

**AS91167 Demonstrate understanding of oxidation-reduction
Level 2, 3 Credits (Internal)**

This achievement standard involves demonstrating understanding of oxidation-reduction.

Achievement	Achievement with Merit	Achievement with Excellence
Demonstrate understanding of oxidation-reduction.	Demonstrate in-depth understanding of oxidation-reduction.	Demonstrate comprehensive understanding of oxidation-reduction.

Definitions

Oxidation is the loss of electrons. Reduction is the gain of electrons.

Oxidation is an increase in oxidation number. Reduction is a decrease in oxidation number.



Balancing Redox Half Equations

Work out the formula of the species before and after the change

Balance the atoms that are not H or O

Balance the O's by adding water molecule(s) to the appropriate side

Balance the H's by adding H⁺ ion(s) to the appropriate side

Balance the charge by adding e⁻(s) to the "more positive" side of the equation

To combine two Redox Half Equations

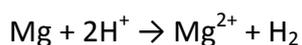
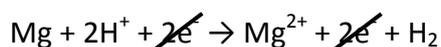
Write out the two half equations

Multiply either/both equations so that the electrons in each half equation balance

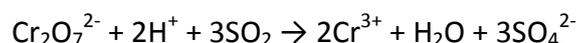
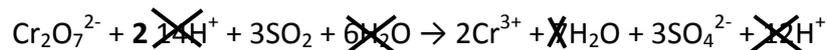
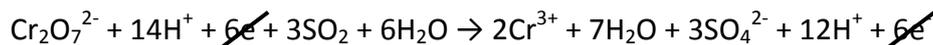
Add the two equations together and cancel out the electrons

Cancel out anything else that appears on both sides of the equation (usually H⁺ ions or H₂O molecules)

Example 1: When silvery grey magnesium metal is added to a colourless solution of hydrochloric acid, bubbles of colourless gas are observed and the magnesium disappears after a few minutes, producing a colourless solution.



Example 2: Colourless sulfur dioxide gas is bubbled into acidified, dichromate solution, $\text{Cr}_2\text{O}_7^{2-}$. A colour change from orange to green is observed. The orange $\text{Cr}_2\text{O}_7^{2-}$ ions are reduced to the green chromium (III) ions, Cr^{3+} . Colourless sulfate ions, SO_4^{2-} , are also formed in solution.



The oxidant is the dichromate solution, $\text{Cr}_2\text{O}_7^{2-}$, and it is reduced to Cr^{3+} .

SO_2 is the reducing agent. In the lab it is often more convenient to use a colourless solution of hydrogen sulfite, HSO_3^-



Rules for assigning oxidation numbers/states

The oxidation number of an element is zero, 0

In molecules the sum of the oxidation numbers adds up to zero

In polyatomic ions, the sum of the oxidation numbers adds up to the charge on the ion

In simple monatomic ions the oxidation number is the same as the charge on the ion

H in compounds is always +1 except in metal hydrides e.g. NaH where it is -1

O in compounds is always -2 except in peroxides e.g. H_2O_2 where it is -1

F in compounds is always -1



RED OX