AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.2.2.7

Properties of metals and alloys

Past-paper questions

Tier	**Higher**
Question groups	**4**
Available paper years	**2021–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

5.2.2.7 Properties of metals and alloys

Question 01

November 2021 | 8464/C/1H | Original Q4

0 4 Carbon can exist in a number of different structures.

0 4 . 1 The first fullerene to be discovered was Buckminsterfullerene.

What is the formula of Buckminsterfullerene?

[1 mark]

Tick (✓) **one** box.

- C_{40} ☐
- C_{50} ☐
- C_{60} ☐
- C_{70} ☐

0 4 . 2 Graphite is a form of carbon.

Explain why graphite conducts electricity.

[2 marks]

5.2.2.7 Properties of metals and alloys

Question 01 · continued

Steel is an alloy of iron and carbon.

0 4 . 3 Explain why steel is harder than iron.

[3 marks]

0 4 . 4 Iron is alloyed with carbon and other metals to make stainless steel.

A stainless steel fork contains 71.92% iron.

Table 2 shows the mass of each element in the fork.

Table 2

Element	Iron	Carbon	Chromium	Nickel
Mass of element in g	**X**	0.05	10.44	5.80

Calculate the mass of iron (**X**) in the fork.

[4 marks]

X = _____ g

10

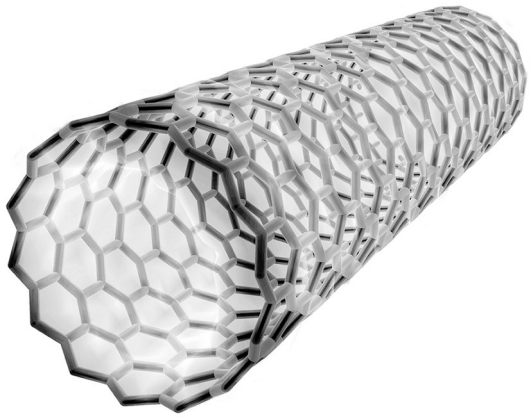
5.2.2.7 Properties of metals and alloys

Question 02

0 5 This question is about structure and bonding.

0 5 . 1 **Figure 5** represents part of a carbon molecule.

Figure 5



Name the type of carbon molecule in **Figure 5**.

[1 mark]

0 5 . 2 Suggest **one** property that makes the carbon molecule in **Figure 5** useful in nanotechnology.

[1 mark]

5.2.2.7 Properties of metals and alloys

Question 02 · continued

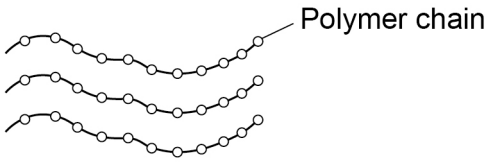
0 5 . 3 An alloy of aluminium contains small amounts of other metals.

Explain why other metals are added to aluminium.

[4 marks]

0 5 . 4 **Figure 6** represents part of the structure of a polymer.

Figure 6



Compare the bonding within the chains with the forces between the chains in this polymer.

[3 marks]

9

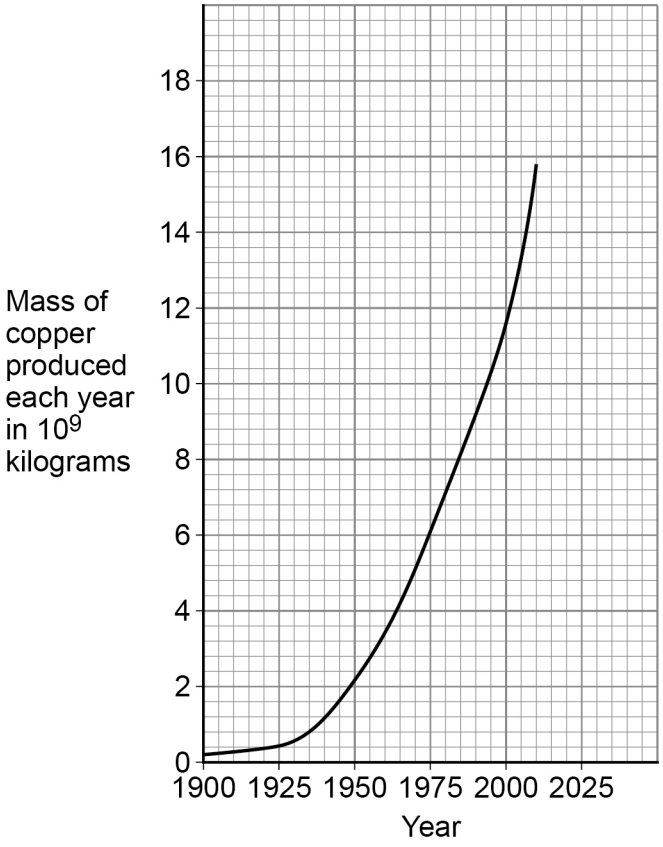
5.2.2.7 Properties of metals and alloys

Question 03

0 1 Copper is a useful metal.

0 1 . 1 **Figure 1** shows the mass of copper produced between 1900 and 2010.

Figure 1



Give **two** conclusions that can be made from **Figure 1**.

