AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.5.2.1

Cells and batteries

Past-paper questions

Tier	**Foundation**
Question groups	**9**
Available paper years	**2007–2025**

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.

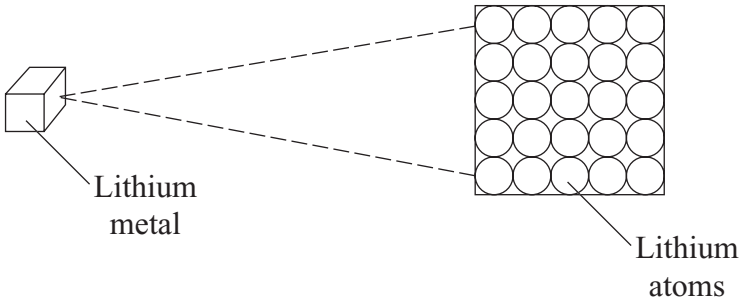
4.5.2.1 Cells and batteries

Question 01

January 2007 | CHY1F | Original Q1 | Legacy

1 Lithium metal is used in alkaline batteries.

(a) The diagram shows the atoms in lithium metal.



Why is lithium metal described as an element?

.....

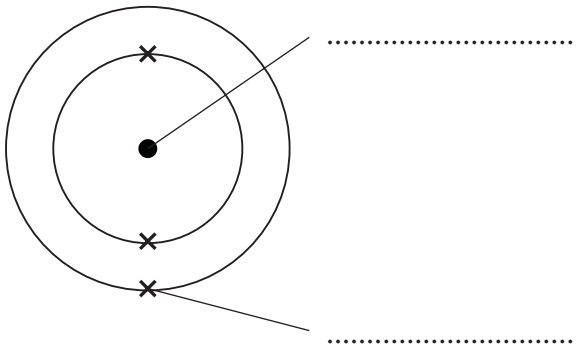
.....

(1 mark)

(b) The diagram below represents a lithium atom.

Choose words from the box to label parts of the atom.

bond	**electron**	**molecule**	**nucleus**



(2 marks)

3

4.5.2.1 Cells and batteries

Question 02

June 2009 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

Hybrid cars have both battery-powered motors and petrol engines. Hybrid cars have been developed so they have reduced carbon dioxide emissions when compared with petrol and diesel cars.

Some figures from manufacturers' tests are shown in the table.

Hybrid car	Price	Fuel economy in km per litre of petrol	Carbon dioxide emissions in g per km
K	£18 000	21.6	109
L	£20 000	23.1	104
M	£11 000	26.1	99
N	£16 000	27.1	94

6A The best way to obtain accurate figures for the amount of carbon dioxide emitted by the cars is to drive each car . . .

1 100 m.

2 1 km.

3 1 km five times, and take the highest value.

4 1 km five times, and take an average value.

6B For these cars, as the fuel economy in km per litre of petrol increases, . . .

1 the carbon dioxide emitted by the cars increases.

2 the carbon dioxide emitted by the cars decreases.

3 the cost of the cars increases.

4 the cars use more petrol per km.

4.5.2.1 Cells and batteries

Question 02 · continued

6C An independent motoring organisation tested the same cars. The values obtained for carbon dioxide emissions were a lot higher than those quoted by the manufacturers.

These values could be considered to be more reliable because the independent motoring organisation . . .

1 is **not** involved in selling cars.

2 is more concerned about environmental issues.

3 used equipment with a greater range.

4 is more likely to be biased.

6D One environmental advantage that a petrol hybrid car has over a conventional petrol car is that . . .

1 when the battery is working, no energy is being used.

2 the addition of a battery makes it lighter.

3 when only the battery is working, no carbon dioxide is being emitted.

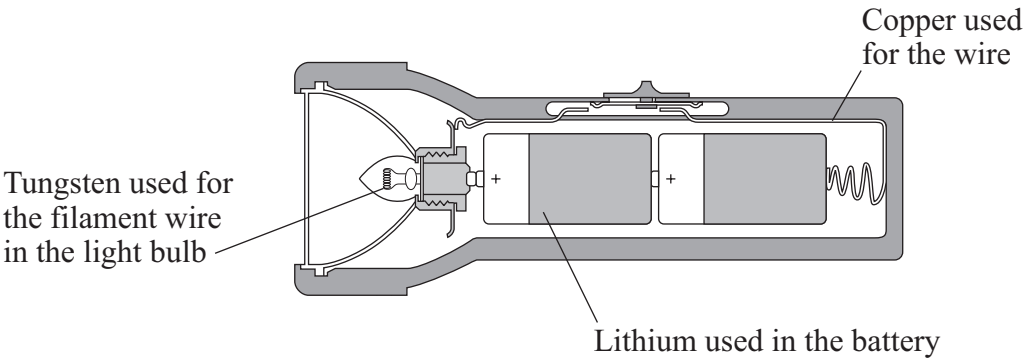
4 the car will produce more sulfur dioxide.

