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# Examiners' Report
# June 2024

## GCSE Chemistry 1CH0 2F

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June 2024

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## Introduction

Paper 2F is the second of the two papers for GCSE Chemistry at Foundation tier.

The paper consists of ten questions in total, six of which form one of the GCSE Combined Science Foundation tier papers. The final three questions in this paper are also found in the equivalent Higher tier chemistry paper.

This paper is targeted at grades up to and including Grade 5.

Most candidates made a good attempt at the majority of questions on the paper with the most able candidates showing a good range of chemistry and practical knowledge alongside sound maths skills. Some candidates were not able to use scientific vocabulary to express their answers clearly, and could not link ideas together to form an explanation.

It was also noted that the separate science questions performed less well than those that also appeared on the Combined Science paper and those questions that contained a lot of information were often not attempted at all.

## Question 1 (a)(i)

The first question on the paper asked for a property of silver that made it a suitable material to make a spoon from.

There were a number of different properties that were accepted as long as they were relevant to silver being used as a spoon, and this question was generally well answered. Properties of silver that are irrelevant to its use in cutlery such as electrical conductivity were ignored.

The most common incorrect answer seen was that silver doesn't rust. This was not accepted as rusting only relates to ferrous metals.

**1** (a) Figure 1 shows a metal spoon.

**Figure 1**

This spoon is made of silver.

(i) Give a reason why silver is a suitable material to use for making a spoon.

**(1)**

it doesn't corrode

ResultsPlus
Examiner Comments

The most common correct answer related to the low reactivity of silver. Other commonly seen responses that scored were that silver is malleable and has a high melting point.

ResultsPlus
Examiner Tip

Make sure that the property relates to the use of the object.

Responses stating that silver doesn't rust were the most frequently seen incorrect answer.

**1** (a) Figure 1 shows a metal spoon.

**Figure 1**

This spoon is made of silver.

(i) Give a reason why silver is a suitable material to use for making a spoon.

**(1)**

it doesn't rust

ResultsPlus
Examiner Comments

Candidates had the right idea about the low reactivity of silver but used an incorrect term in their description and therefore could not score the mark.

ResultsPlus
Examiner Tip

The word 'rust' refers only to metals that contain iron.

This response did not score any marks.

Responses stating that silver is non-corrosive were sometimes seen.

**1** (a) Figure 1 shows a metal spoon.

**Figure 1**

This spoon is made of silver.

(i) Give a reason why silver is a suitable material to use for making a spoon.

**(1)**

non-corrosive

**ResultsPlus**
**Examiner Comments**

It would appear that there is some confusion between corrosive materials and materials that do not corrode.

## Question 1 (a)(ii)

This question asked about advantages of spoons made of wood rather than plastic. Candidates were told that wood comes from trees and that plastic is made from crude oil in order to assist them with their answer.

This was surprisingly poorly answered with most candidates scoring no marks, although there were a lot of near misses. Only the most able candidates scored two marks but many scored one mark, usually for identifying wood as a renewable resource or crude oil as a finite resource. There were fewer responses that considered the fact that plastic does not biodegrade easily and no responses seen at all that mentioned trees taking in carbon dioxide from the atmosphere.

Responses that didn't score were usually too vague such as 'less pollution' or 'better from the environment' or discussed physical properties of the wood and plastic that were often incorrect.

This response scored two marks.

It was rare that two marks were awarded but this candidate has given a response that explains the issues with crude oil stating that it is a finite resource that will eventually run out (whereas we can plant more trees) and also that plastic takes years to break down compared to wood.

The marks cannot be awarded twice but there is enough here for both marks to be awarded.

(ii) **Some spoons are made of wood or plastic, not metal.**

**The raw material for wooden spoons is trees and the raw material for plastic spoons is crude oil.**

**Explain an advantage, other than cost, of using wood rather than plastic.**

**(2)**

plastic Spoons are made of crude oil of which is a non renewble Source meaning the planet is running out of it, this make wood better as we can plant more trees. Wood is also better to brake down so is therefore better for the environment whereas plastic takes years to breake down, however its never fully broken down.

**ResultsPlus**
**Examiner Comments**

This candidate has given the reverse argument about disadvantages of plastic as well as the advantages of wood. Either argument is allowed for the marks but in this case the disadvantages are better explained.

This response scored one mark.

(ii) Some spoons are made of wood or plastic, not metal.

The raw material for wooden spoons is trees and the raw material for plastic spoons is crude oil.

Explain an advantage, other than cost, of using wood rather than plastic.

**(2)**

wood is renewable as more trees can be planted

**ResultsPlus**
**Examiner Comments**

The candidate has stated that wood is renewable and that more trees can be planted. This is the same point made twice and so cannot score more than one mark. There is no explanation as to why planting more trees is an advantage.

This response scored one mark.

**The raw material for wooden spoons is trees and the raw material for plastic spoons is crude oil.**

**Explain an advantage, other than cost, of using wood rather than plastic.**

**(2)**

using wood is biodegradble so it's better for the enviroment where as plastic isn't good for the enviroment as it dosen't break down.

**ResultsPlus**
**Examiner Comments**

The candidate has given the same argument in reverse stating that wood is biodegradable and plastic is not. This is the same marking point and is not awarded twice. The explanation that biodegradable is 'better for the environment' is too vague to score.

**ResultsPlus**
**Examiner Tip**

Be specific about what exactly makes something better (or worse) for the environment.

This response did not score any marks.

(ii) Some spoons are made of wood or plastic, not metal.

The raw material for wooden spoons is trees and the raw material for plastic spoons is crude oil.

Explain an advantage, other than cost, of using wood rather than plastic.

**(2)**

Wood is much more stronger than plastic, as the wood has strong intermolecular forces, however plastic has weak intermolecular forces. wood can be reusable as it's stronger plastic cannot be reusable as it is weaker.

**ResultsPlus**
**Examiner Comments**

The candidate has attempted to explain an advantage by suggesting that wood is stronger than plastic and therefore reusable. Unfortunately this is not necessarily correct and so did not score.

## Question 1 (c)

Calculation questions about nanoparticles are often seen. This question asked for the calculation of the total surface area of a nanocube. Candidates were given the formula to calculate the total surface area but not told how to calculate the area of one face of the cube.

The item scored very well with a large majority of responses scoring at least one mark. Most candidates correctly identified that the cube has six faces and many were also able to calculate the area of one face correctly. Where mistakes were made, the most common was for the calculation of the length multiplied by the number of faces.

This response scored two marks.

The correct answer is on the answer line, but this response also shows how this answer has been calculated.

(c) One nanoparticle has a cube shape that is shown in Figure 2.

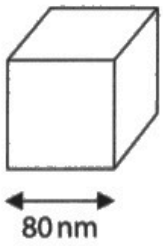



**Figure 2**

Calculate the surface area of this nanoparticle.

6

surface area = area of one face × number of faces

**(2)**

Area of one face = 6400 nm²

6400 × 6 = 38400 nm²

surface area = 38400 nm²

**ResultsPlus**
**Examiner Comments**

The candidate has shown their calculation of the area of one face and then multiplied it by the number of faces.

This response scored one mark.

(c) One nanoparticle has a cube shape that is shown in Figure 2.

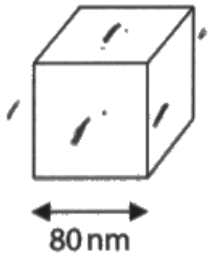



**Figure 2**

Calculate the surface area of this nanoparticle.

surface area = area of one face × number of faces

(2)

surface area = 480 nm²

**ResultsPlus**
**Examiner Comments**

The most commonly seen one mark answer was the correct identification of the number of faces but then multiplying this by the length of one side of the face rather than the area of each face.

This response scored one mark.

The candidate has correctly identified that the cube has six faces but has multiplied this by the perimeter of one face rather than the area of one face.

(c) One nanoparticle has a cube shape that is shown in Figure 2.

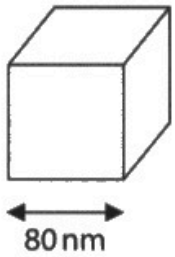



**Figure 2**

Calculate the surface area of this nanoparticle.

surface area = area of one face × number of faces

**(2)**

80 + 80 + 80 + 80 = 320 × 6 =

surface area = 1920 nm²

**ResultsPlus**
**Examiner Comments**

Had the answer on the line been shown with no working then this response would not have scored any marks. The working shows that the candidate has incorrectly calculated the area but multiplied by the correct number of faces and so one mark was able to be awarded.

This response scored one mark.

(c) One nanoparticle has a cube shape that is shown in Figure 2.

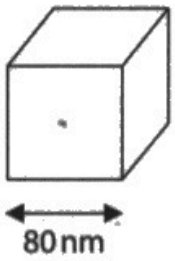



**Figure 2**

Calculate the surface area of this nanoparticle.

surface area = area of one face × number of faces

**(2)**

80nm x 80 nm

= 8x8=64

6400nm²

surface area = 6400 nm²

**ResultsPlus**
**Examiner Comments**

The correct area of one face has been calculated but there is no mention of a number of faces and no further calculation so the second mark could not be awarded.

**ResultsPlus**
**Examiner Tip**

All calculations should show full working.

## Question 2 (a)(i)

This question required candidates to look at a table of information about most of the period 3 elements and answer questions using this table and the Periodic Table.

This part of the question asked candidates to name the missing element.

Most responses correctly identified sulfur as the missing element. Where marks were lost it was usually due to the use of the symbol rather than the naming of the element although it wasn't unusual to see responses naming elements that were actually in the table.

## Question 2 (a)(ii)

The second part of the question asked for the atomic mass of silicon, which candidates were expected to get from their copy of the Periodic Table. This was slightly less well answered than the first part of the question but still performed very well. The most common error was for the atomic number to be given as the answer rather than the mass number.

## Question 2 (a)(iii)

The last part of this question required candidates to use the information to identify the metal and non-metal with the lowest boiling points and the majority scored at least one mark here, with many correctly identifying both elements.

There were two commonly seen errors.

Firstly giving magnesium as the metal with the lowest melting point, suggesting that some candidates do not know that sodium is a metal.

Secondly giving phosphorus or chlorine as the non metal with the lowest melting point, suggesting that some candidates do not know that argon is a metal or aren't able to work with negative numbers.

This response scored two marks.

(iii) State which metal and which non-metal in Figure 3 have the lowest melting points.

**(2)**

metal with lowest melting point

Sodium (Na)

non-metal with lowest melting point

Argon (Ar)

**ResultsPlus**
**Examiner Comments**

Either the name of the element or its symbol were accepted for the mark.

This response scored one mark, for correctly identifying argon as the non-metal with the lowest melting point.

(iii) State which metal and which non-metal in Figure 3 have the lowest melting points.

**(2)**

metal with lowest melting point

Magnesium

non-metal with lowest melting point

argon

**ResultsPlus**
**Examiner Comments**

Magnesium was a common, incorrect answer for the metal with the lowest melting point.

(iii) State which metal and which non-metal in Figure 3 have the lowest melting points.

**(2)**

metal with lowest melting point

Sodium

non-metal with lowest melting point

Silicon

**ResultsPlus**
**Examiner Comments**

This response scored one mark for identifying sodium as the metal with the lowest melting point.

In this case one mark was awarded.

(iii) State which metal and which non-metal in Figure 3 have the lowest melting points.

**(2)**

metal with lowest melting point

Ar

non-metal with lowest melting point

Na

**ResultsPlus**
**Examiner Comments**

This response correctly identifies both elements but they are on the wrong answer line.

## Question 2 (b)(i)

Although the majority of candidates scored the mark for this question, it was very surprising to see how many responses were not able to identify the equipment as a beaker.

Common incorrect responses included: measuring cylinder, measuring jug, measuring beaker, conical flask.

## Question 2 (b)(ii)

Candidates tend to find questions about practical work challenging, and this question was no exception.

Most candidates managed to score at least one mark, although there were also a large number of blank responses. It was common to see that the required improvements could be identified but there were very few explanations as to why these changes would work and therefore very few responses scoring all three marks.

Many responses recognised that the hydrogen gas needed to be more concentrated and identified how to do this but did not say that this would allow enough hydrogen to be collected to successfully test it. Other responses identified that the red litmus paper needed to be put into the mixture but again did not give any explanation as to why this would work.

The most common incorrect response for step 3 was to put the lit splint underneath the beaker, suggesting that it be used to warm the mixture rather than test for hydrogen.

The most common incorrect response for step 4 was either to use dry litmus paper or to replace the red litmus paper with blue.

This response scored all three marks: one mark for step 3 and two marks for step 4.

(ii) A teacher says that step 3 and step 4 will **not** work to show that hydrogen gas and an alkaline solution are produced in the reaction.

Explain **one** change that could be made in each step to make the method work.

**(3)**

step 3 hold the lit splint in the container and listen if there is a ~~squeak~~ squeaky pop sound

step 4 take the damp red litmus paper in the mixture and wait for a colour change.

**ResultsPlus**
**Examiner Comments**

Candidates were more likely to provide an explanation for step 4 rather than step 3. In this case the response correctly identifies that the lit splint needs to be closer to the mixture for step 3 to work, and then goes on to state that if the litmus paper is put into the mixture then a colour change will be seen.

This response scored all three marks: two for step 3 and one for step 4.

(ii) A teacher says that step 3 and step 4 will **not** work to show that hydrogen gas and an alkaline solution are produced in the reaction.

Explain **one** change that could be made in each step to make the method work.

**(3)**

step 3 put a bung ontop so that hydrogen gas can build upthen put the lit splint

step 4 put the litmus paper in the water.

**ResultsPlus**
**Examiner Comments**

It was very unusual to see a correct explanation for the change needed to step 3. This response describes how the hydrogen should be collected but then also explains that this is to allow the gas to build up.

This response scored two marks.

(ii) A teacher says that step 3 and step 4 will **not** work to show that hydrogen gas and an alkaline solution are produced in the reaction.

Explain **one** change that could be made in each step to make the method work.

**(3)**

step 3 Hold the lit SPlint inside the Container but not into the Liquid.

step 4 Put the end of the litmus Paper in the Liquid.

**ResultsPlus Examiner Comments**

The candidate has correctly identified the improvement needed in each step but has not made any attempt to explain how either of these improvements would lead to results.

**ResultsPlus Examiner Tip**

Questions that use the command word 'explain' need to have ideas that are linked together rather than just making statements.

This response scored one mark for correctly identifying that the litmus paper needs to be in the mixture.

(ii) A teacher says that step 3 and step 4 will **not** work to show that hydrogen gas and an alkaline solution are produced in the reaction.

Explain **one** change that could be made in each step to make the method work.

**(3)**

step 3 Place a flame / Bunson burner under the beaker

step 4 Put the litmus paper in the solution

**ResultsPlus**
**Examiner Comments**

The statement about heating the mixture is incorrect.

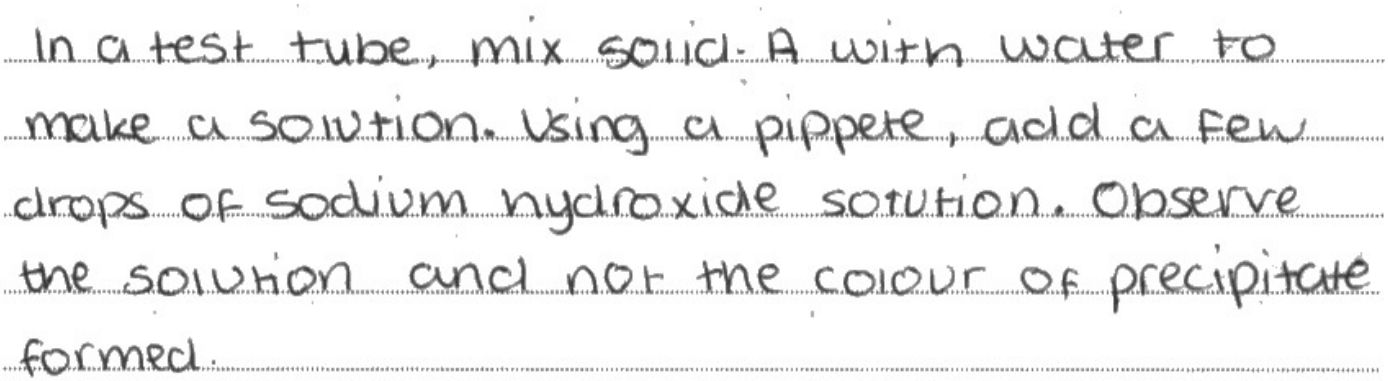
## Question 3 (b)

This was another practical based question, where candidates were given information about an ion test and asked to describe how to carry out the test.

