OCR GCSE GATEWAY CHEMISTRY A · J248

CHEMISTRY



EXAM QUESTION PACK

WS1.3 ANALYSIS AND EVALUATION

SCORE	PERCENTAGE
/81	%

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Gateway Chemistry A (9-1)

Analysis and evaluation

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:
Additional resources may be supplied with this paper.

Other materials required:
- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **81**.
- The total number of marks may take into account some 'either/or' question choices.

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1(a) The table shows the properties of different substances.

Substance	Melting point (°C)	Boiling point (°C)	Soluble in water?	Conducts electricity in solid state?	Conducts electricity in molten state?
A	–210	–196	No	No	No
B	1084	2562	No	Yes	Yes
C	605	1137	Yes	No	Yes
D	–78	–34	Yes	No	No

(i) Which **two** substances are gases at room temperature?

Tick (✓) **two** boxes.

A ☐

B ☐

C ☐

D ☐

[1]

(ii) Substance **C** is an ionic substance.

Use the information in the table to explain why.

---

[2]

(b) You are provided with a mixture of substances **B** and **C**.

Substance **B** is insoluble in water. Substance **C** is soluble in water.

(i) Describe how you could separate substance **B** from the mixture.

---

[3]

(ii) Describe how you would then obtain substance **C** after separating substance **B**.

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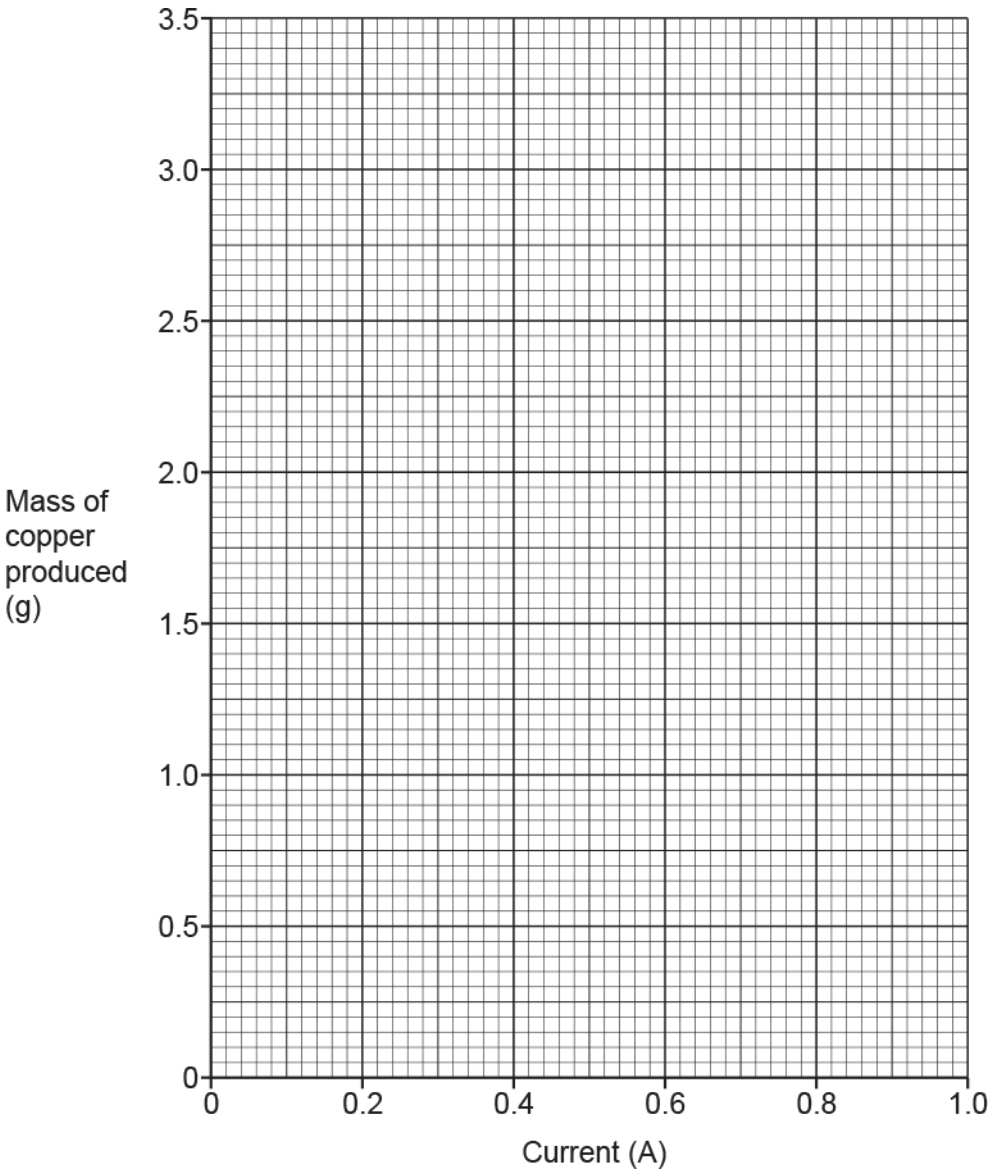
[2]

2 A student investigates the mass of copper made during the electrolysis of aqueous copper chloride.

The student varies the electric current and passes the current for the same time in each experiment. Here is a table of their results.