4.5.2.1 Cells and batteries

Question 03

June 2009 | CHY1F | Original Q1 | Legacy

1 The diagram shows a circuit that is used in a torch. Electrons flow through this circuit.

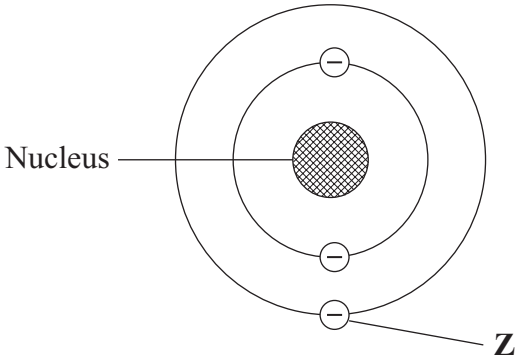


1 (a) Why is copper used for the wire?

.....

(1 mark)

1 (b) The diagram shows the structure of an atom of lithium.



Name the particle labelled **Z**.

.....

(1 mark)

4.5.2.1 Cells and batteries

Question 03 · continued

for mark

1 (c) The table shows some properties of the metals used in the electrical circuit.

Metal	Melting point in °C	Boiling point in °C	Reaction with oxygen
Copper	1083	2582	Reacts **slowly** to form a thin oxide layer on surface
Lithium	179	1317	Reacts **rapidly** to form oxide
Tungsten	3370	5930	Reacts **only** when very hot to form oxide

1 (c) (i) Use information from the table to suggest the order of reactivity for copper, lithium and tungsten.

most reactive .....

.....

least reactive .....

(2 marks)

1 (c) (ii) The filament wire glows because it gets very hot.

Use information from the table to suggest **one** reason why tungsten is used for the filament wire in the light bulb.

.....

.....

(1 mark)

1 (d) The gas used in the light bulb is argon.

Draw a ring around the correct word in the box to complete the sentence.

Argon is used in the light bulb because it is

dense.
solid.
unreactive.

(1 mark)

6

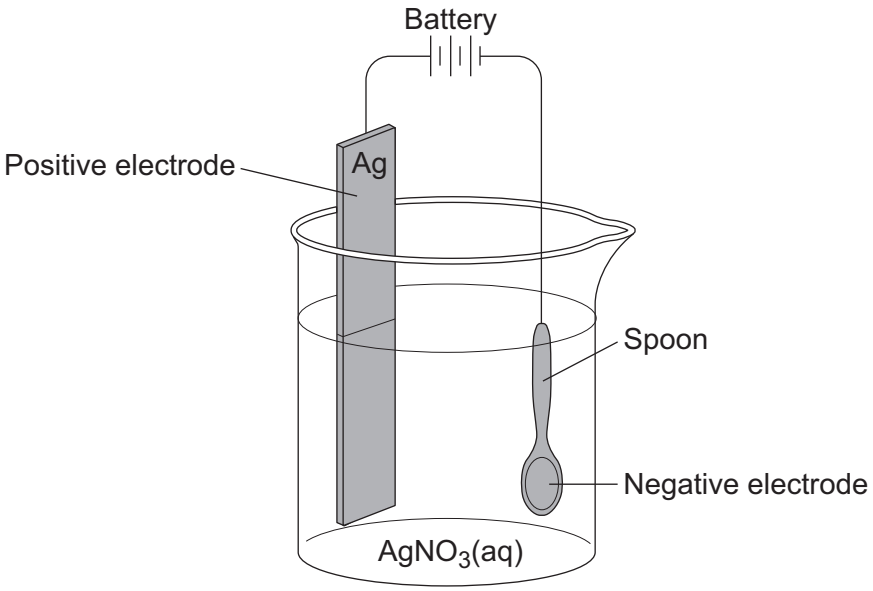
4.5.2.1 Cells and batteries

Question 04

June 2011 | CHY2F | Original Q4 | Legacy

4 Electroplating is used to coat a cheap metal with a thin layer of an expensive metal.

In the diagram a teaspoon made of nickel is being coated with silver.



Silver nitrate, $AgNO_3$, contains silver ions (Ag^+) and nitrate ions (NO_3^-).

4 (a) Solid silver nitrate, $AgNO_3(s)$, does **not** conduct electricity.

