



## Redox reactions 1 Acid soils

### Components

	NAME	DESCRIPTION	AUDIENCE
	<i>Acid soils</i> teachers guide	This guide describes how the video <i>Acid underground</i> can be used to engage students in the topic of redox reactions in the context of acid soils.	teachers
	<i>Acid underground</i> video	This video shows two researchers investigating acid soil in Perth and Mandurah. On-site testing of soil pH and remediation are featured.	teachers and students

### Purpose

To arouse interest in the problem of acid soils and the impact such soils have on the community, as well as elicit students' prior knowledge of oxidation and reduction chemistry.

### Outcomes

Students:

- appreciate human impact on the environment;
- understand that acidic soils are the result of chemical processes, such as oxidation and reduction and acid-base equilibria;
- understand that acidic soils impact on flora and fauna; and
- appreciate that scientific research can lead to alternative ways to solve problems.

### Activity summary

ACTIVITY	POSSIBLE STRATEGY
Teacher introduces the video, <i>Acid underground</i> , which features University of Western Australia researchers, Talitha Santini and Bree Morgan. They explain the problem of acidity in soil caused by soil disturbance due to urban development.	Teacher provides a KWL chart to encourage students to show what they <b>Know</b> , state what they <b>Want</b> to find out and reflect on what they <b>Learned</b> later in the sequence.

### Acknowledgements

Thanks to PhD students Talitha Santini and Bree Morgan (School of Earth and Environment, The University of Western Australia) and Associate Professor Andrew Rate (School of Earth and Environment, The University of Western Australia).

Designed and developed by the Centre for Learning Technology, The University of Western Australia. Production team: Bob Fitzpatrick, Helen Billiald, Alwyn Evans, Sally Harban, Dan Hutton, Paul Ricketts, Gary Thomas and Michael Wheatley, with thanks to Pauline Charman, Jenny Gull, Wendy Sanderson and Charmaine White.

### Technical requirements

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

QuickTime version 7 or later is required to view the video. This is a free download from [www.apple.com/quicktime](http://www.apple.com/quicktime). A high quality MP4 version is available on CD-ROM or download from the SPICE website.

The video contains closed captions.

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## Teacher notes

Presenters in the video mention several sulfide species, including iron monosulfide (FeS) and pyrite (FeS<sub>2</sub>). Both species contribute to the formation of monosulfidic sediment (also known as monosulfidic black ooze or MBO).

Some solutions and current management options to deal with acid sulfate soils are discussed in *Redox reactions 4: Bioremediation*.

The following questions may form the basis of class discussion after viewing the video.

QUESTION	SUGGESTED RESPONSE
Why is hydrogen peroxide used to demonstrate formation of acid in the lake?	Hydrogen peroxide reacts with water to produce large quantities of oxygen that hasten the formation of acidic species.
How does disturbing iron sulfides, such as pyrite, cause the formation of acid?	Iron sulfides are exposed to oxygen in the air when disturbed. The reaction between oxygen and sulfides produces acid.
How could local building works cause soils to become acidic?	Building works could disturb pyrite trapped underground. On exposure to air, pyrite produces acid that is retained in the topsoil.
Suggest why acid soils have been identified as such a serious problem in Mandurah compared to other coastal areas south of Perth.	Compared to other coastal sites south of Perth, Mandurah is a rapidly expanding region. It is likely that more iron sulfides will be exposed and hence more likelihood of acid soils being formed, compared to less developed sites.
How can increasing the depth of bore holes in the Stirling district reduce the incidence of bore water killing plant life?	By tapping into water that lies below acidic groundwater reserves, water that is not acidic can be brought to the surface to water gardens.
Iron sulfides are mentioned in the video. Write formulae for three common iron sulfides.	FeS <sub>2</sub> (pyrite); FeS (pyrrhotite); Fe <sub>3</sub> S <sub>4</sub> (greigite)
What might be done to reduce lake acidity, in the short term.	Acidity may be reduced by adding limestone, or a similar compound, to neutralise the acid.

## Associated SPICE resources

*Redox reactions 1: Acid soils* 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.	<b>Engage</b>
<i>Redox reactions 2: Sulfide chemistry</i> Students explore the chemistry of sulfides through laboratory-based activities.	<b>Explore</b>
<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.	<b>Explain</b>
<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.	<b>Elaborate</b>