AQA GCSE Chemistry

Energy changes · Foundation tier

Questions only

The newest questions on the Foundation papers, about an hour. All 8 are in the exam generator.

Questions	Total marks	Time allowed
5	**51**	**54 min**

Name _____ Class or teacher _____ Date _____

Instructions

- Answer all questions in the spaces provided.
- Use black ink. Show your working for every calculation.
- You may use a scientific calculator and the periodic table insert.
- Print the separate mark scheme when you are ready to mark your answers.

For marking

Q	Source	Marks	Score
1	2023 P1F Q10 / P1H Q2	11	
2	2024 P1F Q3	14	
3	2024 P1F Q7	8	
4	2025 P1F Q2	10	
5	2025 P1F Q3	8	

Total _____ / 51 **Percentage** _____ %

Questions from AQA GCSE past papers, 2023–2025, reproduced for revision. Practise these topics online, with instant marking:
`whiteboardchemistry.com/revision/gcse-chemistry/exam-questions?topics=c5-energy-changes&demand=low,standard&len=0`

Questions

Energy changes · Foundation tier · 5 questions · 51 marks · time allowed 54 min

Q1 · June 2023 · Paper 1 Foundation · Q10 · Paper 1 Higher · Q2 · [11 marks]

This question also needs Quantitative chemistry.

This question is about temperature changes.

A student investigated the change in temperature of a solution when different masses of ammonium nitrate were dissolved in water.

This is the method used.

1. Measure 200 cm^3 of water into a polystyrene cup.

2. Measure the temperature of the water.

3. Add 4.0 g of ammonium nitrate to the water.

4. Stir the solution until all the ammonium nitrate has dissolved.

5. Measure the lowest temperature reached by the solution.

6. Repeat steps 1 to 5 with different masses of ammonium nitrate.

10.1 Give the independent variable and the dependent variable in the investigation.

[2 marks]

