is to scratch, strong – it doesn't break easily.</td></tr>
<tr><th colspan="2">Suggested activities</th><th>Resources</th><th>Useful links</th></tr>
<tr><td colspan="2">Look at a variety of rocks. Compare their appearance and simple physical properties. Encourage observations, and use of key terms.

Hand lenses. Priority – observation and acknowledgement that rocks can be different.

Greater depth – can they identify features that will allow them to group rocks

Go outside and take photos of the local environment – particularly the plants – for the class year book. Link this to the current topic by observing any rocks nearby. Many of the stones they see will have been transported to the site from elsewhere, as gravel. Are all the rocks they can see the same, or different? Do they think they rocks have always been in this area, or were they brought from elsewhere? Why would they have been brought? How? Are some of the things they think of as 'rocks' actually man-made? Rocks are natural objects. How can you tell whether a 'rock' is natural, or something man-made? How would they be made? What from?</td><td>Hand lenses
A range of rocks for observation</td><td></td></tr>
</table>

<table>
<tr><th colspan="4">Enquiry 2: Can rocks change over time?</th></tr>
<tr><th>Links to previous learning</th><th>Scientific skills:</th><th>Assessment criteria</th><th>Curricular links</th></tr>
<tr><td rowspan="3">Y1 – Everyday materials</td><td>EA – Observation over time

Asking questions
Observing and measuring</td><td rowspan="3">Can your children:
- Tell you that weather can change rocks
- State that water dripping on or running over rocks can wear it away</td><td rowspan="3">Horizontal:
History - Stonehenge
Geography

Vertical:
Y5 – Properties of materials</td></tr>
<tr><td>Key concepts:</td></tr>
<tr><td>Rocks change over time – parts of them can get rubbed away.
Water dripping on to rocks, or running over it, can wear it down.
GD should consider the timescales involved.</td></tr>
<tr><th colspan="2">Key terms</th><th colspan="2">Common misconceptions</th></tr>
<tr><td colspan="2">Rock, hard, weather, water, old, time,</td><td colspan="2"></td></tr>
<tr><th colspan="2">Suggested activities</th><th>Resources</th><th>Useful links</th></tr>
<tr><td colspan="2">Go to a local graveyard, and look at the gravestones. Which are the oldest? Is it easy to tell?
What happens to rocks over time? Look at local buildings of different ages. Look at Stonehenge and similar places – do the rocks look the same now as they did when it was constructed? How do you think they will look different?

Concept of weathering. Students can rub rocks together to see whether bits come off. Try and find different rocks, some that are harder than others. Don't use bricks or concrete, or other man made objects – discuss this with students. We're learning about the rocks that are made naturally on Earth. Bricks and concrete are made by sticking small pieces of natural dust together.

Use this lesson to introduce the timescale involved in studying rocks. Look at pictures of rocks that have been weathered by water, then show water running over a rock – how long do they think it will take for the rock to wear down?

Draw or describe how an object made of rock has changed over time. GD – try and describe why/how the changes happen.</td><td>Take a trip to see some old buildings/graveyard</td><td></td></tr>
</table>

<table>
<tr><td colspan="4">Enquiry 3: Where do rocks come from?</td></tr>
<tr><td>Links to previous learning</td><td>Scientific skills:</td><td>Assessment criteria</td><td>Curricular links</td></tr>
<tr><td rowspan="3"></td><td>EA – Pattern seeking

Asking questions
Making predictions
Observing and measuring</td><td rowspan="3">Can your children:
- Describe how sedimentary rocks are formed
- State that in order to make hard salt dough, it needs to be pressed together very hard.</td><td rowspan="3">Horizontal:
Geography

Vertical:
Y5 – Properties of materials</td></tr>
<tr><td>Key concepts:</td></tr>
<tr><td>Rocks can be made from volcanoes, or from bits of weathered rocks that are squashed together.
The harder you squash rock dust together, the harder the rock will be.</td></tr>
<tr><td colspan="2">Key terms</td><td colspan="2">Common misconceptions</td></tr>
<tr><td colspan="2">Rock, weathering, crumbly, dust, squash, pressure, time</td><td colspan="2"></td></tr>
<tr><td colspan="2">Suggested activities</td><td>Resources</td><td>Useful links</td></tr>
<tr><td colspan="2">Some rocks come from volcanoes – watch some video clips.

Other come from bits of old rock, squashed together. Show clips of sedimentary rocks being formed near still water.