Current (A)	Mass of copper produced (g)
0.2	0.6
0.4	1.3
0.6	1.8
0.8	2.5
1.0	3.1

(i) Plot a graph of the student's results and draw a line of best fit.



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[3]

(ii) Use your graph to **estimate** the current needed to make 2.25 g of copper.

Current = ... A **[1]**

(iii) Use your graph, and a calculation, to find the mass of copper that would be produced using 15 A.

Give your answer to **2** significant figures.

Mass of copper produced = ... g **[2]**

3 A student investigates the energy changes in different reaction mixtures, **X**, **Y** and **Z**. **Fig. 19.1** shows the apparatus she uses.

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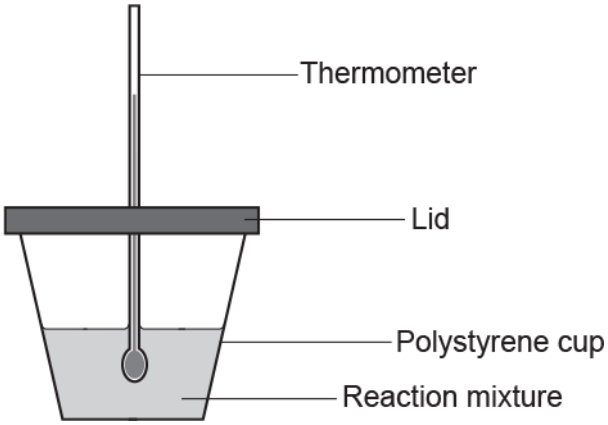


Fig. 19.1

Look at the table of the student's results.

(i) Add the temperature change for each reaction mixture.
Include a + or – sign where relevant.

Reaction mixture	Temperature at start (°C)	Temperature at end (°C)	Temperature change (°C)
X	20.0	25.5	.....
Y	19.0	8.0	.....
Z	20.0	20.0	.....

[1]

(ii) Which reaction mixture has an **endothermic** reaction?

Tick (✓) **one** box.

X ☐

Y ☐

Z ☐

Explain your answer.

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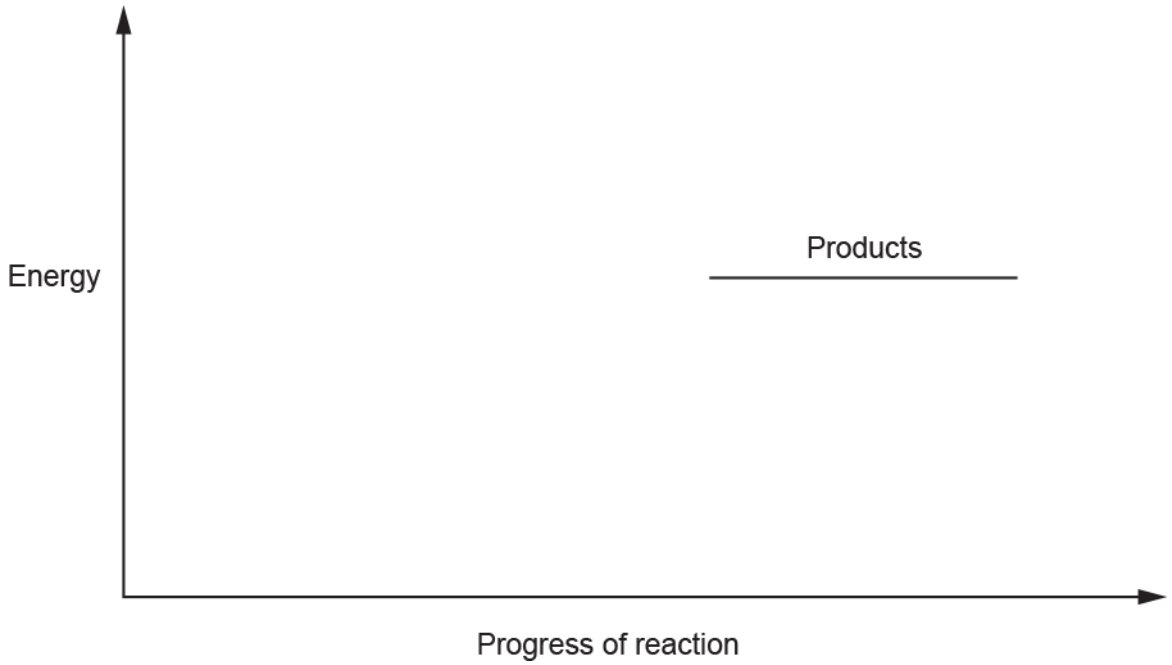
[2]

(iii) Complete the reaction profile for an **endothermic** reaction in **Fig. 19.2**.

The products have already been added.

Label the:

- reactants
- energy change
- activation energy.