Independent variable

Dependent variable

10.2 Table 6 shows the results.

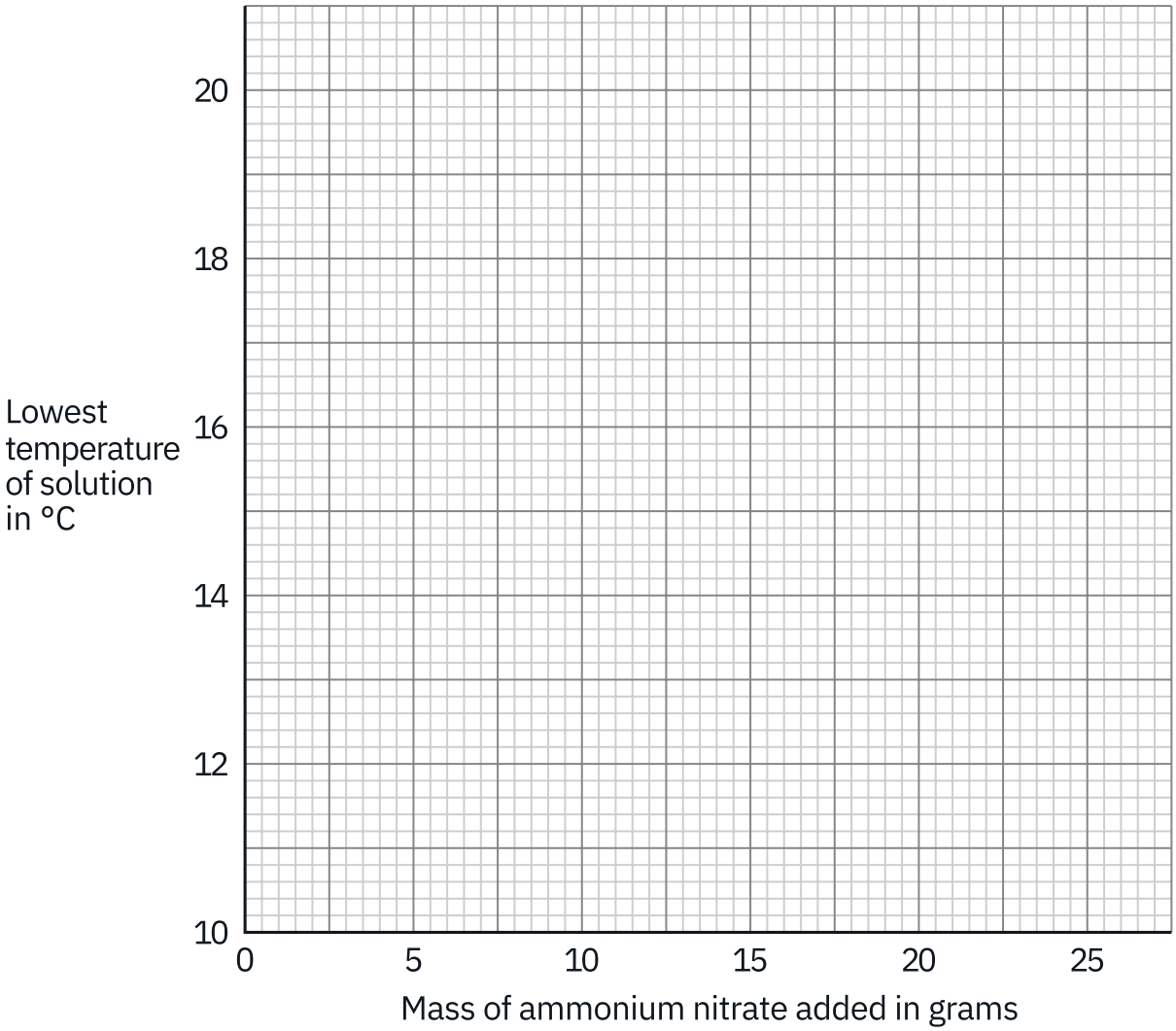
Table 6

Mass of ammonium nitrate added in grams	Lowest temperature of solution in °C
4.0	18.2
8.0	16.2
12.0	15.2
16.0	13.6
20.0	12.4
24.0	10.6

Plot the data from Table 6 on Figure 11.

Draw a line of best fit.

Figure 11



[3 marks]

Draw your answer on the figure above.

10.3 Determine the initial temperature of the water.

You should extend your line of best fit on Figure 11.

Initial temperature of the water = _____ °C

[2 marks]

10.4 How do the results show that dissolving ammonium nitrate in water is endothermic?

[1 mark]

10.5 The student repeated the experiment three more times.

Table 7 shows the results for 8.0 g of ammonium nitrate.

Table 7

	Trial 1	Trial 2	Trial 3	Trial 4	Mean
Lowest temperature of solution in °C	16.2	16.6	16.8	16.4	16.5

The student recorded the mean lowest temperature of the solution for 8.0 g of ammonium nitrate as 16.5 ± 0.3 °C.

Explain why the student included ± 0.3 °C after the mean lowest temperature.

[2 marks]

10.6 What type of error is shown by the results in Table 7?

Tick (✓) **one** box.

Random error	☐
Systematic error	☐
Zero error	☐

[1 mark]

Q2 · June 2024 · Paper 1 Foundation · Q3 · [14 marks]

This question also needs Chemical changes and Quantitative chemistry.

This question is about energy changes of reactions.

Zinc reacts with copper sulfate solution.

The word equation for the reaction is:

zinc + copper sulfate → zinc sulfate + copper

03.1 What type of reaction is the reaction between zinc and copper sulfate solution?

Tick (✓) **one** box.

Combustion	☐
Decomposition	☐
Displacement	☐

[1 mark]

03.2 Calculate the percentage (%) by mass of copper in copper sulfate ($CuSO_4$).

Give your answer to 3 significant figures.

