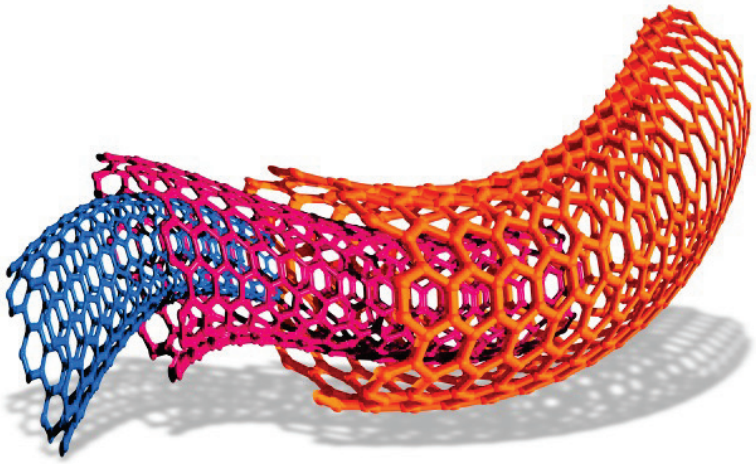
Cambridge Assessment International Education

Example Candidate Responses
Paper 5

Cambridge IGCSE®
Chemistry 0620



Version 2.0

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Contents

Introduction

The main aim of this booklet is to exemplify standards for those teaching IGCSE Chemistry (0620), and to show how different levels of candidates' performance (high, middle and low) relate to the subject's curriculum and assessment objectives.

In this booklet candidate responses have been chosen to exemplify a range of answers. Each response is accompanied by a brief commentary explaining the strengths and weaknesses of the answers.

For each question, response is annotated with clear explanation of where and why marks were awarded or omitted. This, in turn, is followed by examiner comments on how the answer could have been improved. In this way it is possible for you to understand what candidates have done to gain their marks and what they will have to do to improve their marks. At the end there is a list of common mistakes candidates made in their answers for each question.

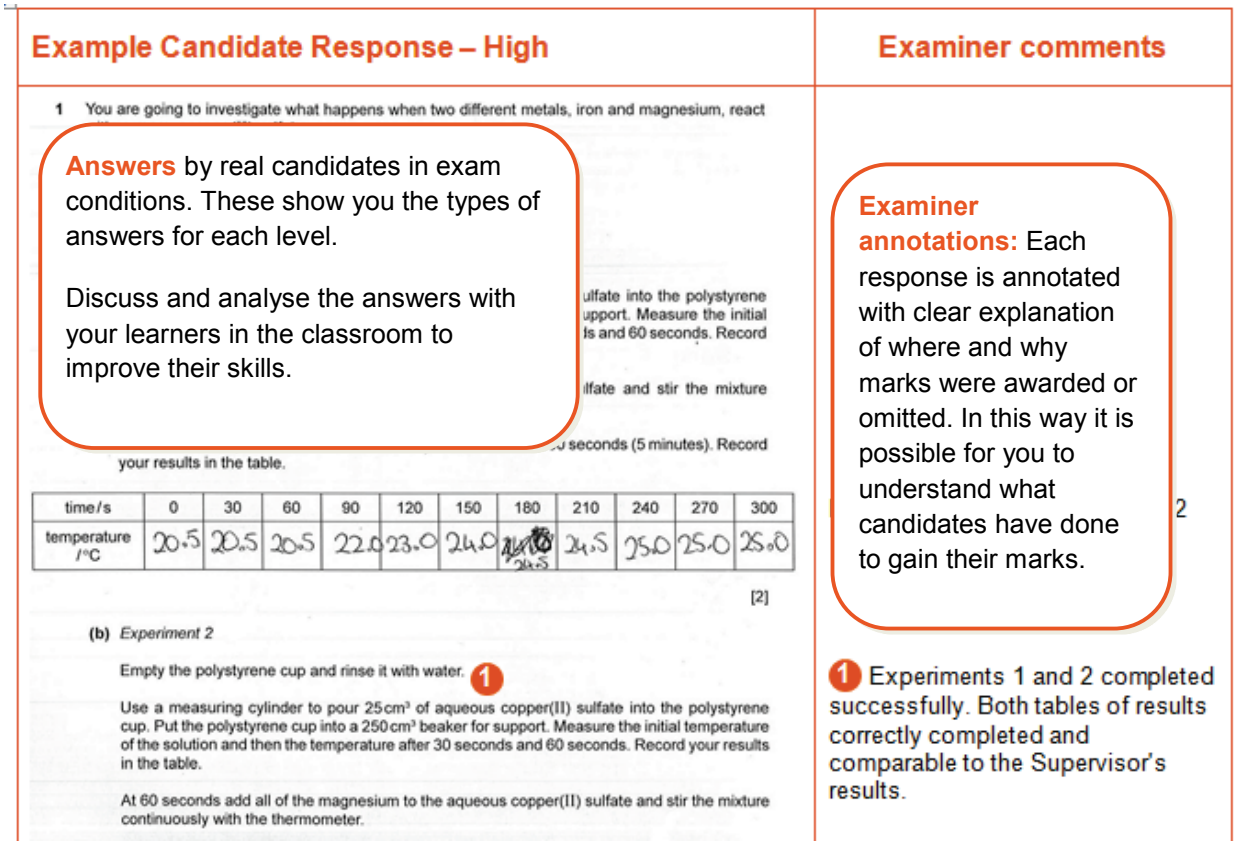
This document provides illustrative examples of candidate work. These help teachers to assess the standard required to achieve marks, beyond the guidance of the mark scheme. Some question types where the answer is clear from the mark scheme, such as short answers and multiple choice, have therefore been omitted.