[3]

Fig. 19.2

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4 Mendeleev left gaps in his Periodic Table for undiscovered elements. He predicted properties of these elements.

Table 23.1 shows the predicted properties for one of these elements in one of the gaps.

Mendeleev called this element 'eka-silicon'.

Appearance	Grey metal
Melting point (°C)	Over 800
Relative atomic mass	72
Density (g / cm^3)	5.5

Table 23.1

Table 23.2 shows some of the elements that were discovered after Mendeleev published his Periodic Table.

	Scandium (Sc)	Gallium (Ga)	Germanium (Ge)	Technetium (Tc)
Appearance	Silver-white metal	Silver-blue metal	Grey-white metal	Grey metal
Melting point (°C)	1541	30	947	2157
Relative atomic mass	45.0	69.7	72.6	98.0
Density (g / cm^3)	3.0	5.9	5.35	11.0

Table 23.2

(i) Which element matches Mendeleev's predictions for 'eka-silicon'?

Tick (✓) **one** box.

Scandium ☐

Gallium ☐

Germanium ☐

Technetium ☐

[1]

(ii) Give **two** reasons for your answer to **(c)(i)**.

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1 ----------

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2 ----------

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[2]

5 Mendeleev left gaps in his Periodic Table for undiscovered elements. He predicted properties of these elements.

Table 17.1 shows the predicted properties for one of these elements in one of the gaps.

Mendeleev called this element 'eka-silicon'.

Appearance	Grey metal
Melting point (°C)	Over 800
Relative atomic mass	72
Density (g / cm^3)	5.5

Table 17.1

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(i) Which element matches Mendeleev's predictions for 'eka-silicon'?

Tick (✓) **one** box.

Scandium ☐

Gallium ☐

Germanium

Technetium ☐

[1]

(ii) Give **two** reasons for your answer to **(i)**.

1 ----------

---

2 ----------

---

[2]

6 A farmer wants to test the pH of soil samples. He researches information about different pH test kits.



Look at the information he finds.

pH test kit	Price	pH of soil sample				
		pH 2	pH 4	pH 7	pH 9	pH 14
A	£4.95	Red	Yellow	Green	Blue	Purple
B	£10.99	Yellow	Yellow	Pink	Pink	Pink
C	£11.50	Pink	Orange	Yellow	Blue	Blue
D	£2.99	Colourless	Colourless	Colourless	Pink	Pink
E	£12.75	Red	Orange	Yellow	Yellow	Yellow

* Evaluate the advantages and disadvantages of the pH test kits and suggest which pH test kit the farmer should use.

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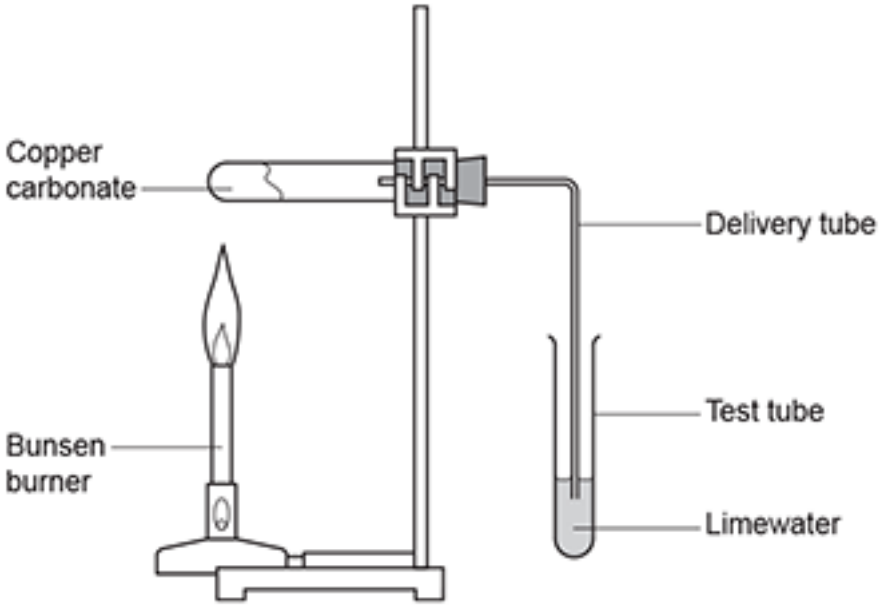
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[6]

7 A student investigates the thermal decomposition of copper carbonate.

copper carbonate → copper oxide + carbon dioxide

Here is the set-up of the apparatus she uses.



The student measures the mass of copper carbonate at the start of the experiment. She then measures the mass of copper oxide made.

She does the experiment five times using a different mass of copper carbonate each time.

Look at her results.