Relative atomic mass (A_r): Cu = 63.5

Relative formula mass (M_r): $CuSO_4$ = 159.5

Percentage by mass (3 significant figures) = _____ %

[3 marks]

03.3 A student investigated the energy change in the reaction between zinc and copper sulfate solution.

This is the method used.

1. Measure 25 cm^3 of copper sulfate solution into a polystyrene cup.

2. Weigh 0.20 g of zinc powder.

3. Add the zinc powder to the copper sulfate solution.

4. Measure the highest temperature reached by the mixture.

5. Repeat steps 1 to 4 using different masses of zinc powder.

Control variables are used to make an investigation a fair test.

Which is a control variable in the investigation?

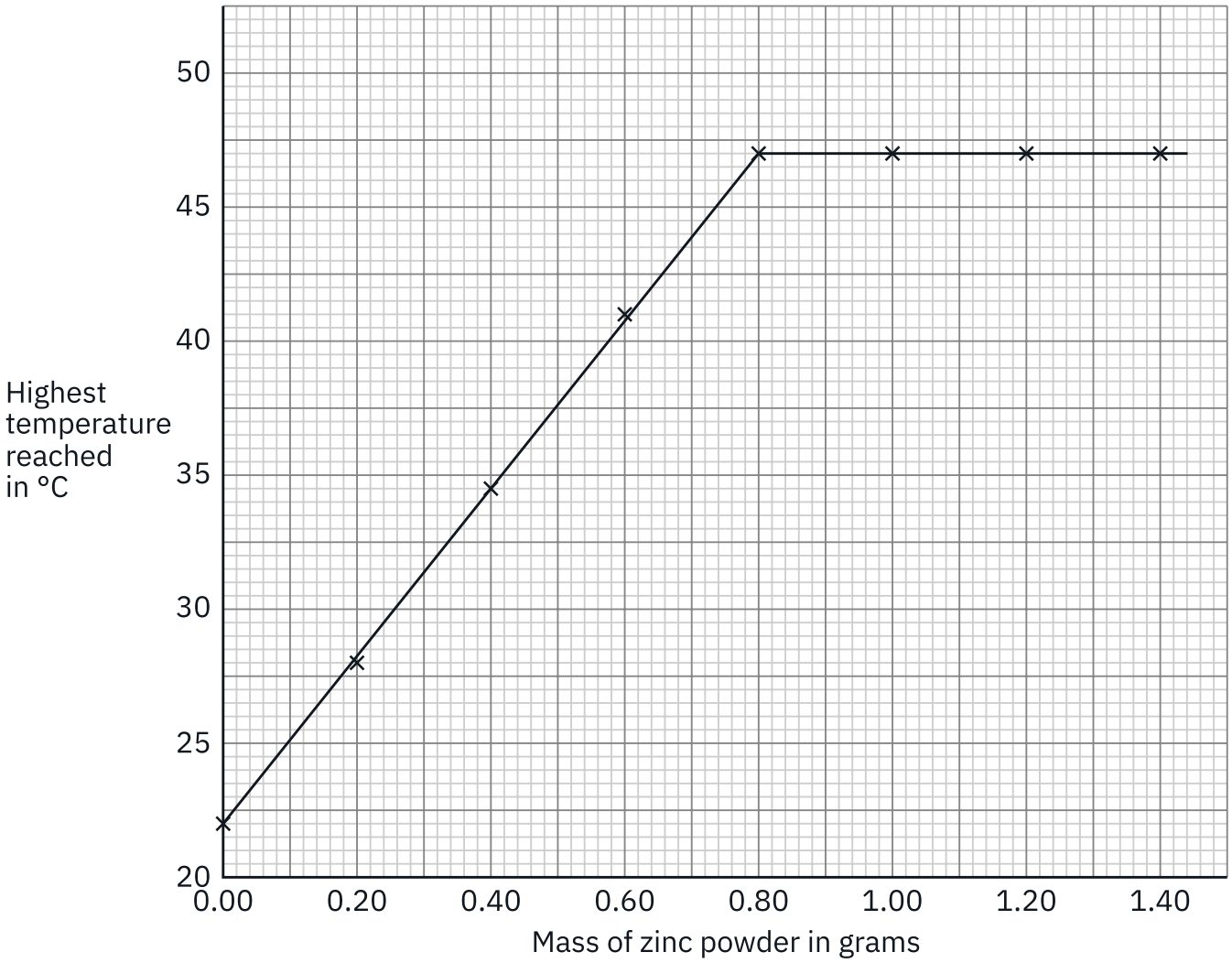
Tick (✓) **one** box.