Most candidates were able to identify at least one suitable piece of laboratory equipment that would be needed to do the test such as a test tube or pipette but very few responses scored any more marks than this.

It was not intended for this question to be particularly challenging and it is unknown whether candidates did not understand what they were being asked to do or whether they did not know how to make a solution from a solid. However, performing ion tests is one of the core practicals on the specification so this should have been an accessible question for most candidates.

This response scored all three marks.




**ResultsPlus**
**Examiner Comments**

The candidate correctly identifies suitable equipment and then correctly describes adding water to the solid and mixing to make a solution before adding the sodium hydroxide.

There were no marks available for adding the sodium hydroxide as this was already given in the question.

**ResultsPlus**
**Examiner Tip**

To make a solution from a solid, add water and stir to mix.

This question scored two marks.

(b) A student is given a container of solid **A** and a bottle of dilute sodium hydroxide solution.

Describe how the student should carry out the test in Figure 5.

Include the names of the apparatus needed.

**(3)**

① make a solution of a compound in a beaker.
② use a pipette to add a few drops of sodium hydroxide solution.
③ gently shake beaker
④ if the solution in the beaker turns white: it contains aluminium ions, blue: contains copper ions, green: iron ions.

**ResultsPlus**
**Examiner Comments**

The first step of the flow chart states to make a solution, so there is no credit for this.

The candidate suggests using a pipette to add the sodium hydroxide and then shakes the two together. Mixing was credited whether it was done before or after adding the sodium hydroxide.

This response scored one mark for identifying suitable pieces of laboratory equipment.

(b) A student is given a container of solid **A** and a bottle of dilute sodium hydroxide solution.

Describe how the student should carry out the test in Figure 5.

Include the names of the apparatus needed.

**(3)**

- use a measuring cylinder to measure out 100cm$^3$ of compound A.
- put 100cm$^3$ of compound A into a beaker
- use a pipette to add a few drops of sodium hydroxide solution into the beaker.
- if a white precipitate forms it contains aluminium ions - if blue it contains copper ions - if green contains iron(II) ions.

**ResultsPlus**
**Examiner Comments**

The rest of the response is copied directly from the flow chart and does not gain any further credit.

This response did not score any marks.

There is no equipment identified and nothing different to the information given in the flow chart.

(b) A student is given a container of solid **A** and a bottle of dilute sodium hydroxide solution.

Describe how the student should carry out the test in Figure 5.

Include the names of the apparatus needed.

**(3)**

he should make a solution of the compound "A" and then add a few drops of sodium hydroxide solution. Then wait to see what precipitate it is

**ResultsPlus**
**Examiner Comments**

It is very common to see answers that just repeat information that has already been given in the question without seeing any new information.

## Question 3 (c)(i)

This question required candidates to use information from the flow chart or their own knowledge to identify the result of the test when iron(II) chloride was tested, and was not as well answered as expected.

To get the mark the response needed to state both green and precipitate and the majority of candidates did not get both words.

Common errors were to state the colour change without stating that a precipitate forms, or to give the incorrect colour for the precipitate. It was also quite common to see fizzing and bubbling as the answer.

This response scored the mark.

(c) Iron(II) chloride is tested using the method in Figure 5.

(i) State what would be **seen** when iron(II) chloride is tested.

**(1)**

A green precipitate

ResultsPlus
Examiner Comments

Green or any shade of green was accepted, but no other colours were accepted.

This response did not score the mark.

(c) Iron(II) chloride is tested using the method in Figure 5.

(i) State what would be **seen** when iron(II) chloride is tested.

**(1)**

a red precipitate.

ResultsPlus
Examiner Comments

There were a number of responses that suggested shades of red and brown as the colour of the precipitate. Presumably these candidates had confused iron(II) with iron(III).

This response did not score the mark.

(c) Iron(II) chloride is tested using the method in Figure 5.

(i) State what would be **seen** when iron(II) chloride is tested.

**(1)**

The solution would turn green

**ResultsPlus**
**Examiner Comments**

Unfortunately there is no mention of a precipitate forming.

This response did not score the mark.

(c) Iron(II) chloride is tested using the method in Figure 5.

(i) State what would be **seen** when iron(II) chloride is tested.

**(1)**

~~damp blue~~ damp blue litmus paper turns red

the bleaches white.

**ResultsPlus**
**Examiner Comments**

The candidate has explained how to test for chlorine gas which would not have been correct even if the question had asked about testing for chloride ions.

## Question 3 (d)(i)

This question asked candidates to form a conclusion based on a negative result for the test given in the flow chart.

Candidates find it more difficult to conclude with a negative test result and the vast majority of responses concluded that no precipitate meant no reaction. Others concluded that there were no ions present in the sample but this conclusion was too broad to be correct.

Only the most able candidates were able to correctly state that no result for the test could only conclude that none of the ions specified in that test were present.

This response scored the mark.

The candidate has correctly concluded that if no precipitate forms then there cannot be any copper, aluminium or iron(II) ions present.

(d) A different compound is tested using the method in Figure 5.

(i) When the sodium hydroxide solution is added, no precipitate forms.

State what can be concluded from this result.

**(1)**

That there is no copper, aluminium or iron(II) ions in the compound.

**ResultsPlus**
**Examiner Comments**

Candidates were awarded the mark if any of copper, aluminium or iron(II) ions were identified.

This response did not score the mark.

(d) A different compound is tested using the method in Figure 5.

(i) When the sodium hydroxide solution is added, no precipitate forms.

State what can be concluded from this result.

(1)

There is no ions in the compound

**ResultsPlus Examiner Comments**

A negative result for this test does not mean that there are no ions at all present in the compound.

**ResultsPlus Examiner Tip**

Some ions do not form a precipitate when reacted with sodium hydroxide.

This response did not score the mark.

(d) A different compound is tested using the method in Figure 5.

(i) When the sodium hydroxide solution is added, no precipitate forms.

State what can be concluded from this result.

(1)

it does not react

**ResultsPlus Examiner Comments**

No visible change does not mean that there has been no reaction.

## Question 3 (d)(ii)

The final part of question 3 required candidates to measure the height of a precipitate and convert their measurement from centimetres into millimetres.

This was well answered, with most candidates scoring both marks.

By far the most common mistake was converting the units to millimetres, with many candidates dividing rather than multiplying or using a factor of 100 rather than 10.

Some candidates also incorrectly gave the height of the solution, or measured the height where the arrow pointed on the diagram. A few gave the height of the test tube.

This response scored two marks.

The candidate has correctly measured the height of the precipitate and correctly converted it into millimetres.

(ii) In an experiment, the height of the precipitate formed in a reaction is measured using a 10 cm ruler.

The apparatus is shown in Figure 6.

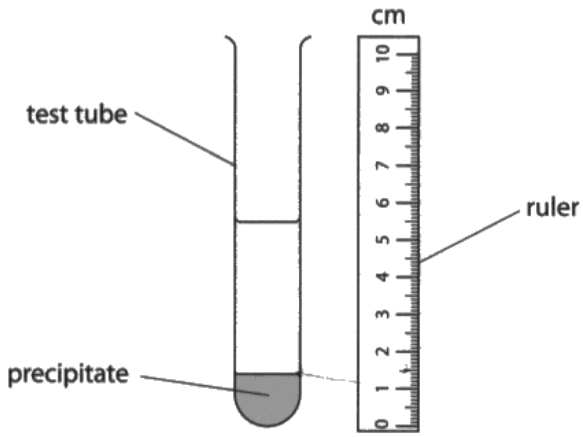



**Figure 6**

Give the height of the precipitate in mm.

**(2)**

1.4 cm = 14 mm

height = 14 mm

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Examiner Comments

Answers between 13 and 15 mm were accepted.

This response scored one mark.

(ii) In an experiment, the height of the precipitate formed in a reaction is measured using a 10 cm ruler.

The apparatus is shown in Figure 6.

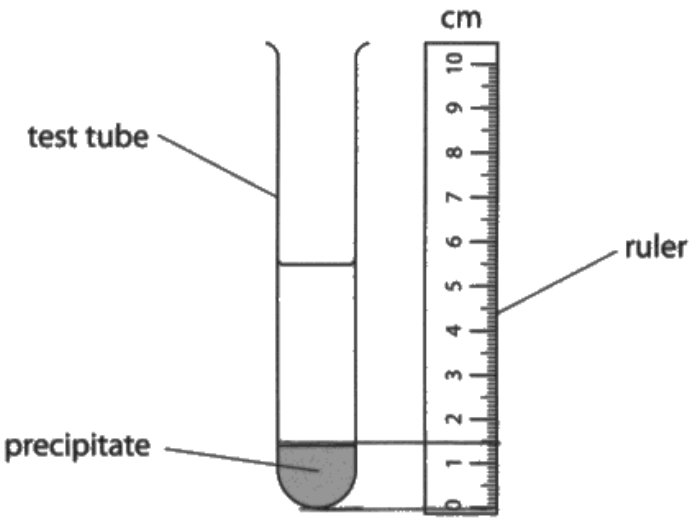



**Figure 6**

Give the height of the precipitate in mm.

**(2)**

1.5cm x 100 = 150mm

height = 150 mm

**ResultsPlus**
**Examiner Comments**

The candidate has measured the height of the precipitate within tolerance but then gone on to multiply their value by 100 and so the second mark is not awarded.

This response scored one mark.

The candidate has measured the height of the solution rather than the precipitate and therefore does not score the first mark. However the conversion is correct and therefore the second mark can be awarded.

(ii) In an experiment, the height of the precipitate formed in a reaction is measured using a 10 cm ruler.

The apparatus is shown in Figure 6.

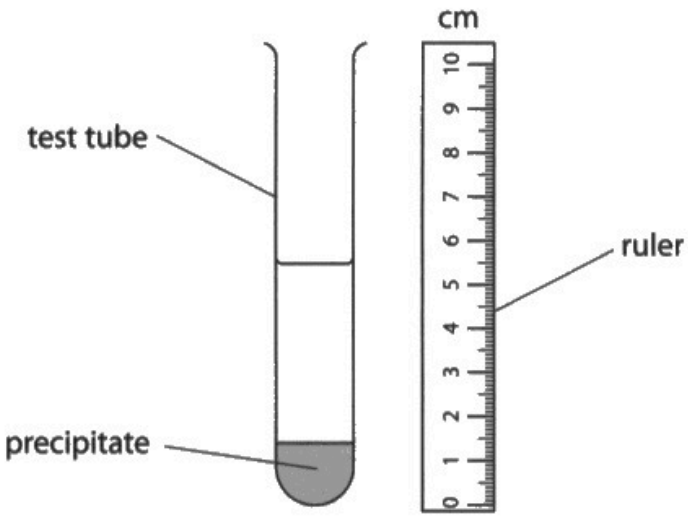



**Figure 6**

Give the height of the precipitate in mm.

**(2)**

5.5 x 10 = 55 mm

height = 55 mm

**ResultsPlus**
**Examiner Comments**

The correct conversion mark was only awarded if the correct height of the precipitate or the solution was measured. It was not given for any other height.

## Question 4 (b)(i)

This question asked candidates to identify a thermometer as a piece of equipment used to measure temperature and unsurprisingly most were able to do this. It was very unusual to see an incorrect response to this question.

## Question 4 (b)(ii)

This part of the question asked candidates to suggest a reason that an insulated cup would be placed inside a beaker when recording temperature changes in an experiment.

The question was well answered generally and lots of candidates scored the mark, however, this was because answers relating to insulation were accepted as well as the actual answer of preventing the cup from falling over. It was expected that most candidates would know that the beaker was included for stability but this was not the case.

Where candidates did not score the mark this was usually because answers related to containing leaks if the insulated cup failed in some way.

This answer scored the mark.

(ii) State **one** reason for using the piece of equipment **A** in Figure 7.

**(1)**

to hold the polystyrene cup so it doesn't fall over.

**ResultsPlus**
**Examiner Comments**

For this practical, the insulated cup is placed inside a beaker for stability but very few responses gave this as the answer. It was much more common to see answers related to providing insulation rather than stability.

This answer scored the mark.

(ii) State **one** reason for using the piece of equipment **A** in Figure 7.

(1)

To insulate equipment B so there isn't excess heat loss which will affect the experiment.

**ResultsPlus Examiner Comments**

The most common, correct response related to providing insulation to the reaction mixture. Although this is not the main reason for using the beaker, it would provide additional insulation and therefore this answer was accepted.

This response did not score the mark.

(ii) State **one** reason for using the piece of equipment **A** in Figure 7.

(1)

Equipment A is used because it prevents any solution or liquids from leaking out.

**ResultsPlus Examiner Comments**

The most common, incorrect answers related to containing leaks from the insulated cup.

This answer did not score the mark.

(ii) State **one** reason for using the piece of equipment **A** in Figure 7.

**(1)**

to measure the temprature change

**ResultsPlus**
**Examiner Comments**

Some candidates did not refer to the beaker, but to the use of the thermometer identified in the previous part of the question.

## Question 4 (b)(iii)

Most candidates recognised that adding a lid to the insulated cup would reduce heat loss from the top of the beaker.

Where the mark was not awarded responses often referred to preventing temperature loss rather than heat loss. Some candidates thought that a lid would prevent air or cold from getting into the beaker.

This response scored the mark.

(iii) A student suggests putting a lid on piece of equipment **B**.

State why this would help to give a more accurate value for the temperature change.

**(1)**

Because then the heat wouldn't escape out the top and into it's surroundings.

ResultsPlus
Examiner Comments

Any indication of preventing heat loss scored.

This response did not score the mark.

(iii) A student suggests putting a lid on piece of equipment **B**.

State why this would help to give a more accurate value for the temperature change.

**(1)**

To keep the temperature in.

ResultsPlus
Examiner Comments

It is common for candidates to use the word temperature instead of heat, and unfortunately this cannot be accepted as they are not the same thing.

This response did not score.

References to something else getting into the cup were not accepted.

(iii) A student suggests putting a lid on piece of equipment **B**.

State why this would help to give a more accurate value for the temperature change.

**(1)**

Because no air would be getting in or out.

**ResultsPlus**
**Examiner Comments**

Many candidates have the misconception of cold getting in rather than heat getting out.

## Question 4 (b)(iv)

For this question, candidates were required to calculate the temperature change in two reactions and identify the reaction that absorbed the most energy.

Most candidates scored three marks on this question, for correctly calculating the difference and including a minus sign where required. However, very few responses correctly indicated the salt with the largest temperature drop as being the one that absorbed the most heat – most chose the reaction with the biggest increase in temperature.

This response scored four marks.

(iv) Four different salts, **P**, **Q**, **R** and **S**, are dissolved in water.

Figure 8 shows the starting temperature of the water and the final temperature of the solution after the salt dissolves.

| | salt P | salt Q | salt R | salt S |
|---|---|---|---|---|
| starting temperature in °C | 20.0 | 20.0 | 20.0 | 20.0 |
| final temperature in °C | 22.4 | 19.5 | 23.0 | 18.5 |
| temperature change in °C | +2.4 | −0.5 | +3.0 | −1.5 |
| salt that absorbed most heat energy when it dissolved | | | | ✓ |

**Figure 8**

Complete the table

- to show the temperature changes when salt **R** and salt **S** dissolve
- by placing a tick (✓) in the box, on the bottom row, for the salt that **absorbs** the most heat energy when it dissolves.

