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Examiners' Report
June 2023

GCSE Chemistry 1CH0 2H

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June 2023

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Introduction

Paper 2H is the second of two Chemistry papers for GCSE Chemistry. There are ten questions on this paper, six of which make up the second Chemistry paper in Combined Science. Questions two, three and four overlap with questions eight, nine and ten on the equivalent Foundation Chemistry paper. There was no advance this session.

Most candidates attempted the majority of questions on the paper. The most able candidates were able to explain their answers using the correct scientific and technical language. They could apply their understanding of Chemistry to familiar and unfamiliar practical scenarios showing a sound understanding of the subject content, as well as being able to apply their mathematical skills.

Question 1 (a)

The first question on the paper had a practical context and asked candidates to calculate the mass of butanol needed to increase the temperature of the water by 1 ^{o} C. The vast majority knew to subtract the values in the table to get 1.08 and then divide by 30.

In the student's investigation, the temperature of the 100 cm^3 water increased by 30 °C.

Calculate the mass of butanol needed to increase the temperature of the 100 cm^3 water by 1 °C.

(2)

134.67 - 133.59 = 1.08 x 30 = 32.4

mass of butanol = 32.4 g

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Examiner Comments

In this example, the candidate carried out the subtraction correctly to gain the first mark, but then multiplied rather than divided their answer so gained just 1 mark.

In the student's investigation, the temperature of the 100 cm^3 water increased by 30 °C.

Calculate the mass of butanol needed to increase the temperature of the 100 cm^3 water by 1 °C.

(2)

mass of butanol = 1.08 g

ResultsPlus
Examiner Comments

A small proportion of candidates carried out the subtraction but then did not take this any further, therefore just gaining 1 mark for the 1.08.

In the student's investigation, the temperature of the 100 cm^3 water increased by 30 °C.

Calculate the mass of butanol needed to increase the temperature of the 100 cm^3 water by 1 °C.

(2)

134.67 − 133.59 = 1.08

1.08 / 30 = 0.036

mass of butanol = 0.036 g

ResultsPlus
Examiner Comments

A good answer that scored both marks.

Question 1 (b)

In Part (ii) of Question 1, candidates were asked to give two variables that should be kept the same in the experiment. Most candidates were able to score 1 mark for this question with the most frequent correct answers relating to the distance from the beaker and the volume of water used. The most significant error made by candidates was related to keeping the volume/mass of the fuel the same showing that they had not read and understood the practical sufficiently.

variable 1

Use the same volume of water at the start

variable 2

Keep beakers of water and spirit burners at equal distances in both experiments.

ResultsPlus
Examiner Comments

A good answer that scored both marks.

variable 1

The volume of the liquid fuel (pentanol)

variable 2

The volume of water

ResultsPlus
Examiner Comments

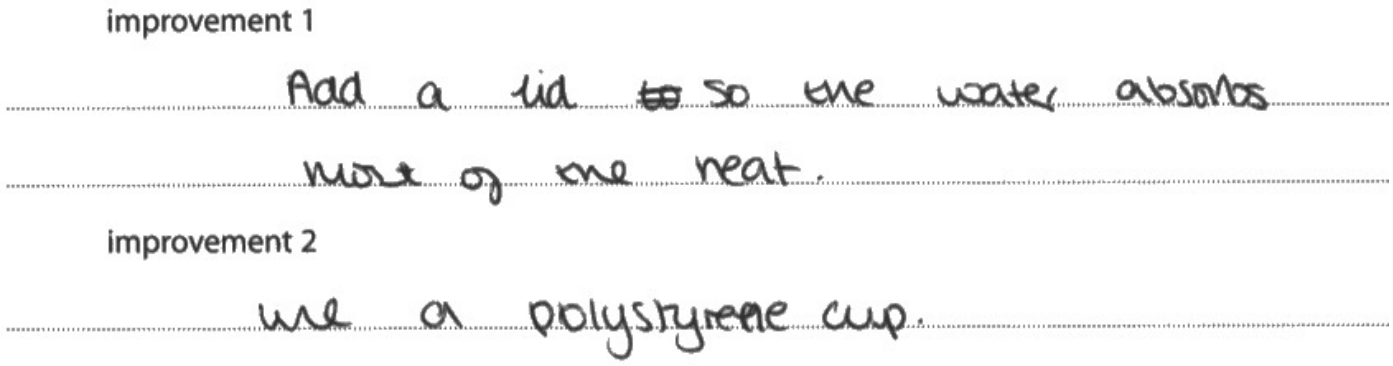
This answer scored 1 mark for the volume of water. A common error was to control the volume of fuel.

Question 1 (c)

In the last part of this question, candidates were asked to suggest two improvements to the apparatus so that more heat energy would be transferred to the water.

Many candidates suggested moving the beaker closer to the spirit burner and adding a lid to the beaker, each gaining a mark. However, a significant number of responses were vague, such as mentioning a "controlled environment" or a "closed system" or putting the setup in a container or box, but without specifying its purpose or design.

A significant number suggested changing the beaker to a polystyrene one, again not thinking through the experiment that had been described in the method.



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Examiner Comments

This example scored 1 mark for adding a lid to the beaker. Using a polystyrene cup would not work when heating with a spirit burner, so this was rejected.

ResultsPlus
Examiner Tip

Ensure that you read any practical methods carefully and study any diagrams given so that you have a full understanding of the practical before you attempt the questions. When you have written your answer, check that the suggestion you have given would work in the context provided.

improvement 1

reduce distance between spirit burner and water

improvement 2

Conduct the experiment in a controlled environment - control in something to the heat lost escape

ResultsPlus
Examiner Comments

This example scored 1 mark for reducing the distance between the spirit burner and the water. The second improvement did not score as it was considered to be too vague.

improvement 1

add draft shields

improvement 2

adjust the height of beaker just above the wicker using a clamp stand

ResultsPlus
Examiner Comments

A good answer that scored both marks.

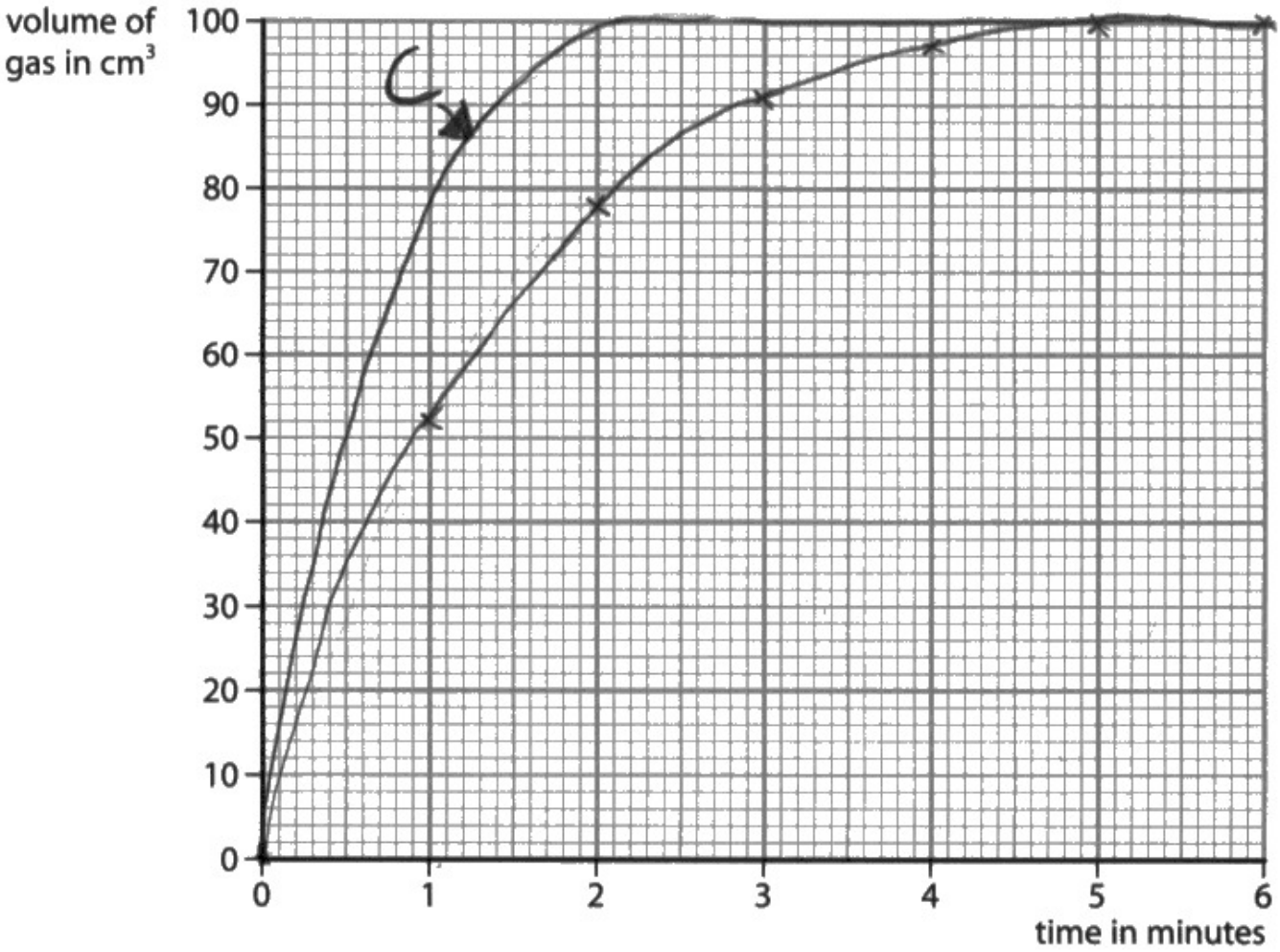
Question 2 (a)