Choose the correct answer in the box to complete the sentence.

are too big	**cannot move**	**are too small**

Solid silver nitrate does **not** conduct electricity because the ions

.....

(1 mark)

4 (b) What substance is added to $AgNO_3(s)$ to turn it into $AgNO_3(aq)$?

Draw a ring around the correct answer.

petrol **alcohol** **water**

(1 mark)

4.5.2.1 Cells and batteries

Question 04 · continued

4 (c) Draw a ring around the correct answer to complete each sentence.

4 (c) (i) Silver ions move to the negative electrode because they have

no charge.

a negative charge.

a positive charge.

(1 mark)

4 (c) (ii) When silver ions reach the negative electrode they turn into silver

atoms.

compounds.

molecules.

(1 mark)

4

Turn over for the next question

4.5.2.1 Cells and batteries

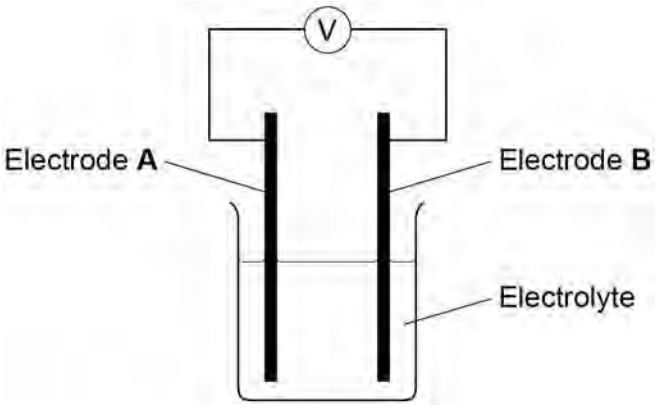
Question 05

June 2018 | 8462/1F | Original Q10

1 0 Chemical reactions can produce electricity.

1 0 . 1 **Figure 13** shows a simple cell.

Figure 13



Which of these combinations would **not** give a zero reading on the voltmeter in **Figure 13**?

[1 mark]

Tick **one** box.

Electrode A	Electrode B	Electrolyte	
Copper	Copper	Sodium chloride solution	☐
Zinc	Zinc	Water	☐
Copper	Zinc	Sodium chloride solution	☐
Copper	Zinc	Water	☐

4.5.2.1 Cells and batteries

Question 05 · continued

Alkaline batteries are non-rechargeable.

1 0 . 2 Why do alkaline batteries eventually stop working?

[1 mark]

1 0 . 3 Why can alkaline batteries **not** be recharged?

[1 mark]

Question 10 continues on the next page

Question 05 · continued

Hydrogen fuel cells and rechargeable lithium-ion batteries can be used to power electric cars.

1 0 . 4 Complete the balanced equation for the overall reaction in a hydrogen fuel cell.

[2 marks]

$$_____\ H_2 + _____ \rightarrow _____\ H_2O$$

1 0 . 5 **Table 7** shows data about different ways to power electric cars.

Table 7

	Hydrogen fuel cell	Rechargeable lithium-ion battery
Time taken to refuel or recharge in minutes	5	30
Distance travelled before refuelling or recharging in miles	Up to 415	Up to 240
Distance travelled per unit of energy in km	22	66
Cost of refuelling or recharging in £	50	3
Minimum cost of car in £	60 000	18 000

Evaluate the use of hydrogen fuel cells compared with rechargeable lithium-ion batteries to power electric cars.

Use **Table 7** and your own knowledge.

[6 marks]

4.5.2.1 Cells and batteries

Question 05 · continued

June 2018 | 8462/1F | Original Q10

11

4.5.2.1 Cells and batteries

Question 06

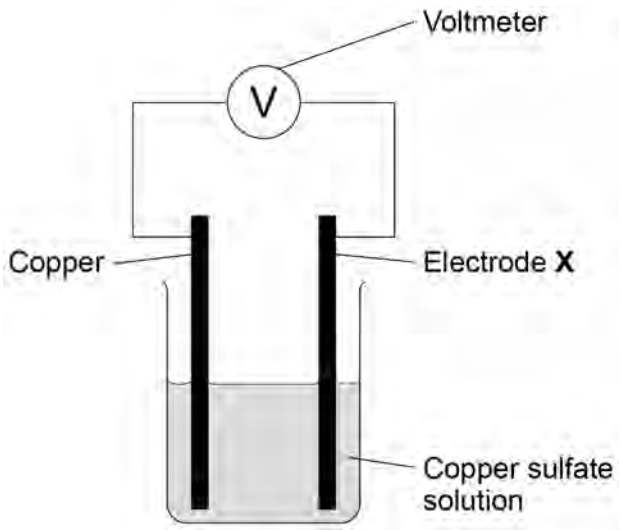
June 2019 | 8462/1F | Original Q4

0 4 This question is about chemical cells and batteries.