The questions, mark schemes and pre-release material used here are available to download as a zip file from the School Support Hub as the Example Candidate Responses Files. These files are:

Question Paper 31, June 2016	
Question paper	0620_s16_qp_31.pdf
Mark scheme	0620_s16_ms_31.pdf
Question Paper 41, June 2016	
Question paper	0620_s16_qp_41.pdf
Mark scheme	0620_s16_ms_41.pdf
Question Paper 51, November 2016	
Question paper	0620_w16_qp_52.pdf
Mark scheme	0620_w16_ms_52.pdf
Question Paper 61, June 2016	
Question paper	0620_s16_qp_61.pdf
Mark scheme	0620_s16_ms_61.pdf

Other past papers, Examiner Reports and other teacher support materials are available on the School Support Hub at www.cambridgeinternational.org/support

How to use this booklet



Example Candidate Response – High

Examiner comments

1 You are going to investigate what happens when two different metals, iron and magnesium, react

ulfate into the polystyrene
upport. Measure the initial
ls and 60 seconds. Record

lfate and stir the mixture

seconds (5 minutes). Record
your results in the table.

time / s	0	30	60	90	120	150	180	210	240	270	300
temperature / °C	20.5	20.5	20.5	22.0	23.0	24.0	24.5	24.5	25.0	25.0	25.0

[2]

(b) *Experiment 2*

Empty the polystyrene cup and rinse it with water. 1

Use a measuring cylinder to pour 25 cm³ of aqueous copper(II) sulfate into the polystyrene cup. Put the polystyrene cup into a 250 cm³ beaker for support. Measure the initial temperature of the solution and then the temperature after 30 seconds and 60 seconds. Record your results in the table.

At 60 seconds add all of the magnesium to the aqueous copper(II) sulfate and stir the mixture continuously with the thermometer.

2

1 Experiments 1 and 2 completed successfully. Both tables of results correctly completed and comparable to the Supervisor's results.

Answers by real candidates in exam conditions. These show you the types of answers for each level.

Discuss and analyse the answers with your learners in the classroom to improve their skills.

Examiner annotations: Each response is annotated with clear explanation of where and why marks were awarded or omitted. In this way it is possible for you to understand what candidates have done to gain their marks.

How the candidate could have improved the answer

The candidate lost marks by not reading the question careful
This careful reading is needed, particularly when answering t

Examiner comments on how the answer could have been improve.

Common mistakes candidates made in this question

- Lack of smooth line graphs and incorrect
- Explanations not given where requested.
- Failure to give the number of points indic

Common mistakes a list of common mistakes candidates made in their answers for each question.

Assessment at a glance

All candidates must enter for three papers.

Core candidates take:	Extended candidates take:
Paper 1 45 minutes A multiple-choice paper consisting of 40 items of the four-choice type. This paper will test assessment objectives AO1 and AO2. Questions will be based on the Core syllabus content. This paper will be weighted at 30% of the final total mark.	**Paper 2** 45 minutes A multiple-choice paper consisting of 40 items of the four-choice type. This paper will test assessment objectives AO1 and AO2. Questions will be based on the Extended syllabus content (Core and Supplement). This paper will be weighted at 30% of the final total mark.
and:	**and:**
Paper 3 1 hour 15 minutes A written paper consisting of short-answer and structured questions. This paper will test assessment objectives AO1 and AO2. Questions will be based on the Core syllabus content. 80 marks This paper will be weighted at 50% of the final total mark.	**Paper 4** 1 hour 15 minutes A written paper consisting of short-answer and structured questions. This paper will test assessment objectives AO1 and AO2. Questions will be based on the Extended syllabus content (Core and Supplement). 80 marks This paper will be weighted at 50% of the final total mark.

All candidates take	
either:	**or:**
Paper 5 1 hour 15 minutes Practical Test This paper will test assessment objective AO3. Questions will be based on the experimental skills in Section 7. The paper is structured to assess grade ranges A*–G. 40 marks This paper will be weighted at 20% of the final total mark.	**Paper 6** 1 hou Alternative to Practical This paper will test assessment objective AO3. Questions will be based on the experimental skills in Section 7. The paper is structured to assess grade ranges A*–G. 40 marks This paper will be weighted at 20% of the final total mark.

Candidates who have studied the Core syllabus content, or who are expected to achieve a grade D or below should be entered for Paper 1, Paper 3 and either Paper 5 or Paper 6. These candidates will be eligible for grades C to G.

Candidates who have studied the Extended syllabus content (Core and Supplement), and who are expected to achieve a grade C or above should be entered for Paper 2, Paper 4 and either Paper 5 or Paper 6. These candidates will be eligible for grades A* to G.

Teachers are reminded that the latest syllabus is available on our public website at www.cambridgeinternational.org and the School Support Hub at www.cambridgeinternational.org/support

Paper 5 – Practical Test

Question 1

Example Candidate Response – Question 1, High	Examiner comments

1 You are going to investigate what happens when two different metals, iron and magnesium, react with aqueous copper(II) sulfate.

Read all the instructions carefully before starting the experiments.

Instructions
You are going to carry out two experiments.

(a) *Experiment 1*

Use a measuring cylinder to pour 25 cm^3 of aqueous copper(II) sulfate into the polystyrene cup provided. Put the polystyrene cup into a 250 cm^3 beaker for support. Measure the initial temperature of the solution and then the temperature after 30 seconds and 60 seconds. Record your results in the table.

At 60 seconds add all of the iron to the aqueous copper(II) sulfate and stir the mixture continuously with the thermometer.

Measure the temperature of the mixture every 30 seconds for 300 seconds (5 minutes). Record your results in the table.

time / s	0	30	60	90	120	150	180	210	240	270	300
temperature / °C	20.5	20.5	20.5	22.0	23.0	24.0	24.5	24.5	25.0	25.0	25.0

[2]

(b) *Experiment 2*

Empty the polystyrene cup and rinse it with water.

Use a measuring cylinder to pour 25 cm^3 of aqueous copper(II) sulfate into the polystyrene cup. Put the polystyrene cup into a 250 cm^3 beaker for support. Measure the initial temperature of the solution and then the temperature after 30 seconds and 60 seconds. Record your results in the table.

