



The reactivity series, including carbon

The reactivity series lists metals in order of how readily they react, with two non-metals, carbon and hydrogen, added as reference points. A more reactive metal can displace a less reactive metal from a compound, and carbon can reduce the oxides of the metals below it: that is how iron is obtained from its ore.

The reactivity series



Worked example

Iron oxide is heated with carbon. Explain what happens and why.

Carbon is above iron in the reactivity series, so carbon can take the oxygen from the iron oxide. The iron oxide is reduced, because it loses oxygen.

A simplified word equation: iron oxide + carbon → iron + carbon dioxide. This is a simplified example of reduction by carbon, not the whole story of a blast furnace.

The common mistake

"Carbon must be a metal, because it is in the reactivity series."

Carbon is a non-metal. It is in the series as a reference point because it can reduce the oxides of the metals below it (zinc, iron, copper), which is how those metals are extracted. It cannot reduce the oxides of metals above it, such as aluminium, which need electrolysis.

Test yourself

- ☐ 1 Which is the most reactive metal in the series?
- ☐ 2 Can carbon be used to extract aluminium from aluminium oxide?
- ☐ 3 What happens to a metal oxide when it is reduced?

GCSE extension

One key blast-furnace reaction: $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$
Carbon monoxide removes the oxygen from iron(III) oxide.

Next topic

Types of chemical reactions

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Answers: 1. Potassium. 2. No: aluminium is above carbon, so aluminium is extracted by electrolysis. 3. It loses its oxygen.