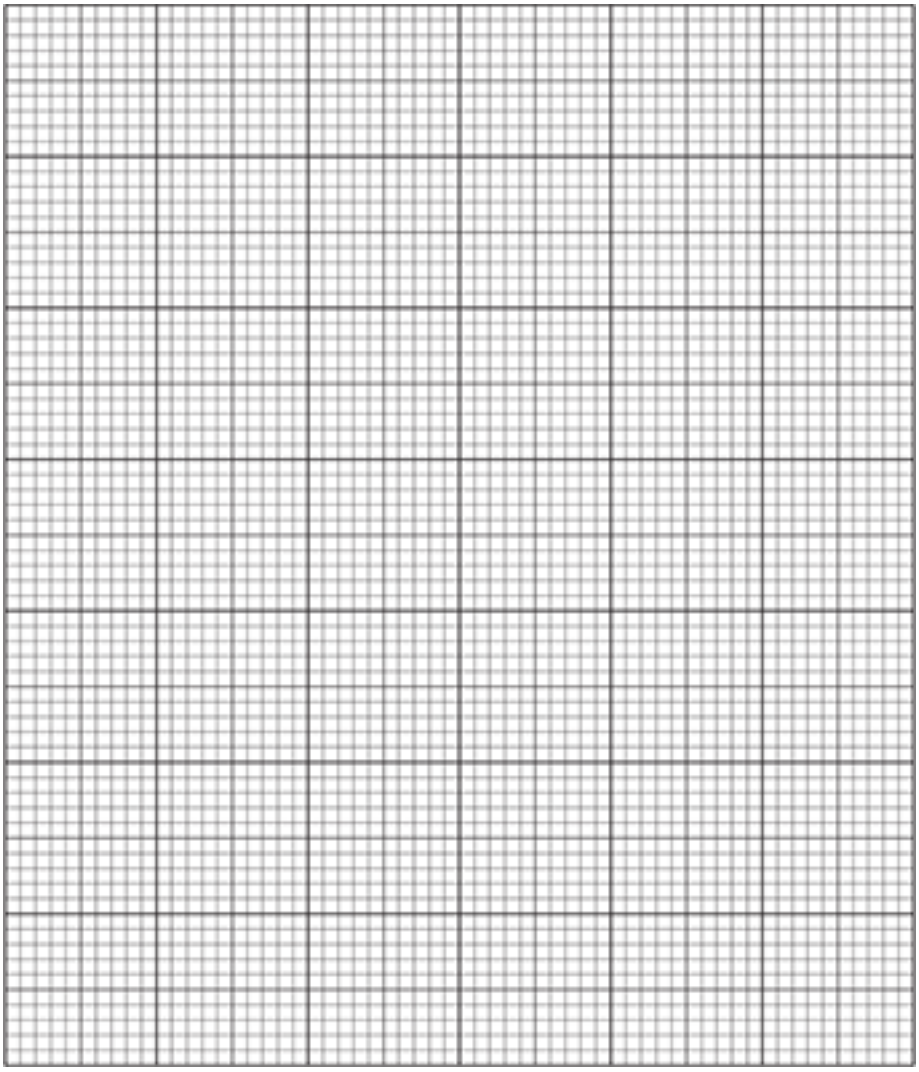
Mass of copper carbonate (g)	Mass of copper oxide (g)
1.00	0.70
2.00	1.35
3.00	1.95
4.00	2.65
5.00	3.30

(i) Plot a graph of the student's results and draw a line of best fit.

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[4]

(ii) What is the mass of copper carbonate that needs to be heated to produce 2.50 g of copper oxide?

Use your graph in your answer.

Mass of copper carbonate = ... g **[1]**

(iii) The mass of copper oxide made in the reaction is less than the mass of the copper carbonate heated.

Suggest why.

---

[1]

8 A student adds a few drops of sodium hydroxide solution to an unknown solution and a blue precipitate is made.

Which metal ion is present in the original solution?

A Calcium
B Copper(II)
C Iron(II)
D Iron(III)

Your answer ☐ [1]

9 A student investigates the reaction between zinc and dilute sulfuric acid.

He measures the time taken to collect 50 cm_3 of hydrogen gas. This time is 65 seconds.

The student investigates four substances which are possible **catalysts** for the reaction.

Substance	Appearance of substance	Time to collect 50 cm^3 of hydrogen (g)	Other observations
A	red-brown powder	19	red-brown powder remains
B	blue solid	15	colourless solution formed
C	red-brown lumps	65	red-brown lumps remain
D	white solid	65	colourless solution formed

Which substance, **A**, **B**, **C** or **D**, is a catalyst for the reaction?

Your answer ☐ [1]

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10 A student investigates the decomposition of hydrogen peroxide.

$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$

0.2 g of oxygen gas is produced in the reaction.

The student uses 0.5 g of manganese(IV) oxide as a catalyst in the reaction.

How much manganese(IV) oxide remains at the end of the reaction?

A 0.2 g
B 0.3 g
C 0.5 g
D 0.7 g

Your answer ☐ **[1]**

11 This question is about elements in the Periodic Table.

Look at the table. It shows some properties of Group 7 elements.

Element	Molecular formula	State at room temperature	Radius of an atom (nm)	Order of reactivity
Fluorine	F_2	.....	0.072	most reactive ↕ least reactive
Chlorine	Cl_2	gas	0.099	
Bromine	Br_2	liquid	0.114	
Iodine	I_2	solid	0.133	
Astatine	At_2	solid	.....	

