

Chemical changes – GCSE Chemistry Paper 1

1. No.2

0 2

This question is about electrolysis.

0 2 . 1

Complete the sentence.

Choose the answer from the box.

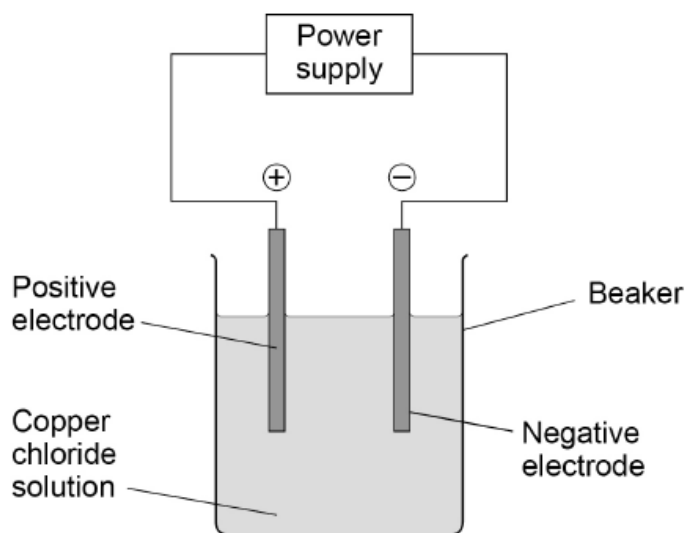
[1 mark]

gaseous

molten

solid

Copper chloride can conduct electricity when in solution or
when _____.

Figure 1 shows the apparatus used for the electrolysis of copper chloride solution.**Figure 1**

There are four ions in copper chloride solution:

- Cu^{2+}
- Cl^-
- H^+
- OH^-

0 2 . 2

Why do Cl^- ions and OH^- ions move to the positive electrode?

[1 mark]

0 2 . 3

Where do the H^+ and OH^- ions come from in the electrolysis of copper chloride solution?

[1 mark]

Tick (✓) **one** box.

Air

☐

Copper chloride

☐

Water

☐

0 2 . 4

Which ion produces a metal?

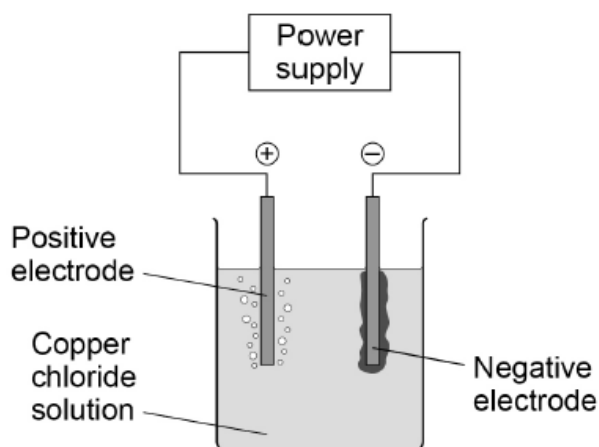
[1 mark]

Tick (✓) **one** box. Cu^{2+} ☐ Cl^- ☐ H^+ ☐ OH^- ☐

0 2 . 5

Figure 2 shows the apparatus during the electrolysis of copper chloride solution.

Figure 2



Describe what is seen at each electrode during the electrolysis of copper chloride solution.

[2 marks]

Positive electrode _____

Negative electrode _____

0 2 . 6

500 cm³ of copper chloride solution contains 6.50 g of copper chloride.

Calculate the mass of copper chloride in 40.0 cm³ of this copper chloride solution.