At 60 seconds add all of the magnesium to the aqueous copper(II) sulfate and stir the mixture continuously with the thermometer.

Measure the temperature of the mixture every 30 seconds for 300 seconds (5 minutes). Record your results in the table.

time / s	0	30	60	90	120	150	180	210	240	270	300
temperature / °C	20.5	20.5	20.5	83.0	86.5	86.0	85.0	83.5	81.0	78.5	76.5

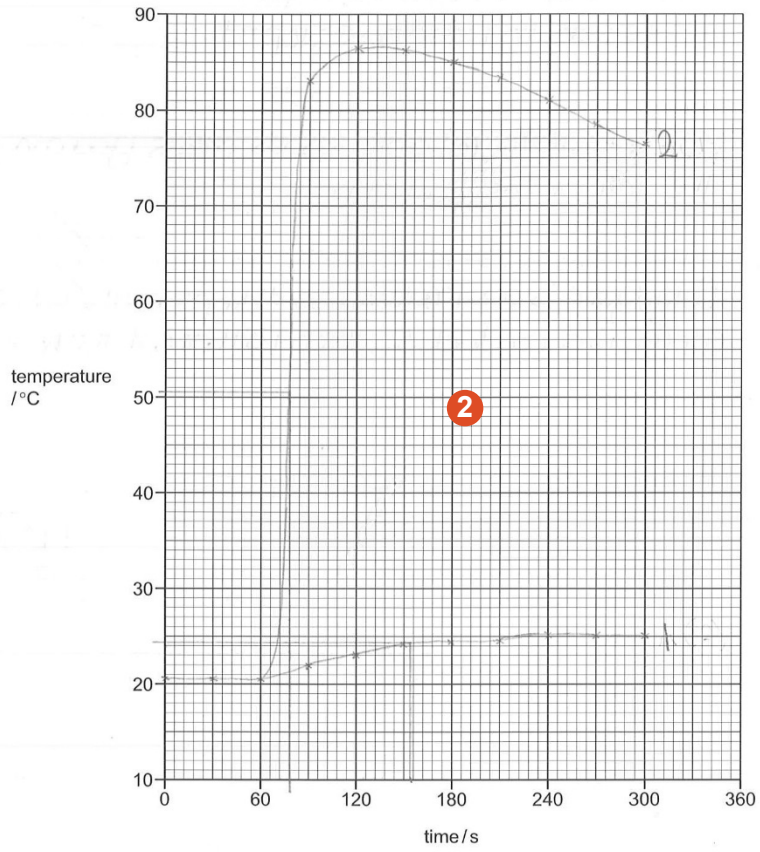
1

[2]

1 Experiments 1 and 2 have been completed successfully. Both tables of results are completed correctly and they are comparable to the supervisor's results.

Mark awarded for (a) = 2 out of 2

Mark awarded for (b) = 2 out of 2

Example Candidate Response – Question 1, High	Examiner comments
(c) Plot the results for Experiments 1 and 2 on the grid and draw **two** smooth line graphs. Clearly label the graphs.  [4] **(d) (i)** **From your graph**, deduce the temperature of the mixture in Experiment 1 after 135 seconds. Show clearly **on the grid** how you worked out your answer. 3 24.5 °C [2] **(ii)** **From your graph**, deduce the time taken for the temperature of the mixture in Experiment 2 to change by 30 °C **after the magnesium was added**. Show clearly **on the grid** how you worked out your answer. 78 s [2] 4	**2** All the points are correctly plotted and the line graphs are drawn smoothly. The graphs are clearly labelled as requested. Mark awarded for (c) = 4 out of 4 **3** The tie line is wrongly drawn from 153 seconds. Credit is given for reading the value from this tie line. Mark awarded for (d) (i) = 1 out of 2 **4** The tie line shows the candidate understands that the temperature will have risen to 20.5 + 30 = 50.5 °C. The time of 78 s is correct but 60 seconds need to be subtracted from this value because the time required is after the magnesium has been added. Mark awarded for (d) (ii) = 1 out of 2

Example Candidate Response – Question 1, High	Examiner comments
(e) Predict the temperature of the mixture in Experiment 2 after one hour. Explain your answer. 20.5°C, as that is the temperature of it's surroundings and the reaction would have stopped. [2] 5 (f) Suggest an advantage of taking the temperature readings every 15 seconds. More ~~accurate~~ reliable results means you can judge the rate of the reaction better 6 [2] (g) Explain why a polystyrene cup is used in the experiments and **not** a copper can. Polystyrene is an insulator, so it traps heat, whereas copper is a conductor, which will absorb the heat. [2] 7 [Total: 18]	5 The candidate realises the reaction is finished. After 1 hour the mixture would have returned to the initial temperature recorded in the table as 20.5 °C. Mark awarded for (e) = 2 out of 2 6 Credit is given for 'more results' but the point about reliability is ignored because it is not relevant. Understanding that the resultant graph would be a smoother/better curve would have gained full credit. Mark awarded for (f) = 1 out of 2 7 The candidate shows knowledge and understanding of the properties of polystyrene. Mark awarded for (g) = 2 out of 2 **Total mark awarded = 15 out of 18**

How the candidate could have improved the answer

The candidate lost marks by not reading the questions carefully, e.g. drawing the wrong tie line. Careful reading was required, especially when answering the more difficult questions.

Example Candidate Response – Question 1, Middle

1 You are going to investigate what happens when two different metals, iron and magnesium, react with aqueous copper(II) sulfate.

Read all the instructions carefully before starting the experiments.

Instructions
You are going to carry out two experiments.

(a) *Experiment 1*

Use a measuring cylinder to pour 25 cm^3 of aqueous copper(II) sulfate into the polystyrene cup provided. Put the polystyrene cup into a 250 cm^3 beaker for support. Measure the initial temperature of the solution and then the temperature after 30 seconds and 60 seconds. Record your results in the table.