Complete the table. Use ideas about trends down a Group to help you. **[2]**

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12(a) A student investigates a white solid.

Table 17.1 shows some of the results of the tests that the student does.

	Test	Results
Test 1	flame test	a lilac flame
Test 2	dilute hydrochloric acid added	effervescence
	gas given off passed into limewater	?

Table 17.1

Which **ion** is shown to be in the white solid by the result of **Test 1**?

[1]

(b)

(i) Which **ion** is shown to be in the white solid by the result of **Test 2**?

[1]

(ii) The **gas** given off in **Test 2** is carbon dioxide, CO_2.

What is the expected result with limewater?

[1]

(c) A student reacts some metals with different salt solutions.

Table 17.2 shows her results.

	Magnesium	Zinc	Iron	Copper
Copper sulfate	blue solution becomes colourless	blue solution becomes colourless	blue solution becomes green	no reaction
Iron sulfate	green solution becomes colourless	green solution becomes colourless	no reaction	no reaction
Magnesium sulfate	no reaction	no reaction	no reaction	no reaction
Zinc sulfate	black coating on magnesium	no reaction	no reaction	no reaction

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Table 17.2

(i) What colour is **iron sulfate** solution?

[1]

(ii) Write down the order of reactivity of the four metals copper, iron, magnesium and zinc.
Use **Table 17.2** to help you.

..... **most reactive**

.....

.....

..... **least reactive** [2]

(iii) Magnesium reacts with copper sulfate, $CuSO_4$.

Magnesium sulfate, $MgSO_4$, and copper are made.

Write the **balanced symbol** equation for this reaction.

[1]

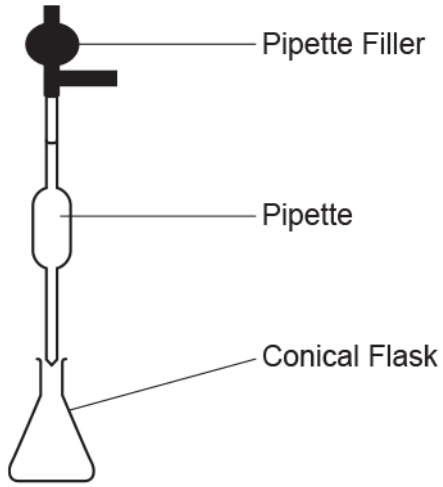
13(a) A student neutralises an alkali with an acid in a titration experiment.

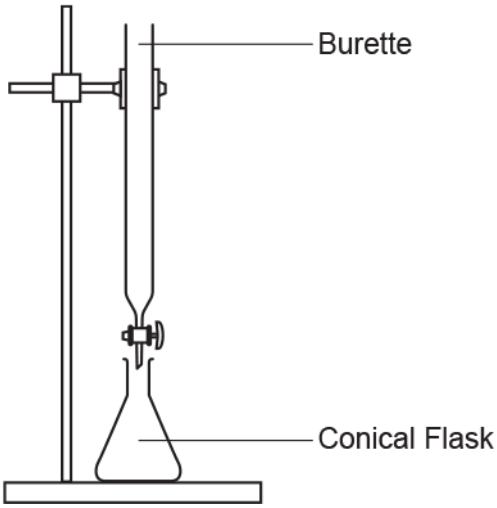
Look at the student's method for her experiment.

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- Measure 25.0 cm^3 of alkali solution into a conical flask using a pipette.
- Add a few drops of universal indicator to the alkali solution.
- Fill the burette to above the 0.0 cm^3 line with acid.
- Quickly add the acid to alkali until the indicator changes colour.
- Repeat the experiment until consistent results are obtained.

Describe and explain **one** improvement the student should make to her method to get a more accurate titration result.

---

[2]

(b) The student repeats the experiment three times.

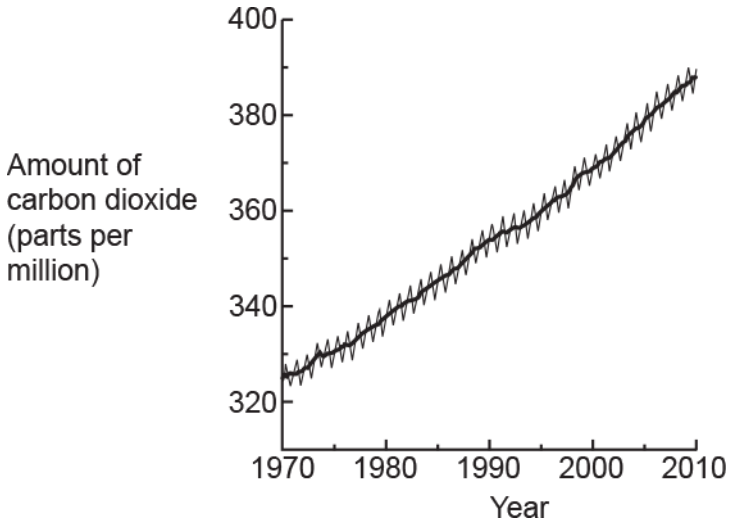
Look at the student's results.