Highest temperature reached by the mixture	☐
Mass of zinc powder	☐
Volume of copper sulfate solution	☐

[1 mark]

03.4 Figure 6 shows the results.

Figure 6



What is the minimum mass of zinc powder needed to react with all the copper sulfate solution?

Use Figure 6.

Minimum mass of zinc powder = _____ g

[1 mark]

03.5 What is the maximum temperature change in the reaction between zinc powder and 25 cm^3 of copper sulfate solution?

Use Figure 6.

Maximum temperature change = _____ °C

[2 marks]

03.6 25 cm^3 of copper sulfate solution contained 6.75 g of copper sulfate.

Calculate the concentration of the solution in g/dm^3.

You should:

- calculate the volume of the solution in dm^3 (1000 cm^3 = 1 dm^3)
- use the equation:

$$\text{concentration of solution in g/dm}^3 = \frac{\text{mass of copper sulfate in grams}}{\text{volume of solution in dm}^3}$$

Volume of solution = _____ dm^3

Concentration of solution = _____ g/dm^3

[3 marks]

03.7 Another student investigated the energy change of the reaction between sodium hydrogencarbonate and hydrochloric acid.

This is the method used.

1. Measure 25 cm^3 of hydrochloric acid.

2. Weigh 1.0 g of sodium hydrogencarbonate.

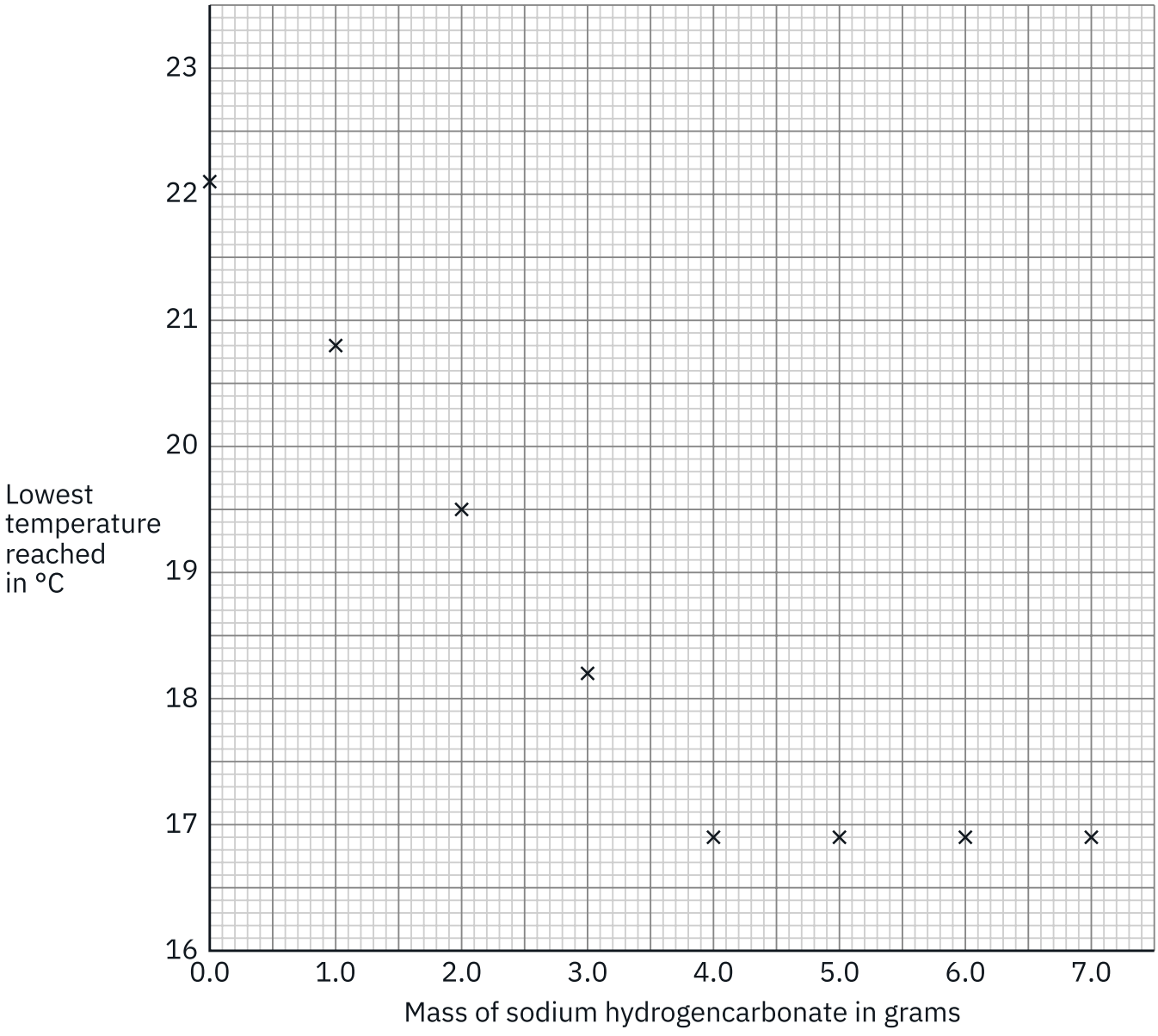