ResultsPlus
Examiner Comments

Temperature differences including signs have been correctly calculated and the most endothermic reaction has been identified.

This response scored three marks.

(iv) Four different salts, **P**, **Q**, **R** and **S**, are dissolved in water.

Figure 8 shows the starting temperature of the water and the final temperature of the solution after the salt dissolves.

| | salt P | salt Q | salt R | salt S |
|---|---|---|---|---|
| starting temperature in °C | 20.0 | 20.0 | 20.0 | 20.0 |
| final temperature in °C | 22.4 | 19.5 | 23.0 | 18.5 |
| temperature change in °C | +2.4 | –0.5 | +3 | -1.5 |
| salt that absorbed most heat energy when it dissolved | | | ✓ | |

**Figure 8**

Complete the table

- to show the temperature changes when salt **R** and salt **S** dissolve
- by placing a tick (✓) in the box, on the bottom row, for the salt that **absorbs** the most heat energy when it dissolves.

ResultsPlus
Examiner Comments

The temperature differences including signs have been correctly calculated.

However, the candidate has identified the reaction that releases most heat rather than absorbs the most heat.

ResultsPlus
Examiner Tip

When a reaction absorbs heat, the temperature goes down.

This response scored two marks for the calculating the correct temperature difference for salt S.

(iv) Four different salts, **P**, **Q**, **R** and **S**, are dissolved in water.

Figure 8 shows the starting temperature of the water and the final temperature of the solution after the salt dissolves.

| | salt P | salt Q | salt R | salt S |
|---|---|---|---|---|
| starting temperature in °C | 20.0 | 20.0 | 20.0 | 20.0 |
| final temperature in °C | 22.4 | 19.5 | 23.0 | 18.5 |
| temperature change in °C | +2.4 | −0.5 | -3 | -1.5 |
| salt that absorbed most heat energy when it dissolved | ✓ | | | |

**Figure 8**

Complete the table

- to show the temperature changes when salt **R** and salt **S** dissolve
- by placing a tick (✓) in the box, on the bottom row, for the salt that **absorbs** the most heat energy when it dissolves.

ResultsPlus
Examiner Comments

Had the candidate correctly identified the most endothermic reaction according to their own results then they would have scored another mark. However, this response clearly identifies the only exothermic reaction according to the calculated results.

This response scored 1 mark for the correct calculation of the temperature change in salt R.

(iv) Four different salts, **P**, **Q**, **R** and **S**, are dissolved in water.

Figure 8 shows the starting temperature of the water and the final temperature of the solution after the salt dissolves.

| | salt P | salt Q | salt R | salt S |
|---|---|---|---|---|
| starting temperature in °C | 20.0 | 20.0 | 20.0 | 20.0 |
| final temperature in °C | 22.4 | 19.5 | 23.0 | 18.5 |
| temperature change in °C | +2.4 | −0.5 | 3.0 | −2.5 |
| salt that absorbed most heat energy when it dissolved | | ✓ | | ✓ |

**Figure 8**

Complete the table

- to show the temperature changes when salt **R** and salt **S** dissolve
- by placing a tick (✓) in the box, on the bottom row, for the salt that **absorbs** the most heat energy when it dissolves.

ResultsPlus
Examiner Comments

There were a number of responses that incorrectly calculated the temperature difference for salt S as 2.5°C, which did not score.

The candidate also correctly identified the endothermic reactions but the question asked for the **most** endothermic reaction.

## Question 4 (b)(v)

The final part of this question asked for the formula of a barium ion and was very poorly answered.

Many candidates simply gave the formula of a barium atom and made no attempt to add any charge to the formula at all. Those that attempted to add a charge often gave $Ba^{+}$ or $BaCl^{-}$ as their answer.

This response scored the mark.

(v) One of the salts dissolved is barium chloride, $BaCl_2$.

Barium chloride contains the chloride ion, $Cl^-$.

Give the **formula** of the barium ion in barium chloride.

**(1)**

$Ba^{2+}$

**ResultsPlus**
**Examiner Comments**

Only the most able candidates were able to work out the correct charge on a barium ion.

This response did not score the mark.

(v) One of the salts dissolved is barium chloride, $BaCl_2$.

Barium chloride contains the chloride ion, $Cl^-$.

Give the **formula** of the barium ion in barium chloride.

**(1)**

Ba

**ResultsPlus**
**Examiner Comments**

Most candidates simply gave the formula of a barium atom without any charge added.

**ResultsPlus**
**Examiner Tip**

The formula for ions includes a charge.

The formula for atoms does not include a charge.

## Question 5 (a)(i)

Most candidates were able to use the displayed formula diagram to correctly identify that compound X had 3 carbon atoms.

Where this was not answered correctly 4 or 6 was usually seen given as the answer.

## Question 5 (a)(ii)

This question was also very well answered, with most candidates correctly identifying hydrogen as the other element in the compound.

Incorrect answers often gave some attempt at naming the compound or identified it as an alkene.

## Question 5 (b)

This question asked candidates to recall some of their knowledge about crude oil fractions, with a diagram to provide some additional support.

There were no options of words to choose to complete the sentences and there were a range of answers, particularly for the last part of the question.

The majority of candidates scored at least one of the first two marks, with the final mark being the most common incorrect answer. Many responses used words such as produced or formed for the last sentence rather than actually identifying a product formed during combustion.

Where candidates did not score the first two marking points it was usually because they had the trend the wrong way round and gave answers of bitumen for the first sentence and lower for the second.

This response scored three marks.

Figure 10 provided some additional scaffolding to help candidates identify the positions of the fractions in the column.

(b) Figure 10 shows where fractions are produced in the fractional distillation of crude oil.

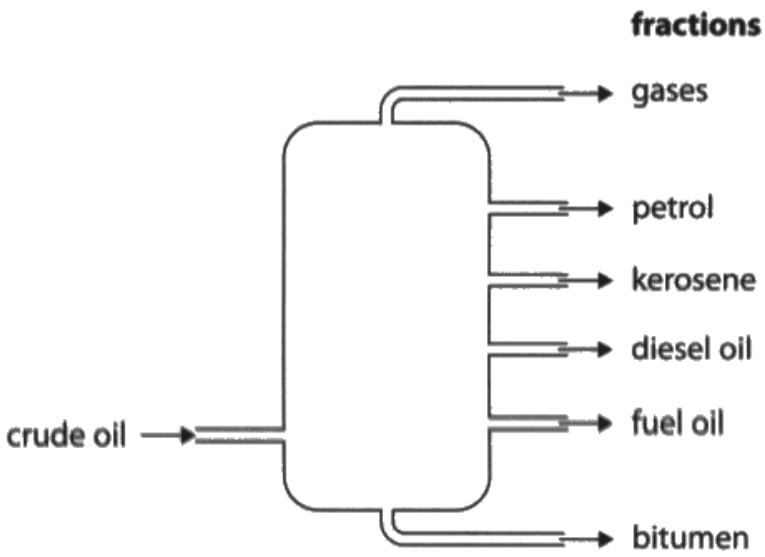



**Figure 10**

Complete the sentences about fractions obtained from crude oil.

**(3)**

The fraction with the smallest molecules is called gases.

Compared to petrol, the boiling point of kerosene is higher.

When petrol burns, one product is carbon dioxide.

**ResultsPlus**
**Examiner Comments**

Carbon dioxide was the most commonly seen correct answer for the last sentence but any of the products of complete or incomplete combustion were accepted.

This response scored two marks.

(b) Figure 10 shows where fractions are produced in the fractional distillation of crude oil.

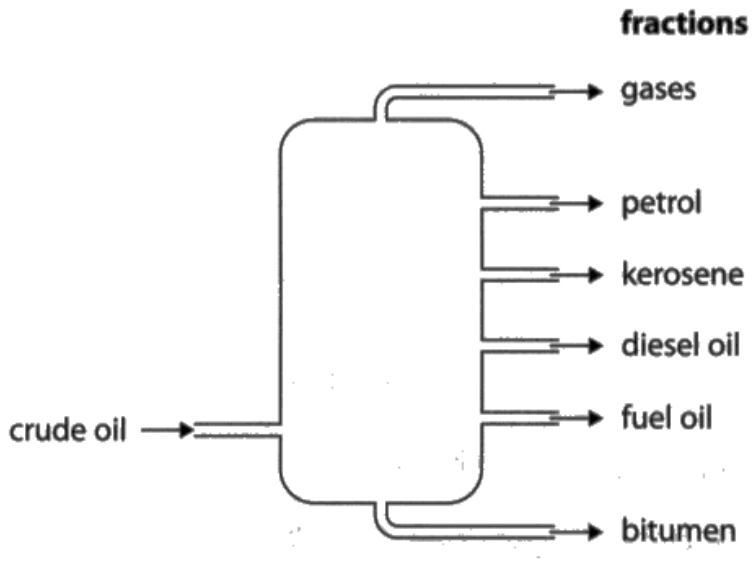



**Figure 10**

Complete the sentences about fractions obtained from crude oil.

**(3)**

The fraction with the smallest molecules is called gases.

Compared to petrol, the boiling point of kerosene is higher.

When petrol burns, one product is created.

**ResultsPlus**
**Examiner Comments**

It was not unusual to see words completing the final sentence that indicated that only one product would be formed when petrol burns. This is not correct and was not credited.

This response scored one mark for identifying one product of combustion.

(b) Figure 10 shows where fractions are produced in the fractional distillation of crude oil.

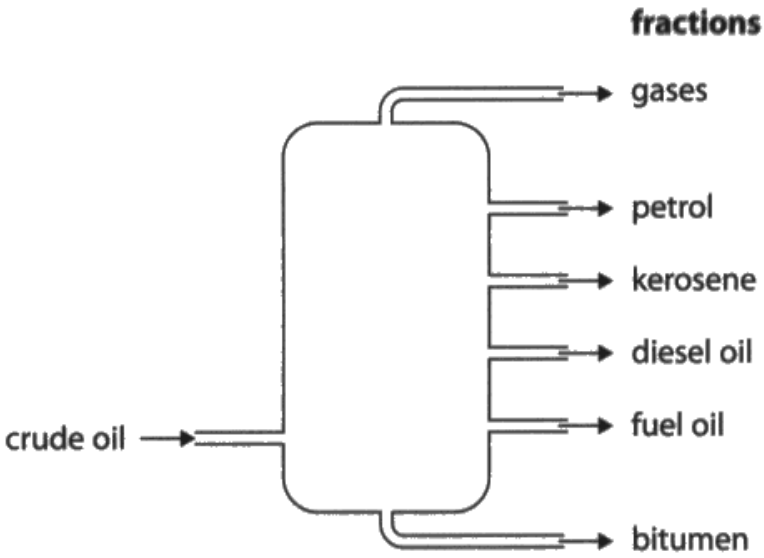



**Figure 10**

Complete the sentences about fractions obtained from crude oil.

**(3)**

The fraction with the smallest molecules is called bitumen.

Compared to petrol, the boiling point of kerosene is lower.

When petrol burns, one product is carbon dioxide.

**ResultsPlus**
**Examiner Comments**

Some candidates indicated that the fractions with the smaller molecules and lower boiling points were at the bottom of the column.

## Question 5 (c)

Candidates found this question particularly challenging and it was not well answered, with a lot of blank responses.

The question contained a lot of information and required a lot of linking ideas together from different topics including: heat changes in chemical reactions, remembering that sulfur dioxide forms acidic solutions and pH changes in neutralisation reactions. It was not surprising that only a very few candidates scored more than one mark here.

There were a number of frequently seen errors:

- that reactions with a temperature increase are endothermic
- the more acidic a solution is, the higher the pH is
- solution W is alkaline

Some responses also suggested that the reaction taking place was between the gas and the water and did not refer to the sodium hydroxide at all. Other responses suggested that the temperature increase was due to the burning of the fuel rather than any chemical reaction.

This response scored three marks.

The candidate has recognised that solution W is acidic and therefore the pH decreases as well as recognising that the temperature increase indicates an exothermic reaction.

(c) When some impure hydrocarbon fuels are burned, sulfur dioxide is one of the products.

Some sulfur dioxide gas is dissolved in water to form solution **W**.

When solution **W** is added to sodium hydroxide solution of pH 12

- the pH changes
- the temperature increases.

Explain how the pH changes and why the temperature increases.

**(3)**

pH will reduce → solution W is acidic
temperature will increase because the reaction is exothermic. Heat is given out to its surroundings

**ResultsPlus**
**Examiner Comments**

There were four marking points available but candidates had to include the idea of an exothermic reaction in order to score maximum marks.

This response scored two marks.

(c) When some impure hydrocarbon fuels are burned, sulfur dioxide is one of the products.

Some sulfur dioxide gas is dissolved in water to form solution **W**.

When solution **W** is added to sodium hydroxide solution of pH 12

- the pH changes
- the temperature increases.

Explain how the pH changes and why the temperature increases.

**(3)**

When Sulfur dioxide is dissolved in water the solution becomes Sulfuric acid, and is acidic. When the acidic Solution (W) is added to Sodium Hydroxide which is an alkali the pH lowers and in the right proportion it will be neutralised.

**ResultsPlus**
**Examiner Comments**

The candidate has given three marking points relating to the neutralisation reaction but has not mentioned that the reaction is exothermic and therefore could not score maximum marks.

**ResultsPlus**
**Examiner Tip**

Make sure both parts of the question are answered to gain maximum marks.

This response scored two marks.

(c) When some impure hydrocarbon fuels are burned, sulfur dioxide is one of the products.

Some sulfur dioxide gas is dissolved in water to form solution **W**.

When solution **W** is added to sodium hydroxide solution of pH 12

- the pH changes
- the temperature increases.

Explain how the pH changes and why the temperature increases.

**(3)**

The temperature increases because the reaction is exothermic so the reaction heats up. The pH of the solution increases because solution W is acidic.

**ResultsPlus**
**Examiner Comments**

The candidate correctly states that the reaction is exothermic and that solution W is acidic. However, they then state that the pH will increase when they solutions are mixed.

This response scored one mark for recognising that solution W is acidic.

(c) When some impure hydrocarbon fuels are burned, sulfur dioxide is one of the products.

Some sulfur dioxide gas is dissolved in water to form solution **W**.

When solution **W** is added to sodium hydroxide solution of pH 12

- the pH changes
- the temperature increases.

Explain how the pH changes and why the temperature increases.

**(3)**

The pH changes as solution W must be acidic here for changing the alkaline solution pH.

**ResultsPlus**
**Examiner Comments**

There is no mention of how the pH changes, just a repeat of the information from the question that there is a change in pH.

**ResultsPlus**
**Examiner Tip**

Be specific about changes – state whether there is an increase or a decrease.

This response did not score any marks.

(c) When some impure hydrocarbon fuels are burned, sulfur dioxide is one of the products.

Some sulfur dioxide gas is dissolved in water to form solution **W**.

When solution **W** is added to sodium hydroxide solution of pH 12

- the pH changes
- the temperature increases.

Explain how the pH changes and why the temperature increases.

**(3)**

temperature increases - endothermic

pH increases - becomes more acidic

**ResultsPlus**
**Examiner Comments**

Unfortunately the candidate has stated that the increase in temperature is endothermic and that an increase in acidity increases the pH. There is no mention of solution W being an acid or that the reaction is a neutralisation.

## Question 6 (a)

Most candidates were able to identify that bromine is a liquid at room temperature but there were some issues with identifying the colour. Very few responses included the colour red and therefore did not score the mark.

Other errors included descriptions of chlorine and iodine at room temperature.

This response scored two marks.

**6** This question is about bromine.

(a) Give the colour and physical state of bromine at room temperature.

**(2)**

colour red-brown

physical state liquid

**ResultsPlus**
**Examiner Comments**

Bromine is a dark, red-brown liquid at room temperature.