Titration number	1	2	3
Volume of acid (cm^3)	25.75	23.60	23.70

Calculate the **accurate** volume of the acid that reacts with the alkali.

Accurate volume of acid = ... cm^3 **[2]**

14 The graph shows the amount of carbon dioxide in the Earth's atmosphere from 1970 to 2010.



Describe the trend in the amount of carbon dioxide in the Earth's atmosphere from 1970 to 2010.

---

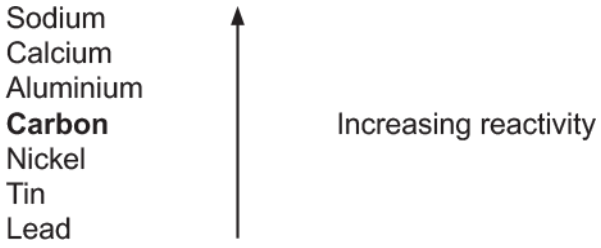
[1]

15(a) Aluminium is a metal.

Aluminium is extracted from an ore called bauxite.

Electrolysis is used to extract the aluminium.

Use the reactivity series to explain why aluminium cannot be extracted from bauxite by heating the bauxite with carbon.



[1]

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(b) Drinks cans are often made from aluminium.

4.0 kg of bauxite makes 1.0 kg of aluminium.

285 000 kJ of energy is needed to make 1.0 kg of aluminium from bauxite.

Aluminium can be **recycled**.

4.0 kg of recycled aluminium makes 3.8 kg of aluminium.

14 250 kJ of energy is needed to produce 1.0 kg of aluminium from recycled aluminium.

(i) Describe how aluminium is recycled.

---

[2]

(ii) Describe and explain **two** advantages of recycling aluminium.

Use the information in the question in your answer.

---

[3]

16 Fractional distillation separates crude oil into useful fractions.

Look at the table.

It shows the percentage of each fraction made from crude oil. It also shows the percentage of each fraction needed for everyday uses.

Fraction	Percentage made by fractional distillation	Percentage needed for everyday uses
Gases	4	11
Petrol	11	22
Naphtha	10	18
Paraffin	12	20
Fuel oil	22	10
Waxes and tar	23	4

(i) Which fraction is **made** in the **greatest** percentage?

Tick (✓) **one** box.

Gases ☐

Petrol ☐

Naphtha ☐

Paraffin ☐

Fuel oil ☐

Waxes and tar ☐

[1]

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(ii) Which fraction is **needed** in the **smallest** percentage?

Tick (✓) **one** box.

Gases ☐

Petrol ☐

Naphtha ☐

Paraffin ☐

Fuel oil ☐

Waxes and tar ☐

[1]

17 A student investigates the decomposition of hydrogen peroxide.

$2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$

0.2g of oxygen gas is produced in the reaction.

The student uses 0.5 g of manganese(IV) oxide as a catalyst in the reaction.

How much manganese(IV) oxide remains at the end of the reaction?

A 0.2g
B 0.3g
C 0.5g
D 0.7g

Your answer ☐ **[1]**

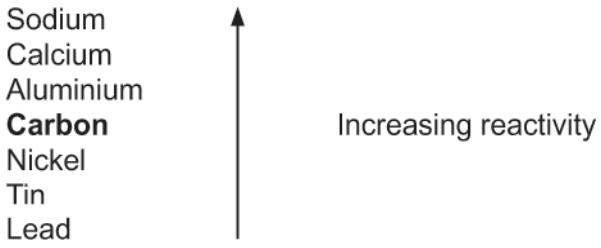
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18(a) Aluminium is a metal.

Aluminium is extracted from an ore called bauxite.

Electrolysis is used to extract the aluminium.

Use the reactivity series to explain why aluminium cannot be extracted from bauxite by heating the bauxite with carbon.



[1]

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(b) Drinks cans are often made from aluminium.

4.0 kg of bauxite makes 1.0 kg of aluminium.

285000 kJ of energy is needed to make 1.0 kg of aluminium from bauxite.

Aluminium can be **recycled**.

4.0 kg of recycled aluminium makes 3.8 kg of aluminium.

14250 kJ of energy is needed to produce 1 kg of aluminium from recycled aluminium.

(i) Describe how aluminium is recycled.

---

[2]

(ii) Describe and explain **two** advantages of recycling aluminium.
Use the information in the question in your answer.

---

[3]

19 Sodium is in Group 1 of the Periodic Table.

Rubidium is another element in Group 1.

Rubidium reacts much faster than sodium does.

Explain why.

Use ideas about electrons in your answer.

---

[2]

20 A student investigates the reactivity of four metals, **A**, **B**, **C** and **D**.

He adds a small piece of each metal to cold water.

He then adds a small piece of each metal to dilute hydrochloric acid.

Look at his results.