3. Add the sample of sodium hydrogencarbonate to the hydrochloric acid.

4. Measure the lowest temperature reached by the mixture.

5. Repeat steps 1 to 4 using different masses of sodium hydrogencarbonate.

Figure 7 shows the results.

Figure 7



Draw **two** straight lines of best fit on Figure 7.

The lines should cross.

[2 marks]

Draw your answer on the figure above.

03.8 Which statement describes the energy change in the reaction shown in Figure 7?

Tick (✓) **one** box.

Energy is **transferred to** the surroundings so the reaction is **endothermic**.	☐
Energy is **transferred to** the surroundings so the reaction is **exothermic**.	☐
Energy is **taken in from** the surroundings so the reaction is **endothermic**.	☐
Energy is **taken in from** the surroundings so the reaction is **exothermic**.	☐

[1 mark]

Q3 · June 2024 · Paper 1 Foundation · Q7 · [8 marks]

This question also needs Chemical changes.

This question is about chemical cells.

07.1 A student connects four 1.5 V cells in series to make a battery.

What is the total voltage produced by the battery?

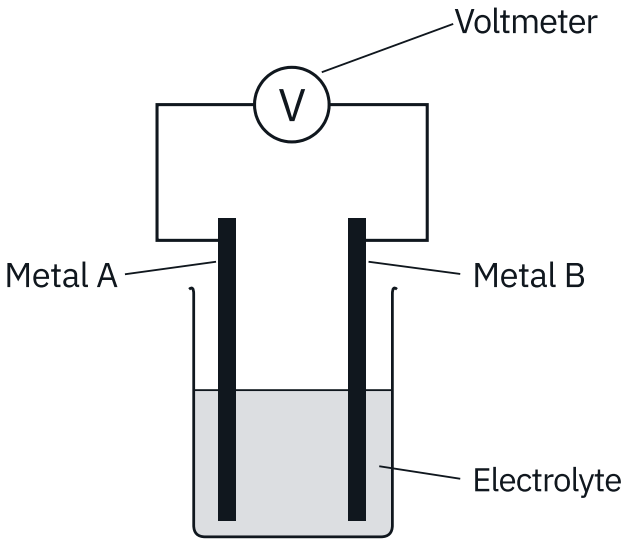
Voltage = _____ V

[1 mark]

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

Figure 14 shows a chemical cell.