Question 2 focused on an investigation between marble chips and dilute hydrochloric acid. Part (a) asked candidates to plot the results of the investigation on the grid and draw a curve of best fit.

The vast majority of candidates were able to complete the graph successfully gaining full marks.

Candidates who lost marks often did so due to curves not being draw dot to dot with a ruler, not starting at (0,0), starting at a minute other than 1, or finishing at a minute other than 5.

A few candidates lost a mark by extending their curve line beyond 100 cm^3.



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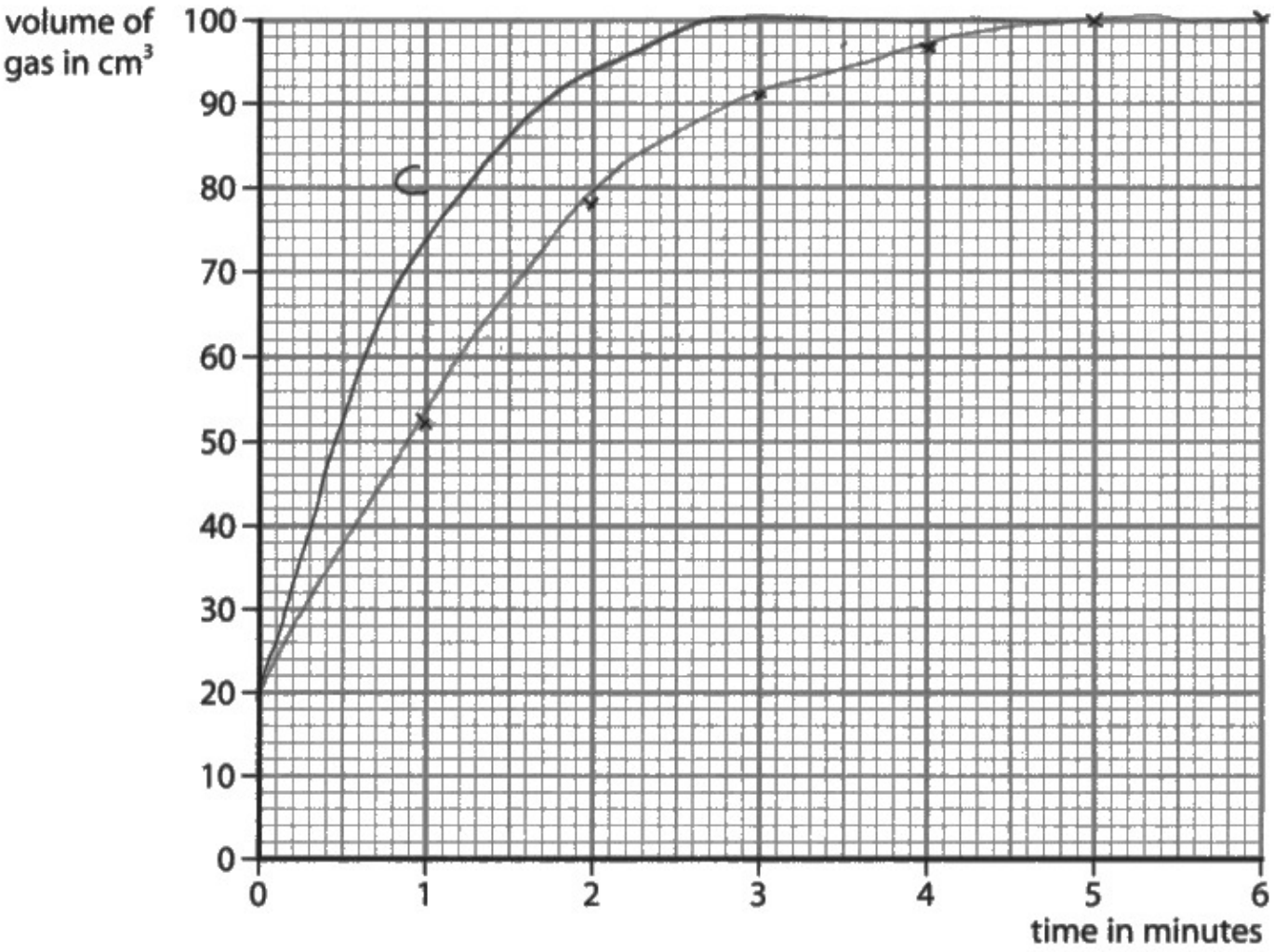
Examiner Comments

A good graph that gained all 3 marks.



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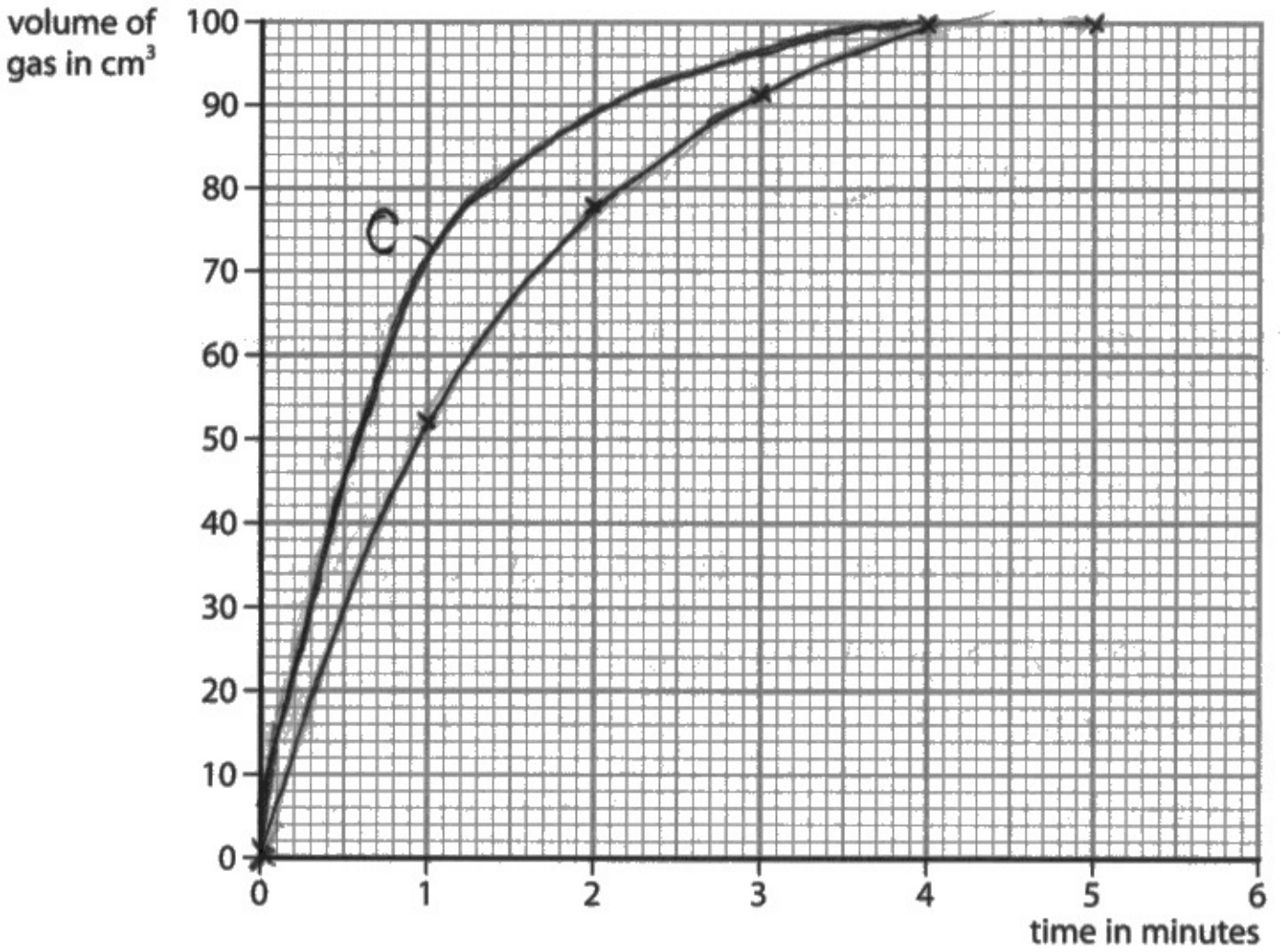
Examiner Comments