This response scored one mark for identifying that bromine is a liquid at room temperature.

It was common to see the colour stated as brown alone, which was not accepted. There needed to be some reference to red in order to score the mark.

**6** This question is about bromine.

(a) Give the colour and physical state of bromine at room temperature.

**(2)**

colour Brown

physical state liquid

**ResultsPlus**
**Examiner Comments**

Candidates often gave colours of halogen solutions rather than the colour of bromine. The colour of iodine solution, brown, was a very common incorrect response.

This response scored one mark for bromine being a liquid at room temperature.

**6** This question is about bromine.

(a) Give the colour and physical state of bromine at room temperature.

**(2)**

colour orange

physical state liquid

**ResultsPlus**
**Examiner Comments**

It was also very common to see the colour of bromine solution given rather than pure bromine.

## Question 6 (b)(i)

This question was very well answered with most responses scoring both marks.

The most common errors were using bromine and bromide interchangeably, and there were a significant number of candidates that attempted to write a balanced equation, which was almost always incorrect.

(b) Bromine reacts with hydrogen to form hydrogen bromide.

(i) Write the word equation for this reaction.

(2)

Bromine + hydrogen → Hydrogen Bromide

ResultsPlus
Examiner Comments

This response scored two marks.

(b) Bromine reacts with hydrogen to form hydrogen bromide.

(i) Write the word equation for this reaction.

(2)

hydrogen + bromide → hydrogen bromide

ResultsPlus
Examiner Comments

This response scored one mark for the correct product.

ResultsPlus
Examiner Tip

Bromide and bromine are not the same thing.

This response scored one mark for the reactants.

(b) Bromine reacts with hydrogen to form hydrogen bromide.

(i) Write the word equation for this reaction.

(2)

Bromine + hydrogen → hydrogen bromine

**ResultsPlus**
**Examiner Comments**

Unfortunately the product is incorrectly named as hydrogen bromine and does not score.

This response did not score any marks.

A number of candidates attempted to write a balanced equation rather than a word equation. This is much more difficult than writing a word equation and was almost never correct because candidates did not remember that bromine and hydrogen are diatomic.

(b) Bromine reacts with hydrogen to form hydrogen bromide.

(i) Write the word equation for this reaction.

(2)

Br + H → BrH

**ResultsPlus**
**Examiner Comments**

A balanced equation must be fully correct to score marks for a word equation.

**ResultsPlus**
**Examiner Tip**

Learn which elements form diatomic molecules.

## Question 6 (b)(ii)

Candidates needed to know that hydrogen bromide forms an acidic solution in order to be able to answer this question and it seems as though many were not aware of this as fewer than half of the responses scored the mark.

Candidates are familiar with hydrochloric acid and should also be aware that other hydrogen halides behave similarly when dissolved in water.

## Question 6 (c)

This question required candidates to give an answer that suggested that fluorine would react more quickly than chlorine and most candidates managed to do this. Where marks were lost it was usually due to the suggestion that fluorine would react at the same rate as chlorine, with candidates giving the answer of 'reacts very quickly'.

This response scored one mark.

(c) Bromine and the other halogens react with hot iron wool.

Figure 11 shows the relative speed of some of these reactions.

| halogen | relative speed of reaction |
|---|---|
| fluorine | |
| chlorine | reacts very quickly |
| bromine | reacts quickly |
| iodine | reacts slowly |

**Figure 11**

Fluorine also reacts with hot iron wool.

Use Figure 11 to predict the relative speed of this reaction.

**(1)**

reacts much quicker than chlorine does.

**ResultsPlus**
**Examiner Comments**

Any indication of the reaction being faster than chlorine was accepted. Some responses like this one directly compared the speed to chlorine while other responses suggested 'reacts very, very quickly' or 'reacts instantly'.

This response did not score.

(c) Bromine and the other halogens react with hot iron wool.

Figure 11 shows the relative speed of some of these reactions.

| halogen | relative speed of reaction |
|---|---|
| fluorine | |
| chlorine | reacts very quickly |
| bromine | reacts quickly |
| iodine | reacts slowly |

**Figure 11**

Fluorine also reacts with hot iron wool.

Use Figure 11 to predict the relative speed of this reaction.

**(1)**

reacts very quickly.

**ResultsPlus**
**Examiner Comments**

A lot of responses gave 'reacts very quickly' as the answer. This could not be accepted as it suggests the reaction rate for fluorine was the same as chlorine.

This response did not score.

(c) Bromine and the other halogens react with hot iron wool.

Figure 11 shows the relative speed of some of these reactions.

| halogen | relative speed of reaction |
|---|---|
| fluorine | |
| chlorine | reacts very quickly |
| bromine | reacts quickly |
| iodine | reacts slowly |

**Figure 11**

Fluorine also reacts with hot iron wool.

Use Figure 11 to predict the relative speed of this reaction.

**(1)**

reacts very slowly

**ResultsPlus**
**Examiner Comments**

A few responses suggested that fluorine would be the slowest of all of the reactions.

## Question 6 (d)

This question asked candidates to calculate the mass of each element in a sample of potassium bromide, given the percentage of potassium by mass.

When candidates attempted this question it was usually very well answered and most scored all three marks.

Where marks were lost it was usually due to mixing up the values for potassium and bromine or rounding errors in the calculation where candidates had obviously not used a calculator.

This response scored three marks.

(d) Potassium bromide contains 32.8% potassium by mass.

Calculate the mass of potassium and the mass of bromine in 500 g potassium bromide.

(3)

32.8% of 500g = 164 g

500 - 164 = 336 g

mass of potassium = 164 g

mass of bromine = 336 g

**ResultsPlus**
**Examiner Comments**

Most candidates calculated the mass of potassium and then subtracted their answer from the total mass to work out the mass of bromine.

This response scored two marks.

(d) Potassium bromide contains 32.8% potassium by mass.

Calculate the mass of potassium and the mass of bromine in 500 g potassium bromide.

(3)

10% = 50 2% = 10

100% − 32.8% = 67.2% 20% = 100 0.8% = 3.75

32.8% of 500 = 163.75 30% = 150

500 − 163.75 2.8% = 13.75

mass of potassium = 163.75 g

mass of bromine = 336.25 g

**ResultsPlus**
**Examiner Comments**

The candidate has calculated the mass of potassium using an alternative method, which has given a slightly inaccurate answer.

This error has been carried through, with the rest of the calculation being correct and so two marks are awarded.

**ResultsPlus**
**Examiner Tip**

Chemistry calculations should be done using a calculator.

This response scored one mark.

(d) Potassium bromide contains 32.8% potassium by mass.

Calculate the mass of potassium and the mass of bromine in 500 g potassium bromide.

**(3)**

32·8% potassium bromide

32·8% x 500 = 164

mass of potassium = ..... g

mass of bromine = ..... g

**ResultsPlus**
**Examiner Comments**

The candidate has correctly calculated the mass of potassium in the sample but there is no attempt to calculate the mass of bromine and so no further marks could be awarded.

## Question 7 (a)(i)

Most candidates were able to correctly identify the lines on the displayed formula as bonds which was accepted but very few gave the fully correct answer of covalent or molecular bonds.

Where mistakes were made it was usually due to candidates stating double bonds and not making any mention of the bonds between hydrogen and carbon atoms or not using the word 'bond' at all, suggesting that the lines were links or connections.

This response scored the mark.

**7** (a) The structure of one molecule of compound **L** is shown in Figure 12.

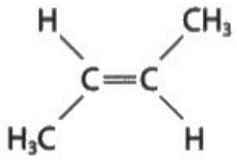



**Figure 12**

(i) State what the lines between the atom symbols represent in Figure 12.

**(1)**

bonds

**ResultsPlus**
**Examiner Comments**

Bonds was the most commonly seen response but other correct responses include: covalent bonds, molecular bonds, double and single bonds and shared pair of electrons.

This response did not score.

**7** (a) The structure of one molecule of compound **L** is shown in Figure 12.

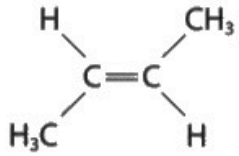



**Figure 12**

(i) State what the lines between the atom symbols represent in Figure 12.

**(1)**

double bond

**ResultsPlus**
**Examiner Comments**

There were other lines on the formula that did not represent a double bond and therefore this only scored if single bonds were also mentioned.

This response did not score the mark.

Presumably the candidate was trying to indicate that the lines were bonds with the hydrogen atoms but unfortunately gave the name of a different type of bond, which is not correct.

**7** (a) The structure of one molecule of compound **L** is shown in Figure 12.

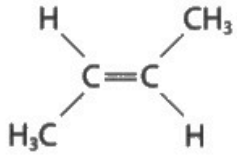



**Figure 12**

(i) State what the lines between the atom symbols represent in Figure 12.

**(1)**

hydrogen bond

**ResultsPlus**
**Examiner Comments**

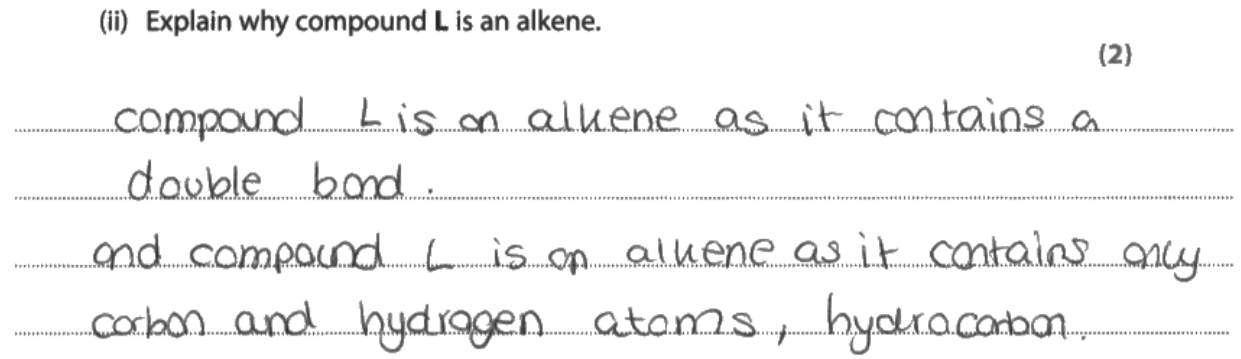
Hydrogen bonds are a type of intermolecular force rather than a covalent bond.

## Question 7 (a)(ii)

Most responses to this question scored one mark, but there were very few two mark responses.

Candidates usually correctly identified that alkenes contain double bonds but it was far less common to see that alkenes are also hydrocarbons.

This response scored two marks.


(ii) Explain why compound **L** is an alkene.

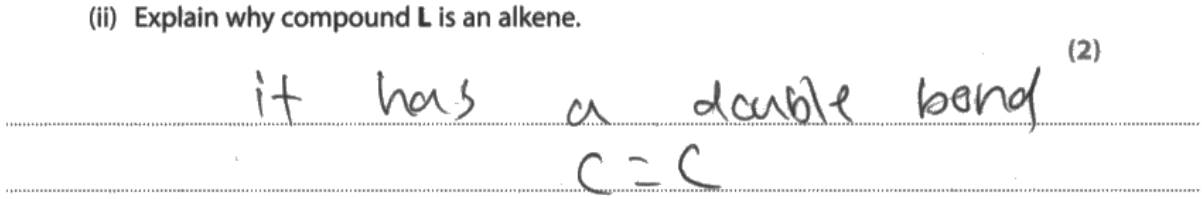
**(2)**

compound L is an alkene as it contains a double bond.
and compound L is an alkene as it contains only carbon and hydrogen atoms, hydrocarbon.

**ResultsPlus**
**Examiner Comments**

Very few responses identified both double bond and hydrocarbon.

This response scored one mark.


(ii) Explain why compound **L** is an alkene.

**(2)**

it has a double bond
C=C

**ResultsPlus**
**Examiner Comments**

Most candidates could identify that alkenes contain a double bond but then didn't add anything further to their answer.

**ResultsPlus**
**Examiner Tip**

The answer 'unsaturated hydrocarbon' would have scored both marks.

This response scored one mark.

The candidate has correctly identified that the compound contains only hydrogen and carbon but fails to mention the double bond.

(ii) **Explain why compound L is an alkene.**

**(2)**

Its a hydrocarbon as its only hydrogen and carbon, as well as this the top right says $CH_3$ which is the symbol for carbon hydroxide. Hydroxide shows its a Alkali

**ResultsPlus**
**Examiner Comments**

A lot of candidates were confused by the methyl groups and suggested that this might have something to do with the compound being an alkene.

## Question 7 (a)(iii)

This question was a simple calculation using numbers in standard form, and most candidates that attempted the question were able to score both marks.

Where mistakes were made it was usually simple transcription errors or candidates attempting to evaluate the calculation without using a calculator and ending up with a power of ten error.

There were also occasionally responses where candidates had written the correct answer within the calculation but then not put the standard form part of the answer onto the final answer line.

This response scored two marks.

(iii) 1 molecule of compound **L** has a mass of $9.302 \times 10^{-23}$ g.

82,500 molecules of compound **L** combine to form 1 polymer molecule.

Calculate the mass of this polymer molecule.

**(2)**

$9.302 \times 10^{-23} \times 82500 = 7.67415 \times 10^{-18}$

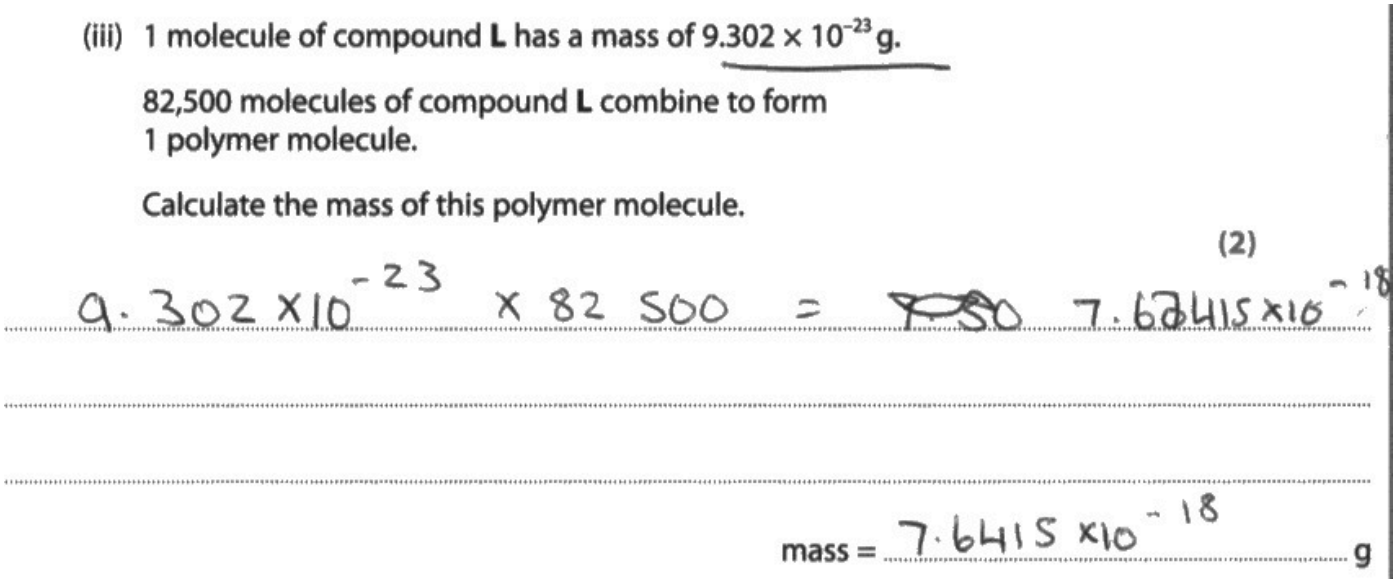
mass = $7.67415 \times 10^{-18}$ g

**ResultsPlus**
**Examiner Comments**

The correct answer is calculated in the working space and then correctly transferred onto the answer line.

