

Extraction Oxidation Reduction

GCSE Chemistry · Written to the shared content for AQA, Edexcel and OCR

Name _____ Class _____ Date _____

1. Worked example

Explain why iron can be extracted by heating iron oxide with carbon but aluminium cannot. (2 marks)

Step 1 · Iron

Iron is less reactive than carbon, so carbon can remove the oxygen from iron oxide (reduce it).

Step 2 · Aluminium

Aluminium is more reactive than carbon, so carbon cannot reduce aluminium oxide; electrolysis is used instead.

Answer: Carbon reduces oxides of metals less reactive than itself

Check: Compare each metal's position with carbon.

2. Now try one with the steps

In the reaction $2\text{CuO} + \text{C} \rightarrow 2\text{Cu} + \text{CO}_2$, identify which substance is oxidised and which is reduced. (2 marks)

Step 1 · Reduced

Step 2 · Oxidised

Answer:

3. Practice

Show your working. The marks tell you how much is expected.

1. Explain why gold is found in the Earth metal itself. [1]

2. Define the term ore. [1]

3. Name the method used to extract metals that are less reactive than carbon from their oxides. [1]

4. Explain why aluminium is not extracted by heating its oxide with carbon. [1]
5. Define reduction in terms of oxygen. [1]
6. In $2\text{CuO} + \text{C} \rightarrow 2\text{Cu} + \text{CO}_2$, name the substance that is reduced. [1]
7. Calculate the percentage by mass of iron in iron(III) oxide, Fe_2O_3 . (Fe = 56, O = 16) [2]
8. An ore contains 2% copper by mass. Calculate the mass of copper, in kg, in 500 kg of ore. [1]
9. Zinc oxide is reduced by carbon: $\text{ZnO} + \text{C} \rightarrow \text{Zn} + \text{CO}$. Calculate the mass of zinc, in g, from 8.1 g of zinc oxide. (Zn = 65, O = 16) [3]
10. Calculate the mass of copper, in g, produced from 15.9 g of copper(II) oxide. $2\text{CuO} + \text{C} \rightarrow 2\text{Cu} + \text{CO}_2$ (Cu = 63.5, O = 16) [3]
11. Describe how bioleaching extracts copper. [2]
12. Give two reasons why phytomining and bioleaching are being developed. [2]
13. Explain why $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$ is a reduction. [1]

14. Write a balanced equation for the displacement of copper from copper(II) sulfate leachate by scrap iron. [1]

4. Before you hand it in

"Carbon is oxidised, so the reaction is oxidation."

In carbon reduction, the metal oxide is reduced and the carbon is oxidised: it is a redox reaction.

Using electrolysis for every metal

Electrolysis is used only for metals more reactive than carbon; carbon reduction is cheaper.

"Phytomining is fast."

Biological methods are slow but useful for low-grade ores.