Suitable for UK KS3 students or ages 11-14

Carbonate conundrum

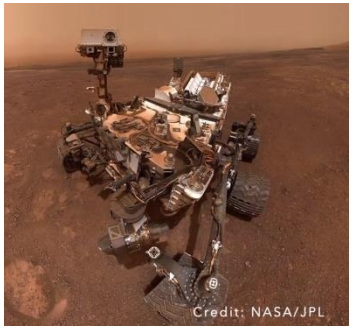
Student worksheet

Studying Mars

Scientists in laboratories all around the world are very interested in finding out more about our nearest planetary neighbour - Mars.

One of these scientists is Lucy, who works in The University of Oxford's Department of Earth Sciences. She is a chemist who is studying what went on in lakes on the surface of Mars billions of years ago.

Mars today is a cold, dry planet but we have evidence from images and samples of rocks collected by Mars rovers that Mars' surface was once covered in rivers and lakes. This is especially exciting because it means that perhaps Mars was once home to early life.



Mars' early atmosphere

Lucy is trying to work out how Mars was once warm enough to have lakes on its surface. One idea she is testing is that Mars' atmosphere was once much thicker than it is today and high in carbon dioxide. As carbon dioxide is a greenhouse gas, this would have acted like a blanket, keeping Mars warm enough for liquid water.

Mars has recently been explored by rovers including Curiosity and Spirit. NASA's Mars Exploration Rover, Spirit, explored Gusev crater, which was once a massive lake.

Spirit detected rocks that were high in metal carbonates, such as iron carbonate ($FeCO_3$). These carbonates probably came from a reaction between the water in the lake and the surrounding rocks. To form carbonates, the water had to be high in carbonic acid, which is formed when carbon dioxide from the atmosphere dissolves in water.

This means that the presence of carbonate-rich rocks on Mars could be evidence that Mars once had a thick atmosphere rich in carbon dioxide.

Your task

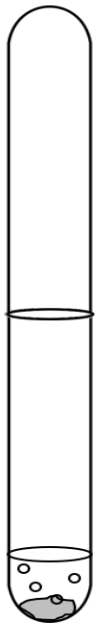
Work out a way of detecting if a rock collected from Mars contains carbonates.

You will:

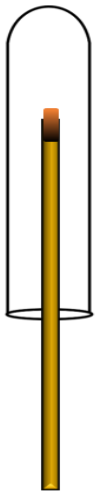
- Design a test that shows a substance is a carbonate.
- Write how the test can be used to show that a rock contains carbonates.

Gas tests

Test for oxygen



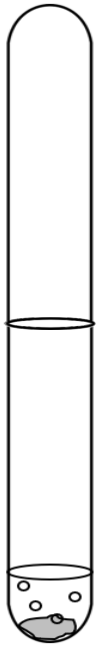
1. Collect the gas



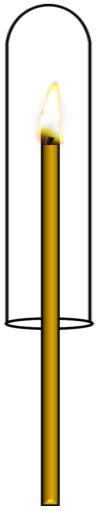
2. Add a glowing splint

If the gas is oxygen…

Test for hydrogen



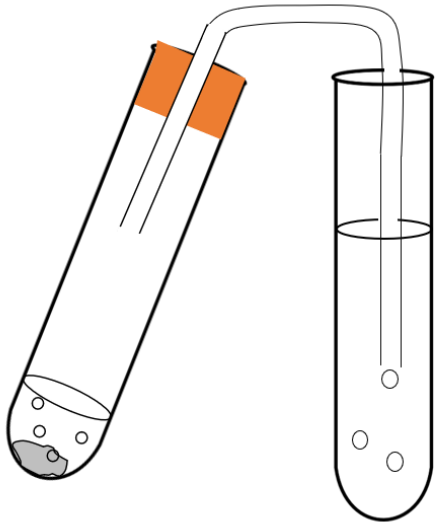
1. Collect the gas



2. Add a lighted splint

If the gas is hydrogen…

Test for carbon dioxide



Bubble the gas through limewater

If the gas is carbon dioxide…