

Make your own rock

Investigating how loose sediment may be stuck together to form a 'rock'

Ask a pupil to take a handful of sand and see if it is possible to make a 'rock' by squeezing it as hard as possible. *(it isn't!)*

To become hard rocks, most sediments need to be cemented together. This idea can be tested with a variety of 'cements'. Before carrying out each part of the activity, ask pupils to predict how strong they think each 'rock' will be when it has dried.

Dampen some sand with water and pack it tightly into the bottom of an old plastic cup or small pot. Cut away the plastic carefully and leave the sand pellet to dry.

Repeat this several times, but mix the sand beforehand with any suitable 'cements' that come to hand. Use a ratio of about one part of 'cement' to four parts of damp sand. The 'cements' could include salt, sugar, plaster of Paris, etc. **(Refer to note in Resource List)**

Note: Pupils should be warned not to confuse manufactured builders' cement powder with the materials that they are using. An alternative name for these could be 'rock glue'.

If an old 20 ml syringe is available, the nozzle end can be cut off with a hacksaw and the syringe used several times to make a more uniform series of 'rock' pellets than can be achieved with the plastic cups described above.

Ask the pupils to devise a fair way to test the strength of their rocks after they have hardened. When the 'rocks' have become hard (which may take a day or so), pupils can then be invited to test them to destruction, to see which were made with the strongest cements. If possible, give them a piece of real sandstone to test as well. If they plan a series of tests, they should try the least destructive one first!

Many sedimentary rocks were once loose sediments that were cemented by natural cements in a very similar way. Natural cements were deposited by fluids flowing through the spaces between the grains.



Making a 'rock' pellet in the lab using a sawn-off syringe



The 'kitchen table' version:- a) Mixing the damp sand and plaster



b) cutting out the hardened pellet



c) the result – a lovely smooth 'rock'!



Conglomerate – a rock made of rounded pebbles cemented together naturally. The cement in this case is silica, which is very hard. (Photos: P. Kennett)

The back up

Title: Make your own rock

Subtitle: Investigating how loose sediment may be stuck together to form a 'rock'

Topic: Compaction and cementation of sediments. Making, and subsequently testing, 'rocks' using sand and a range of 'cements'.

Age range of pupils: 8-18 years

Time needed to complete activity: 15 mins

Pupil learning outcomes: Pupils can:

- demonstrate how 'rocks' are made by compacting and cementing loose sand;
- devise a fair way of testing the strength of their 'rocks';
- explain that the strength of a rock may depend as much on the cement that holds the particles together as it does on the composition of the particles themselves.

Context: The activity could form part of a lesson dealing with sedimentary rocks and how they are formed. It may have applications to local building materials.

Following up the activity:

Pupils can be asked to test the strength of any real rocks that may be available. If the sample has a flat surface, one simple test is to drop a ball bearing onto it from a height of, say 2m, and record how high it bounces back. The more resistant the rock, the higher the rebound.

Underlying principles:

- Many basic textbooks claim (wrongly) that sediments become hard rocks simply by compacting them.
- This normally applies only to fine grained sediments, such as clays, where electrostatic attraction helps to hold the particles together.
- With sands and coarser grained sediments, some sort of natural 'cement' is needed to bind the particles together.

- The chemicals to form such a 'cement' come from groundwater, which is present in most sediments.
- In practice, the cementing agent is usually either silica (SiO_2), calcium carbonate (CaCO_3) or various compounds of iron.
- Most naturally occurring rocks are more strongly cemented than those which can be made in a school classroom.

Thinking skill development:

A pattern is established that the tougher the cement is, then the tougher will be the rock. Relating the findings from artificial cements in the classroom to real sedimentary rocks is a bridging concept.

Resource list:

- sand
- expendable small plastic cups or pots
- if available – old 20ml syringes with the nozzle end cut off with a hacksaw
- water
- a range of "cements", e.g. salt, sugar, plaster of Paris. **Note: Care should be taken in using plaster of Paris, since it gives out heat as it sets; only tiny quantities are needed. Builders' cement powder is alkaline and should not be used.**
- stirring sticks
- scissors, for cutting up the plastic cups
- large ball bearing, or similar item, for testing the strength of the "rocks" by dropping on to them

Useful links: Compaction and cementation of sediments and other activities, in 'The Dynamic Rock Cycle', on the Earth Science Education Unit website: [http://www.earthscienceeducation.com/The_making_of_sedimentary_rocks - http://education.usgs.gov/schoolyard/RockSedimentary.html](http://www.earthscienceeducation.com/The_making_of_sedimentary_rocks_-_http://education.usgs.gov/schoolyard/RockSedimentary.html)

Source: Earth Science Teachers' Association (1991) *Science of the Earth 11 – 14 Secondhand rocks – introducing sedimentary processes* Sheffield: Geo Supplies Ltd.

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