Figure 14



Which is a suitable electrolyte for a chemical cell?

Tick (✓) **one** box.

Pure water	☐
Solid lead bromide	☐
Sodium chloride solution	☐

[1 mark]

07.3 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]

Q4 · June 2025 · Paper 1 Foundation · Q2 · [10 marks]

This question also needs Chemical changes.

Metals react with acids to produce a salt and a gas.

02.1 Which salt is produced when magnesium reacts with hydrochloric acid?

Tick (✓) **one** box.

Magnesium chloride	☐
Magnesium nitrate	☐
Magnesium sulfate	☐

[1 mark]

02.2 Which gas is produced when magnesium reacts with hydrochloric acid?

Tick (✓) **one** box.

Carbon dioxide	☐
Chlorine	☐
Hydrogen	☐
Oxygen	☐

[1 mark]

02.3 A student investigated the temperature change in the reaction between metals and hydrochloric acid.

This is the method used.

1. Measure 25 cm^3 of hydrochloric acid at 20 °C into a container.

2. Add 1 g of a metal.

3. Record the temperature change.

4. Repeat steps 1 to 3 using a different metal.

Draw **one** line from the type of variable to the name of the variable in the investigation.

Type of variable	Name of variable
	Mass of metal
Dependent variable	Temperature change
Independent variable	Type of metal
	Volume of hydrochloric acid

[2 marks]

02.4 Which container would be the most suitable to reduce energy transfer with the surroundings?

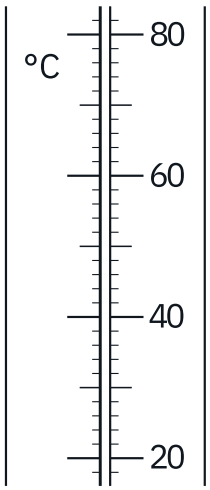
Tick (✓) **one** box.

A copper can	☐
A glass beaker	☐
A polystyrene cup	☐

[1 mark]

02.5 Figure 1 shows part of the scale of the thermometer used in the investigation.

Figure 1



What is the resolution of the thermometer?

Tick (✓) **one** box.

1 °C	☐
2 °C	☐
10 °C	☐
20 °C	☐

[1 mark]

02.6 The reaction between a metal and an acid is exothermic.

What happens to the temperature of the mixture during the reaction?

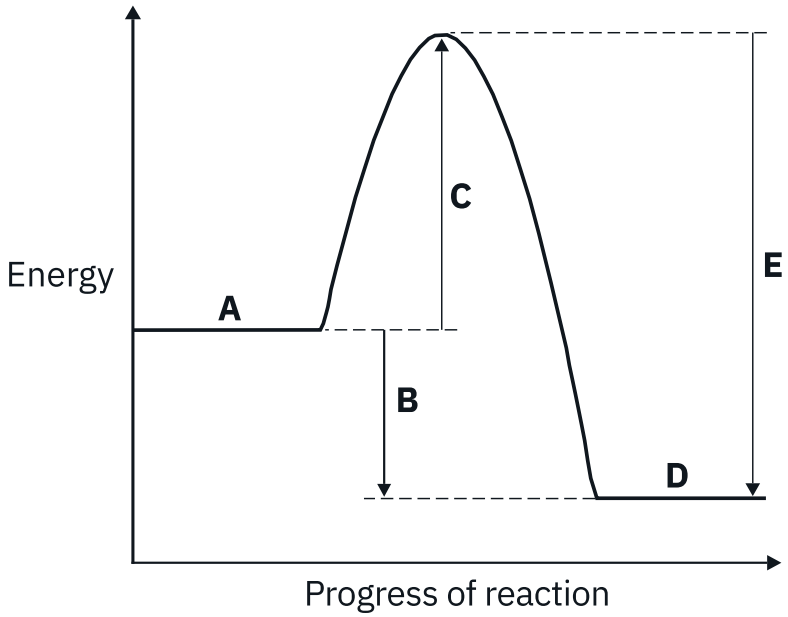
Tick (✓) **one** box.

