




### Components

	NAME	DESCRIPTION	AUDIENCE
	<i>Acid soils and redox</i> teachers guide	This guide explains how a learning object and accompanying worksheet can be used to explain how redox processes cause some soils to become acidic.	teachers
	<i>Redox explorer</i> learning object	A learning object demonstrates how a series of redox reactions, involving sulfides and iron, produces acidic soils.	students
	<i>Redox processes</i> worksheet	This worksheet accompanies the learning object, <i>Redox explorer</i> . Students use the learning object to answer questions about redox processes.	students

### Purpose

To **Explain** how acid soils are formed so students can develop their understanding of oxidation and reduction processes.

### Outcomes

Students:

- explain how redox reactions can lead to the formation of sulfide rich sediments;
- explain how redox reactions cause some soils to become acidic; and
- assign oxidation numbers, and write balanced redox equations, using half equations.

### Activity summary

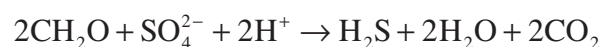
ACTIVITY	POSSIBLE STRATEGY
Students use the learning object, <i>Redox explorer</i> , to complete the worksheet, <i>Redox processes</i> .	Pairs or individuals work through learning object. Students complete the worksheet individually.
Class discussion of answers and points of interest.	whole class

### Teacher notes

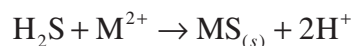
#### Explanation of oxidation in waterlogged soil

Question 7e on the worksheet asks about reactions that take place in waterlogged soil. The learning object shows two reduction reactions taking place, but the oxidation half reaction is not shown as this chemistry is complex. Carbon is oxidised from organic matter, represented by  $\text{CH}_2\text{O}$  (oxidation number 0), to form carbon dioxide (oxidation number +4).

Anaerobic, sulfur-reducing bacteria use sulfate in respiration processes, instead of oxygen, to oxidise carbon in organic matter.



Hydrogen sulfide then converts metal ions to metal sulfide deposits.



Pyrite, however, has a complex structure in which the two sulfur ions act as a  $\text{S}_2^{2-}$  group and not as separate  $\text{S}^{2-}$  ions in each  $\text{Fe}^{2+}\text{S}_2^{2-}$  formula unit of pyrite. The worksheet that accompanies the learning object focusses upon reactions which do not involve this group, but involve the  $\text{S}^{2-}$  ion.

#### Further practice

Further practice in determining oxidation numbers can be gained by students completing Set 24 – Oxidation Number in STAWA Exploring Chemistry Stage 2, page 174.

## Technical requirements

The teachers guide and worksheet require Adobe Reader (version 5 or later), which is a free download from [www.adobe.com](http://www.adobe.com).

The learning object requires Adobe Flash Player version 8 or later (this is a free download from [www.adobe.com](http://www.adobe.com)). It can be placed on a web or file-server and run either locally or remotely in a web browser.

## Acknowledgements

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## Associated SPICE resources

*Redox reactions 3: Acid soils and redox* may be used in conjunction with related SPICE resources to address the broader topic of redox.

DESCRIPTION	LEARNING PURPOSE
<i>Redox reactions (overview)</i> This learning pathway shows how a number of SPICE resources can be combined to teach the topic of redox reactions.	
<i>Redox reactions 1: Acid soils</i> A video shows scientists studying acid sulfate soils in two different environments and raises student awareness of the broader problem.	Engage
<i>Redox reactions 2: Sulfide chemistry</i> Students explore the chemistry of sulfides through laboratory-based activities.	Explore
<i>Redox reactions 3: Acid soils and redox</i> An interactive learning object explains the chemistry of redox processes that lead to the formation of acid sulfate soils.	Explain
<i>Redox reactions 4: Bioremediation</i> Students investigate how acid sulfate soil problems can be dealt with through a practical activity and a case study.	Elaborate