[2 marks]

Mass = _____ g

2. No.5

0 5

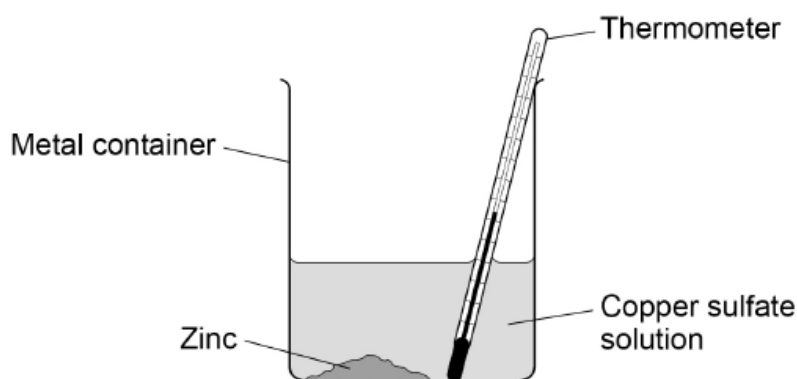
A student investigated the change in temperature when different masses of zinc were added to copper sulfate solution.

This is the method used.

1. Measure the volume of copper sulfate solution using a measuring cylinder.
2. Pour the copper sulfate solution into a metal container.
3. Add 2 g of zinc.
4. Measure the temperature of the solution.
5. Repeat steps 1 to 4 with different masses of zinc.

Figure 7 shows the apparatus.

Figure 7



0 5 . 1

Give **three** improvements to the investigation to make the results more accurate.

[3 marks]

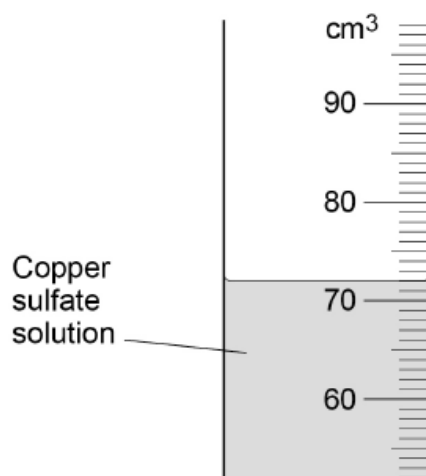
- 1 _____

- 2 _____

- 3 _____

0 5 . 2 Figure 8 shows part of the measuring cylinder.

Figure 8



What is the volume of copper sulfate solution in Figure 8?

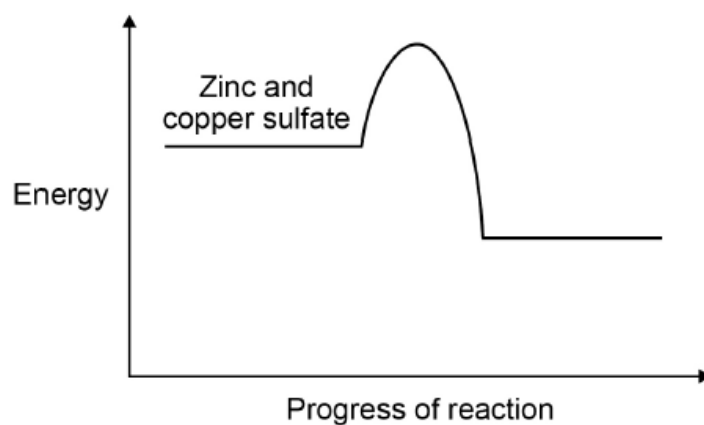
[1 mark]

Volume = _____ cm^3

0 5 . 3 When zinc was added to copper sulfate solution the temperature increased.

Figure 9 shows the reaction profile.

Figure 9



What type of reaction is shown in Figure 9?

[1 mark]

Tick (✓) one box.