At 60 seconds add all of the iron to the aqueous copper(II) sulfate and stir the mixture continuously with the thermometer.

Measure the temperature of the mixture every 30 seconds for 300 seconds (5 minutes). Record your results in the table.

time / s	0	30	60	90	120	150	180	210	240	270	300
temperature / °C	18	17	17	18	20	21	22	22	23	23	24

[2]

(b) *Experiment 2*

Empty the polystyrene cup and rinse it with water.

Use a measuring cylinder to pour 25 cm^3 of aqueous copper(II) sulfate into the polystyrene cup. Put the polystyrene cup into a 250 cm^3 beaker for support. Measure the initial temperature of the solution and then the temperature after 30 seconds and 60 seconds. Record your results in the table.

At 60 seconds add all of the magnesium to the aqueous copper(II) sulfate and stir the mixture continuously with the thermometer.

Measure the temperature of the mixture every 30 seconds for 300 seconds (5 minutes). Record your results in the table.

time / s	0	30	60	90	120	150	180	210	240	270	300
temperature / °C	18	18	18	60	78	80	80	78	77	74	73

1 [2]

Examiner comments

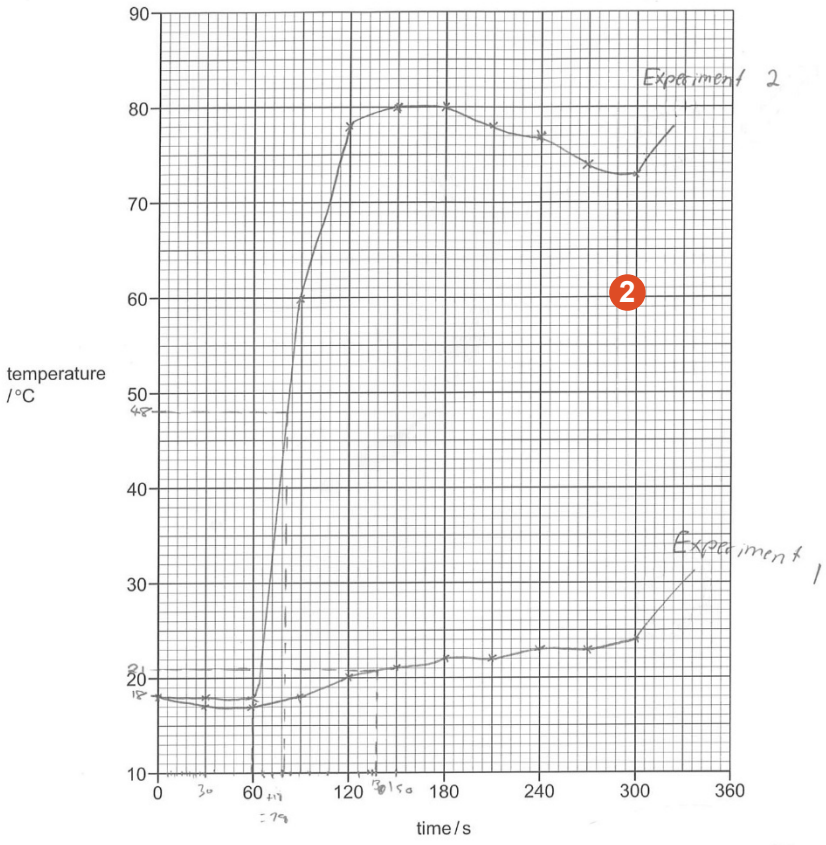
1 Both experiments have been carried out. The tables of results are completed correctly. The first three readings should be similar to show the instructions have been followed as requested.

Mark awarded for (a) = 2 out of 2

Mark awarded for (b) = 2 out of 2

Example Candidate Response – Question 1, Middle	Examiner comments

(c) Plot the results for Experiments 1 and 2 on the grid and draw **two** smooth line graphs. Clearly label the graphs.



2

[4]

(d) (i) **From your graph**, deduce the temperature of the mixture in Experiment 1 after 135 seconds.
Show clearly **on the grid** how you worked out your answer.

3

21 °C ..... °C [2]

(ii) **From your graph**, deduce the time taken for the temperature of the mixture in Experiment 2 to change by 30 °C **after the magnesium was added**.
Show clearly **on the grid** how you worked out your answer.

4

18 ..... s [2]

2 All points are plotted correctly. The line graphs are not smooth and go up at the end so only partial credit is given for the labels.

Mark awarded for (c) = 3 out of 4

3 The tie line is incorrectly positioned at 138*s* but credit is given for the value.

Mark awarded for (d) (i) = 1 out of 2

4 The candidate shows a good understanding of the steps required to work out the answer. The tie line at 48 °C is clearly shown.

Mark awarded for (d) (ii) = 2 out of 2

Example Candidate Response – Question 1, Middle	Examiner comments
(e) Predict the temperature of the mixture in Experiment 2 after one hour. Explain your answer. 19 °C, it would've naturally cooled down back to room temperature. 5 [2] (f) Suggest an advantage of taking the temperature readings every 15 seconds. You will get more accurate results on the graph. 6 [2] (g) Explain why a polystyrene cup is used in the experiments and **not** a copper can. Copper is conductive and also may react with the experiment, polystyrene is not conductive and will not react. 7 [2] [Total: 18]	5 The candidate does not give an explanation for a correct answer in terms of the reaction finishing. Mark awarded for (e) = 1 out of 2 6 Reference to accuracy alone is not enough. The idea of more readings leading to a smoother graph is required. Mark awarded for (f) = 0 out of 2 7 The idea that copper conducts heat gains credit. There is no explanation in terms of heat losses causing errors in the results. Mark awarded for (g) = 1 out of 2 **Total mark awarded = 12 out of 18**

How the candidate could have improved the answer

The two graphs drawn were not smooth. Graphs should be straight lines drawn with a ruler or smooth curves.

