Suitable for UK KS4 students or ages 14-16

Mars Rocks!

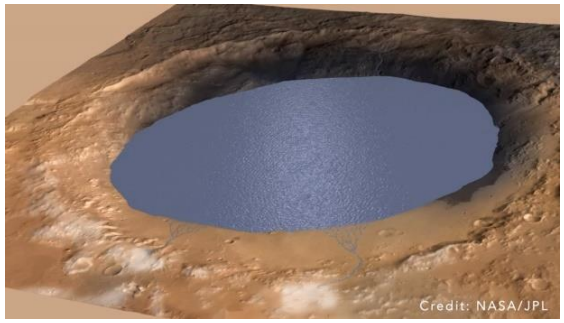
Student worksheet

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.

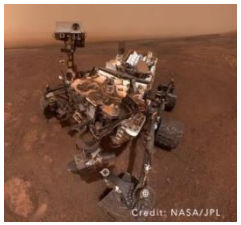
Mars today is a cold, dry planet but we have evidence that Mars' surface was once covered in rivers and lakes. This is especially exciting because it means that perhaps Mars was once home to early life.



Mars' early atmosphere

Lucy is trying to work out how Mars was once warm enough to have liquid water 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.

The carbon dioxide in the atmosphere would have dissolved in lake water creating an acid called carbonic acid. This might then have reacted with compounds, like iron oxide, in the surrounding rocks to create new compounds.



NASA's Mars Exploration Rovers like Curiosity (see picture) and Spirit have collected and tested rock samples on Mars to see what compounds they contain.

Also, meteorites from Mars have reached Earth allowing scientists to analyse rocks that were once on Mars. These rocks hold clues that can help us understand if Mars' atmosphere was carbon-dioxide rich in the distant past.

Your task

Work out what kinds of compound scientists should be looking for in Mars rocks to support the theory that Mars' atmosphere was once high in carbon dioxide.You should:

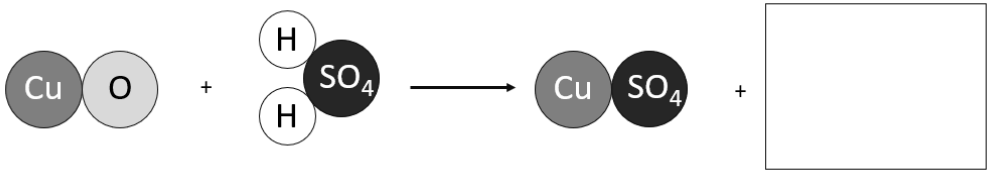
- Explore what happens when metal oxides react with acids
- Use the sheets 'writing equations' and 'ion cards' to help you work out what compounds scientists should look for.

Mars Rocks!

Writing equations

1. You made blue copper(II) sulfate crystals. Copper(II) sulfate is a salt. What was the other product?

Remember, in a chemical reaction the particles in the reactants are rearranged to form the products. So, you can work out the missing product by rearranging the particles – what is left over?



2. Write the word and symbol equation for the reaction.

3. Write word and symbol equations for these reactions. Cut out and use the ion cards to help you work out the formula of the oxides and salts formed. Make sure the equations are balanced – the number of atoms on each side has to be the same.

a) calcium oxide + sulfuric acid (H_2SO_4)

b) zinc(II) oxide (ZnO) + hydrochloric acid (HCl)

c) sodium oxide + nitric acid (HNO_3)

d) aluminium oxide + phosphoric acid (H_3PO_4)