A student investigated the voltage produced by different chemical cells.

Figure 7 shows the apparatus.

Figure 7



This is the method used.

1. Use cobalt metal as electrode **X**.

2. Record the cell voltage.

3. Repeat steps 1 and 2 using different metals as electrode **X**.

0 4 . 1 Suggest **two** variables the student should keep the same to make the investigation valid.

[2 marks]

1 _____

_____

2 _____

_____

Table 1 shows the student's results.

Table 1

Electrode X	Voltage of the cell in volts
cobalt	0.62
magnesium	2.71
zinc	1.10

0 4 . 2 Write the three metals used for electrode **X** in order of reactivity.

Use **Table 1**.

[1 mark]

Most reactive _____

_____

Least reactive _____

0 4 . 3 Copper is used as electrode **X** in **Figure 7**.

Predict the voltage of this cell.

Give **one** reason for your answer.

[2 marks]

Voltage = _____ volts

Reason _____

_____

4.5.2.1 Cells and batteries

Question 06 · continued

0 4 . 4 Describe how to make a 12 V battery using 1.5 V cells.

[2 marks]

0 4 . 5 Which is the most suitable use for a non-rechargeable cell?

[1 mark]

Tick (✓) **one** box.

- Electric toy ☐
- Laptop computer ☐
- Mobile phone ☐

0 4 . 6 Hydrogen fuel cells or rechargeable cells can be used to power electric vehicles.

Suggest **one** advantage and **one** disadvantage of using a hydrogen fuel cell compared with a rechargeable cell.

[2 marks]

Advantage of hydrogen fuel cell _____

Disadvantage of hydrogen fuel cell _____

10

4.5.2.1 Cells and batteries

Question 07

November 2021 | 8462/1F | Original Q2

0 2 This question is about chemical cells and batteries.

0 2 . 1 Three different types of battery can be used to power a TV remote control.

Table 1 gives information about these batteries.

Table 1

	Zinc-carbon battery	Alkaline battery	Nickel-metal hydride battery
Cost of battery in £ (pounds)	0.17	0.50	1.50
Rechargeable?	No	No	Yes
Time before needing to replace or recharge in months	5	12	8

Give **one** advantage of each type of battery.

[3 marks]

Zinc-carbon _____

_____

Alkaline _____

_____

Nickel-metal hydride _____

_____

0 2 . 2 **Figure 3** shows a symbol printed on batteries.

Figure 3



This symbol shows that batteries should not be put in household waste.

Suggest why batteries should **not** be put in household waste.

[1 mark]

_____

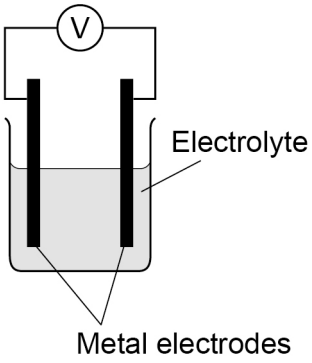
_____

4.5.2.1 Cells and batteries

Question 07 · continued

Figure 4 shows a chemical cell.

Figure 4



0 2 . 3 The order of reactivity of three metals is shown below.

Iron	(Most reactive)
Tin	↑
Copper	(Least reactive)

Which combination of metal electrodes would give the highest voltage in the chemical cell in **Figure 4**?

[1 mark]

Tick (✓) **one** box.

Copper and iron ☐

Iron and tin ☐

Tin and copper ☐

0 2 . 4 The voltage produced by the cell in **Figure 4** depends on the type of electrodes and the type of electrolyte.

Suggest **one** other factor that could affect the voltage produced.

[1 mark]

4.5.2.1 Cells and batteries

Question 07 · continued

0 2 . 5 Water is produced in a hydrogen fuel cell.

Complete the word equation to show the reaction that produces water in a hydrogen fuel cell.

[2 marks]

_____ + _____ → water

8

4.5.2.1 Cells and batteries

Question 08

0 7 This question is about chemical cells.

0 7 . 1 A student connects four 1.5 V cells in series to make a battery.

What is the total voltage produced by the battery?