No explanations were given in response to questions with the command word 'Explain'.

Example Candidate Response – Question 1, Low	Examiner comments

1 You are going to investigate what happens when two different metals, iron and magnesium (powder), react with aqueous copper(II) sulfate.

Read all the instructions carefully before starting the experiments.

Instructions
You are going to carry out two experiments.

(a) *Experiment 1*

Use a measuring cylinder to pour 25 cm^3 of aqueous copper(II) sulfate into the polystyrene cup provided. Put the polystyrene cup into a 250 cm^3 beaker for support. Measure the initial temperature of the solution and then the temperature after 30 seconds and 60 seconds. Record your results in the table.

At 60 seconds add all of the iron to the aqueous copper(II) sulfate and stir the mixture continuously with the thermometer.

Measure the temperature of the mixture every 30 seconds for 300 seconds (5 minutes). Record your results in the table.

time / s	0	30	60	90	120	150	180	210	240	270	300
temperature / °C	19	19	19	21	22	22	22.5	23	23	23.5	23.5

[2]

(b) *Experiment 2*

Empty the polystyrene cup and rinse it with water. 1

Use a measuring cylinder to pour 25 cm^3 of aqueous copper(II) sulfate into the polystyrene cup. Put the polystyrene cup into a 250 cm^3 beaker for support. Measure the initial temperature of the solution and then the temperature after 30 seconds and 60 seconds. Record your results in the table.

At 60 seconds add all of the magnesium to the aqueous copper(II) sulfate and stir the mixture continuously with the thermometer.

Measure the temperature of the mixture every 30 seconds for 300 seconds (5 minutes). Record your results in the table.

time / s	0	30	60	90	120	150	180	210	240	270	300
temperature / °C	19	19	19	78	85	87	85	84	81.5	79	77

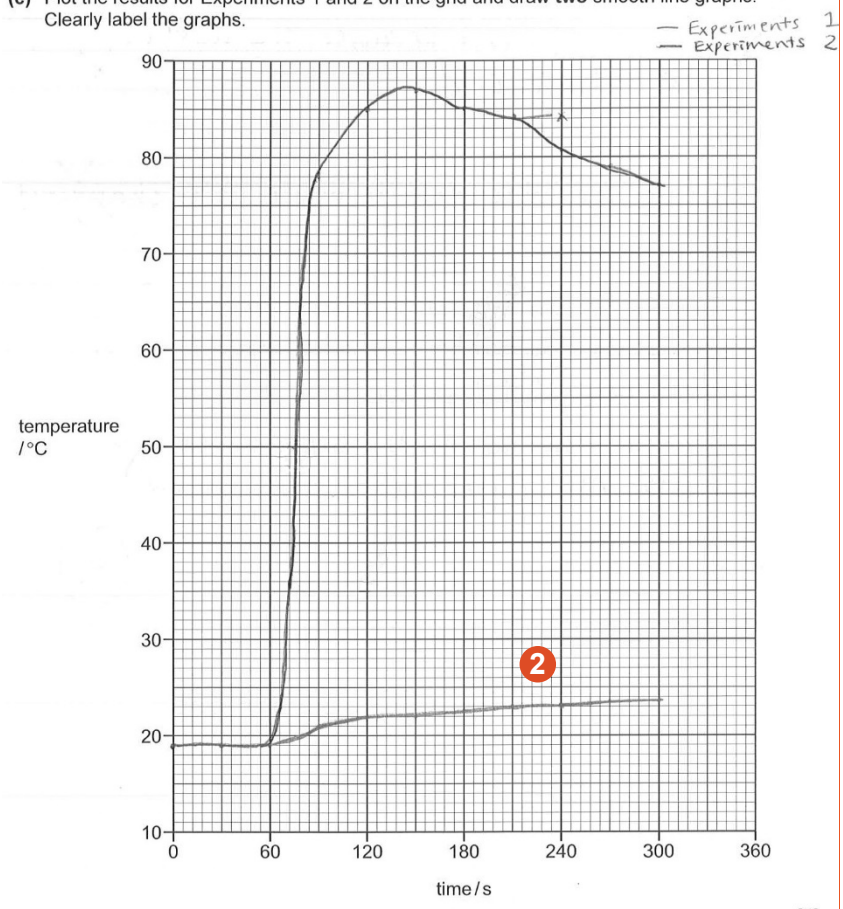
[2]

1 Experiments 1 and 2 have been carried out successfully.

Both tables of results are completed correctly.

Mark awarded for (a) = 2 out of 2

Mark awarded for (b) = 2 out of 2

Example Candidate Response – Question 1, Low	Examiner comments
(c) Plot the results for Experiments 1 and 2 on the grid and draw **two** smooth line graphs. Clearly label the graphs.  [4] **(d) (i)** **From your graph**, deduce the temperature of the mixture in Experiment 1 after 135 seconds. Show clearly **on the grid** how you worked out your answer. 3 ..... 22 ..... °C [2] **(ii)** **From your graph**, deduce the time taken for the temperature of the mixture in Experiment 2 to change by 30 °C **after the magnesium was added**. Show clearly **on the grid** how you worked out your answer. 4 ..... 60 ..... s [2]	2 All points are plotted correctly and the graph is smooth. Mark awarded for (c) = 4 out of 4 3 The candidate has read the value correctly but fails to show clearly on the grid how the answer is worked out. Mark awarded for (d) (i) = 1 out of 2 4 There is a lack of knowledge and understanding. Mark awarded for (d) (ii) = 0 out of 2

Example Candidate Response – Question 1, Low	Examiner comments
(e) Predict the temperature of the mixture in Experiment 2 after one hour. Explain your answer. It's getting lower Because the mixture is getta getting cold. [2] 5 (f) Suggest an advantage of taking the temperature readings every 15 seconds. We can see more details while it's changing. [2] 6 (g) Explain why a polystyrene cup is used in the experiments and **not** a copper can. ~~Because if the mixture is getting hot, then copper can is going hot together.~~ [2] Because the chemicals might be able to reacts with copper can. [Total: 18] 7	5 The candidate gives a vague answer which is not enough to gain credit. The explanation that the reaction is finished and the temperature of the mixture would return to room temperature is not realised. Mark awarded for (e) = 0 out of 2 6 No appreciation is evident here that more results would be obtained which would result in a smoother graph. Mark awarded for (f) = 0 out of 2 7 There is a lack of knowledge and understanding about the insulating properties of polystyrene results in a guessed answer. Mark awarded for (g) = 0 out of 2 **Total mark awarded = 9 out of 18**

How the candidate could have improved the answer

The instruction to 'Show clearly **on the grid**…' was ignored.