Decreases	☐
Stays the same	☐
Increases	☐

[1 mark]

02.7 Figure 2 shows the reaction profile for the reaction between a metal and an acid.

Figure 2



Which letter in Figure 2 represents the reactants?

Tick (✓) **one** box.

A	☐
B	☐
C	☐
D	☐
E	☐

[1 mark]

02.8 Which letter in Figure 2 represents the activation energy?

Tick (✓) **one** box.

A	☐
B	☐
C	☐
D	☐
E	☐

[1 mark]

02.9 Which letter in Figure 2 represents the overall energy change?

Tick (✓) **one** box.

A	☐
B	☐
C	☐
D	☐
E	☐

[1 mark]

Q5 · June 2025 · Paper 1 Foundation · Q3 · [8 marks]

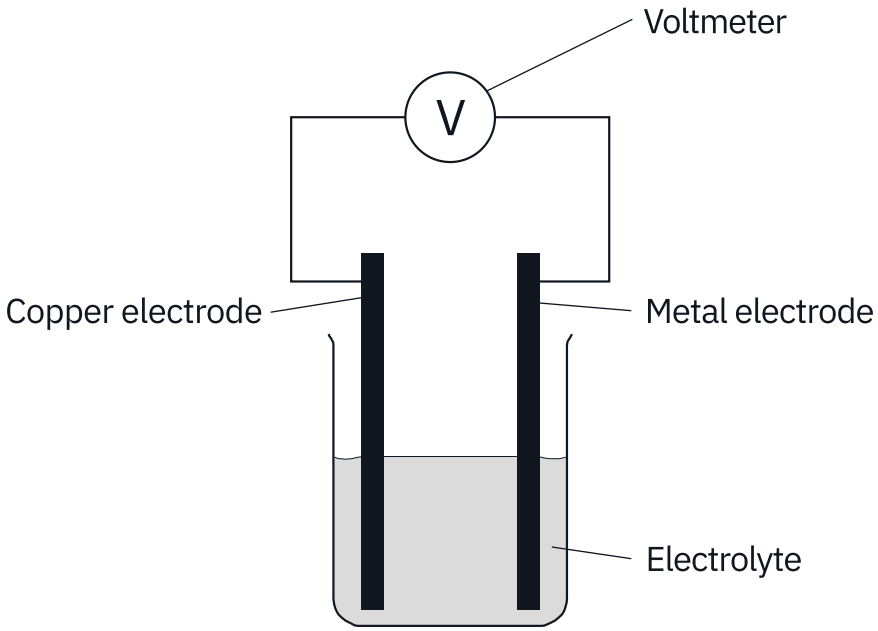
This question also needs Chemical changes.

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

03.1 Which substance could be used as the electrolyte in the cell in Figure 3?

Tick (✓) **one** box.

Pure water	☐
Sodium chloride solution	☐
Solid potassium bromide	☐

[1 mark]

03.2 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

03.3 Write the four metals A, B, C and D in order of reactivity.

Use Table 2.

[1 mark]

Most reactive

Least reactive

03.4 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.

Number of cells = _____

[2 marks]

03.5 Fuel cells can be used to power electric cars.

Complete the sentence.

Choose the answer from the box.

ammonia methane water

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

[1 mark]

03.6 Rechargeable cells can be recharged when an external electrical current is supplied.

Complete the sentence.

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

[1 mark]

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