Endothermic

☐

Exothermic

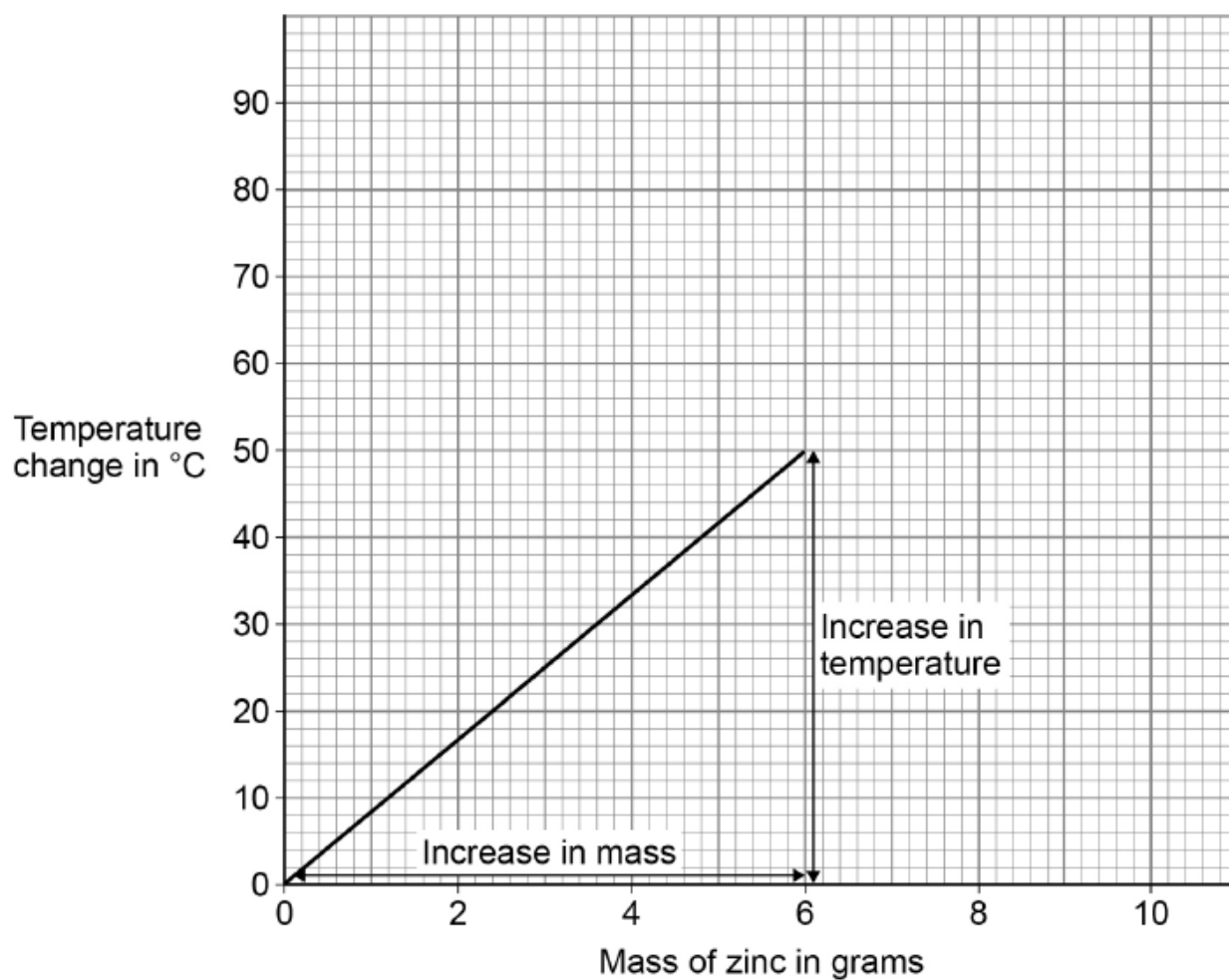
☐

Neutralisation

☐

Figure 10 shows the results.

Figure 10



0 5 . 4 Determine the gradient of the line in **Figure 10**.

Use the equation:

$$\text{gradient} = \frac{\text{increase in temperature in } ^\circ\text{C}}{\text{increase in mass in grams}}$$

[4 marks]

Gradient = _____ $^\circ\text{C}$ per g

0 5 . 5 Suggest why the student should **not** use more than 10 g of zinc.

