Extraction & Uses of Metals

Question Paper

Level	GCSE
Subject	Chemistry
Exam Board	Edexcel IGCSE
Module	Double Award (Paper 1C)
Topic	Chemistry in Industry
Sub-Topic	Extraction & Uses of Metals
Booklet	Question Paper

Time Allowed: **53 minutes**

Score: **/44**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	75%	70%	60%	55%	50%	<50%

1 Most metals are extracted in a blast furnace or by electrolysis.

(a) (i) The chemical equations for two reactions that occur during the extraction of aluminium are

A $Al^{3+} + 3e^- \rightarrow Al$

B $\underline{C} + O_2 \rightarrow CO_2$

For each of these reactions, complete the table to show whether the underlined species is being oxidised or reduced. In each case, explain your choice.

(3)

Reaction	Species oxidised or reduced	Explanation of choice
A		
B		

(ii) Reaction **A** takes place at the negative electrode during the extraction of aluminium.

Write an ionic half-equation for the reaction at the positive electrode.

(2)

.....

(iii) Reaction **B** gives a waste product during the extraction of aluminium.

What effect does this reaction have on the positive electrodes?

(1)

.....

.....

(iv) Reaction **B** is also important in the extraction of iron in a blast furnace.

Name the raw material that reacts with oxygen and state why the reaction is important.

(2)

Raw material .....

Importance of reaction .....

.....

(b) Galena (PbS) and cerussite ($PbCO_3$) are two ores of lead. A mining company is considering which of these two ores to use for the extraction of lead.

The equations for the reactions occurring are

Process using galena:

$$2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$$

$$2PbO + C \rightarrow 2Pb + CO_2$$

Process using cerussite:

$$PbCO_3 \rightarrow PbO + CO_2$$

$$2PbO + C \rightarrow 2Pb + CO_2$$

(i) Both processes form carbon dioxide, which the mining company hopes to sell.

Complete the table to show **two** uses of carbon dioxide and a property on which each use depends.

(4)

Use	Property

(ii) One disadvantage of using galena is that the sulfur dioxide produced can cause acid rain.

Write a chemical equation to show the formation of an acidic solution from sulfur dioxide and state one effect of acid rain.

(2)

Equation .....

Effect .....

.....

(c) The company uses a sample of cerussite containing 500 g of $PbCO_3$

Calculate the maximum mass of lead that can be obtained from this sample of cerussite.

(3)

Mass of lead = ... g

(Total for Question 1 = 17 marks)

2 A student was asked to compare the industrial processes used to extract aluminium and iron from their ores.

(a) (i) Name the main ore used as the source of iron.

(1)

.....

(ii) Aluminium is extracted from purified aluminium oxide.

What is the formula of aluminium oxide?

(1)

.....

(iii) One solid element is used in the extraction of both metals.

Identify this element and state its purpose in the extraction of aluminium.

(2)

Element .....

Purpose .....

.....

(iv) One gaseous element takes part in a reaction needed in the extraction of iron.

Identify this element and state its purpose in the extraction of iron.

(2)

Element .....

Purpose .....

.....

(b) The student wrote this statement:

The extractions of aluminium and iron both involve reduction and oxidation reactions.

(i) What name is given to a reaction that involves both reduction and oxidation?

(1)

.....

(ii) Why does this equation represent a reduction reaction?

$$Al^{3+} + 3e^- \rightarrow Al$$

(1)

.....

(iii) The equation for a reaction that occurs in some extractions of iron is

$$C + H_2O \rightarrow CO + H_2$$

Identify the substance oxidised in this reaction, giving a reason for your choice.

(2)

Substance oxidised .....

Reason .....

.....

(c) Both extractions occur at a high temperature.

Neither extraction uses a catalyst.

(i) What is meant by the term **catalyst**?

(2)

.....

.....

.....

.....

(ii) State one reason why cryolite is used in the extraction of aluminium.

(1)

.....

.....

(d) Several equations can be written for the reactions occurring in the extractions.

(i) Write the chemical equation for the reaction between iron(III) oxide (Fe_2O_3) and carbon monoxide (CO).

(2)

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(ii) This equation represents a reaction used to remove impurities in the extraction of iron.

$$CaO + SiO_2 \rightarrow CaSiO_3$$

State the type of reaction occurring in this equation.

(1)

.....

(iii) Complete the table by giving the common name for calcium silicate.

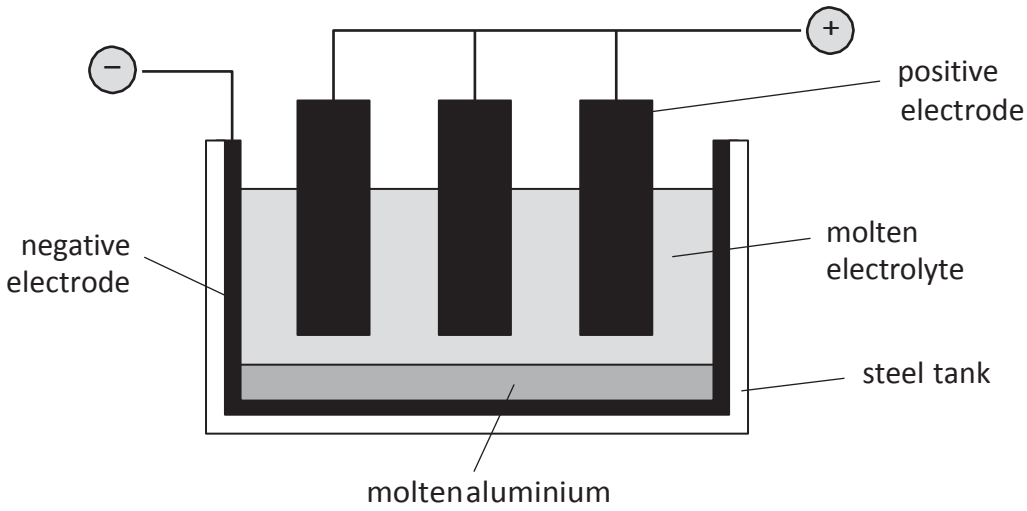
(1)

Formula of compound	Chemical name	Common name
CaO	calcium oxide	quicklime
$CaSiO_3$	calcium silicate	

(Total for Question 2 = 17 marks)

3 This question is about the extraction and uses of aluminium.

(a) Aluminium is extracted from aluminium oxide by electrolysis.



What are the electrodes made of?

(2)

Negative electrode .....

Positive electrode .....

(b) (i) Explain why the operating temperature would need to be very high if pure aluminium oxide were used as the electrolyte.

(1)

.....

.....

(ii) Describe how the operating temperature is kept low.

(1)

.....

.....

.....

.....

(c) The ionic half-equation for the reaction at the negative electrode is

$$Al^{3+} + 3e^- \rightarrow Al$$

What type of reaction is occurring at the negative electrode?

Explain your answer.

(2)

(d) The waste gases escaping from the electrolysis cell contain carbon dioxide.

Describe how the carbon dioxide is formed.

(2)

(e) Aluminium is used to make cans for food and drinks.

State two properties of aluminium that make it suitable for this use.

You should not refer to cost in your answers.

(2)

1

2

(Total for Question 3 = 10 marks)