In this example that scored 2 marks. 6 points have been plotted correctly so 2 marks are awarded for plotting.

The curve does not pass through 0,0 so the curve of best fit did not score.



ResultsPlus
Examiner Comments

In this example, the candidate gained 1 mark.

5 points have been plotted correctly, so 1 mark was awarded for plotting.

The curve has not reached to the end of their plotted points, so no mark was awarded for the line of best fit.

Question 2 (b)(i)

This question was well answered with the vast majority of candidates being able to use the equation given to successfully calculate the rate of reaction.

(b) Rate of reaction can be calculated using

$$\text{rate of reaction} = \frac{\text{volume of gas produced in 1 minute}}{\text{1 minute}}$$

Figure 5 shows the rates of reaction calculated from the results of this experiment.

The rate of reaction for the time interval 2 to 3 minutes is missing.

time interval	0 to 1 minute	1 to 2 minutes	2 to 3 minutes	3 to 4 minutes	4 to 5 minutes
rate of reaction in $cm^3\ min^{-1}$	52	26		6	3

Figure 5

(i) Calculate the rate of reaction for the time interval 2 to 3 minutes.

(1)

91 - 78 = 13 $\quad \frac{13}{1} = 13$

rate of reaction = 13 $cm^3\ min^{-1}$

ResultsPlus
Examiner Comments

A good answer which scored the mark.

(b) Rate of reaction can be calculated using

$$\text{rate of reaction} = \frac{\text{volume of gas produced in 1 minute}}{\text{1 minute}}$$

Figure 5 shows the rates of reaction calculated from the results of this experiment.

The rate of reaction for the time interval 2 to 3 minutes is missing.

time interval	0 to 1 minute	1 to 2 minutes	2 to 3 minutes	3 to 4 minutes	4 to 5 minutes
rate of reaction in $cm^3\ min^{-1}$	52	26	13.	6	3

Figure 5

(i) Calculate the rate of reaction for the time interval 2 to 3 minutes. $\frac{13}{60}$ **(1)**

rate of reaction = 0.216 $cm^3\ min^{-1}$

ResultsPlus
Examiner Comments

In some cases, candidates did not use the equation given carefully and tried to convert the minutes into seconds and so did not gain the mark.

ResultsPlus
Examiner Tip

When given a calculation, always check the units in the stem or the answer line to check if you need to convert, or not as in this case.

Question 2 (b)(ii)

In part (b)(ii), candidates were asked to state and explain what happens to the rate of reaction as the acid reacts with the marble chips in the experiment. A good proportion of candidates were able to state that the rate decreased and then explain that this was because the reactants were used up. A much smaller proportion were then able to explain this in terms of collisions between particles to gain the last mark.

(ii) State and explain what happens to the rate of reaction as the acid reacts with the marble chips in this experiment.

(3)

The rate of reaction gradually decreases as the marble chips react with the hydrochloric acid, As the experiment continues the marble chips get used up to form the gas and the rate slows down until all the marble chips have reacted

ResultsPlus
Examiner Comments

This example scored 2 marks. The candidate has stated that the rate of reaction decreases to gain the first marking point and that the marble chips are used up so gains the second marking point. There is no mention of collisions becoming less frequent and so the third mark was not scored.

(ii) State and explain what happens to the rate of reaction as the acid reacts with the marble chips in this experiment.

(3)

The rate of reaction decreases as it reacts with the marble chips as the concentration decreases as more acid reacts to form a gas. As concentration decreases collisions are less frequent as there are less reacting atoms.

ResultsPlus
Examiner Comments

This example scored 3 marks. The candidate has stated that the rate of reaction decreases for the first marking point, they stated that the concentration of the acid decreases and that there are less frequent collisions.

(ii) State and explain what happens to the rate of reaction as the acid reacts with the marble chips in this experiment.

(3)

· As the time of reaction increase, the rate of reaction decrease
· Lots Huge increase of gas at first two mins, but slow down gradually when time increased

ResultsPlus
Examiner Comments

This example scored just 1 mark for stating that the rate of reaction decreases.

Question 2 (c)

In part (c), candidates were required to draw a line on the grid to show the results for the reaction with smaller marble chips.

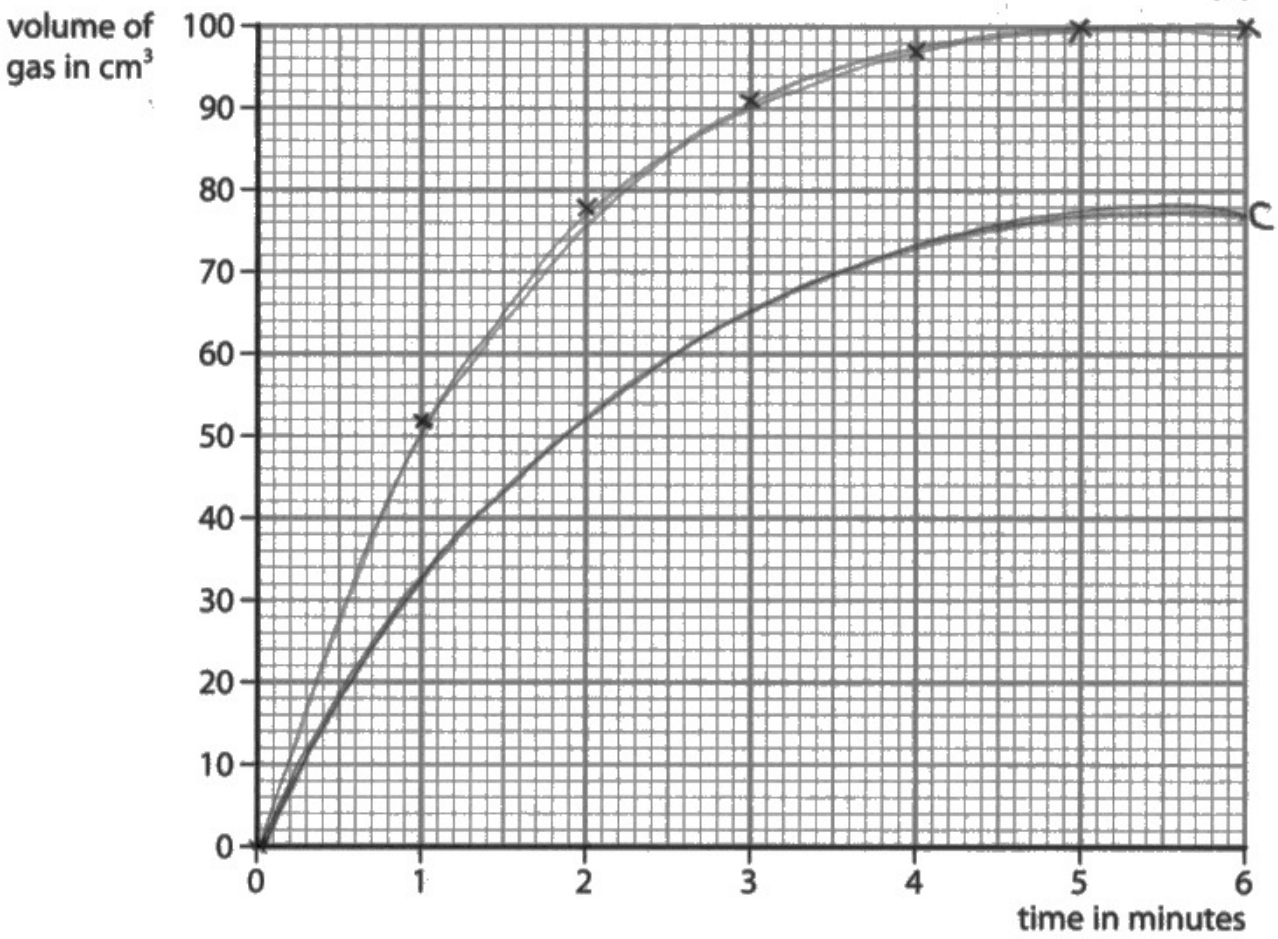
Many candidates were able to correctly draw the curve. Usual errors were drawing the line to the right of the original line or not taking care and drawing a line that levelled off above 100cm^3.