Use **Figure 10**.

You should extend the graph line.

[2 marks]

3. No.7

0 7

Acids react to produce salts.

Universal indicator is added to water and then nitric acid is added to the mixture.

0 7 . 1

Give the colour change when nitric acid is added to the mixture of universal indicator and water.

[1 mark]

Tick (✓) **one** box.

Blue to red

☐

Green to purple

☐

Green to red

☐

Red to purple

☐

0 7 . 2

What happens to the pH of water when nitric acid is added?

[1 mark]

Tick (✓) **one** box.

Decreases

☐

Stays the same

☐

Increases

☐

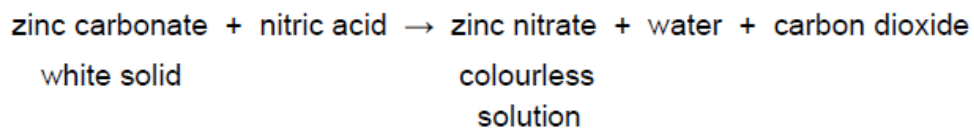
0 7 . 3

What is the state symbol for nitric acid?

[1 mark]

Zinc carbonate reacts with nitric acid.

The word equation for the reaction is:



0 7 . 4

Give **two** observations that would be made when zinc carbonate is added to nitric acid until the zinc carbonate is in excess.

[2 marks]

1 _____

2 _____

0 7 . 5

The formula of the zinc ion is Zn^{2+}

The formula of the nitrate ion is NO_3^-

What is the formula for zinc nitrate?

[1 mark]

Tick (✓) **one** box.

ZnNO_3

☐

$\text{Zn}(\text{NO}_3)_2$

☐

Zn_2NO_3

☐

$\text{Zn}_2(\text{NO}_3)_2$

☐

Acids react with insoluble metal oxides to produce salts.

[6 marks]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

4. No.2

0 2

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0 2 . 1

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[1 mark]

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☐

Green to purple

☐

Green to red

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Red to purple

☐

0 2 . 2

What happens to the pH of water when nitric acid is added?

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☐

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☐

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☐

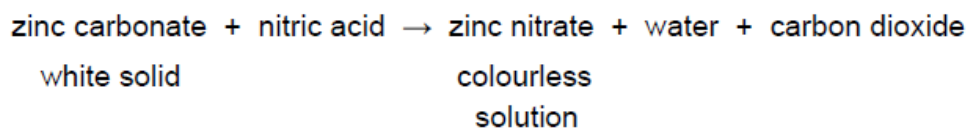
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[1 mark]

Tick (✓) **one** box.

ZnNO_3 ☐

$\text{Zn}(\text{NO}_3)_2$ ☐

Zn_2NO_3 ☐

$\text{Zn}_2(\text{NO}_3)_2$ ☐

Acids react with insoluble metal oxides to produce salts.

[6 marks]

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

5. No.3

0 3

This question is about energy change.

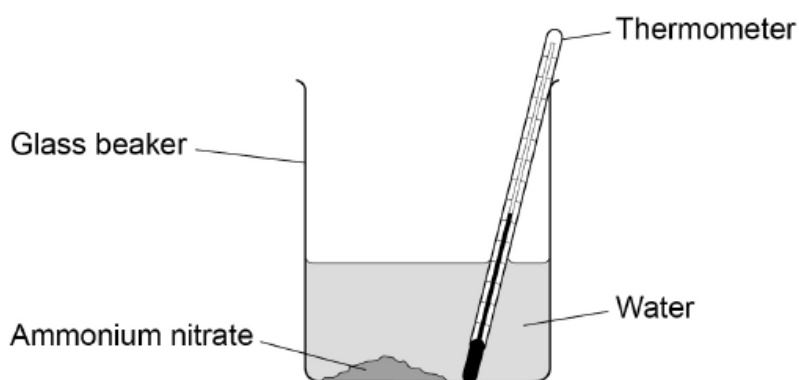
A student investigated the temperature change when 10 g of ammonium nitrate was added to 100 cm³ of water.