Activity to illustrate the making of sedimentary rocks. Make some salt dough or playdough. Show how the dry materials are crumbly and won't stick together. Adding water helps – but you need pressure to get it to stick together. In real life this happens when more and more bits of rock settle on top.

Use moulds (like biscuit moulds) to show how this happens. Put some loose/unsquashed dough in one mould, and squash some in more tightly in to a second mould, and then squash dough very firmly into a third (this could be done by piling heavy objects on top, to simulate more layers of weathered rock landing on top).

Leave to dry. Students should predict which 'biscuit' will be the hardest once they have dried. Relate this to rocks. Students should have reasons for their predictions – they should be able to tell you why they think this will happen – e.g when we make sandcastles. At the end of the investigation, students should review their prediction.</td><td>Materials for making salt dough
Biscuit moulds
Heavy objects – books are fine</td><td></td></tr>
</table>

Metamorphic rocks – no indication on the PoS that students need to know about them. If students are interested, the salt dough can be baked to illustrate how they're formed. Putting chocolate chips in will demonstrate how fossils in metamorphic rocks are often destroyed, while they remain intact in sedimentary ones. This will be useful for next lesson. Don't teach about metamorphic rocks if it will undermine understanding of sedimentary rocks, which is important for understanding fossils.		

<table>
<tr><td colspan="4">Enquiry 4 – What do fossils tell us?</td></tr>
<tr><td>Links to previous learning</td><td>Scientific skills:</td><td>Assessment criteria</td><td>Curricular links</td></tr>
<tr><td></td><td>EA – Pattern seeking

Asking questions
Making predictions
Observing and measuring
Recording data
Key concepts:
Fossils are the remains of living things that got buried in rocks as they formed.
The longer ago something lived, the deeper underground it will be found.</td><td>Can your children:
- Tell you that fossils are the remains of things that lived a long time ago
- Relate the age of a fossil to which layer of rock it was found in
GD – consider how long it takes for rocks to form, and link to when the dinosaurs lived</td><td>Horizontal:

Vertical:
Y6 - Evolution</td></tr>
<tr><td colspan="2">Key terms</td><td colspan="2">Common misconceptions</td></tr>
<tr><td colspan="2">Fossil, dinosaur, lived, died, buried, rocks, layers</td><td colspan="2">Fossils are not actually bones but the ‘imprint’ of the part that was slowest to decompose when the animal died. Students don’t need to know the process – but if they are curious, encourage them to explore what actually happens.</td></tr>
<tr><td>Suggested activities</td><td>Resources</td><td colspan="2">Useful links</td></tr>
<tr><td>What do students know about fossils, and dinosaurs, and rocks?

Show a range of dinosaurs, and point out that we know some lived before others. Beware of saying that some dinosaurs are ‘older’ than others. Look at unexpected fossils – including plants – not just classic dinosaurs.

Students will work in groups of 2-3.
All the groups are going to bury items in sand, layer by layer, in the storage containers. Put the first item in, and cover until you have an even layer of sand that covers the item. Continue until you have hidden as many items as you can – only one per layer. Groups should record the order in which they buried the items.

Once all the items are hidden, they should swap containers with another group. Can they correctly identify the order in which the items were hidden? Recording data – each group should keep a record of what they found and where, in order to compare with what the ‘hiding’ group</td><td>Deep storage container (e.g. for holding flour or pasta)
Sand
Model dinosaurs or other small plastic objects</td><td colspan="2"></td></tr>
</table>

recorded. Use the comparisons to evaluate which ways of recording data are best. For discussion – the **first** items to be found were the **last** to be hidden – relate this to finding fossils in rocks. If they get the order wrong – can they and the original group identify why this happened (e.g. the layer of sand not being deep enough)? Any answer they come up with is probably relevant to real life. Try not to refer to the 'oldest' fossils, but the ones that 'lived the longest time ago'. You could make a timeline to go with the depth of sand.		