A small number of candidates drew a tangent, resulting in 0 marks.

(a) On the grid, plot the results shown in Figure 4.

Draw a curve of best fit.

(3)



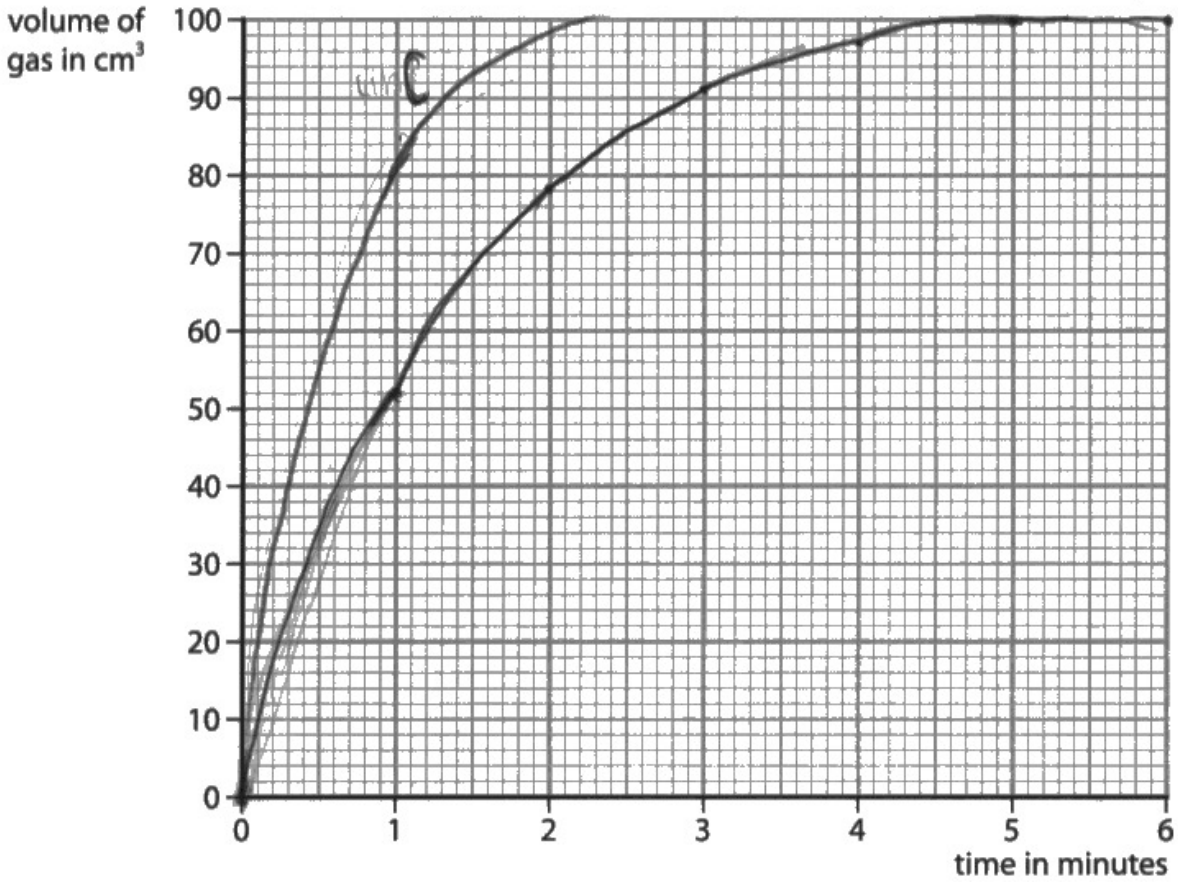
ResultsPlus
Examiner Comments

This example scored 0 marks as it was to the right of the original curve and did not level off at 100cm^3.

(a) On the grid, plot the results shown in Figure 4.

Draw a curve of best fit.

(3)



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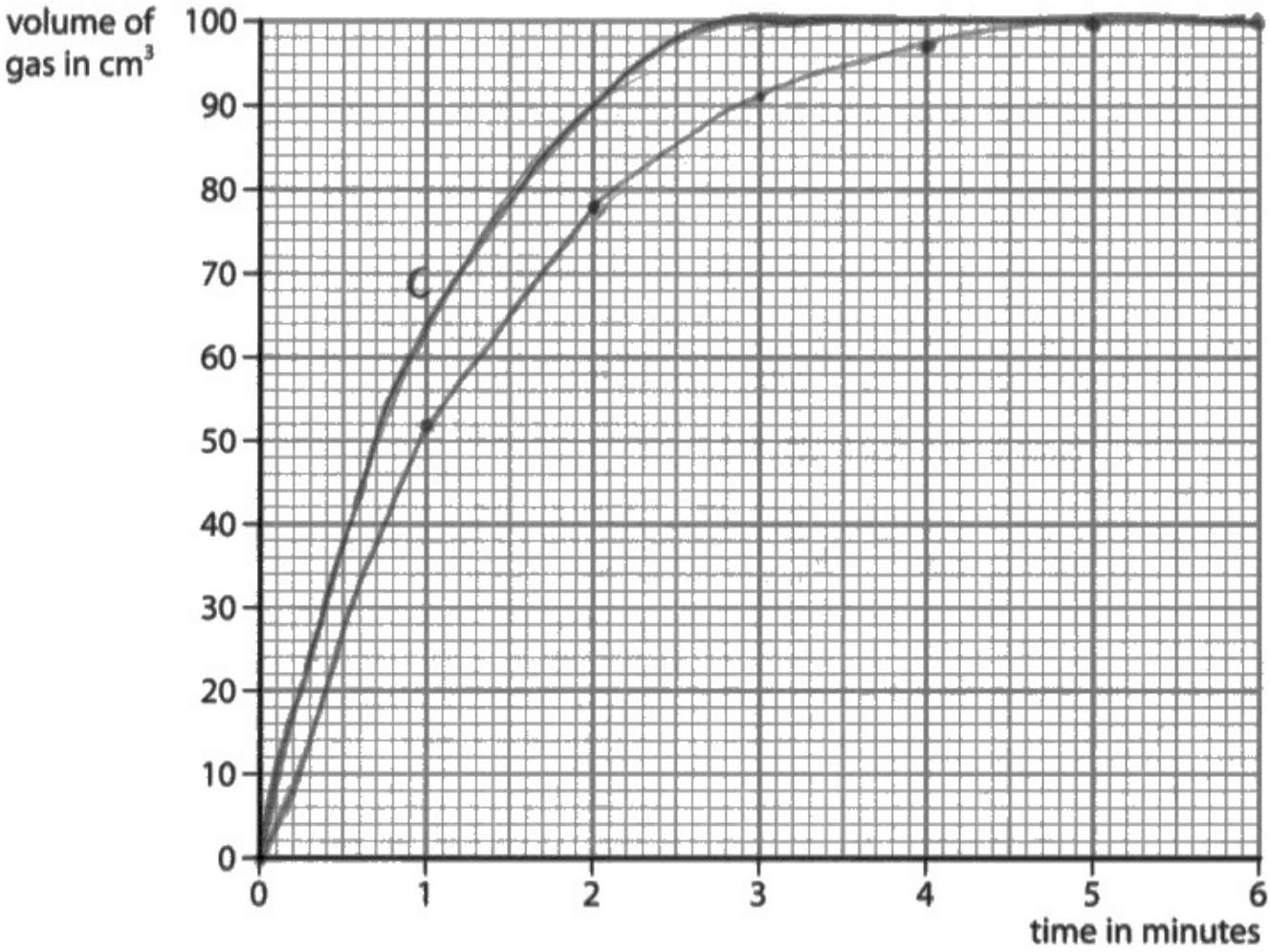
Examiner Comments

