

The Rock Cycle – Teacher Notes

Three Main Types of Rocks

Rocks on Earth are constantly being recycled. Rocks at the surface are broken down into tiny pieces, washed or blown to another location, buried by newer bits of former rocks, and then turned into new kinds of rocks by a variety of processes.

What are the three main types of rocks and how are they formed?

Types of rocks	How they form
Igneous	crystallising from molten rock (magma or lava)
Sedimentary	compaction and cementation of sediments
Metamorphic	recrystallising an existing rock due to heat and pressure

Weathering

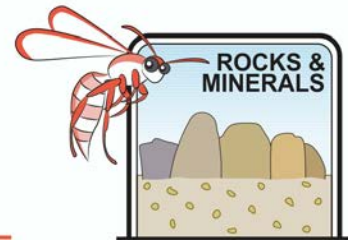
Weathering is the process by which rocks are broken to form sediments (smaller pieces of rocks) or otherwise altered. Weathering occurs by physical processes (such as water washing away bits of rock), chemical processes (such as iron minerals in a rock rusting by oxidation), or biological processes (such as plants or animals affecting the rocks).

Read through the following examples of weathering. Then choose the correct category for each example – is it an example of physical, or chemical or biological weathering?

Example	Physical, chemical or biological weathering?
Skateboard riders damaging a rock outcrop.	biological
The outside of a rock changing from dark grey to a rusty red colour after it has been exposed to the atmosphere.	chemical (oxidation/rusting)
Crushing a rock with a hammer.	biological – a person wielded the hammer
A dark rock cracking after a hot day is rapidly followed by a very cold night.	physical (expansion and contraction due to heat)
A glacier freezing onto the side of a valley and plucking off a piece of rock.	physical (freeze/thaw)
Exhaust fumes from cars causing acid rain which damages marble statues.	chemical
Tree roots breaking off lumps of rock from a cliff.	biological
Crumbling of marble rocks alongside a major roadway because of car exhaust dissolved in rain.	chemical
A waterfall constantly running over a rock ledge.	physical

Describe TWO ways water can break rock into smaller pieces.

Water is unusual because, when it freezes, its molecules rearrange and take up more room: in other words, the volume of frozen water increases. Liquid water can enter cracks and on freezing expand to break rock. Rocks carried in moving water such as rivers or the ocean can bash against each other and break into sediments.






The Rock Cycle – Teacher Notes

Erosion

Erosion is the removal and transport of sediment. Erosion causes sediments to move away from the parent rock, to eventually end up somewhere new. The 'agents' of erosion are the different forces that remove and transport sediment, and these forces can be physical, chemical, or biological.

In each picture below, what agent(s) of erosion are wearing (or have worn) away the rocks?

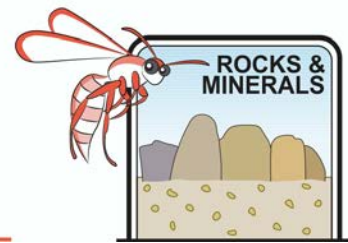
Picture	Agents of erosion
	<p>Biological agents (carved by humans)</p>
	<p>Physical agents (water in the river)</p>
	<p>Physical agents (wind and water) Chemical agents (salt) Biological agents (humans)</p>

What are the two main agents of erosion in nature?

Wind and water.