This response scored one mark.

The candidate has calculated the correct answer and written it in the answer space. Unfortunately they have made an error when copying this answer onto the answer line and does not score the evaluation mark.



(iii) 1 molecule of compound **L** has a mass of $9.302 \times 10^{-23}$ g.

82,500 molecules of compound **L** combine to form 1 polymer molecule.

Calculate the mass of this polymer molecule.

(2)

$9.302 \times 10^{-23} \times 82\,500 = 7.67415 \times 10^{-18}$

mass = $7.6415 \times 10^{-18}$ g

**ResultsPlus**
**Examiner Comments**

The answer written on the final answer line is marked as the final answer.

This response scored one mark.

(iii) 1 molecule of compound **L** has a mass of $9.302 \times 10^{-23}$ g.

82,500 molecules of compound **L** combine to form 1 polymer molecule.

Calculate the mass of this polymer molecule.

**(2)**

$9.302 \times 10^{-23} \times 82500 =$

mass = $7.67415 \times 10^{28}$ g

**ResultsPlus**
**Examiner Comments**

There is an error in the final answer, with the index value being at 28 rather than – 18. However, one mark is awarded as the candidate has written down the correct calculation in the working space.

## Question 7 (b)

This question required candidates to match different natural polymers with their monomers and most candidates scored full marks here.

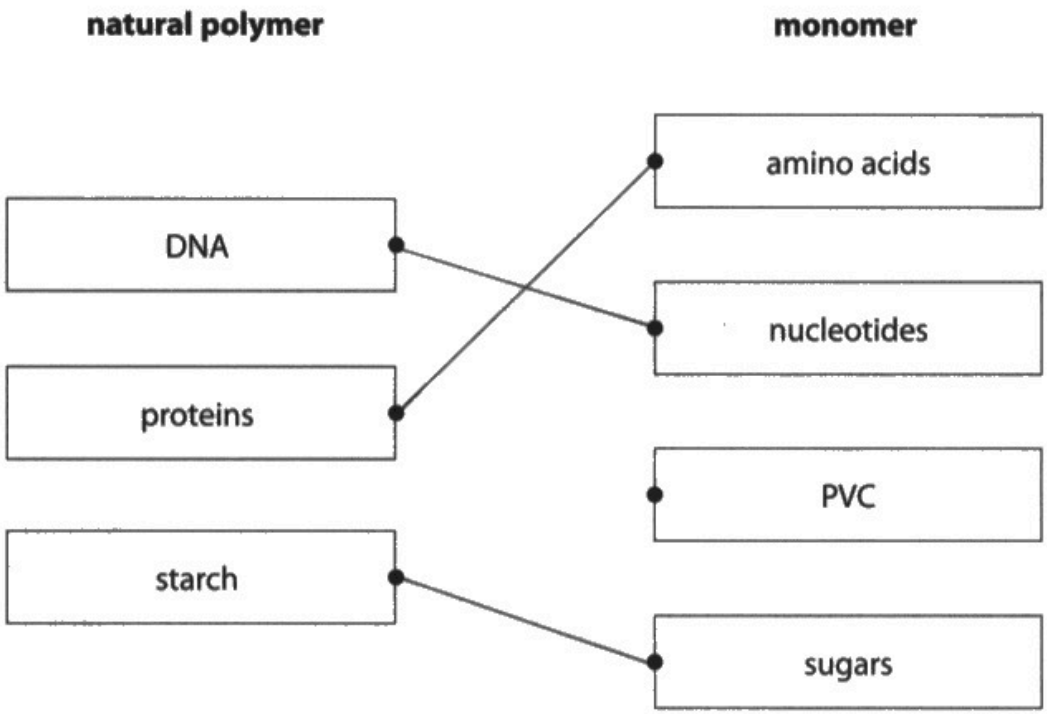
Where mistakes were made it was usually due to drawing more than one line to or from a box, or mixing up the DNA and protein monomers.

This response scored two marks.

(b) Some naturally occurring molecules are polymers.

Draw **one** straight line from each natural polymer to its monomer.

**(2)**




ResultsPlus
Examiner Comments

Correctly matches all three polymers to the correct monomer.

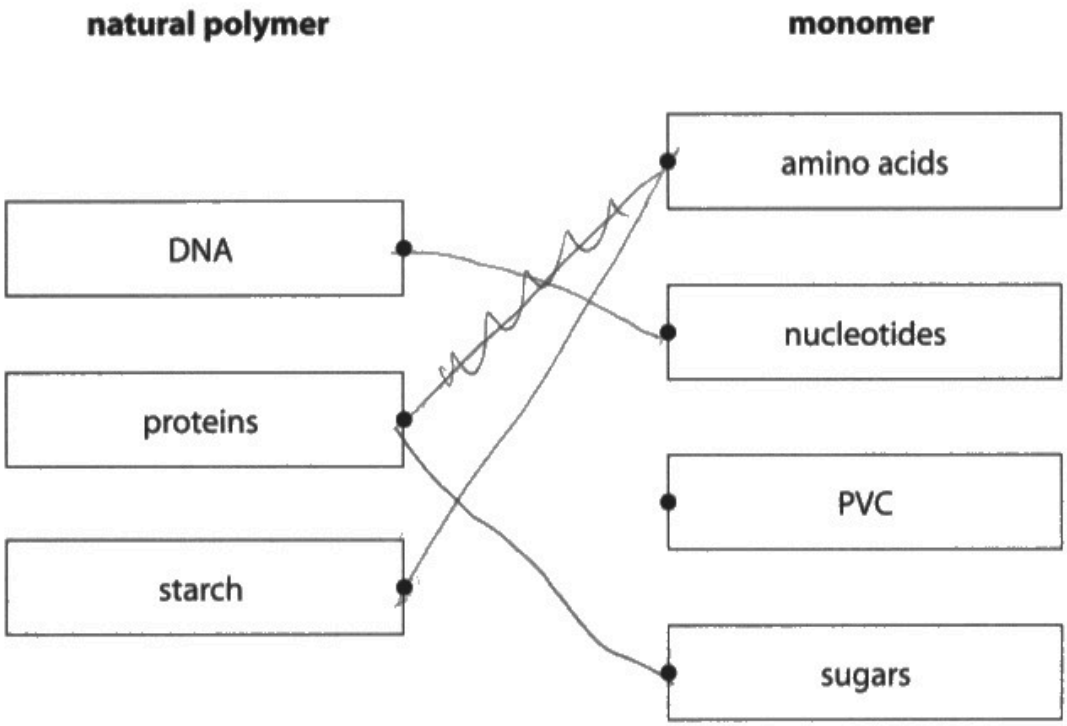
This response scored one mark.

One mark was awarded if one or two of the polymers were correctly matched with their monomer.

(b) Some naturally occurring molecules are polymers.

Draw **one** straight line from each natural polymer to its monomer.

**(2)**




**ResultsPlus**
**Examiner Comments**

A number of candidates drew a line to PVC, even though it is not a monomer.

## Question 7 (c)

The first of the six mark questions asked candidates to identify four different compounds based on results of different tests, and to explain their reasoning.

The majority of candidates scored some marks for this question but there were very few level 3 responses. There were also fewer blank responses than have been seen in previous series.

There were a lot of opportunities for candidates to score marks as there was a lot of information given in the table, but unfortunately this proved to be a problem for some candidates as they were not able to explain their answers without simply copying data from the table. The explanations only needed to be slightly more than the information on the table in order to score but this was not seen very often.

Most candidates were able to correctly identify E as carbon dioxide and sometimes linked this to the test results by stating that limewater turning milky is the test for carbon dioxide. Others scored explanation marks for recognising that carbon dioxide would not burn and produce carbon dioxide.

After E, the compound that most identified correctly was G (ethane) although the reasons given for this were often weak. Very few candidates recognised the bromine water test for alkenes and it was common to see ethene and butane incorrectly identified. Many candidates thought that the higher boiling point for H indicated a double bond as it would require more energy to break.

This is an example of a level 3 response that scored six marks.

*(c) Figure 13 shows information about four compounds, **E**, **F**, **G** and **H**.

The compounds are in no particular order

- butane
- carbon dioxide
- ethane
- ethene.

| compound | boiling point in °C | reaction with limewater | reaction with bromine water | products when burned in oxygen |
|---|---|---|---|---|
| **E** | –78 | mixture turns milky | no reaction | does not burn |
| **F** | –104 | no reaction | mixture goes colourless | carbon dioxide and water |
| **G** | –89 | no reaction | no reaction | carbon dioxide and water |
| **H** | –1 | no reaction | no reaction | carbon dioxide and water |

**Figure 13**

Use all of the information in Figure 13 to identify which of the four compounds, **E**, **F**, **G** and **H**, is

- butane
- carbon dioxide
- ethane
- ethene.

You must give reasons for your choices.

**(6)**

Product E is carbon dioxide because is turns cloudy when reacted with limewater. which is the test for $CO_2$. it also does not produce anything when burned with oxyger

~~Prdt~~ product F is ethene because it goes colourless when reacted with bromine due to it being unsaturated

Product G is ethane because it has a lower boiling point than product H as it has less carbon atoms

This means that product H is butane

**ResultsPlus**
**Examiner Comments**

The candidate has correctly identified all four compounds and given a good explanation for each one that adds their own knowledge to the information given.

Carbon dioxide is linked with limewater being the test for this gas.

Ethene is linked to the bromine water test for unsaturated compounds.

Ethane and butane are linked to the number of carbon atoms and boiling points.

There were very few responses showing this level of correct detail.

This is an example of a level 2 response.

*(c) Figure 13 shows information about four compounds, **E**, **F**, **G** and **H**.

The compounds are in no particular order

- butane
- carbon dioxide
- ethane
- ethene.

| compound | boiling point in °C | reaction with limewater | reaction with bromine water | products when burned in oxygen |
|---|---|---|---|---|
| **E** | –78 | mixture turns milky | no reaction | does not burn |
| **F** | –104 | no reaction | mixture goes colourless | carbon dioxide and water |
| **G** | –89 | no reaction | no reaction | carbon dioxide and water |
| **H** | –1 | no reaction | no reaction | carbon dioxide and water |

**Figure 13**

Use all of the information in Figure 13 to identify which of the four compounds, **E**, **F**, **G** and **H**, is

- butane
- carbon dioxide
- ethane
- ethene.

You must give reasons for your choices.

**(6)**

Compound E :
is carbon dioxide, I know this because when testing for carbon dioxide you do a limewater test, when doing this test you should see the reaction turn milky this shows that carbon dioxide is present

Compound F:
is ethene, I know this because when testing for bromine water it should always turn orange to colourless, this only works if it is an alkene if it was an alkane no reaction would happen.

Compound G:
IS Butane, I know this because it has a lower boiling point than ethane this makes butane more volatile and flammable As you go down the #lkanes boiling points get lower.

Compound H:
is ethane, I know this because it has a higher boiling point than Butane

**ResultsPlus**
**Examiner Comments**

The candidate correctly identifies two of the compounds, carbon dioxide and ethene, with a detailed explanation for each that is not directly copied from the table. However, ethane and butane are incorrectly identified as the candidate has suggested that ethane has a higher boiling point than butane and so the response cannot get into level 3.

**ResultsPlus**
**Examiner Tip**

Use the information in the table to help with an answer but always add your own knowledge as well.

This is an example of a level 1 response.

*(c) Figure 13 shows information about four compounds, **E**, **F**, **G** and **H**.

The compounds are in no particular order

- butane
- carbon dioxide
- ethane
- ethene.

| compound | boiling point in °C | reaction with limewater | reaction with bromine water | products when burned in oxygen |
|---|---|---|---|---|
| **E** | –78 | mixture turns milky | no reaction | does not burn |
| **F** | –104 | no reaction | mixture goes colourless | carbon dioxide and water |
| **G** | –89 | no reaction | no reaction | carbon dioxide and water |
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**Figure 13**

Use all of the information in Figure 13 to identify which of the four compounds, **E**, **F**, **G** and **H**, is

- butane
- carbon dioxide
- ethane
- ethene.

You must give reasons for your choices.

**(6)**

We can see that compound E corresponds with carbon dioxide, as when they both react with limewater, it goes cloudy / milky, hence why E is Carbon Dioxide.

**ResultsPlus**
**Examiner Comments**

The candidate has correctly identified compound E as carbon dioxide and links this to the reaction with limewater with a very small amount of new knowledge demonstrated – that limewater goes **cloudy** in carbon dioxide. However there is no attempt to identify any of the other compounds.

## Question 8 (a)

This question asked for the completion of a labelled diagram to show equipment that would be used to collect and measure the volume of gas produced in a reaction.

The diagrams were of very variable quality but the best were drawn using a pencil and ruler and fully labelled.

It was expected that the majority of candidates would be able to draw and label a gas syringe but unfortunately this ended up being a low scoring item. This was often due to incorrect labelling of gas syringes or measuring cylinders, not labelling the diagram at all or drawing equipment that would be more suitable for performing simple distillation.

This response scored two marks.

Suitable equipment had to be drawn and labelled in order to score both marks. One mark was available for completing the diagram and one mark for the correct labelling of the apparatus.

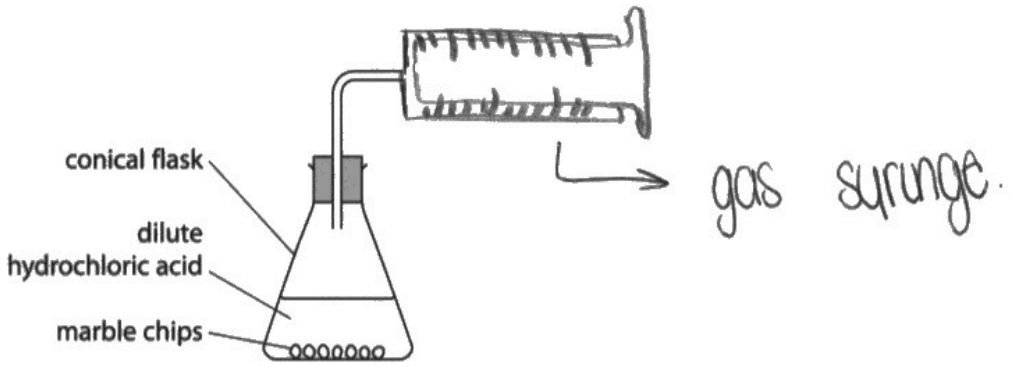
**8** A student investigates the reaction between marble chips and dilute hydrochloric acid.

The student measures the total volume of carbon dioxide gas produced each minute, for 10 minutes.

(a) Figure 14 shows part of the apparatus used in the experiment.

Complete Figure 14 by drawing and labelling apparatus that could be used to collect and measure the volume of the carbon dioxide gas.

**(2)**




**ResultsPlus**
**Examiner Comments**

Some drawings of gas syringes looked like measuring cylinders, so it was essential that equipment was correctly labelled as poorly drawn diagrams did not score, but there was a mark available for correct labelling.

This response scored two marks.

Some candidates attempted to draw the alternative method of collecting a gas using downward displacement of water, which was more complicated than a delivery tube attached to a gas syringe.

**8** A student investigates the reaction between marble chips and dilute hydrochloric acid.

The student measures the total volume of carbon dioxide gas produced each minute, for 10 minutes.

(a) Figure 14 shows part of the apparatus used in the experiment.

Complete Figure 14 by drawing and labelling apparatus that could be used to collect and measure the volume of the carbon dioxide gas.