This example scored 1 mark. The line was to the left of the original line but stopped at 100cm^3 and did not level off so did not gain the second mark.

Draw a curve of best fit.

(3)



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Examiner Comments

A good example which scored both marks.

Question 3 (a)

In general, this question was well answered by candidates with the majority of candidates scoring both marks available for correctly identifying that group 1 metals have one electron in their outer shell. Where candidates lost marks, it was often as they had the misconception that these elements needed to gain an electron for a full outer shell.

Many candidates included additional details about why group 1 metals are in that group, showcasing a good understanding of the topic although this was not required for the mark.

3 Figure 6 shows some information about the group 1 metals.

group 1 metal	atomic number	relative atomic mass
lithium	3	7
sodium	11	23
potassium	19	39
rubidium	37	85
caesium	55	133

Figure 6

(a) Explain, in terms of their electronic configurations, why these metals are placed in group 1 of the periodic table.

(2)

All of these elements have one electron in their outer most shell, therefore they lose that one to become ionic and form a 1+ ion.

ResultsPlus
Examiner Comments

A good answer that scored both marks. The additional information at the end of the answer was not required for the mark.

Question 3 (c)

Candidates found adding the numbers to balance the equation and adding the state symbol straight forward with the majority scoring both marks available. Where candidates lost the mark, it was often for giving the incorrect state symbol.

(c) The word equation for the reaction of potassium with bromine is

potassium + bromine → potassium bromide

Add the missing state symbol and balance the equation for this reaction.

(2)

2 K(aq) + Br_2(g) → 2 KBr(s)

ResultsPlus Examiner Comments

The candidate scored 1 mark for balancing the equation correctly. The state symbol was incorrect and so the second mark was not scored.

(c) The word equation for the reaction of potassium with bromine is

potassium + bromine → potassium bromide

Add the missing state symbol and balance the equation for this reaction.

(2)

2 K(s) + Br_2(g) → 2 KBr(s)

ResultsPlus Examiner Comments

A good answer that scored both marks.

Question 3 (d)(i)

In general, candidates found explaining the meaning of the term isotope quite straightforward with many gaining the two marks available.

Where candidates lost marks, it was often because they confused their sub-atomic particles, stating that the number of neutrons stayed the same and the number of protons was different.

In some cases, candidates lost a mark as they stated that an isotope is a compound or 'elements' with the same number of protons have the same number of neutrons.

(d) A sample of potassium contains three isotopes, potassium-39, potassium-40 and potassium-41.

(i) Explain the meaning of the term **isotopes**.

(2)

Different forms of the same element that have the same number of protons but a different number of neutrons.

ResultsPlus
Examiner Comments

A good answer that scored both marks.

same element with a different atomic mass so different number of protons and neutrons.

ResultsPlus
Examiner Comments

This example scores 1 mark. Same element would have scored 1 mark; however, the candidate has also stated different number of protons which is rejected and so the mark cannot be awarded. The different number of neutrons was still awarded.

~~Same atomic number~~ Elements with same atomic number but dissrent mass number.

ResultsPlus
Examiner Comments

This answer scored 1 mark. Same atomic number and different mass number would gain 2 marks; however, the candidate has referred to elements rather than an element therefore a mark of 1 rather than 2 was awarded.

ResultsPlus
Examiner Tip

Candidates should be careful with their use of key terms to ensure that the chemistry is correct.

Question 3 (d)(ii)

In part (d)(ii), candidates were asked to calculate the relative atomic mass of a sample of potassium. Many candidates performed well in the calculation with the majority scoring both marks available.

Where candidates did not score, it seemed as if they had not come across isotopic calculations before and carried out a number of different calculations using the numbers given in the stem.

(ii) This sample of potassium contains

93.25% potassium-39

0.02% potassium-40

6.73% potassium-41

Calculate the relative atomic mass of this sample of potassium.

(2)

$$\frac{(93.25 \times 39) + (0.02 \times 40) + (6.73 \times 41)}{100}$$

$$= 39.1$$

relative atomic mass = 39.1

ResultsPlus
Examiner Comments

A good answer that gained both marks.

93.25 × 39 = 3636.75

0.02 × 40 = 0.8 ÷ 3 =

6.73 × 41 = 275.93 1304.5

3913.48

relative atomic mass = 1304.5

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Examiner Comments

The first mark was scored for initial multiplication. The second mark was not scored because the candidate has divided by 3 rather than 100.

40 + 41 + 39

relative atomic mass = 120

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Examiner Comments

A common incorrect answer that scored no marks.

Question 4 (a)

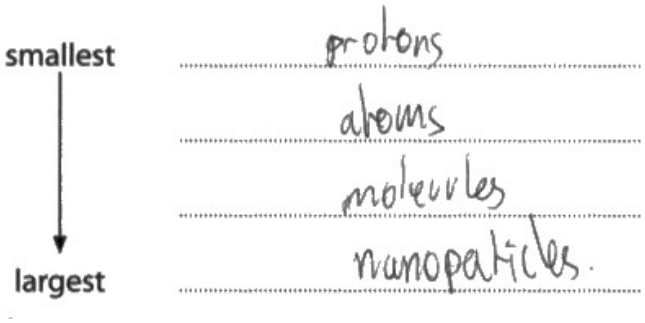
Candidates found it quite difficult to put the types of particle from smallest to largest with under half of candidates scoring both marks.

There was a clear misconception from candidates that nanoparticles must be the smallest particle out of the four given.

4 (a) Atoms, molecules, nanoparticles and protons are types of particle.

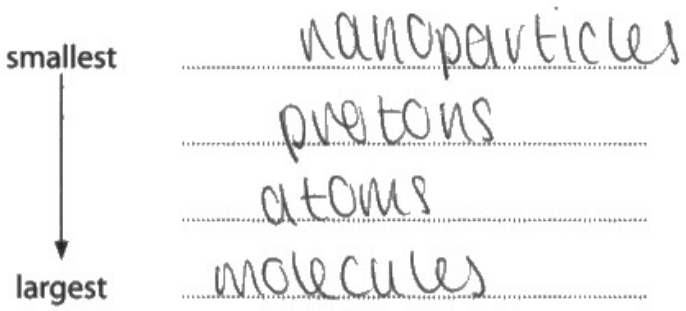
List these four types of particle in order of size from smallest to largest.