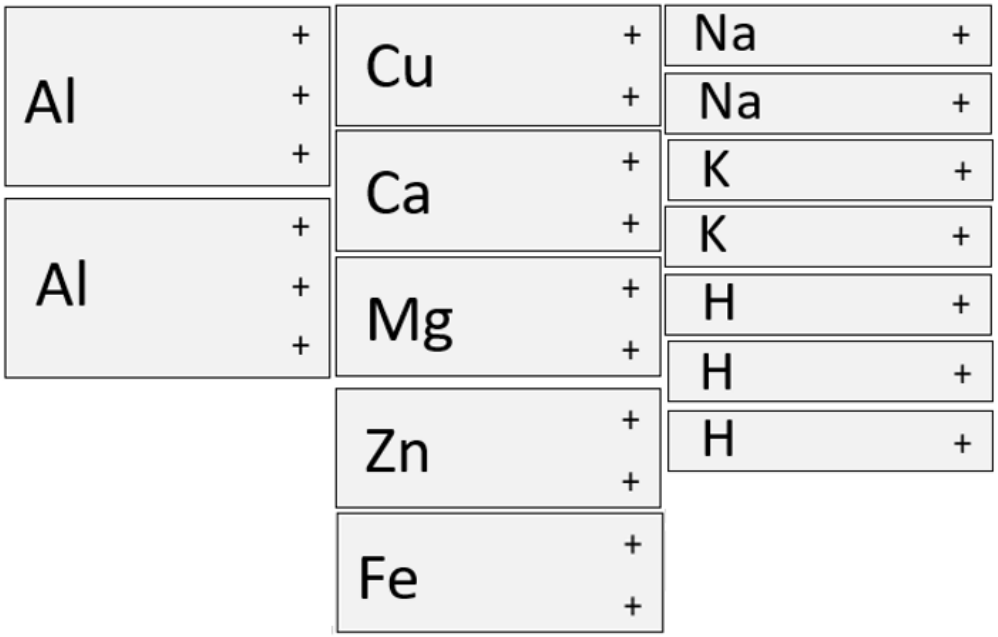
e) magnesium oxide + nitric acid

f) iron(II) oxide (FeO) + hydrochloric acid

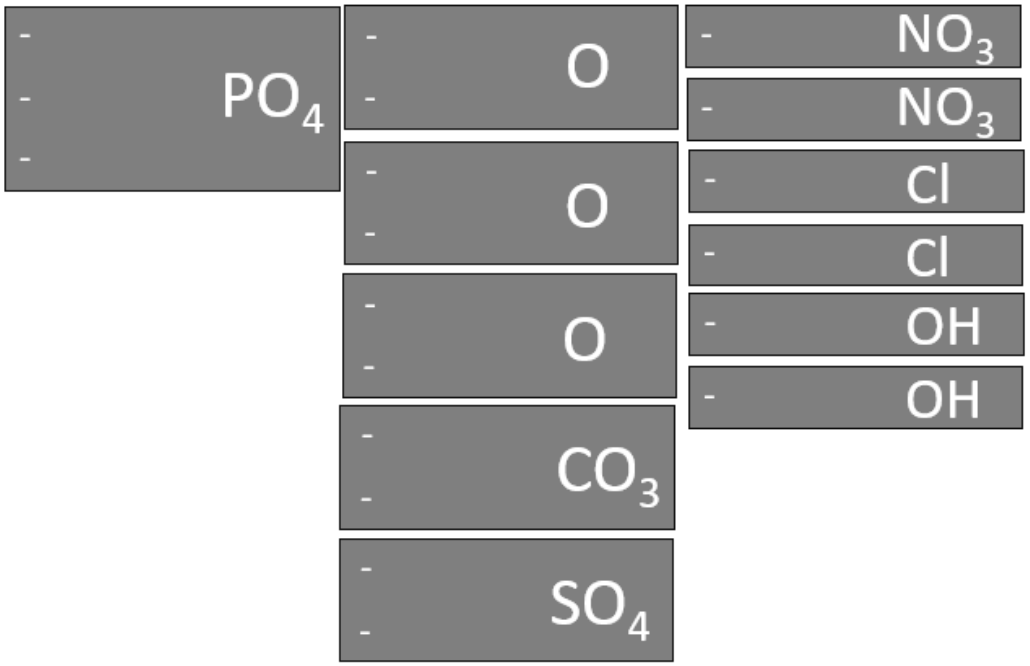
4. One reaction that scientists think happened in lakes in Mars billions of years ago was between iron(II) oxide and carbonic acid (H_2CO_3). Write the word and symbol equation for this reaction. Explain what compound scientists should be looking for as evidence that this reaction happened.

Ion cards

Metal ions



Non-metal ions



Names of ions:

PO_4^{3-} = phosphate O^{2-} = oxide CO_3^{2-} = carbonate

SO_4^{2-} = sulfate NO_3^- = nitrate Cl^- = chloride

OH^- = hydroxide