**(2)**

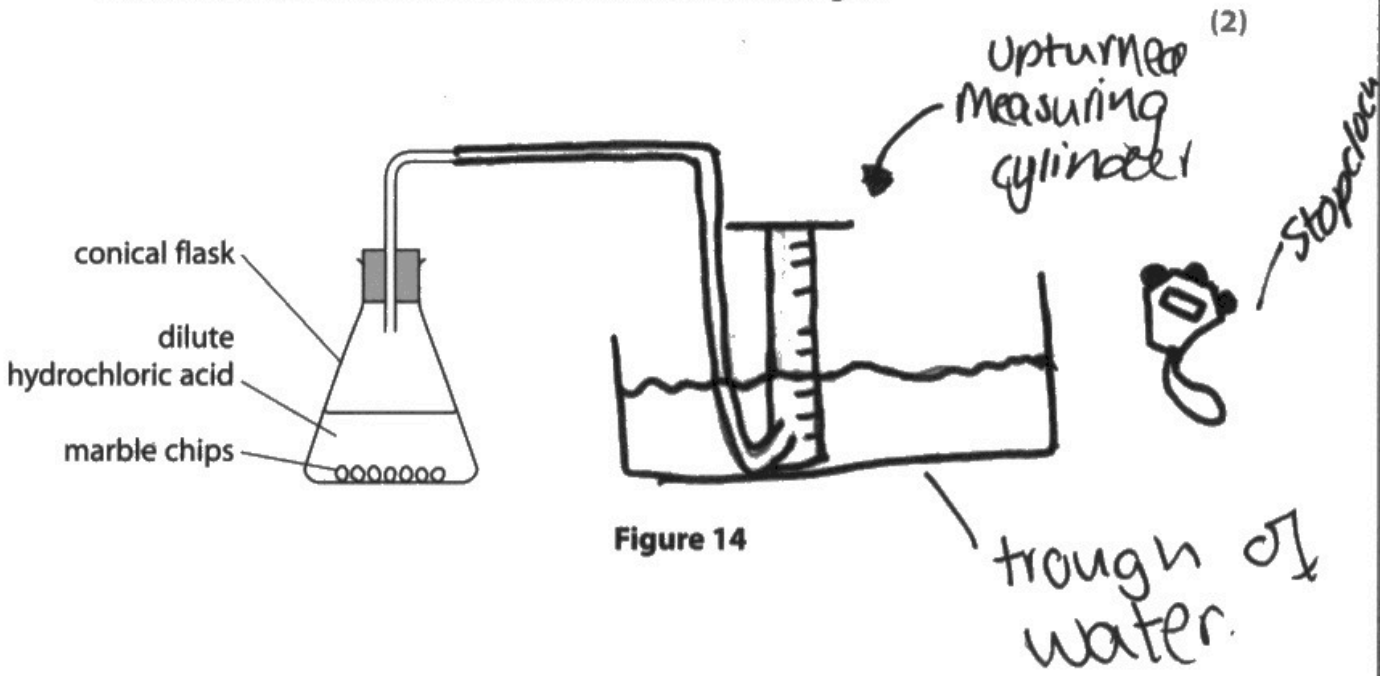



**Figure 14**

**ResultsPlus**
**Examiner Comments**

This is an excellent example of a labelled diagram.

Small errors were allowed but the diagram had to show a set up that would allow the gas produced in the reaction to be collected and its volume measured.

This response scored one mark.

Unfortunately the measuring cylinder is labelled as a test tube and so both marks could not be awarded.

**8** A student investigates the reaction between marble chips and dilute hydrochloric acid.

The student measures the total volume of carbon dioxide gas produced each minute, for 10 minutes.

(a) Figure 14 shows part of the apparatus used in the experiment.

Complete Figure 14 by drawing and labelling apparatus that could be used to collect and measure the volume of the carbon dioxide gas. **(2)**

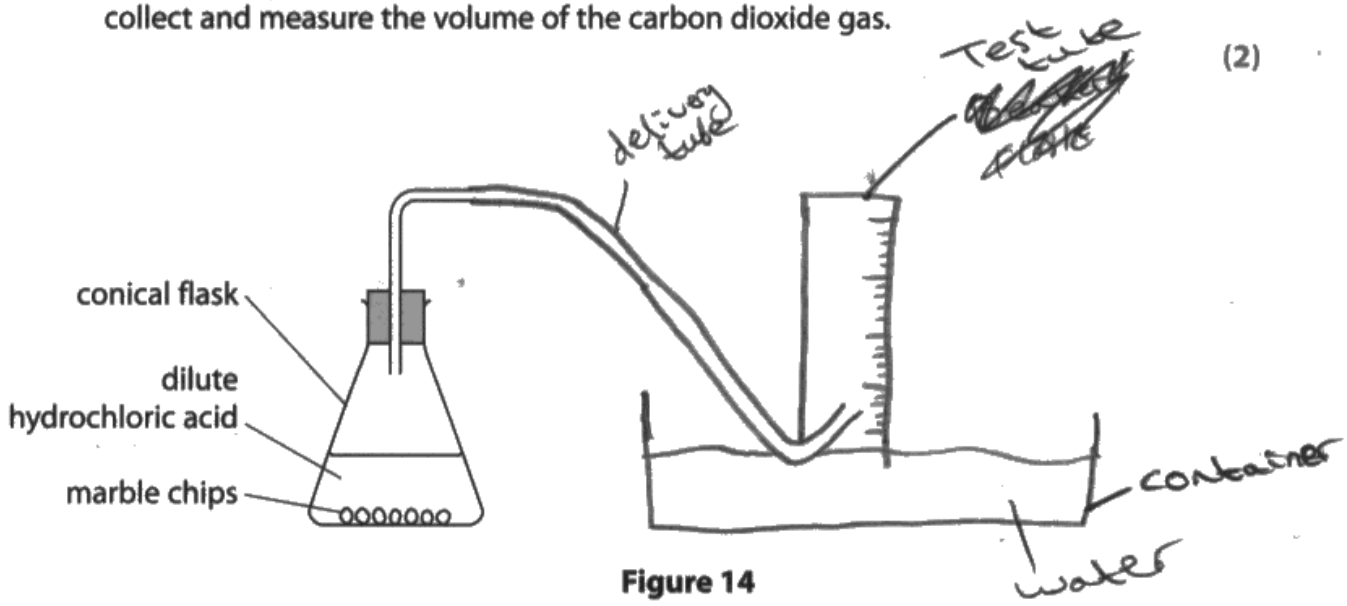



**Figure 14**

**ResultsPlus**
**Examiner Comments**

The drawing is just about acceptable, but a test tube would not measure the volume of gas and so the labelling mark is not scored.

This response did not score any marks.

**8** A student investigates the reaction between marble chips and dilute hydrochloric acid.

The student measures the total volume of carbon dioxide gas produced each minute, for 10 minutes.

(a) Figure 14 shows part of the apparatus used in the experiment.

Complete Figure 14 by drawing and labelling apparatus that could be used to collect and measure the volume of the carbon dioxide gas.

**(2)**

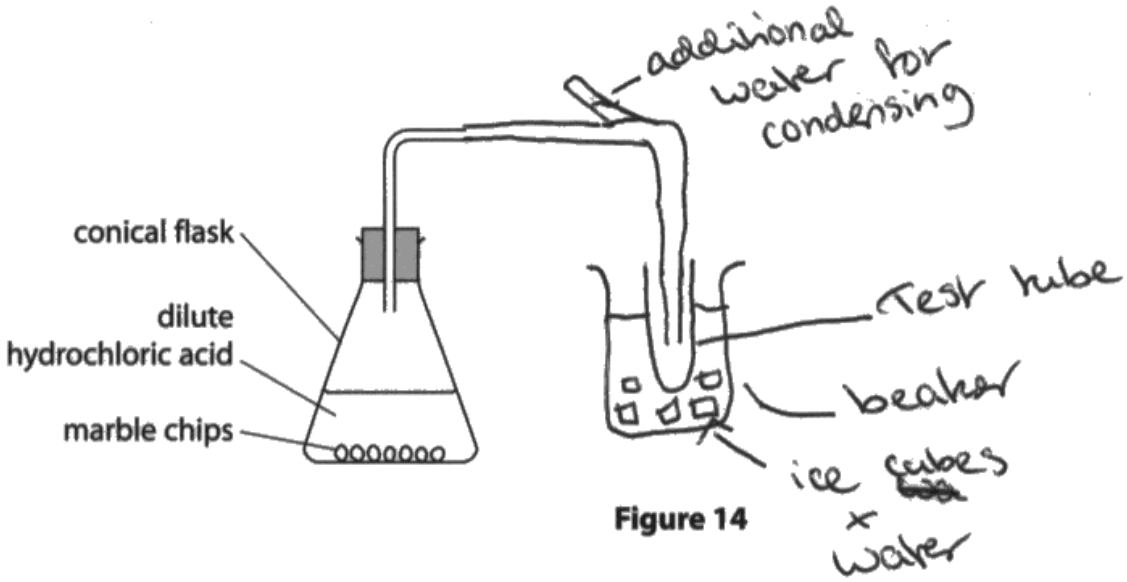



**Figure 14**

**ResultsPlus**
**Examiner Comments**

There were a significant number of responses that showed some sort of set up for condensing and collecting a vapour and were very similar to a diagram showing simple distillation that appeared on Paper 1.

## Question 8 (b)(i)

For this question, candidates were asked to use a graph to determine the volume of gas produced in the first 3.5 minutes of a reaction.

Most candidates were able to get the answer of 47 (or an answer within tolerance) directly from the graph. Where candidates did not score it was usually because they did not read the value of volume at the time asked for in the question, with 3 minutes being the most common error.

## Question 8 (b)(ii)

This question asked for the calculation of the rate of reaction using a tangent that was already drawn onto the graph.

This is a particularly challenging maths skill for foundation level students, although they should be familiar with calculating the gradient of a line, and it was relatively low scoring.

Very few candidates actually used the tangent given and simply divided the measured volume at 3.5 minutes by that time, which luckily gave an answer that was within the range that scored one or two marks.

There were a wide range of values that scored marks but very few responses scored maximum marks.

This response scored three marks.

(ii) Using the tangent, calculate the rate of reaction at 3.5 minutes in $cm^3$ per minute.

$$\text{rate of reaction} = \frac{\text{change in gas volume}}{\text{change in time}}$$

(3)

$70-25=45$

$\frac{70-25}{7-0} = \frac{45}{7}$

$\frac{45}{7} = 6.428571$

rate = 6.43 $cm^3$ per minute

**ResultsPlus Examiner Comments**

The candidate has clearly shown by their working that they have used the tangent to calculate the rate and has also evaluated their answer correctly.

This response scored two marks.

(ii) Using the tangent, calculate the rate of reaction at 3.5 minutes in $cm^3$ per minute.

$$\text{rate of reaction} = \frac{\text{change in gas volume}}{\text{change in time}}$$

(3)

rate of reaction = 46 ÷ 3.5

= 13.142857

= 13.1 $cm^3$ (1 dp)

rate = 13.1 $cm^3$ per minute

**ResultsPlus Examiner Comments**

Some candidates simply divided the total volume produced at 3.5 minutes by the time and were lucky to obtain a numerical answer that was within the one or two mark range.

**ResultsPlus Examiner Tip**

Rate of reaction is about the change in volume over a period of time rather than the total volume of gas produced in a certain amount of time.

This response scored one mark.

(ii) Using the tangent, calculate the rate of reaction at 3.5 minutes in $cm^3$ per minute.

$$\text{rate of reaction} = \frac{\text{change in gas volume}}{\text{change in time}}$$

(3)

70 - 20 = ~~50~~ 46 ~~ml~~ 46

6.6

$\frac{46}{6.5}$ = 7.076923 = 6.96

rate = ~~6.96~~ 7.07 $cm^3$ per minute

**ResultsPlus**
**Examiner Comments**

Where final answers were outside of the accepted range on the mark scheme then one mark could be awarded for calculating either the change in volume or the change in time using the tangent.

In this response, the correct change in volume has been shown in the calculation and so one mark is awarded. The change in time is not correct.

## Question 8 (c)

Questions about factors affecting the rate of reaction appear frequently and the quality of response is variable.

This question asked how using smaller marble chips would affect the rate of reaction and was generally well answered. Most candidates correctly recognised that smaller marble chips would increase the rate of reaction but far fewer responses correctly linked this to the larger surface area of the smaller chips.

Some responses suggested that smaller chips would produce less gas and therefore the reaction would be quicker because it would finish quicker. Others suggested that the smaller chips had a smaller surface area and so the reaction would be quicker. A few candidates did not state what would happen to the reaction rate at all and could therefore not score both marks.

This response scored both marks.

The candidate has correctly stated that the reaction would be faster and gave both accepted explanations – that the surface area is larger and there will be more chance of successful collisions.

(c) The student repeats the experiment using the same mass of smaller marble chips.

All other conditions remain the same.

Explain the effect on the rate of reaction of using smaller marble chips.

**(2)**

The rate of reaction will be higher as there is higher surface area so more chance of succesful collisions.

**ResultsPlus**
**Examiner Comments**

Very few candidates used the explanation of more frequent collisions to score the second mark.

This response scored one mark.

The candidate has correctly identified that the reaction will be quicker, but thinks that this is due to a smaller surface area.

(c) The student repeats the experiment using the same mass of smaller marble chips.

All other conditions remain the same.

(because) Explain the effect on the rate of reaction of using smaller marble chips.

**(2)**

The effect on the rate of reaction of using smaller marble chips is that it will react more quickly by fizzing because there is a lesser amount of surface area.

**ResultsPlus**
**Examiner Comments**

Some candidates thought that smaller marble chips meant a lower mass of chips, even though the question states that all variables except the size of the chip remain the same.

**ResultsPlus**
**Examiner Tip**

Smaller pieces of solid = larger surface area

This response did not score any marks.

(c) The student repeats the experiment using the same mass of smaller marble chips.

All other conditions remain the same.

Explain the effect on the rate of reaction of using smaller marble chips.

**(2)**

the reaction would take longer due to the marble chips being smaller while everything else is the same as before meaning it would take longer to get a reaction

**ResultsPlus**
**Examiner Comments**

The candidate has correctly stated that a smaller surface area increases the rate of reaction but then linked this to the smaller chips used in this reaction, which is not correct.

## Question 8 (e)

This question was very poorly answered, indicating that many candidates are not familiar with alternative ways of measuring gas production. The question excluded volume and so responses suggesting gas syringes and measuring cylinders were ignored.

There were some inventive answers such as counting bubbles and looking for colour changes or precipitates but very few candidates knew about measuring the change in mass.

This response scored the mark.

(e) In this experiment the volume of carbon dioxide gas produced is measured.

Give a different way that the amount of carbon dioxide produced can be measured.

**(1)**

Measuring the mass lost

**ResultsPlus**
**Examiner Comments**

The candidate has correctly identified that gases produced in a reaction will result in a loss of mass if they are not contained.

**ResultsPlus**
**Examiner Tip**

This practical works well with small marble chips and doing the reaction on a balance. It shows an obvious mass loss very quickly.

This response did not score.

(e) In this experiment the volume of carbon dioxide gas produced is measured.

Give a different way that the amount of carbon dioxide produced can be measured.

(1)

by using a gas syringe.

**ResultsPlus**
**Examiner Comments**

Most candidates suggested a gas syringe or measuring cylinder even though volume measurements had been excluded in the question.

This response did not score.

(e) In this experiment the volume of carbon dioxide gas produced is measured.

Give a different way that the amount of carbon dioxide produced can be measured.

(1)

amount of bubbles produced.

**ResultsPlus**
**Examiner Comments**

There were some inventive answers, including responses that suggested counting bubbles of gas. Presumably from photosynthesis practicals in biology.

## Question 8 (f)

This was another very low scoring question. Candidates seem to struggle with the idea of not being able to see a visible change at the end of a reaction and are not good at expressing answers when something has not happened or something is no longer present.

There were a few different alternatives that would have scored the mark: a colourless or clear solution, no more marble chips or no more bubbling.