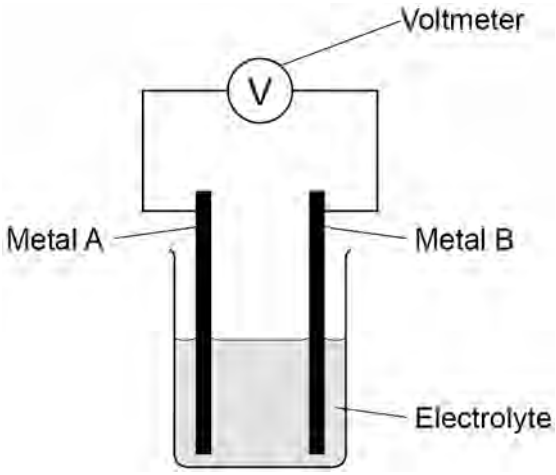
[1 mark]

Voltage = _____ V

A chemical cell can be made using two different metals in contact with an electrolyte.

Figure 14 shows a chemical cell.

Figure 14



0 7 . 2 Which is a suitable electrolyte for a chemical cell?

[1 mark]

Tick (✓) **one** box.

Pure water ☐

Solid lead bromide ☐

Sodium chloride solution ☐

4.5.2.1 Cells and batteries

Question 08 · continued

0 7 . 3 A student made the hypothesis:

'The voltage produced by a cell depends on the difference in the reactivity of metal **A** and metal **B**.'

Plan an investigation to test this hypothesis.

Your plan should produce valid results.

Use **Figure 14**.

[6 marks]

8

4.5.2.1 Cells and batteries

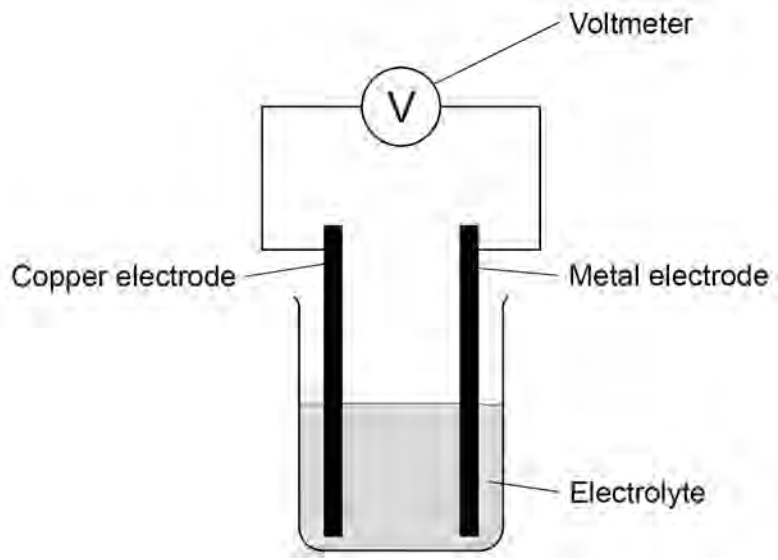
Question 09

0 3 Cells contain chemicals that react to produce electricity.

A student investigated the voltage produced by four different cells.

Figure 3 shows the apparatus.

Figure 3



This is the method used.

1. Measure the voltage produced by the cell using metal **A** as the metal electrode.
2. Repeat using different metals as the metal electrode.

Table 2 shows the results.

Table 2

Metal electrode	Voltage in volts
A	1.1
B	0.0
C	0.8
D	2.7

4.5.2.1 Cells and batteries

Question 09 · continued

0 3 . 1 Which substance could be used as the electrolyte in the cell in **Figure 3**?

[1 mark]

Tick (✓) **one** box.

Pure water ☐

Sodium chloride solution ☐

Solid potassium bromide ☐

0 3 . 2 Which metal **A**, **B**, **C** or **D** was copper?

Give **one** reason for your answer.

Use **Figure 3** and **Table 2**.

[2 marks]

Metal _____

Reason _____

_____

0 3 . 3 Write the four metals **A**, **B**, **C** and **D** in order of reactivity.

Use **Table 2**.

[1 mark]

Most reactive _____

_____

_____

Least reactive _____

4.5.2.1 Cells and batteries

Question 09 · continued

0 3 . 4 A battery consists of several cells connected together in series.

Each cell has a voltage of 3.6 V.

Calculate the number of cells needed to make a battery of voltage 14.4 V.

[2 marks]

Number of cells = _____

0 3 . 5 Fuel cells can be used to power electric cars.

Complete the sentence.

Choose the answer from the box.

[1 mark]

ammonia	**methane**	**water**

The overall reaction in a hydrogen fuel cell involves the oxidation of hydrogen to produce _____.

0 3 . 6 Rechargeable cells can be recharged when an external electrical current is supplied.

Complete the sentence.

[1 mark]

When an external electrical current is supplied to a rechargeable cell, the chemical reaction is _____.

8