More detail was needed in answers which showed a vague approach and a lack of knowledge and understanding.

Common mistakes candidates made in this question

- Line graphs were not smooth.
- Tie lines were incorrect.
- Not giving explanations when requested.
- Not giving the number of points indicated by the mark allocation of the question.

Question 2

Example Candidate Response – Question 2, High	Examiner comments

2 You are provided with two solutions, solution **Q** and solution **R**.
Carry out the following tests on solution **Q** and solution **R**, recording all of your observations at each stage.

tests on solution Q

(a) Divide solution **Q** into four equal portions in four test-tubes. Carry out the following tests.

(i) Use pH indicator paper to measure the pH of the first portion of solution **Q**.

pH 2 (1) [1]

(ii) Add a 2 cm strip of magnesium ribbon to the second portion of solution **Q**. Test the gas given off.
Record your observations.

Fizzing, bubbles produced. Lit splint went 'pop' when introduced to the test-tube. (2) [2]

(iii) Add a spatula measure of sodium carbonate to the third portion of solution **Q**. Test the gas given off.
Record your observations.

Fizzing. Limewater went cloudy when gas given off was ran through it, used a pipette. [2]

(iv) Add a few drops of dilute nitric acid and about 1 cm^3 of aqueous barium nitrate to the fourth portion of solution **Q**.
Record your observations.

White precipitate formed. (3) [1]

tests on solution R

(b) Divide solution **R** into four equal portions in four test-tubes. Carry out the following tests.

(i) Measure the pH of the first portion of solution **R**.

pH 10 (4) [1]

(ii) Add several drops of aqueous sodium hydroxide to the second portion of solution **R** and shake the test-tube.
Then add excess aqueous sodium hydroxide to the test-tube.
Record your observations.

~~When added excess drops of NaOH the solution went colourless with white precipitate~~ [2]

when added few drops white precipitate
when added excess NaOH clear colourless solution
with no precipitate. (5)

(1) *pH* value is in the correct range (0–3).

Mark awarded for (a) (i) = 1 out of 1

(2) Fizzing is observed. The correct tests on gases are produced and the results of the tests are clearly stated.

Mark awarded for (a) (ii) = 2 out of 2

Mark awarded for (a) (iii) = 2 out of 2

(3) The expected observation is given.

Mark awarded for (a) (iv) = 1 out of 1

(4) *pH* value is in the allowed range (10–14).

Mark awarded for (b) (i) = 1 out of 1

(5) The wrong result is given for when excess aqueous sodium hydroxide is added. The answer should be insoluble.

Mark awarded for (b) (ii) = 1 out of 2

Example Candidate Response – Question 2, High	Examiner comments
(iii) Add aqueous silver nitrate to the third portion of solution **R** and leave to stand for about 5 minutes. Record your observations. Yellow ppt precipitate formed with colourless solution 6 [2] (iv) Add a spatula measure of iron(II) sulfate crystals to the fourth portion of solution **R** and shake the mixture. Record your observations. Solution went dark green. 7 [1] (c) Identify solution **Q**.<br~~Sulphate~~ Sol Sulfuric acid. [2] (d) Identify solution **R**. Aluminium (III) iodide [2] 8 [Total: 16]	6 The precipitate is incorrectly described as yellow instead of brown. Mark awarded for (b) (iii) = 1 out of 2 7 The candidate fails to note the presence of a precipitate. Mark awarded for (b) (iv) = 0 out of 1 Mark awarded for (c) = 2 out of 2 8 The candidate fails to work out that the *pH* value of 10 obtained in (b) (i) indicates the presence of hydroxide ions. The presence of iodide ions has been inferred from an erroneous observation in (b) (iii). Mark awarded for (d) = 0 out of 2 **Total mark awarded = 11 out of 16**

How the candidate could have improved the answer

Some observations were not fully described, e.g. dark green precipitate was only given as dark green.

Example Candidate Response – Question 2, Middle

2 You are provided with two solutions, solution **Q** and solution **R**.
Carry out the following tests on solution **Q** and solution **R**, recording all of your observations at each stage.

tests on solution Q

(a) Divide solution **Q** into four equal portions in four test-tubes. Carry out the following tests.

(i) Use pH indicator paper to measure the pH of the first portion of solution **Q**.

pH ..... [1]

(ii) Add a 2 cm strip of magnesium ribbon to the second portion of solution **Q**. Test the gas given off.
Record your observations.

when magnesium was added it bubbled and when a lit splint was added it poped gas is hydrogen [2]

(iii) Add a spatula measure of sodium carbonate to the third portion of solution **Q**. Test the gas given off.
Record your observations.

bubble put gas through limewater turned cloudy, gas is co2 [2]

(iv) Add a few drops of dilute nitric acid and about 1 cm^3 of aqueous barium nitrate to the fourth portion of solution **Q**.
Record your observations.

cloudy percipate formed from colourless solution [1]

tests on solution R

(b) Divide solution **R** into four equal portions in four test-tubes. Carry out the following tests.