<table>
<tr><th colspan="4">Enquiry 5 – Can we identify different forces?</th></tr>
<tr><th>Links to previous learning</th><th>Scientific skills:</th><th>Assessment criteria</th><th>Curricular links</th></tr>
<tr><td rowspan="3">EY – make observations … and explain why some things occur, and talk about changes</td><td>EA – Pattern seeking

Asking questions
Making predictions
Observing and measuring</td><td rowspan="3">Can your children:
- Tell you that a force is a push or a pull
- If something moves or stops, identify what force makes it happen</td><td rowspan="3">Horizontal:

Vertical:
Y5 - forces</td></tr>
<tr><td>Key concepts:</td></tr>
<tr><td>We call anything that can push or pull something a ‘force’.
A force can make something move or stop.
GD – forces can also change the way something moves, and also change their shape.</td></tr>
<tr><th colspan="2">Key terms</th><th colspan="2">Common misconceptions</th></tr>
<tr><td colspan="2">Squeeze, squash, press, roll, bounce, stretch</td><td colspan="2">Force, energy and power all have very specific meanings in science. Try to avoid use of ‘energy’ and ‘power’ if you mean ‘force’. Forces can be big or small, and an opposite force can make them smaller. E.g. when you’re pushing something, friction can make your push force smaller. You don’t need any reference to energy when discussing this.</td></tr>
<tr><th colspan="2">Suggested activities</th><th>Resources</th><th>Useful links</th></tr>
<tr><td colspan="2">Next lesson, we want to investigate some of the problems involved in moving rocks to Stonehenge using Stone Age tools – but to do this, we need to learn about forces. What we learn today will help us with our investigation next lesson.

Forces are a push or a pull, that either make something move or stop, changes the way it moves, or changes its shape. Students should focus on making predictions. Will a push or a pull change the object? What change will happen? Students should record their predictions, and then be aware that they are testing to see whether they were correct or not. They should be encouraged to record what prior knowledge they have which leads them to make their prediction – this could just be experience, e.g. ‘when I have squashed something before, this is what happens’.

They will not be ‘doing’ or ‘seeing’ anything new – opening a zip on a pencil case is something they might do every day – but they should be seeing it like a scientist, and starting to group that action with similar actions that they observe.</td><td>Toy vehicles, balls of different sizes and materials, pull along toys, rubber bands, bulldog clips, beanbags, pencil case with zip, spectacle case, rulers, rubbers, scissors, calculators, screw top pots or bottles, coins, any other safe gadgets or tools</td><td></td></tr>
</table>

Investigate this – look at a range of objects (see resources) and see how you can make them move, change their motion or change their shape. Using verbs - see key terms – say **what you do** to make them move, or change their shape. Each object can relate to a number of different verbs. In each case, you should be able to classify the action as a push or a pull. *In the case of twisting, like removing a bottle top, it may be a push and a pull simultaneously.* Consider different sports – you could look at a range of pictures – and where push and pull forces are important. Show images of different sporting activities – can you identify where a push or a pull is happening? This is where force is being applied.		

<table>
<tr><th colspan="4">Enquiry 6 – Why is moving rocks to Stonehenge a big deal?</th></tr>
<tr><th>Links to previous learning</th><th>Scientific skills:</th><th>Assessment criteria</th><th>Curricular links</th></tr>
<tr><td></td><td>EA – Comparative/fair testing

Asking questions
Making predictions
Setting up tests
Key concepts:
The smoother a surface is, the easier it is to push or pull something along it.
When we are investigating the effect of something, it's important that we only change that one thing.
GD – discuss how hard it is to push or pull in terms of the size of a force</td><td>Can your children:
- State that it is easier to push something over a smooth surface than a rough one
- Tell you what they are trying to find out, and what they did to make the test fair</td><td>Horizontal:

Vertical:
Y5 – Forces
KS3&4 physics.</td></tr>
<tr><th colspan="2">Key terms</th><th colspan="2">Common misconceptions</th></tr>
<tr><td colspan="2">Force, push, pull, big, small, easier, smooth, rough</td><td colspan="2">Students have many misconceptions around friction. It will be explored again throughout the curriculum. The important thing for them to understand at this stage is that it is a pushing force that acts when two objects are in contact. If this is reinforced, they can build on this knowledge in Y5 and further.</td></tr>
<tr><th colspan="2">Suggested activities</th><th>Resources</th><th>Useful links</th></tr>
<tr><td colspan="2">The rocks which make Stonehenge were brought there from a long distance away. No-one knows how the rocks were brought there, using Stone Age tools. Scientists have some theories, because they have investigated what the easiest ways to do it would have been.

GD students can consider that if you make it easier to push something, you have decreased the size of the push force needed.

Compare how easy it is to push a friend on a swing, compared to pushing them along the classroom while they sit on a chair. Students should try and identify why it is different. The chair in the classroom has to be pushed along another surface, rather than just through the air. Where two objects touch (like the chair leg and the floor), friction occurs, which is a force which pushes back on something that's moving. GD – when pushing a swing, the air pushes back – as seen when people's hair flows behind them – but the force from the air pushing back is much smaller than the friction from the floor pushing back.