(2)



ResultsPlus
Examiner Comments

A good answer that scored both marks



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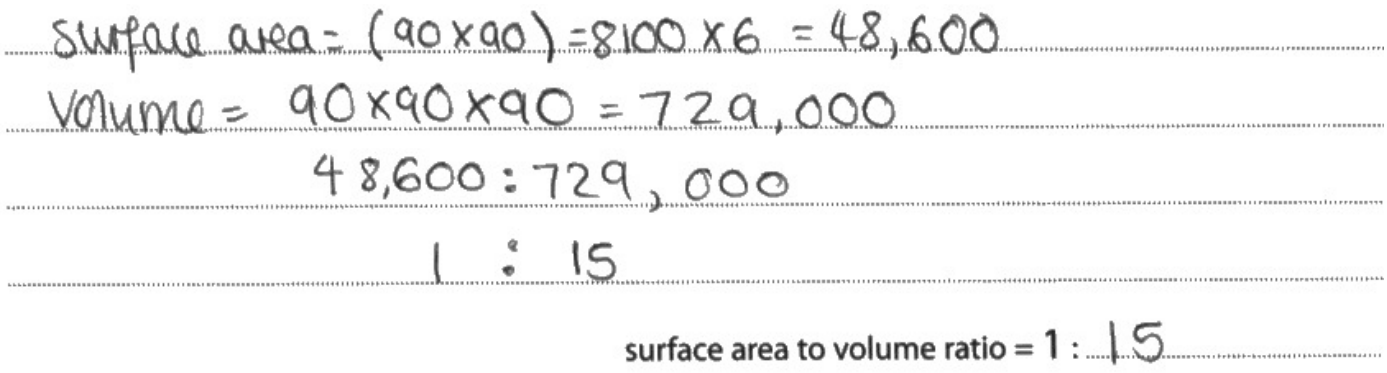
Examiner Comments

A common misconception was that nanoparticles are the smallest particle of the four.

Question 4 (b)(ii)

In part (b)(ii), candidates were asked to calculate the simplest surface area to volume ratio of a nanoparticle cube. In general, candidates performed well with the majority scoring the full 3 marks available. A common mistake was forgetting to multiply the surface area by 6. With error carried forward, this meant that 2 marks were awarded.



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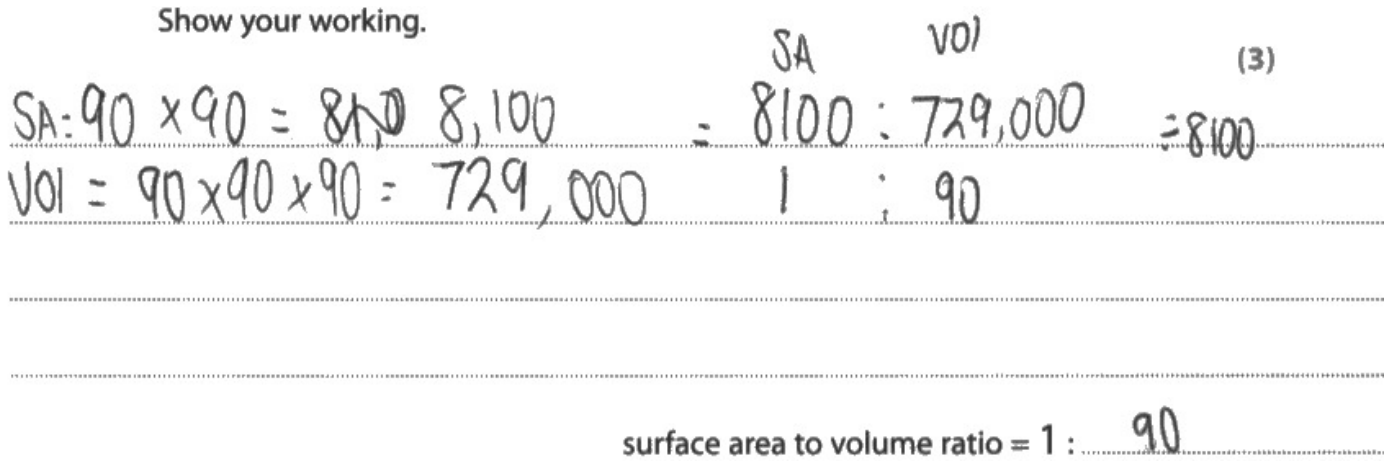
Examiner Comments

A good answer, with clear and logical working that scored all 3 marks.



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Examiner Comments

In this example, the surface area has been incorrectly calculated so the first mark is not awarded. However, the volume has been correctly calculated, so the second mark is awarded. With error carried forward, the last mark for the ratio of 1:90 from the incorrect SA:V gains the last mark.

Question 4 (c)(i)

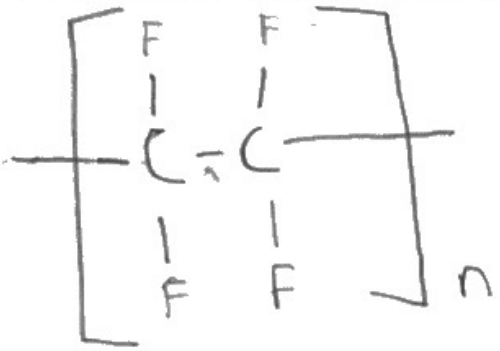
It was pleasing to see that the majority of candidates were able to draw the structure of the repeating unit of poly(tetrafluoroethene) to gain both marks.

Where candidates lost marks, it was often because they left the double bond in the repeat unit.

(i) Tetrafluoroethene can form the polymer poly(tetrafluoroethene).

Draw a diagram to show the structure of the repeating unit of this polymer.

(2)



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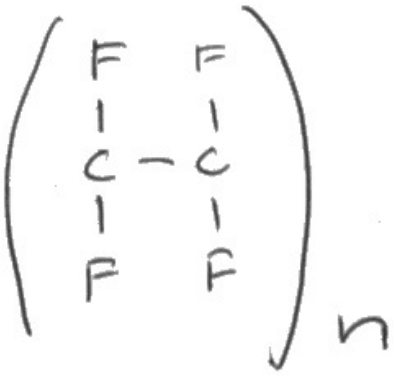
Examiner Comments

A good response which scored the 2 marks.

Draw a diagram to show the structure of the repeating unit of this polymer.

(2)



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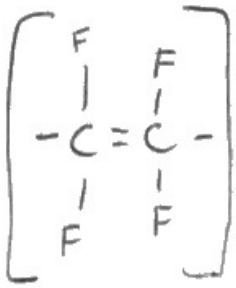
Examiner Comments

The candidate has drawn the repeat unit without a double bond, but has forgotten to add the linking bonds. Therefore just 1 mark was scored.

Draw a diagram to show the structure of the repeating unit of this polymer.

(2)



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Examiner Comments

The candidate has drawn the repeat unit with linking bonds, but has left the double bond in. Therefore just 1 mark was scored.

Question 4 (c)(ii)

Candidate responses varied significantly. Many candidates incorrectly linked Teflon to plastics or confused it with other polymers like uPVC. Some provided a use and a property, but without a clear reason. The most common and correct answer was identifying the use of non-stick frying pans and linking it to food not sticking. Clothing was another common use stated, but few linked it to 'easy to remove stains'; most gave the reasons such as 'flexible or soft' instead. A common incorrect response seen was "toothpaste", confusing fluoride with Teflon.

Some candidates had identified the properties of Teflon accurately but provided an incorrect use, such as citing it for water pipes due to its slippery surface, which allows water to slide through easily.

(ii) Poly(tetrafluoroethene) is also known as Teflon™.

State one use of poly(tetrafluoroethene) and explain how one of its properties makes it suitable for that use.

(3)

use

non-stick pans

explanation

it is unreactive and slippery so food does not stick stick or react to it when in a pan and food is cooking

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Examiner Comments

A good answer which gained the full 3 marks.

use

Bag

explanation

It's soft and flexible, so it can change shape, and be shaped easily

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Examiner Comments

A common answer that scored no marks.

