

GCSE Combined Science: Trilogy

Worksheet: Using electrolysis to extract metals

TIME 15 min	TOTAL 16 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
-----------------------	--------------------------	------------------------------	-----------------------------------

Topics: Using electrolysis to extract metals

NAME	CLASS	DATE
-------------	--------------	-------------

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Aluminium is extracted by the electrolysis of molten aluminium oxide.

0 1 . 1

The aluminium oxide is mixed with another compound so that the electrolyte melts at a lower temperature.

Name this compound.

.....

.....

.....

.....

[1 mark]

0 1 . 2

State the main disadvantage of extracting a metal by electrolysis, compared with reduction using carbon.

.....

.....

[1 mark]

0 2

Aluminium is extracted from aluminium oxide by electrolysis.

0 2 . 1

Explain why aluminium is extracted by electrolysis and not by reduction with carbon.

.....

.....

[1 mark]

0 2 . 2

What is the positive electrode made from?

.....

.....

.....

[1 mark]

0 2 . 3

Name the product formed at the negative electrode.

.....

.....

.....

[1 mark]

0 2 . 4

Why is extracting metals by electrolysis expensive?

Tick (✓) **one** box.

Large amounts of energy are needed to melt the compound and to produce the electric current.

☐

The electrodes are made of a precious metal.

☐

The products are all gases.

☐

Aluminium oxide is very rare.

☐

[1 mark]

0 3

In industrial aluminium production, the electrolyte (molten aluminium oxide dissolved in cryolite) must be kept molten continuously, sometimes for years at a time.

0 3 . 1

Explain why the electrolyte must be kept molten throughout the process.

.....

.....

.....

.....

[2 marks]

0 3 . 2

Suggest one reason why it would be costly to let the electrolyte cool and solidify.

.....

.....

[1 mark]

0 4

Table 1 gives information about extracting three metals.

Table 1

Metal	Position relative to carbon	Typical extraction method
Iron	below carbon	reduction with carbon
Aluminium	above carbon	electrolysis of the molten oxide
Copper	below carbon	reduction with carbon

0 4 . 1

Using Table 1, explain why extracting iron is generally cheaper than extracting aluminium.

.....

.....

.....

.....

[2 marks]

0 5

In the manufacture of aluminium, the electrolyte is a molten mixture of aluminium oxide and cryolite.

0 5 . 1

Explain why a mixture of aluminium oxide and cryolite is used as the electrolyte, rather than aluminium oxide alone.

.....

.....

.....

.....

[2 marks]

0 5 . 2

Explain why the positive electrodes must be replaced regularly.

.....

.....

.....

.....

[2 marks]

0 5 . 3

Name the gas formed when the positive electrode wears away.

.....

.....

.....

.....

[1 mark]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Using electrolysis to extract metals · 16 marks

Question 1 (2 marks)

01.1 [1 mark]

Answer: cryolite

- cryolite (1)
-

01.2 [1 mark]

- electrolysis uses a very large amount of electrical energy, making it expensive (1)
-

Question 2 (4 marks)

02.1 [1 mark]

- aluminium is more reactive than carbon (1)
-

02.2 [1 mark]

Answer: carbon (graphite)

- carbon / graphite (1)
-

02.3 [1 mark]

Answer: aluminium

- aluminium (1)
-

02.4 [1 mark]

Correct: Large amounts of energy are needed to melt the compound and to produce the electric current.

Question 3 (3 marks)

03.1 [2 marks]

- ions must be free to move for electrolysis (conduction and discharge at the electrodes) to continue (1)
- if the electrolyte solidified, it would stop conducting and production would stop (1)

03.2 [1 mark]

- allow: a large amount of energy and time would be needed to re-melt the solidified electrolyte before production could restart (1)

Question 4 (2 marks)

04.1 [2 marks]

- iron is extracted by reduction with carbon, which needs much less energy (just heating) than electrolysis (1)
- aluminium must be extracted by electrolysis (because it is more reactive than carbon), which needs large amounts of electrical energy, making it far more expensive (1)

Question 5 (5 marks)

05.1 [2 marks]

- the mixture has a lower melting point than aluminium oxide (1)
- so less energy is needed (to melt it), which reduces costs (1)

Notes: Do not accept 'cryolite is a catalyst'.

05.2 [2 marks]

- oxygen is produced at the positive electrode (1)
- the oxygen reacts with the carbon electrode to form carbon dioxide, so the electrode wears away / burns away (1)

05.3 [1 mark]

Answer: carbon dioxide

- carbon dioxide (1)

Notes: Allow carbon monoxide.