Candidates were obviously more familiar with the idea of the marble chips being in excess because the vast majority of responses stated that there would be unreacted marble chips left in the flask. Where candidates did understand that there would be unreacted hydrochloric acid left over a lot simply stated that this is what would be seen.

This response scored a mark.

(f) In this experiment there is an excess of dilute hydrochloric acid.

State what you would **see** in the conical flask at the end of the experiment.

**(1)**

colourless solution

ResultsPlus
Examiner Comments

The candidate has recognised that the marble chips would have fully reacted with only a colourless solution left.

This response scored the mark.

(f) In this experiment there is an excess of dilute hydrochloric acid.

State what you would **see** in the conical flask at the end of the experiment.

**(1)**

more dilute hydrochloric acid left over in the flask and no marbles left.

**ResultsPlus**
**Examiner Comments**

Stating that hydrochloric acid would be left over was not enough to score the mark as this is not something that can be seen. This response scored the mark for stating that there would be no marbles left (presuming that marbles means marble chips).

This response did not score the mark.

(f) In this experiment there is an excess of dilute hydrochloric acid.

State what you would **see** in the conical flask at the end of the experiment.

**(1)**

You would see a solution with marble chips that weren't fully dissolved in the reaction.

**ResultsPlus**
**Examiner Comments**

Most responses suggested that there would be marble chips left over in the flask at the end of the reaction. Presumably candidates are more familiar with this in a practical situation.

This response did not score the mark.

Bubbles and fizzing are common answers for any visible observations in a reaction, whether or not a gas is being produced.

(f) In this experiment there is an excess of dilute hydrochloric acid.

State what you would **see** in the conical flask at the end of the experiment.

**(1)**

Bubbling and fizzing.

**ResultsPlus**
**Examiner Comments**

Had the candidate stated that the bubbling stopped then this would have scored a mark.

## Question 9 (a)

Candidates are expected to know how to test for a number of gases including oxygen and it was surprising how few candidates scored marks on this question.

The main issue appeared to be that candidates did not know the term 'glowing splint' as many responses knew that the splint would relight but did not identify that it had to be glowing. Many responses stated that a lit splint should be used while others suggested a burnt out or extinguished splint. Unfortunately unless a glowing splint was used then the second mark could not be awarded.

A number of candidates described the squeaky pop test as the test for oxygen.

This response scored two marks.

**9** This question is about the atmosphere.

(a) Describe the test to show that a gas is oxygen.

**(2)**

Put a glowing splint in test tube full of oxygen and it relights.

**ResultsPlus**
**Examiner Comments**

A surprisingly low number of candidates scored marks for this question.

**ResultsPlus**
**Examiner Tip**

Glowing splint, lit splint and splint are all different.

This response scored one mark.

**9** This question is about the atmosphere.

(a) Describe the test to show that a gas is oxygen.

**(2)**

put a glowing splint in a test tube

**ResultsPlus Examiner Comments**

One mark responses were very rare. If candidates correctly identified a glowing splint then they usually also identified that it would relight.

This response did not score any marks.

**9** This question is about the atmosphere.

(a) Describe the test to show that a gas is oxygen.

**(2)**

Put a split into a chamber of Oxygen and if it relight Oxygen is present.

**ResultsPlus Examiner Comments**

Many responses were near misses. In this case a splint will not relight if it has not previously been lit.

This response did not score any marks as the second mark was dependent on the first.

**9** This question is about the atmosphere.

(a) Describe the test to show that a gas is oxygen.

**(2)**

Lit splint relights when oxygen is present

ResultsPlus
Examiner Comments

A splint cannot relight if it is already lit.

## Question 9 (b)

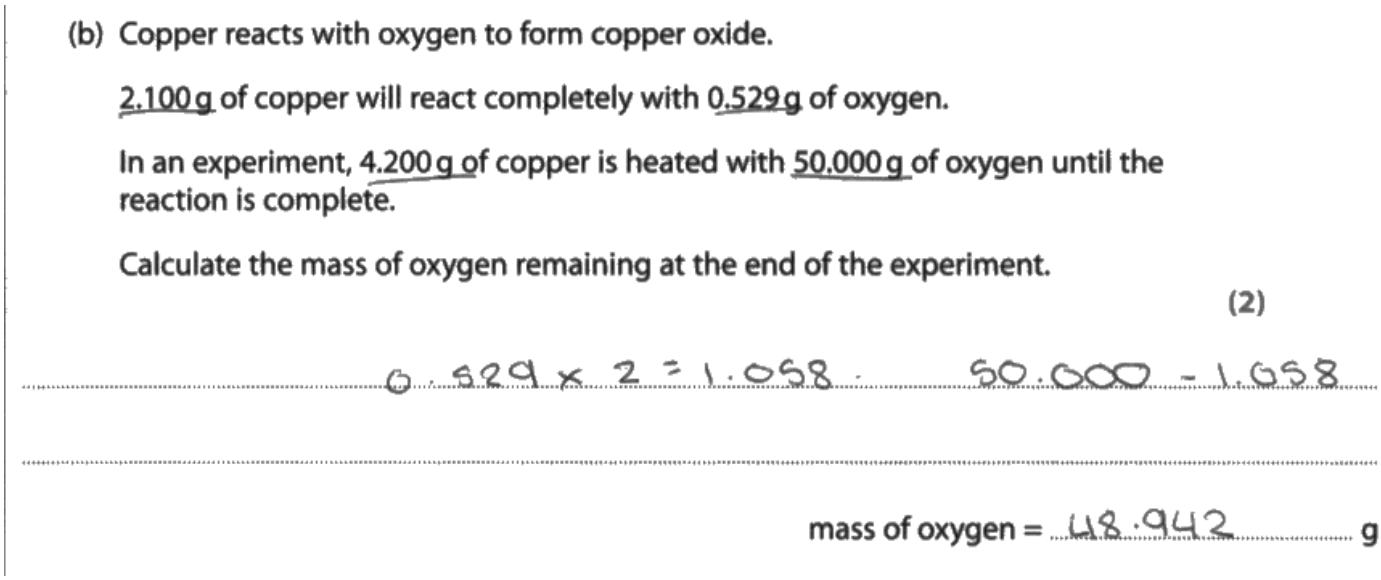
This question was a two step calculation that required candidates to multiply a number by two and subtract the answer from 50.

However, this was not well answered and the majority of responses did not score any marks.

Some responses divided the numbers in an attempt to find a ratio but rarely came up with the answer of two. Other responses simply took the mass of copper away from the mass of oxygen and did not score.

If a candidate correctly calculated the total mass of oxygen required to react with the copper then they often went on to get the correct answer.

This response scored two marks.



(b) Copper reacts with oxygen to form copper oxide.

2.100 g of copper will react completely with 0.529 g of oxygen.

In an experiment, 4.200 g of copper is heated with 50.000 g of oxygen until the reaction is complete.

Calculate the mass of oxygen remaining at the end of the experiment.

(2)

0.529 x 2 = 1.058 50.000 - 1.058

mass of oxygen = 48.942 g

**ResultsPlus**
**Examiner Comments**

The candidate has correctly calculated the mass of oxygen required and subtracted the answer from the volume of oxygen given for the reaction.

This response scored one mark.

(b) Copper reacts with oxygen to form copper oxide.

2.100 g of copper will react completely with 0.529 g of oxygen.

In an experiment, 4.200 g of copper is heated with 50.000 g of oxygen until the reaction is complete.

Calculate the mass of oxygen remaining at the end of the experiment.

**(2)**

2.100 x 2 = 4.200g — 0.529 x 2 = 1.058

mass of oxygen = 1.058 g

**ResultsPlus**
**Examiner Comments**

The candidate has correctly calculated the mass of oxygen required for the reaction but not subtracted this from the volume of oxygen.

This response did not score any marks.

(b) Copper reacts with oxygen to form copper oxide.

2.100 g of copper will react completely with 0.529 g of oxygen.

In an experiment, 4.200 g of copper is heated with 50.000 g of oxygen until the reaction is complete.

Calculate the mass of oxygen remaining at the end of the experiment.

**(2)**

50.000 - 4.200 = 45.8

mass of oxygen = 45.8 g

**ResultsPlus**
**Examiner Comments**

A common incorrect response was for candidates to subtract the mass of the copper from the mass of oxygen given.

## Question 9 (c)(i)

This question asked for an explanation of reactivity of the noble gases, specifically in relation to electrons.

Most candidates attempted this question, but it was not high scoring at all and only a small number of responses scored both marks.

Some responses lost marks for stating a specific number of electrons in the outer shell which was not correct – usually 8 but also 2 and 0, but most responses that scored were awarded the first marking point. The question required an answer in terms of electrons and without any reference to electrons then full marks could not be awarded.

This response scored two marks.

The candidate states that the outer electron shell is full and therefore electrons are not lost or gained.

Full electron shells alone would not have been enough to score the first mark.

(c) Helium, neon and argon are all inert.

(i) Explain, in terms of electrons, why these gases are inert.

**(2)**

They all have full outershells so they don't lose or gain electrons

**ResultsPlus**
**Examiner Comments**

Reference to not sharing electrons with other atoms was also accepted for the second mark.

This response scored one mark.

(c) Helium, neon and argon are all inert.

(i) Explain, in terms of electrons, why these gases are inert.

(2)

all have full outer shells

**ResultsPlus Examiner Comments**

There is no reference to loss, gain or sharing of electrons and so the second mark was not awarded.

This response did not score any marks.

Some responses stated a number of electrons in the outer shell, none of which were correct.

(c) Helium, neon and argon are all inert.

(i) Explain, in terms of electrons, why these gases are inert.

(2)

because they have no electrons in their outer shell

**ResultsPlus Examiner Comments**

A number of candidates seem to think that there are empty electron shells surrounding the nucleus of an atom if there are not enough electrons to fill all of the shells.

## Question 9 (d)

The second of the six mark questions was better attempted and answered overall than the first one, although there were still very few level 3 responses.

Candidates were expected to use the information in the table to discuss the effect that plants have had on the composition of the Earth's atmosphere and the temperature on Earth over time.

Again, there were fewer blank responses than have been seen in previous years but a lot of responses simply copied information from the table without adding any additional information or linking ideas together. Other responses missed the point of the question and simply described the evolution of the atmosphere over time.

More able candidates were able to link the changes in the atmosphere to photosynthesis and the coverage of plants on Earth but only the most able went on to link the changes in gas percentages to the temperature of the Earth.

The most common misconceptions seen in this question were to suggest that plants breathe and to name photosynthesis as respiration.

This is a level 3 response.

In order to access level 3, candidates had to discuss the effect of plant life on the Earth's temperature as well as the composition of the atmosphere. Very few responses mentioned the changing temperature with reference to plant life and so there were not a lot of level 3 responses.

This response gives the correct equation for photosynthesis and then goes on to discuss how the changing plant coverage on Earth affected the levels of carbon dioxide in the air. Either of these responses alone would have been enough to access level 2.

The final paragraph discusses the increasing levels of carbon dioxide in the atmosphere and how this leads to increased global warming. The response links this change back to deforestation and is therefore easily into level 3.

*(d) Figure 16 shows how plant life and the atmosphere of Earth have changed over time.

| period of time | plant life | amount of carbon dioxide in atmosphere | amount of oxygen in atmosphere |
|---|---|---|---|
| the earliest Earth | no plant life | very high | none |
| about 3,500 million years ago | plant life evolved | high | very low |
| about 10,000 years ago | about 60% of land covered by trees | 0.03% | about 21% |
| today | less than 40% of land covered by trees | 0.04% | about 21% |

**Figure 16**

Explain the effect that plant life has had on the Earth's atmosphere and the temperature of the Earth.

You should refer to the information in Figure 16 including

- the plant life
- the amounts of carbon dioxide
- the amounts of oxygen

(6)

the earliest Earth

Before plants were on Earth, volcanic activity resulted in there being lots of carbon dioxide and water vapour on Earth and no oxegen. However as the Earth cooled down, the water vapour condensed into the oceans and the carbon dioxide dissolved into the water and then the carbonates formed sediment. This allowed for plants to grow on earth.

In order for plants to respire they had to photosynthesise. The equation for photosynthesis is,

carbon dioxide + water → glucose + oxegen.

This meant that plants would take in the carbon dioxide from the atmosphere, decreasing it and as a result of this, produced oxegen. However plant life was not very abundant 3-5 million years ago so this was very small scale.

~~However~~ However plants such as trees covered about 60% of the land 10,000 years ago so this meant lots of photosynthesis producing an abundance of oxegen in the atmosphere, bringing it up to 21% and carbon dioxide levels to 0.03%. At this point the Earth was very cool so new life forms ~~However~~ started to evolve, such as humans or homo sapiens.

However, today with deforestation, Trees only cover 40% of the land. That's a 20% decrease in 10,000 years. As ~~acts~~ a result of this oxegen levels have not risen and stay at 21%. However factories and the emission of green house gases has resulted in carbon dioxide levels rising, absorbing heat from the sun and warming up Earth. This is known as Global warming. As a result of this ice caps are melting and sea levels are rising causing inhospitable conditions for plants. With more plants dying the oxegen levels will decrease and $CO_2$ levels will once more arise, resulting in Earth heating up once more.

ResultsPlus
Examiner Comments

The first part of the response discussing the evolution of the atmosphere was not credited as it was not relevant to the question.

This is a level 2 response.

*(d) Figure 16 shows how plant life and the atmosphere of Earth have changed over time.

| period of time | plant life | amount of carbon dioxide in atmosphere | amount of oxygen in atmosphere |
|---|---|---|---|
| the earliest Earth | no plant life | very high | none |
| about 3,500 million years ago | plant life evolved | high | very low |
| about 10,000 years ago | about 60% of land covered by trees | 0.03% | about 21% |
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**Figure 16**

Explain the effect that plant life has had on the Earth's atmosphere and the temperature of the Earth.

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- the amounts of oxygen

**(6)**

as more and more biodiversity was introduced onto Earth levels of $CO_2$ began to decrease however when Plant life began to be removed levels of $CO_2$ beyan to increase as Plant life increased oxygen levels increased as it is a byproduct of Photosynthesis

ResultsPlus
Examiner Comments

The majority of candidates gave level 2 responses to this question, by correctly linking the changing levels of carbon dioxide and oxygen to the amount of plant coverage on Earth.

This response states that carbon dioxide is used and oxygen is produced in photosynthesis and links the amounts of these gases to the amount of plant coverage.

This is a level 1 response.

*(d) Figure 16 shows how plant life and the atmosphere of Earth have changed over time.

| period of time | plant life | amount of carbon dioxide in atmosphere | amount of oxygen in atmosphere |
|---|---|---|---|
| the earliest Earth | no plant life | very high | none |
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**Figure 16**

Explain the effect that plant life has had on the Earth's atmosphere and the temperature of the Earth.

You should refer to the information in Figure 16 including

- the plant life
- the amounts of carbon dioxide
- the amounts of oxygen

**(6)**

Plant life evolving meant that oxygen is produced into the earths atmosphere because plants make oxygen

**ResultsPlus**
**Examiner Comments**

Candidates could score level 1 marks by correctly identifying the trend in carbon dioxide levels and/or oxygen levels over time.

This response has no reference to carbon dioxide levels so cannot get into level 2 but correctly states that plants produce oxygen and so scores level 1.

This is a level 1 response.

*(d) Figure 16 shows how plant life and the atmosphere of Earth have changed over time.

| period of time | plant life | amount of carbon dioxide in atmosphere | amount of oxygen in atmosphere |
|---|---|---|---|
| the earliest Earth | no plant life | very high | none |
| about 3,500 million years ago | plant life evolved | high | very low |
| about 10,000 years ago | about 60% of land covered by trees | 0.03% | about 21% |
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**Figure 16**

Explain the effect that plant life has had on the Earth's atmosphere and the temperature of the Earth.

You should refer to the information in Figure 16 including

- the plant life
- the amounts of carbon dioxide
- the amounts of oxygen

**(6)**

Plant life is good because its ~~#~~ pretty and the plants take the carbon dioxide.