When something is moving along a surface, friction pushes back against it. The bigger the push from friction, the slower the object will move.</td><td>Wooden ramps
Cars/trucks to travel down the ramps
Different surfaces to extend 1-2m beyond the ramp
Metre rulers</td><td>https://www.bbc.co.uk/bitesize/clips/zjr3cdm
Showing students carrying out a friction test.
Potentially upsetting car crash test scenes at the start.</td></tr>
</table>

We want to test which material has the most friction with the truck's wheels. **The investigation should be set up as in the clip.** The students should be involved in setting up the investigation, with an emphasis on how to make the test fair. *We are not testing the initial push force, or the surface of the ramp – these should be kept the same. What we are testing is the surface the truck moves along after the ramp. This is the only thing that should be changed.*		

<table>
<tr><td colspan="4">Enquiry 7a: Could you move rocks to Stonehenge? Alternative lesson 7b below</td></tr>
<tr><td>Links to previous learning</td><td>Scientific skills:</td><td>Assessment criteria</td><td>Curricular links</td></tr>
<tr><td rowspan="2"></td><td>EA – Problem solving

Asking questions
Making predictions
Evaluating</td><td rowspan="2">Can your children:
- Suggest something that would make the push or pull forces involved smaller
- Tell you what was particularly good or bad about their idea
GD – suggest improvements</td><td rowspan="2">Horizontal:

Vertical:
Y5 Forces</td></tr>
<tr><td>Key concepts:
Moving the rocks to Stonehenge from Wales involved huge pushing and/or pulling forces.
The people must have done things to make it easier to push or pull the rocks</td></tr>
<tr><td colspan="2">Key terms</td><td colspan="2">Common misconceptions</td></tr>
<tr><td colspan="2">Force, heavy, push, pull, big, small, easier, smooth, rough</td><td colspan="2"></td></tr>
<tr><td colspan="2">Suggested activities</td><td>Resources</td><td>Useful links</td></tr>
<tr><td colspan="2">Challenge activity – can the students move a rock/heavy object a set distance, using Stone Age tools? This is about minimising the force of friction. Identifying features in surfaces (including those of a rock) that will reduce the force needed to move it.

The main problem: Stone age people did not have tools to lift & carry the rocks away from the ground. If you push or pull a rock along the ground, there will be friction. Stonehenge people needed to do things to make the effect of friction smaller.

LOTS of video clips to watch, of people trying to work out how they did it. Important to emphasise to students – we're investigating how they were MOVED TO Stonehenge, not lifted up. Key to movement across the ground is minimising friction (stopping it 'rubbing' against the ground) so that they don't have to push so hard to move the rock. You can do this on whatever scale suits you – they could do it with a rock/brick outside, or on the tables inside. The students could discuss what Stoneage tools might have been used.</td><td>Different depending on the scale at which you do this – see activities.</td><td></td></tr>
</table>

They should **evaluate** their method. They could evaluate how realistic it was in comparison to the Stonehenge rocks, or how well they minimised the friction.		

Enquiry 7b: Rock balancing ***Alternative lesson 7a above***			
Links to previous learning	**Scientific skills:**	**Assessment criteria**	**Curricular links**
	EA – Problem solving Asking questions Making predictions **Evaluating** **Key concepts:** When you try and balance rocks, the top rock pushes against the bottom one. The smoother rocks are, the more easily they will move past each other.	**Can your children:** - State that the smoother a rock is, the more easily another rock will move along it - Tell you what was particularly good or bad about their method *GD – suggest improvements*	**Horizontal:** **Vertical:** Y5 - Forces

Key terms	**Common misconceptions**	
Force, heavy, push, pull, big, small, easier, smooth, rough		
Suggested activities	**Resources**	**Useful links**
This is about maximising the force of friction. If you don't have enough friction, the rocks will move. You need a rough surface, and not too much force (weight) in order for the rocks to stay still. Look at rock balancing. Can they do it? Go outside and try and find suitable rocks to do it with. Consider which rocks to do it with – you could investigate smooth & rough rocks. It should be easier to balance two rough rocks than two smooth ones – but it may not be! Students can explore this. The rough rocks have more friction, so *should* balance more easily. Greater depth students can consider what other factors might affect whether they balance (no need for actual answers – just that they are questioning, and trying to come up with ways of finding out the answer).		