"

Metal	Observations in water	Observations in dilute hydrochloric acid
A	slow bubbling	very fast bubbling
B	no reaction	no reaction
C	fast bubbling	very fast bubbling
D	no change	slow bubbling

Write down the order of reactivity of the four metals **A**, **B**, **C** and **D**.

..... **most reactive**

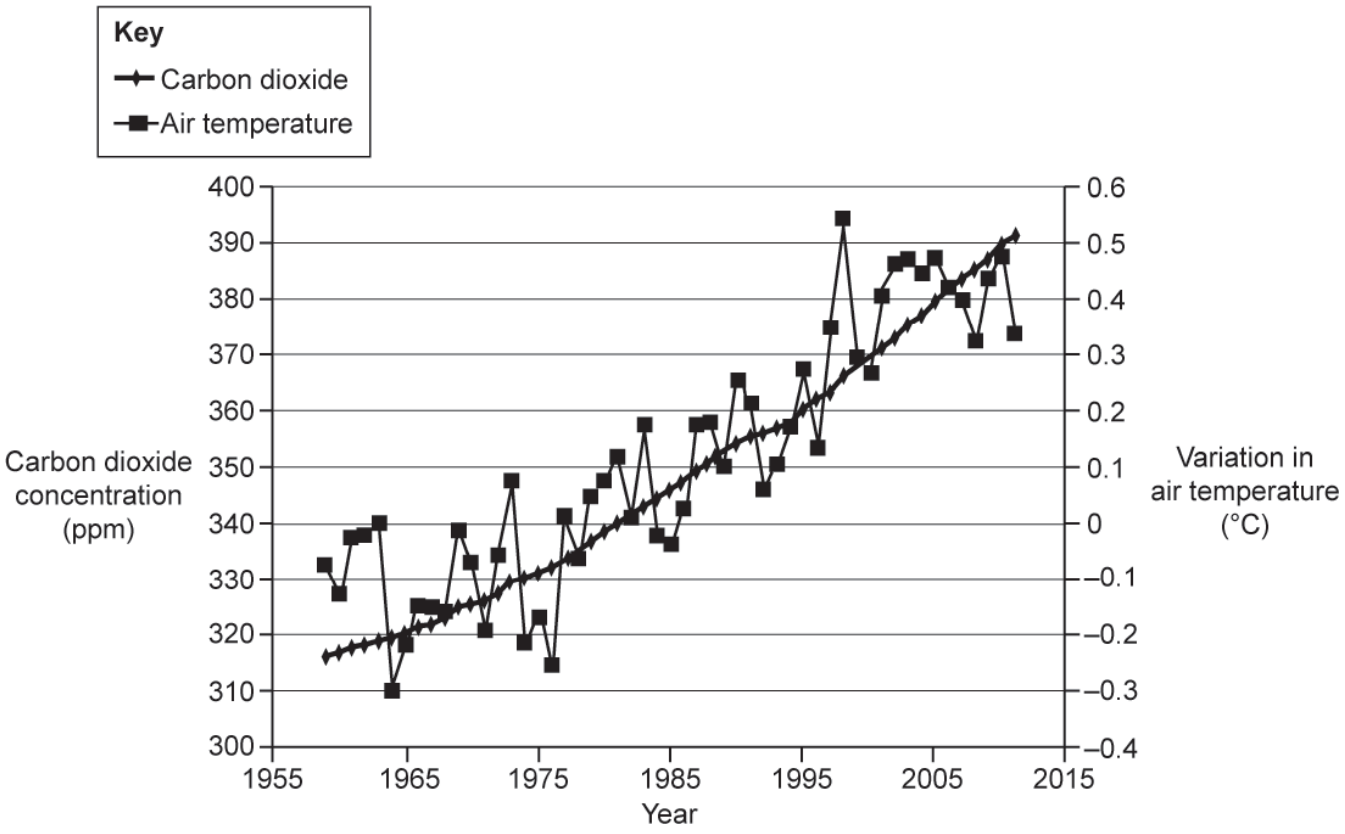
.....

.....

..... **least reactive** [2]

21 This question is about the Earth's atmosphere.

The graph shows how carbon dioxide concentration and air temperature have changed between 1955 and 2015.



Evaluate the information shown in the graph.

To what extent does the graph support a link between carbon dioxide levels and global warming?

[2]

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22 Some students investigate the reaction between sodium thiosulfate and dilute hydrochloric acid.

They want to find out how **temperature** changes the rate of reaction.

Fig. 18.3 is a diagram of their experiment.

Add dilute hydrochloric acid and start timing

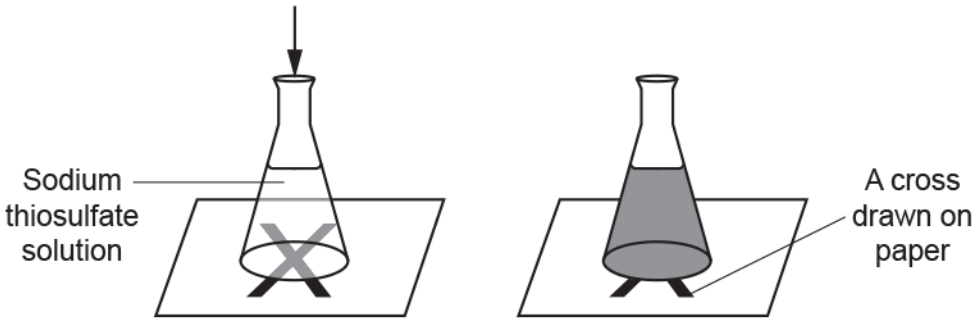


Fig. 18.3

A yellow solid is made during the reaction.