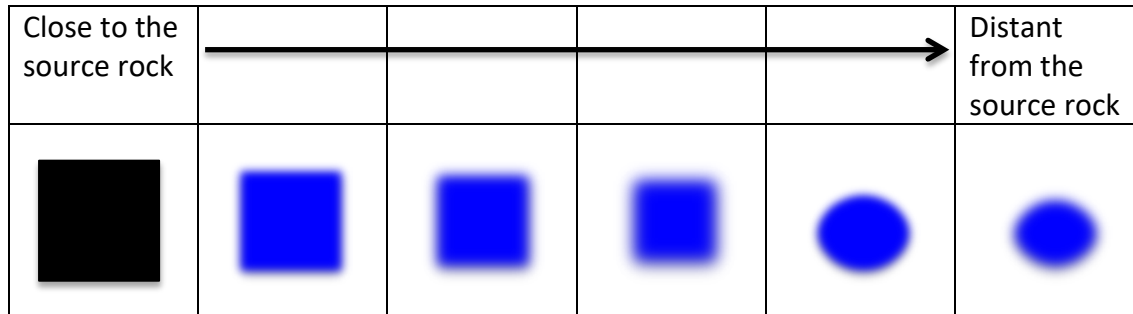
How can something as gentle as the wind erode rock?

Dust carried in the wind scrapes off and carries away pieces of rock.



The Rock Cycle – Teacher Notes

Let's say a cube of rock is removed from its source rock. Draw what changes would happen to the cubic piece of rock as it is carried away along the course of a river. What would the rock look like?



The piece of rock will become both smaller and rounder.

Deposition

Erosive agents (particularly wind and water) tend to deposit sediments based on their size; larger sediments are found closer to their source rock, whilst smaller sediments are more easily transported farther away. This is because it takes more energy to carry a big piece than a small piece. Imagine you had to carry a piece of rock until you got tired: if the rock weighed 10 kilos, you might get tired very quickly and drop it, but if the rock weighed 10 grams, you might be able to carry it very far.

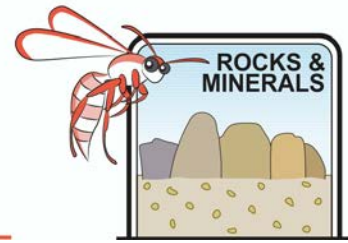
This is also the reason that deposited sediments tend to be 'sorted' (i.e. all of a similar size) depending on the distance from the source rock: the longer the transported distance, the more sorted by size the rock pieces become.

At which location along a riverbed would you expect to find a deposit of all clast sizes ranging from small to large?

	Why or why not?
Half way along the river system.	No. Most of the large clasts would already have dropped out.
On the river flats.	No. By the time the riverbed has flattened out the river could only carry finer sediments such as silt and mud.
Close to the source rock.	Yes. The clasts would not have had a chance to be sorted.
After the river meets the sea.	No. Meeting the sea slows the river flow dramatically. It can only carry and deposit very fine sediment.

A river is flowing well after heavy rain. It is carrying a mixture of sediment sizes. What will happen if there is a dry spell and the river flow slows down?

As the river loses its carrying power it will drop the largest and heaviest rocks first and then increasingly finer and finer sediments afterwards. The sediment deposited will decrease in grain size upwards. This is called graded bedding.



The Rock Cycle – Teacher Notes

Lithification - Changing sediments into sedimentary rock

The word 'lithification' comes from the ancient Greek word 'lithos' which means rock; the term basically means 'to turn into a rock'. There are two important processes by which sediments (loose bits of clasts, sand, dirt, etc.) can be lithified: compaction or cementation.

Describe how compaction forms sedimentary rocks.

Once sediments are buried deeply, the weight of overlying sediment 'squishes' the sediments together tightly.

Describe how cementation forms sedimentary rocks.

New minerals (e.g. calcite, iron oxides, clay minerals, silicas, etc.) form in the pore spaces between sediment grains, effectively 'gluing' the pieces together.

Sedimentary rocks deep in the Earth's crust can be subjected to intense heat and pressure, which can make the minerals in the rock recrystallise. What is the name of this process?

Metamorphism

Very, very deep in the Earth's crust, rocks can be subjected to such high temperatures that they actually melt. When they cool down, the minerals crystallise. **What kinds of rocks are produced by this process?**

Igneous rocks.

The Rock Cycle

Now that you've explored all the steps involved in the rock cycle, draw a diagram of the rock cycle showing the three main types of rocks and all the processes.