**ResultsPlus**
**Examiner Comments**

Simple statements were enough to score at least 1 mark. In this case the response correctly states that plants take in carbon dioxide.

## Question 10 (a)(i)

This question required candidates to identify the corrosive hazard symbol and suggest a safety precaution to be taken when working with corrosive substances.

The item was marked independently and the majority of responses scored at least one mark.

The most common errors were to identify the hazard symbol as harmful or irritant rather than corrosive or to be too generic with safety precautions. Some responses lost a mark for identifying the risks associated with working with corrosive materials rather than suggesting a safety precaution.

This response scored both marks.

**10** (a) Figure 17 shows a poly(ethene) bottle containing substance **K** with one of its hazard symbols showing.

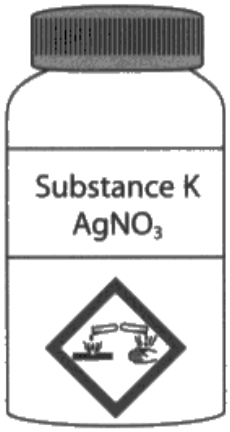



**Figure 17**

(i) Explain a safety precaution that should be taken when using a substance with the hazard symbol shown in Figure 17.

**(2)**

Wear gloves as the substance is corrosive.

**ResultsPlus**
**Examiner Comments**

The candidate has correctly identified the hazard symbol and suggested the relevant precaution of wearing gloves.

This response scored one mark.

**10** (a) Figure 17 shows a poly(ethene) bottle containing substance **K** with one of its hazard symbols showing.

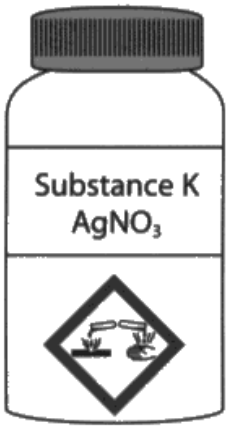



**Figure 17**

(i) Explain a safety precaution that should be taken when using a substance with the hazard symbol shown in Figure 17.

**(2)**

Using gloves as the substance may cause irritation to the skin

**ResultsPlus**
**Examiner Comments**

The candidate has suggested a suitable safety precaution but has not correctly identified the hazard.

This response scored one mark.

The candidate has correctly identified the hazard but the suggestion of protective gear is too vague to score.

**10** (a) Figure 17 shows a poly(ethene) bottle containing substance **K** with one of its hazard symbols showing.

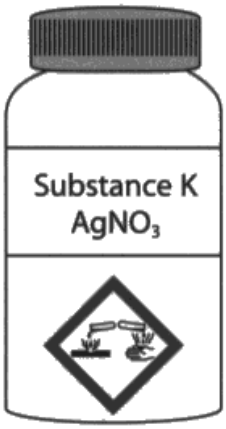



**Figure 17**

(i) Explain a safety precaution that should be taken when using a substance with the hazard symbol shown in Figure 17.

**(2)**

wear protective gear as its corrosive

**ResultsPlus**
**Examiner Comments**

Either gloves or goggles would have been accepted as a suitable precaution.

**ResultsPlus**
**Examiner Tip**

Safety precautions should be specific to the hazard.

## Question 10 (a)(ii)

Candidates were given the formula $AgNO_3$ and asked to give the name of the substance labelled K.

Most candidates attempted this question but the majority of responses were not correct.

Silver was often correctly identified but fewer candidates were able to identify the nitrate group. Common incorrect responses included silver silver nitroxide, silver nitrogen oxide, silver nitrogen hydroxide.

Some candidates misread the formula and stated that the compound contained aluminium rather than silver. There were also a significant number of candidates that did not look at the formula at all and identified substance K as potassium.

## Question 10 (a)(iii)

This question asked candidates to state a property of poly(ethene) that makes it suitable container.

It was well attempted but not well answered with the majority of responses not scoring the mark. Many candidates were able to identify properties of poly(ethene) but these were not always relevant to its use as a container for chemical storage.

The most common correct answer seen related to the inert nature of poly(ethene).

This response scored the mark.

(iii) State **one** property of poly(ethene) that makes it a suitable material to make a container for storing substances.

**(1)**

unreactive

**ResultsPlus**
**Examiner Comments**

Any description of poly(ethene) being unreactive was enough to award the mark, although this was not always well described by candidates.

This response did not score the mark.

As with a similar question at the beginning of the paper many candidates confused the meaning of corrode and corrosive.

(iii) State **one** property of poly(ethene) that makes it a suitable material to make a container for storing substances.

**(1)**

Non corrosive

**ResultsPlus**
**Examiner Comments**

Other common misconceptions included the idea that polymers are malleable or have high melting points.

## Question 10 (a)(iv)

This was one of the worst answered questions on the paper, with only a very small number of candidates scoring any marks at all.

It is a challenging question but it also highlights a lack of practical skills and understanding as to how and why qualitative analysis is carried out.

Many candidates did not seem to understand why the test would not work and suggested that a specific volume of acid needed to be added. A significant number of responses also did not seem to understand that the acids they use in their own practical work are almost always dilute.

This response scored two marks.

(iv) A student tests a solid for chloride ions.

The student uses the following method.

**step 1** dissolve a small amount of the solid in water

**step 2** add some dilute hydrochloric acid

**step 3** add a few drops of a solution of **K**

**step 4** observe whether or not a white precipitate forms.

This method to show whether the solid contains chloride ions will not work.

Explain a change that needs to be made to **step 2** to allow this method to work.

**(2)**

add dilute nitric acid instead, because dilute hydrochloric acid already contains chloride ions thus the test will show an incorrect result.

**ResultsPlus**
**Examiner Comments**

Responses scoring both marks were very rare. Only a very few candidates identified that hydrochloric acid should not be used to test for chloride ions because it contains chloride ions.

This response scored one mark.

(iv) A student tests a solid for chloride ions.

The student uses the following method.

**step 1** dissolve a small amount of the solid in water

**step 2** add some dilute hydrochloric acid

**step 3** add a few drops of a solution of **K**

**step 4** observe whether or not a white precipitate forms.

This method to show whether the solid contains chloride ions will not work.

Explain a change that needs to be made to **step 2** to allow this method to work.

**(2)**

Instead of using hydrochloric acid the student could use nitric acid

**ResultsPlus**
**Examiner Comments**

Candidates that scored one mark often correctly suggested an alternative acid or stated that hydrochloric acid should not be used but did not offer any explanation.

This response did not score any marks.

(iv) A student tests a solid for chloride ions.

The student uses the following method.

**step 1** dissolve a small amount of the solid in water

**step 2** add some dilute hydrochloric acid

**step 3** add a few drops of a solution of **K**

**step 4** observe whether or not a white precipitate forms.

This method to show whether the solid contains chloride ions will not work.

Explain a change that needs to be made to **step 2** to allow this method to work.

**(2)**

add non-diluted (concentrated) hydrochloric acid.

**ResultsPlus**
**Examiner Comments**

One commonly seen suggestion was to replace the dilute hydrochloric acid with concentrated hydrochloric acid.

**ResultsPlus**
**Examiner Tip**

The acids used in the majority of practical work at GCSE are dilute solutions.

## Question 10 (b)

This question was very challenging for the majority of candidates on the foundation paper. In order to score full marks candidates needed to know three common chemical formulae and then also balance the equation. Most candidates made an attempt at answering the question but it was very low scoring overall. However, this is not unsurprising at the very end of the paper where the questions are most demanding.

This response scored three marks.

(b) In the test for carbonate ions, the carbonate ions react with an acid.

Sodium carbonate, $Na_2CO_3$, is reacted with dilute hydrochloric acid.

Complete and balance the equation for this reaction.

(3)

$Na_2CO_3 + 2HCl \rightarrow$ $CO_2$ + $H_2O$ + $2NaCl$

**ResultsPlus**
**Examiner Comments**

Very few candidates were able to give all three correct formulae and then balance the equation as well.

**ResultsPlus**
**Examiner Tip**

Candidates should learn the formulae of some of the most common chemical reactants and products.

This response scored two marks.

(b) In the test for carbonate ions, the carbonate ions react with an acid.

Sodium carbonate, $Na_2CO_3$, is reacted with dilute hydrochloric acid.

Complete and balance the equation for this reaction.

(3)

$Na_2CO_3 + 2HCl \rightarrow$ NaCl + $H_2O$ + $CO_2$

**ResultsPlus**
**Examiner Comments**

The candidate has given all three correct formula but there is no attempt to balance the equation and so full marks cannot be awarded.

This response scored one mark.

(b) In the test for carbonate ions, the carbonate ions react with an acid.

Sodium carbonate, $Na_2CO_3$, is reacted with dilute hydrochloric acid.

Complete and balance the equation for this reaction.

(3)

$Na_2CO_3 + 2HCl \rightarrow$ $Na_2Cl$ + $CO_2$ + $H_2O$

**ResultsPlus**
**Examiner Comments**

Candidates that gave two correct chemical formulae were awarded one mark. In this response the candidate has given the correct formula for carbon dioxide and water but not for sodium chloride.

This response did not score any marks.

(b) In the test for carbonate ions, the carbonate ions react with an acid.

Sodium carbonate, $Na_2CO_3$, is reacted with dilute hydrochloric acid.

Complete and balance the equation for this reaction.

**(3)**

$Na_2CO_3 + 2HCl \rightarrow$ Na 2 + CO 3 + 2HCl

**ResultsPlus**
**Examiner Comments**

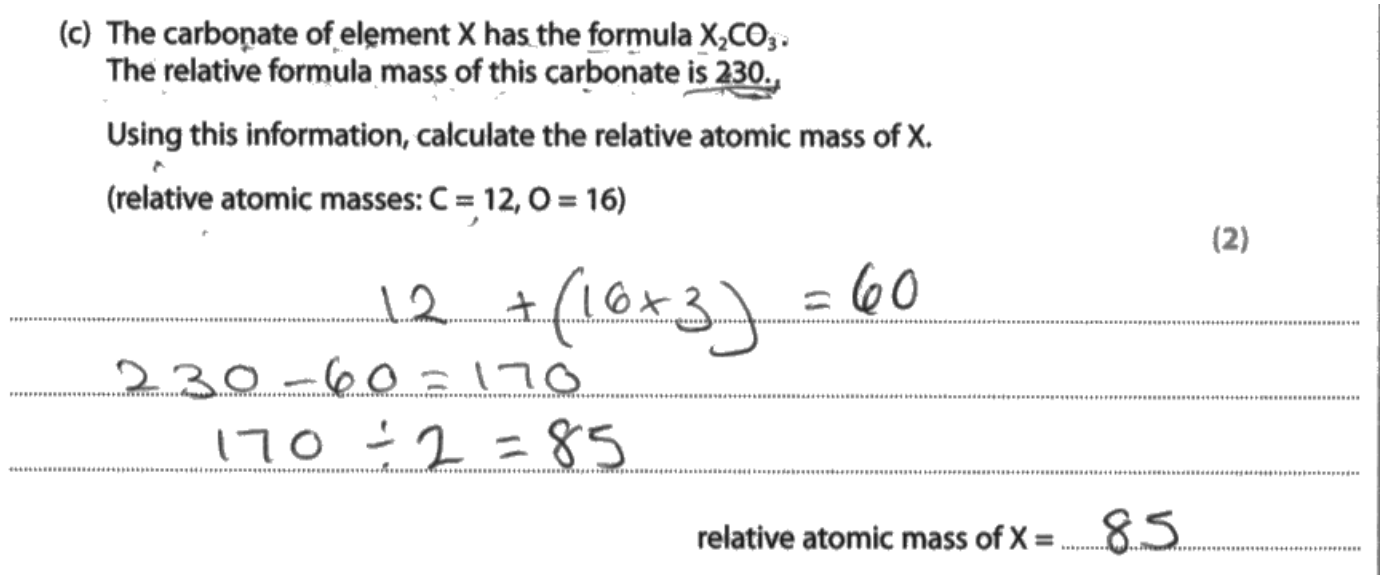
It was common to see the formula of sodium carbonate broken into sodium and carbonate and given as the products of the reaction.

## Question 10 (c)

The last question on the paper required candidates to work out the relative atomic mass of one element in a compound, given the relative formula mass. It was better answered than some of the earlier parts of question 10 with a good number of students scoring at least one mark.

Candidates were required to calculate the relative formula mass of the carbonate group, subtract it from the formula mass and divide their answer by 2. As long as working out was shown clearly then any error in the calculation of the formula mass of carbonate was carried forward and one mark could still be scored.

This response scored two marks.



(c) The carbonate of element X has the formula $X_2CO_3$.
The relative formula mass of this carbonate is 230.

Using this information, calculate the relative atomic mass of X.

(relative atomic masses: C = 12, O = 16)

(2)

12 + (16 × 3) = 60

230 − 60 = 170

170 ÷ 2 = 85

relative atomic mass of X = 85

**ResultsPlus**
**Examiner Comments**

The candidate has shown full working throughout and correctly calculated 85 as their final answer.

This response scored one mark.

(c) The carbonate of element X has the formula $X_2CO_3$.
The relative formula mass of this carbonate is 230.

Using this information, calculate the relative atomic mass of X.

(relative atomic masses: C = 12, O = 16)

**(2)**

$12 + (16 \times 3) = 12 + 48 = 60$

$230 - 60 = 170$

relative atomic mass of X = 170

**ResultsPlus**
**Examiner Comments**

The candidate has correctly calculated the formula mass of the carbonate group and subtracted it from the total formula mass. However they have not completed the calculation by dividing the 170 by 2 and so only one mark is scored.

This response scored one mark.

(c) The carbonate of element X has the formula $X_2CO_3$.
The relative formula mass of this carbonate is 230.

Using this information, calculate the relative atomic mass of X.

(relative atomic masses: C = 12, O = 16)

**(2)**

36 + 48 = 84

230 - 84 = 146

146 ÷ 2 = 73

12 x 3 = 36

16 x 3 = 48

relative atomic mass of X = 73

**ResultsPlus**
**Examiner Comments**

A number of candidates incorrectly calculated the formula mass of the carbonate group as 84 rather than 60. As working is shown and the rest of the calculation is correct then one mark is awarded.

This response did not score any marks.

(c) The carbonate of element X has the formula $X_2CO_3$.
The relative formula mass of this carbonate is 230.

Using this information, calculate the relative atomic mass of X.

(relative atomic masses: C = 12, O = 16)

**(2)**

relative atomic mass of X = 168

**ResultsPlus**
**Examiner Comments**

As the candidate has not shown any of their working out and the final answer is incorrect then there is no opportunity to award any marks.

**ResultsPlus**
**Examiner Tip**

Marks are often awarded for getting parts of the calculation correct, even if the final answer is not correct.

## Paper Summary

Based on the performance in this examination paper candidates should:

- Make the effort to write clearly and legibly. Examiners are only able to mark work that they can read.
- Learn the difference between the command words 'describe' and 'explain'.
- Practice linking ideas together for exam questions that are worth more than one mark.
- Focus on using and improving their scientific literacy. Candidates often struggle to use scientific language correctly and show a poor understanding of some of the key terms used in chemistry.
- Improve their general literacy. Candidates sometimes make no attempt to answer questions that contain more than one or two sentences.
- Clearly show all working out for calculation questions.
- Ensure that their calculation answers are rounded correctly and given to the correct number of significant figures or decimal places if this is asked for in the question.
- Make sure that they have experience of all of the chemistry core practicals as a minimum.
- Learn the names of equipment commonly used in chemistry practicals.
- Focus on their knowledge and understanding of the separate chemistry content on Paper 2, particularly testing for anions and cations as described in the specification.

To help with the above, centres are encouraged to make use of the past GCSE questions using Exam Wizard to target particular topics and assessment objectives.

## Grade boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

https://qualifications.pearson.com/en/support/support-topics/results-certification/grade-boundaries.html

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