This is the method used.

1. Measure the temperature of 100 cm³ of water.
2. Add 10 g of ammonium nitrate.
3. Stir once.
4. Measure the temperature of the solution every minute for 7 minutes.

Figure 3 shows the apparatus.

Figure 3



0 3 . 1

What is the dependent variable in this investigation?

[1 mark]

0 3 . 2

Give **three** improvements to the investigation to make the results more accurate.**[3 marks]**

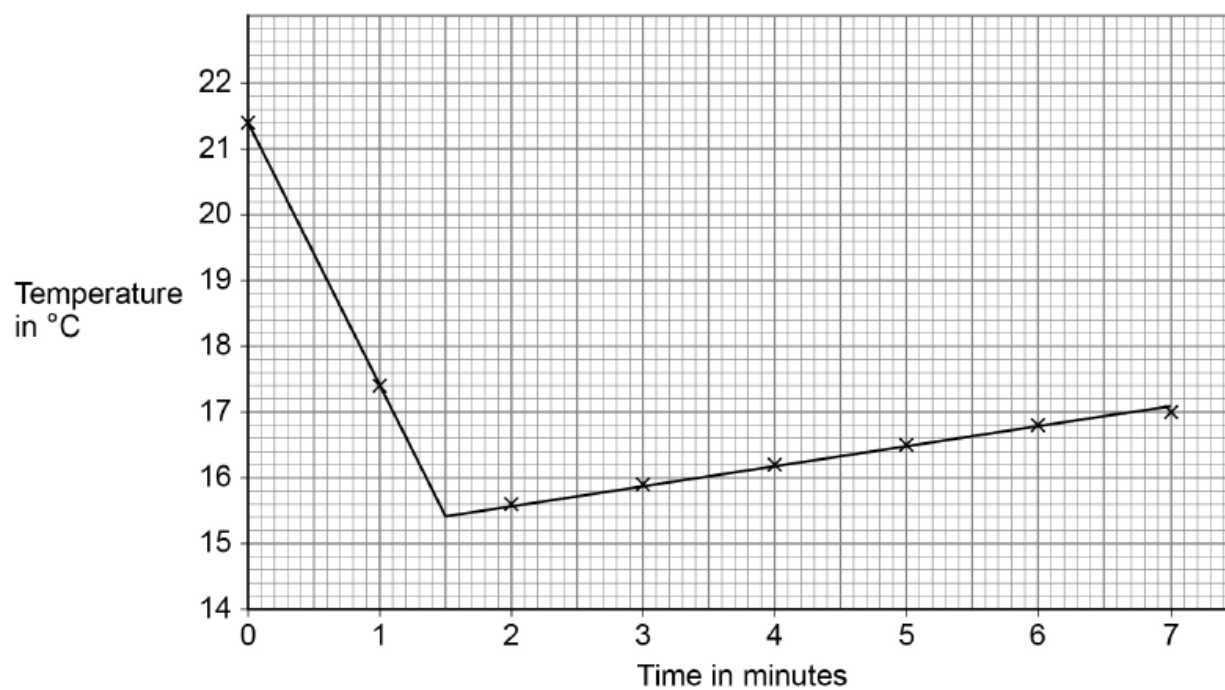
1 _____

2 _____

3 _____

0 3 . 3 Figure 4 shows the results.

Figure 4



Explain the results.