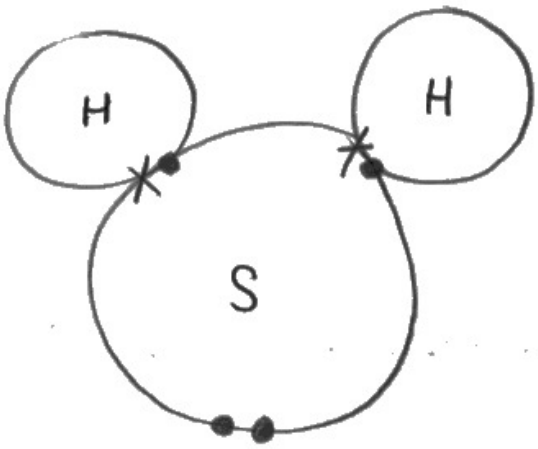
Question 5 (b)

Question 5(b) asked candidates to draw the dot and cross diagram for a molecule of hydrogen sulfide. In general, candidates performed well in the question with a large proportion being able to draw the correct diagram and scoring full marks. Candidates who did not score full marks often were able to show the two shared pairs of electrons, but then did not get the rest of the molecule correct.

Draw the dot and cross diagram for a molecule of hydrogen sulfide.

Show outer electrons only.

(2)



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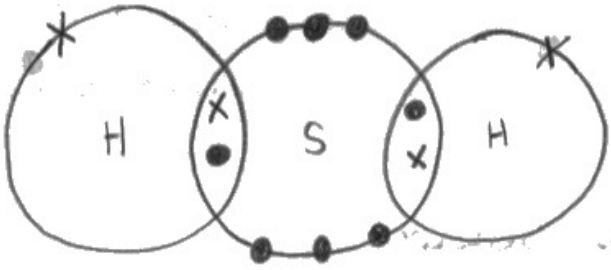
In this example, the candidate scored 1 mark for the shared pairs of electrons, but the sulfur only had two further electrons so the rest of the molecule was incorrect and the second mark not awarded.



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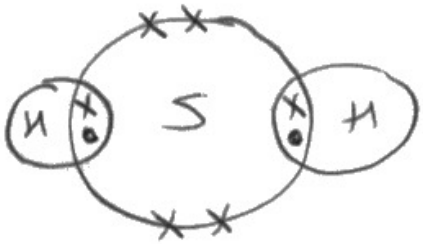
Examiner Comments

In this example, the candidate scored 1 mark for the shared pairs of electrons, but the rest of the molecule was not correct with extra electrons on the hydrogen and too many electrons on the sulfur, so the second mark was not awarded.



ResultsPlus
Examiner Comments

A good answer which scored both marks.

Question 5 (c)

Part (c) of Question 5 asked candidates to explain how impurities in fossil fuels can result in acid rain. A range of marks were seen with answers seen varying in detail and understanding.

Many were able to refer to sulfur as the impurity and its combustion forming sulfur dioxide.

Common mistakes included not identifying the dissolving/reacting of sulfur dioxide with water and using vague phrases like 'mixing' or 'condensing', but a good proportion of candidates understood the formation of sulfuric acid. Some wrongly mentioned nitrogen in the air, rather than impurities in fossil fuels, reacting to produce nitrogen oxides and nitric acid.

Fossil fuels contain sulfur impurities. When these fossil fuels undergo combustion, they oxidise the sulfur into sulfur dioxide. Sulfur dioxide then rises and dissolves in the clouds. It lowers the pH of the water vapour, making it acidic. When it eventually precipitates, the rainwater is acidic, also known as acid rain.

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Examiner Comments

A good answer that scored all 3 marks.

Whe fossil fuels are burnt, impurities such as carbon dioxide and nitrogen can be gas can be released, which evaporate moves up into the clouds, which causes acid rain to be produced. This can damage PH of soil. Those gases The impurities evaporate into the clouds and condensate when it rains again. This causes acid rain

ResultsPlus
Examiner Comments

In this example, the candidate has not focused their answer on the impurities in the fossil fuels as requested by the question, and so did not score any credit.

ResultsPlus
Examiner Tip

Candidates should ensure that they read the question carefully and consider highlighting or underlining key words or phrases as they go. If they have time, they should go back and check that their answer addresses the question set.

Question 5 (d)(i)

Candidates found it straightforward to state a piece of equipment that could be used to measure the pH of the liquid in the experiment with a large proportion of candidates scoring the mark.

(d) A student investigates the effect of acid rain on cress plants.

The student uses this method.

step 1 grow 20 cress plants in each of two dishes, **A** and **B**

step 2 water the cress plants in dish **A** with 10 cm^3 of dilute hydrochloric acid with a pH of 2

step 3 water the cress plants in dish **B** with 10 cm^3 of pure water with a pH of 7

step 4 repeat steps 2 and 3 every day for one week

step 5 count how many plants are still alive after one week.

(i) State what piece of equipment the student could use to measure the pH of each liquid.

(1)

Universal indicator

ResultsPlus
Examiner Comments

Universal indicator scored the mark.

(1)

pH meter

ResultsPlus
Examiner Comments

pH meter scored the mark.

Question 5 (d)(ii)

Candidates found explaining an improvement to the method which would make the results more valid more challenging with many scoring no marks.

The most common correct answer was that sulfuric acid should be used rather than hydrochloric because acid rain contains sulfuric acid.

Many candidates clearly did not read the method carefully as they gave repeats of the method as their answer, for example 'measuring the volume of water', which had already been given in the method or 'watering the plants every day', which had also already been given.

Some candidates discussed ideas that would improve the reliability rather than the validity of the investigation. These were ignored.

(ii) Explain **one** improvement that the student could make to the method to make the results more valid.

(2)

grow more plants to see how larger numbers are effected. Use Sulfuric acid, as that is what acid rain actualy is and the plants may react differently to different acids.

(Total for Question 5 = 9 marks)

ResultsPlus
Examiner Comments

A common correct answer that scored 2 marks.

Repeat the experiment at least 3 or more times and find an average of plants still alive as there may have been an anomally somewhere.

ResultsPlus Examiner Comments

Repeating the test was ignored and so no marks were scored for this answer.

keep the growing condition of the 2 dishes the same before start step 2 and 3.

ResultsPlus Examiner Comments

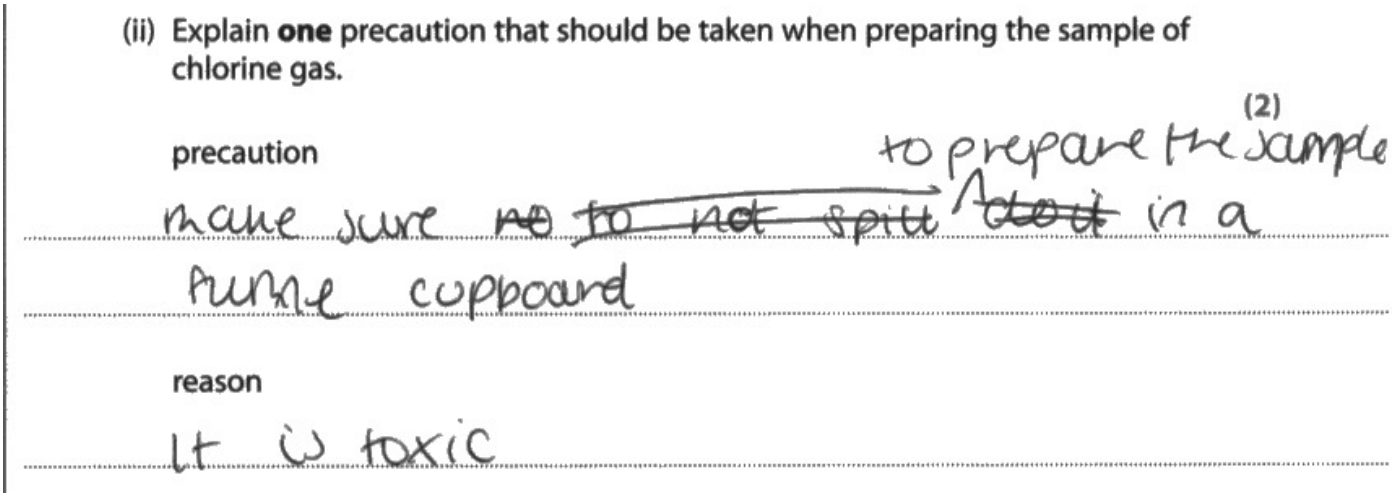
Keeping the growing conditions the same was considered too vague for credit.