(i) Measure the pH of the first portion of solution **R**.

pH 3 [1]

(ii) Add several drops of aqueous sodium hydroxide to the second portion of solution **R** and shake the test-tube.
Then add excess aqueous sodium hydroxide to the test-tube.
Record your observations.

When added in small amounts unreacted when in excess still unreactive [2]

Examiner comments

1 pH is in the correct range (0–3).

Mark awarded for (a) (i) = 1 out of 1

2 Bubbles are seen and recorded. The lighted splint test is stated and the result obtained gains full credit.

Mark awarded for (a) (ii) = 2 out of 2

3 Bubbles are recorded and 'limewater turns cloudy' is the expected test for carbon dioxide gas.

Mark awarded for (a) (iii) = 2 out of 2

4 Cloudy, milky and turbid are not specific descriptions for a positive sulfate test. White precipitate is specific.

Mark awarded for (a) (iv) = 0 out of 1

Mark awarded for (b) (i) = 0 out of 1

5 The candidate shows a lack of knowledge and understanding of the use of aqueous sodium hydroxide to identify metal cations.

Mark awarded for (b) (ii) = 0 out of 2

Example Candidate Response – Question 2, Middle	Examiner comments
(iii) Add aqueous silver nitrate to the third portion of solution **R** and leave to stand for about 5 minutes. Record your observations. turned from etc colourless Solution to dark brown then to light brown then finally Stayed the same [2] (iv) Add a spatula measure of iron(II) sulfate crystals to the fourth portion of solution **R** and shake the mixture. Record your observations. 6 colourless turned clear ~~substance~~ solution to dark cream [1] (c) Identify solution **Q**. Hydrogen sulfate 7 [2] (d) Identify solution **R**. ammonium ~~carbonate~~ sulfite 8 [2] [Total: 16]	Mark awarded for (b) (iii) = 1 out of 2 6 The formation of precipitates in (ii) and (iii) is not recorded. Mark awarded for (b) (iv) = 0 out of 1 7 Solution Q is sulfuric acid. Hydrogen sulfate is allowed as an alternative name. Mark awarded for (c) = 2 out of 2 8 Solution R is aqueous calcium hydroxide. This is a guessed answer. Incorrect observations made earlier in the question lead to this error. Mark awarded for (d) = 0 out of 2 **Total mark awarded = 8 out of 16**

How the candidate could have improved the answer

Greater clarity and detail were needed when recording observations of tests carried out.

Example Candidate Response – Question 2, Low

2 You are provided with two solutions, solution **Q** and solution **R**.
Carry out the following tests on solution **Q** and solution **R**, recording all of your observations at each stage.

tests on solution Q

(a) Divide solution **Q** into four equal portions in four test-tubes. Carry out the following tests.

(i) Use pH indicator paper to measure the pH of the first portion of solution **Q**.

pH ~~4~~ 2 [1]

(ii) Add a 2 cm strip of magnesium ribbon to the second portion of solution **Q**. Test the gas given off.
Record your observations.

Tested for hydrogen and popping sound was heard. Hydrogen is given off [2]

(iii) Add a spatula measure of sodium carbonate to the third portion of solution **Q**. Test the gas given off.
Record your observations.

Tested for oxygen with a glowing splint and the splint relighted. Oxygen is present [2]

(iv) Add a few drops of dilute nitric acid and about 1 cm^3 of aqueous barium nitrate to the fourth portion of solution **Q**.
Record your observations.

Milky precipitate forms on top and when mixed becomes a solution [1]

tests on solution R

(b) Divide solution **R** into four equal portions in four test-tubes. Carry out the following tests.

(i) Measure the pH of the first portion of solution **R**.

pH 12 [1]

(ii) Add several drops of aqueous sodium hydroxide to the second portion of solution **R** and shake the test-tube.
Then add excess aqueous sodium hydroxide to the test-tube.
Record your observations.

Nothing happens / No reaction [2]

Examiner comments

1 Solution Q is sulfuric acid. pH is in the correct range (0–3).

Mark awarded for (a) (i) = 1 out of 1

2 The candidate does not record the observation that the mixture fizzes/bubbles. A test result is given but the test using a lighted splint is not given.

Mark awarded for (a) (ii) = 0 out of 2

3 No observation is given. The candidate shows a lack of knowledge and understanding – the gas tested is thought to be oxygen instead of carbon dioxide.

Mark awarded for (a) (iii) = 0 out of 2

4 The vague description of a milky precipitate instead of a white precipitate is penalised.

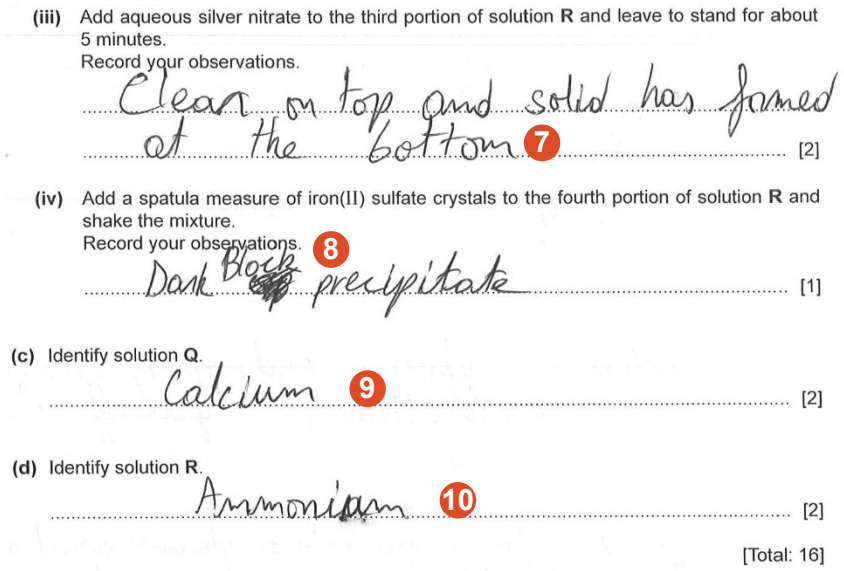
Mark awarded for (a) (iv) = 0 out of 1

5 Solution R is aqueous calcium hydroxide and a pH in the allowed range (10–14) gained credit.

Mark awarded for (b) (i) = 1 out of 1

6 The formation of a white precipitate which does not dissolve in excess aqueous sodium hydroxide is the expected observation.