The students time how long it takes for the cross to disappear. This is the reaction time.

Look at their results.

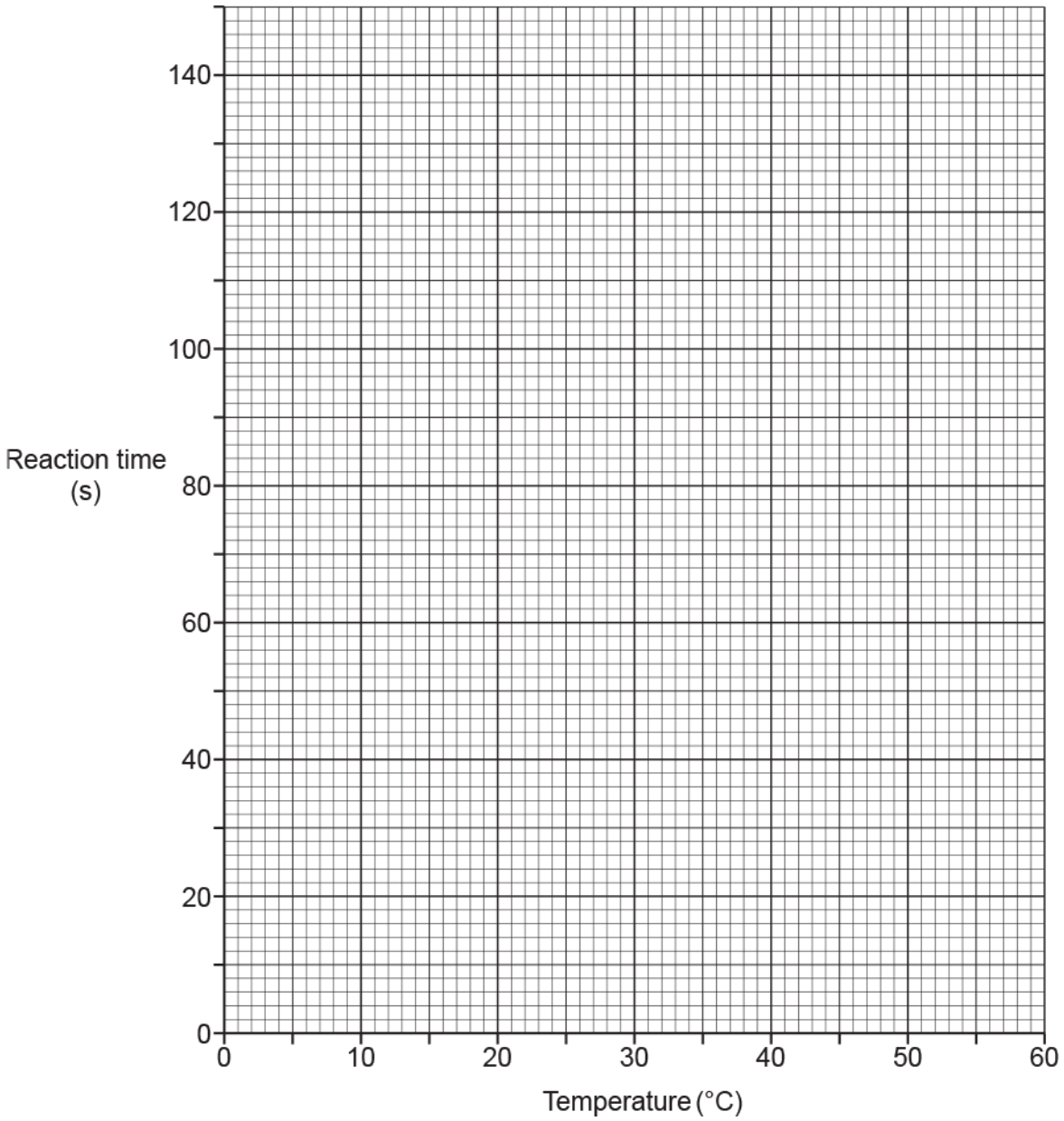
Temperature (°C)	Reaction Time (s)
10	140
20	56
30	34
40	26
50	22

(i) Plot a graph of the results on the grid. Draw a line of best fit.

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[3]

(ii) What is the reaction time at **25 °C**?

Reaction time = ... s **[1]**

(iii) What happens to the **rate of reaction** as the temperature increases?

[1]

(iv) Explain your answer to **(iii)**. Include ideas about collisions between particles in your answer.

---

[2]

END OF QUESTION PAPER

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