[2 marks]

1 _____

_____

2 _____

_____

Question 1 continues on the next page

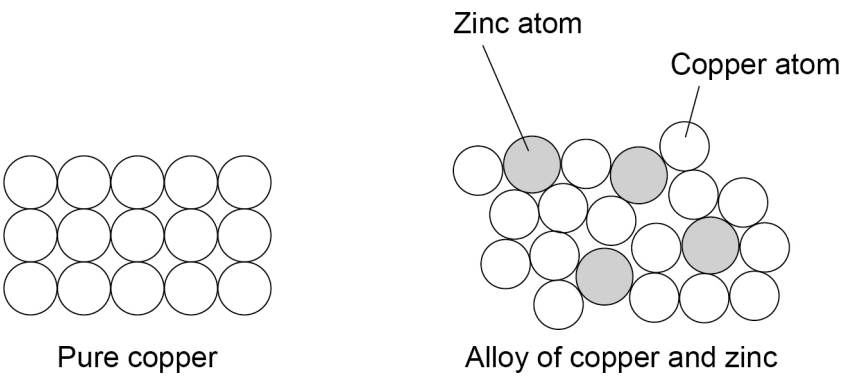
5.2.2.7 Properties of metals and alloys

Question 03 · continued

Mixtures of copper and zinc are heated to produce alloys.

0 1 . 2 **Figure 2** represents the structures of pure copper and of an alloy of copper and zinc.

Figure 2



Explain why the alloy of copper and zinc is harder than pure copper.

Use **Figure 2**.

[3 marks]

5.2.2.7 Properties of metals and alloys

Question 03 · continued

0 1 . 3 A 5.25 g sample of an alloy of copper and zinc contains 13.5% zinc by mass.

Calculate the mass of **copper** in the 5.25 g sample.

Give your answer to 3 significant figures.

[4 marks]

Mass of **copper** (3 significant figures) = _____ g

9

Turn over for the next question

5.2.2.7 Properties of metals and alloys

Question 04

0 4 This question is about metals.

0 4 . 1 Iron is extracted from iron oxide by reduction with carbon.

Why can iron be extracted by reduction with carbon?

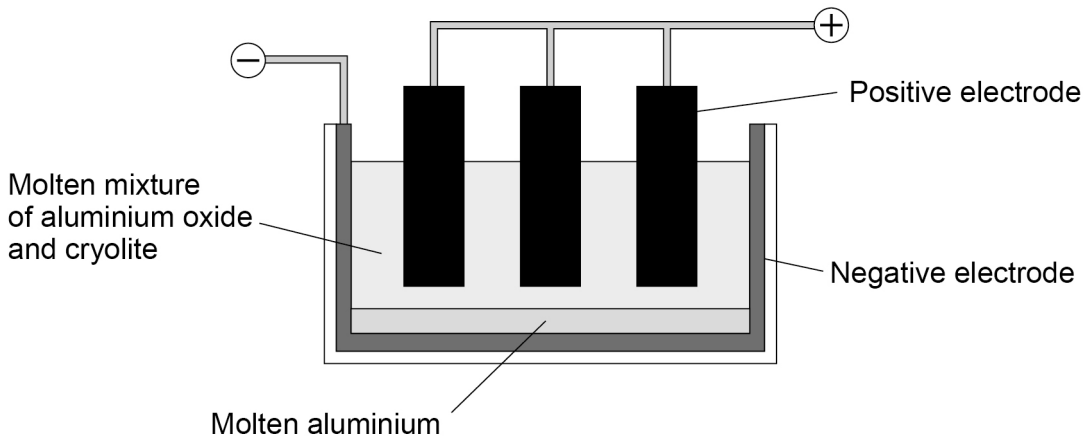
Answer in terms of reactivity.

[1 mark]

Aluminium is extracted by the electrolysis of aluminium oxide.

Figure 4 shows the apparatus used to extract aluminium.

Figure 4



5.2.2.7 Properties of metals and alloys

Question 04 · continued

0 4 . 2 Explain why a mixture of aluminium oxide and cryolite is used as the electrolyte instead of only aluminium oxide.

[2 marks]

0 4 . 3 Oxygen gas is produced at the positive electrode.

Write a balanced half equation for the production of oxygen at the positive electrode.

[2 marks]

_____ → _____ + _____

Question 4 continues on the next page

Question 04 · continued

Chromium is extracted by reacting chromium oxide with aluminium.

The equation for the reaction is:

$$Cr_2O_3 + 2\,Al \rightarrow Al_2O_3 + 2\,Cr$$

0 4 . 4 Which substance in the equation is reduced?

[1 mark]

Table 3 shows the relative cost of extracting equal masses of aluminium, chromium and iron.

Table 3

Metal	Relative cost of extraction
Aluminium	2
Chromium	20
Iron	1

0 4 . 5 Give **one** reason for the difference in the cost of extracting aluminium and **iron**.

Use **Table 3**.

[1 mark]

5.2.2.7 Properties of metals and alloys

Question 04 · continued

0 4 . 6 Give **one** reason for the difference in the cost of extracting aluminium and **chromium**.

Use **Table 3**.

[1 mark]

0 4 . 7 Metals are mixed together to form alloys.

Explain why alloys are harder than pure metals.

[3 marks]

11