Mark awarded for (b) (ii) = 0 out of 2

Example Candidate Response – Question 2, Low	Examiner comments
	7 The candidate recognises the formation of a solid but no colour is described. No credit is given as a brown precipitate is not described. Mark awarded for (b) (iii) = 0 out of 2 8 The formation of a precipitate is recorded but the colour is described as black instead of green. Mark awarded for (b) (iv) = 0 out of 1 9 The candidate is unable to conclude that an acid is present despite the correct result for the test in (a) (i). Mark awarded for (c) = 0 out of 2 10 The presence of hydroxide ions has not been inferred from the test in (b) (i). Mark awarded for (d) = 0 out of 2 **Total mark awarded = 2 out of 16**

How the candidate could have improved the answer

The candidate needed to describe the tests carried out as well as the results obtained from the tests.

The candidate showed a lack of knowledge and understanding.

Common mistakes candidates made in this question

- Making careless observations lacking the detail necessary to correlate with the marks allocated.
- Not using the practical notes provided to identify substances from the results obtained from the tests.

Question 3

Example Candidate Response – Question 3, High	Examiner comments

3 A liquid cleaner is a mixture of three substances. These substances are shown in the table.

name of substance	properties of substance
water	liquid, boiling point 100 °C
sodium carbonate	solid, soluble in water
silica	solid, insoluble in water

Plan experiments to obtain separate pure samples of each substance from the mixture in the liquid cleaner. You are provided with common laboratory apparatus.

~~1) Divide 1) Pour 30 cm³ of liquid~~
1) Measure 30 cm³ of liquid cleaner using a burette and pour it into ~~an evaporating dish~~ flask with a condenser on top
2) Heat it till 100°C. Condense the gas given off.
3) After condensation has occured add ~~to~~ anhydrous copper (II) sulfate ~~to measure~~ to the ~~liquid~~ gas condensed (liquid). If ~~it~~ the solution goes blue, then the solution is pure water.
~~4) Now there are 2 substance left in the liquid~~

..... [6]

[Total: 6]

1) Measure 30 cm³ of liquid cleaner using a burette.
2) Pour it into a funnel with filter paper and collect the left over in a ~~beaker~~ flask.
~~3) The residue left is the silica,~~
3) Take the residue off the filter paper, which is silica.
4) On top of the flask attach a condenser pipe and heat the flask till 100°C and condense the gas. Have a thermometer using ice to measure the temprature inside the flask.
5) Test the condensed gas (liquid) ~~with~~ by adding anhydrous copper (II) sulfate, if the solution changes to ~~colour~~ blue then that means it is pure water.
~~6) There must be crystals formed on the flask too~~ Continued on Pg 8

Q3) 6) There must be crystals formed in the flask, wait for it to cool down, that is ~~Sodium Carbonate~~ pure Sodium carbonate.

~~7) Don~~

1 Silica is separated by filtration.

2 Water obtained by heating and condensing vapour scores both marks.

3 Sodium carbonate is separated out as crystals after cooling.

Total mark awarded = 5 out of 6

How the candidate could have improved the answer

The silica was separated by filtration. However, the candidate failed to purify the silica by washing it with water and then drying.

Example Candidate Response – Question 3, Middle

3 A liquid cleaner is a mixture of three substances. These substances are shown in the table.

name of substance	properties of substance
water	liquid, boiling point 100 °C
sodium carbonate	solid, soluble in water
silica	solid, insoluble in water

Plan experiments to obtain separate pure samples of each substance from the mixture in the liquid cleaner. You are provided with common laboratory apparatus.

Step 1: Boil off the wate by using a bunsen and solution in a beaker. Collect the gas.
Step 2: Mix the remande with wate than filter using filte paper and a funnel. The solid will be the silica
Step 3: again boil off the remaining liquid to obtain the sodium carbonate
Step 4: Cool down the gas collected in step 1 to obtain the water

[6]

[Total: 6]

Examiner comments

1 Silica is obtained from the mixture by filtration. The idea of purifying the silica by washing it with water and then drying the residue is not realised.

2 Sodium carbonate is separated by evaporation.

3 The candidate separates the water successfully in Steps 1 and 2.

Total mark awarded = 4 out of 6

How the candidate could have improved the answer

The silica was separated by filtration. However, the candidate failed to purify the silica by washing it with water and then drying.

Example Candidate Response – Question 3, Low	Examiner comments
3 A liquid cleaner is a mixture of three substances. These substances are shown in the table. name of substance / properties of substance water / liquid, boiling point 100 °C sodium carbonate / solid, soluble in water silica / solid, insoluble in water Plan experiments to obtain separate pure samples of each substance from the mixture in the liquid cleaner. You are provided with common laboratory apparatus. Filter the liquid cleaner to get the silica out of the mixture. Then use the distillation method to separate the water from the soluble sodium carbonate. Filtration method then simple distillation is the way to separate all of the substances 1 [6] [Total: 6]	1 The candidate separates the silica from the mixture but does not purify it by washing with water and drying. Distillation separates the water. There is no detail as to how the sodium carbonate is obtained. **Total mark awarded = 3 out of 6**

How the candidate could have improved the answer

The silica was separated by filtration. However, the candidate failed to purify the silica by washing it with water and then drying.

The candidate failed to separate the sodium carbonate from the mixture.

Common mistakes candidates made in this question

- Failing to purify the silica obtained from filtration.
- Separating the water successfully by heating the mixture but not mentioning condensing/cooling the vapour to obtain the liquid.

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