Extraction of iron on a match head

Learning objectives

1 Safely investigate heating iron oxide on a match head to reduce iron.

2 Explain why metals need to be extracted from their ores.

3 Explain the process of extracting metals using reduction with carbon.

4 Identify which species are oxidised and which are reduced.

Introduction

In this experiment, you will reduce iron(III) oxide with carbon on a match head to produce iron.

Equipment

Apparatus

- Safety glasses
- Match (non-safety)
- Tongs (crucible tongs)
- Weighing boat (small white plastic ones are ideal)
- Spatula
- Bunsen burner
- Heat resistant mat
- Magnet (e.g. bar magnet)

Chemicals

Small amounts of the following:



- Iron(III) oxide powder
- Sodium carbonate powder (IRRITANT)
- Water

Health and safety

Wear safety glasses throughout.

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Method

1. Dip the head of a match in water to moisten it.
2. Roll the damp match head first in sodium carbonate powder, then in iron(III) oxide powder.
3. Hold the match in a pair of tongs. Put the head of the match into a blue Bunsen flame (air-hole open). The match will flare and burn. Do not allow the match to burn more than halfway along its length.
4. Allow the match to cool for about 30 seconds.
5. Use a spatula to crush the charred part of the match into a small plastic weighing boat.
6. Move a magnet around under the weighing boat - some of the small particles will move around in the weighing boat following the track of the magnet. Do not dip the magnet into the particles directly.

Follow-up questions

1. In this experiment, iron was produced by reacting the iron(III) oxide with carbon from the matchstick.

   (a) Write a word equation for the reaction you have carried out.

   _____ + _____ →_____ + _____

   (b) Write a balanced symbol equation for this reaction.

   _____ + _____ →_____ + _____

   (c) State and explain whether the iron in iron(III) oxide has been oxidised or reduced in this process. Write a redox half-equation to support your answer.

_____

_____

2. Explain why this method can be used to extract iron. Suggest a metal which could **not** be extracted in this way.

_____

_____

3. Lead is often extracted from its main ore, galena, which primarily contains lead sulfide, PbS.

   (a) Define the term ‘ore’.

_____

_____

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(b) The first stage of the process involves reacting lead sulfide with oxygen to produce lead oxide. Sulfur dioxide is also produced. Write a word equation for this process.

_____ + _____ →_____ + _____

(c) The lead oxide can then be reacted with carbon to produce lead.
Lead oxide is made up of Pb^{2+} and O^{2-} ions.
Write a balanced symbol equation for this reaction.

_____ + _____ →_____ + _____

(d) What does this tell you about lead's position in the reactivity series relative to carbon?

_____

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