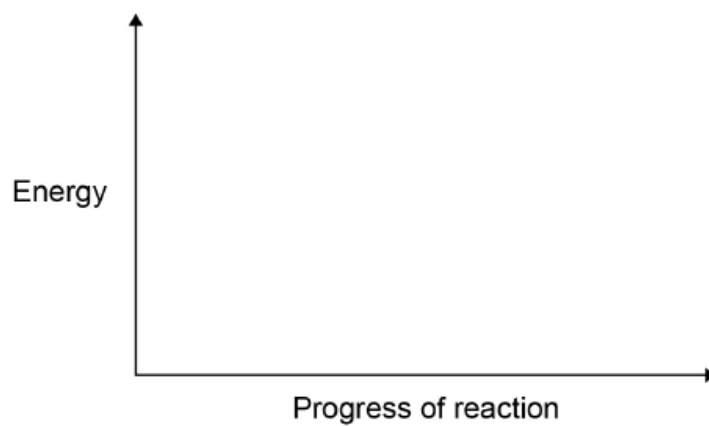
[4 marks]

0 3 . 4 Draw a reaction profile for an exothermic reaction.

You should label:

- the energy level of the reactants and of the products
- the activation energy
- the overall energy change.

[4 marks]



6. No.5

0 5

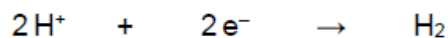
This question is about the electrolysis of aqueous solutions.

Hydrogen gas and chlorine gas are produced when sodium chloride solution is electrolysed.

0 5 . 1

Hydrogen ions (H^+) are attracted to the negative electrode.

The half equation for the reaction at the negative electrode is:



What type of reaction happens at the negative electrode?

Give the reason for your answer.

[2 marks]

Type of reaction _____

Reason _____

0 5 . 2

Chloride ions are attracted to the positive electrode.

Complete the half equation for the production of chlorine gas (Cl_2).

[2 marks]



0	5	.	3
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Hydrogen gas and oxygen gas are produced when sodium sulfate solution is electrolysed.

Explain how oxygen gas is produced in the electrolysis of sodium sulfate solution.

[4 marks]

7. No.7

0 7

Methane, ethane, propane and butane all react with oxygen to produce carbon dioxide and water.

0 7 . 1

Suggest why a mixture of methane and oxygen does **not** react at room temperature.

Answer in terms of particles.

[2 marks]

0 7 . 2

Table 3 shows the energy released when methane, ethane and propane react with oxygen to produce carbon dioxide and water.

Table 3

	Compound reacted with oxygen		
	Methane	Ethane	Propane
Formula of compound	CH ₄	C ₂ H ₆	C ₃ H ₈
Energy released in kJ/mol	680	1160	1640

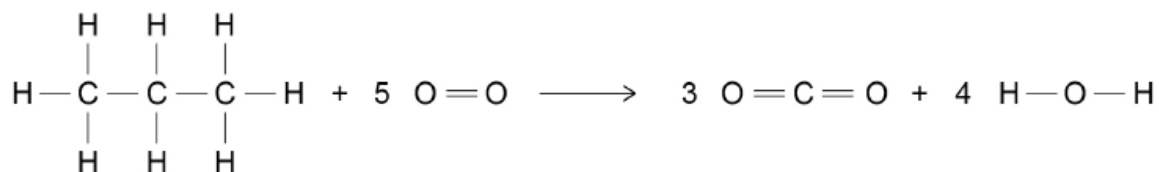
Predict the energy released when butane (C₄H₁₀) reacts with oxygen to produce carbon dioxide and water.

[1 mark]

Energy released = _____ kJ/mol

0 7 . 3 Propane reacts with oxygen to produce carbon dioxide and water.

The displayed formula equation for the reaction is:



The reaction is exothermic.

In the reaction, the energy released when forming new bonds is 1640 kJ/mol greater than the energy needed when breaking bonds.

Table 4 shows bond energies.

Table 4

Bond	H—C	C—C	O=O	C=O	O—H
Bond energy in kJ/mol	410	X	500	740	460

Calculate the C—C bond energy (X).

[5 marks]

X = _____ kJ/mol