Question 6 (a)(ii)

Question 6 focused on the preparation of chlorine gas. Candidates were provided with a diagram of the apparatus used and hazard symbols for the reagents and of chlorine. In Part (ii) candidates were asked to explain one precaution that should be taken when preparing a sample of the chlorine gas. Candidates found it hard to fully explain a precaution with a small proportion scoring both marks, but many scoring at least one mark.

Where candidates scored 1 mark, it was often for correctly identifying that chlorine is toxic but suggesting a gas mask as the preferred precaution, with very few mentioning a fume cupboard. Some candidates suggested standard safety protection like gloves and goggles but linked this to chlorine instead of HCl so again only scored 1 mark.

Very few answers were seen linking KMnO4 to a safety precaution.


(ii) Explain **one** precaution that should be taken when preparing the sample of chlorine gas.

(2)

precaution

make sure ~~no to not spill~~ to prepare the sample ~~dont~~ in a fume cupboard

reason

it is toxic

ResultsPlus
Examiner Comments

A good answer which scored both marks.

precaution

Wear a mask or keep your head away from it.

reason

It is toxic and you don't want to inhale it.

ResultsPlus Examiner Comments

A common 1 mark answer. Wear a mask or keep your hand away was ignored so the mark for the precaution was not awarded. The marking points are marked independently, so 'it is toxic' was allowed for the reason.

precaution

Do it in a fume cupboard.

reason

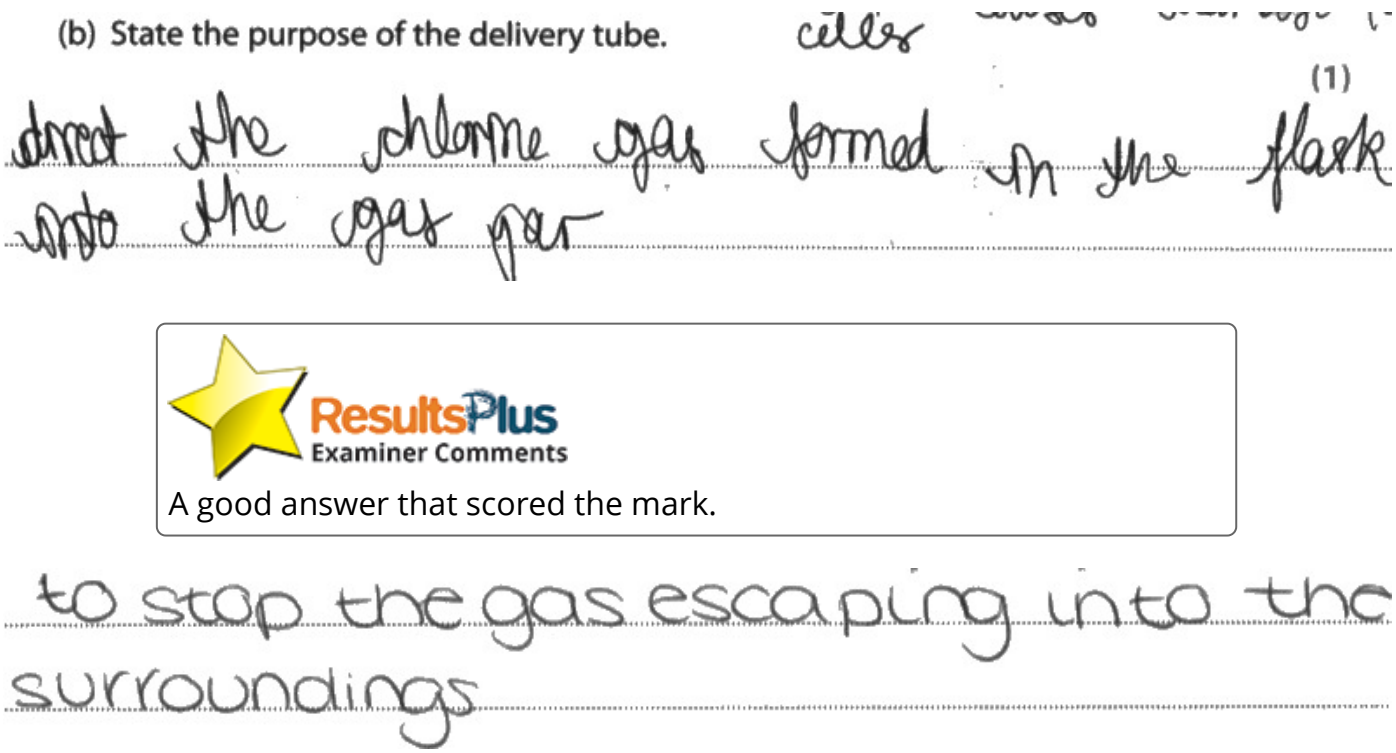
chlorine gas is harmful.

ResultsPlus Examiner Comments

This example scored 1 mark for using a fume cupboard, stating that chlorine gas is 'harmful/dangerous' is not equivalent to 'toxic' and so the second mark was not awarded.

Question 6 (b)

Part (b) of Question 6 asked candidates to state the purpose of the delivery tube. C andidates found it difficult to articulate their answers with many giving answers that were too vague. There were many responses mentioning the delivery tube in terms of preventing gas from escaping, rather than moving it from the flask to the jar, whilst others mentioned that it was there to store the gas.


(b) State the purpose of the delivery tube.

(1)

direct the chlorine gas formed in the flask into the gas jar

ResultsPlus
Examiner Comments

A good answer that scored the mark.

to stop the gas escaping into the surroundings

ResultsPlus
Examiner Comments

Ideas about preventing the gas from escaping did not score.

Question 6 (c)

Candidates found suggesting why the damp blue litmus was placed at the top of the gas jar quite difficult. However, a good proportion knew that damp litmus paper bleached in the presence of chlorine to gain a mark.

Some stated that the litmus was there to test if chlorine has been made, more stated that it was there to see if chlorine was escaping. Few knew that it was there to see when the gas jar is full.

(c) **Suggest why damp blue litmus is placed at the top of the gas jar.**

(2)

In order to test to see whether chlorine is present - damp blue litmus turns red then bleached white. Mineral wool allows gasses to pass through.

ResultsPlus
Examiner Comments

A good answer that scored both marks.

Question 6 (d)

In the last part of Question 6, candidates were provided with the formula of two of the substances in the reaction and given the names of the other four substances. They were then asked the write the balanced equation for the reaction.

Candidate performance varied, with scores ranging from 0 to 3, but very few received 0 marks. Common mistakes included forgetting that chlorine is diatomic and providing incorrect formulae for magnesium chloride (MgCl) and potassium chloride (KCl_2). A few scripts omitted chlorine altogether, indicating that candidates had not read the question stem carefully. Whilst saying this, the majority managed to write 4 or 5 correct formulae on the appropriate sides of the arrow to gain one mark. Of those that were able to write all 6 formulae correctly, around half were then able to successfully balance the equation.

Several candidates successfully gave the multiples including ½ mole of double the number of moles of the original balanced equation. This was allowed and full credit still awarded.

(d) In the reaction, potassium manganate(VII), $KMnO_4$, reacts with hydrochloric acid to form manganese chloride, $MnCl_2$, potassium chloride, chlorine and water.

Write the balanced equation for the reaction.

5 Cl (3)

$KMnO_4 + 8HCl \longrightarrow MnCl_2 + KCl + [redacted] + 4H_2O$

ResultsPlus
Examiner Comments

A common error was to forget that chlorine was diatomic. This meant that only 5 formulae were correct and 1 mark was awarded.

ResultsPlus
Examiner Tip

Candidates should be familiar with the formula of common compounds in the specification and should be able to recall which elements are diatomic.

Write the balanced equation for the reaction.

(3)

$2KMnO_4 + 6HCl \rightarrow 2MnCl_2 + 2KCl + 3H_2O$

ResultsPlus
Examiner Comments

A noticeable number of candidates did not read the question carefully and omitted chlorine altogether. This meant that only 5 formulae were correct and 1 mark was awarded.

ResultsPlus
Examiner Tip

Candidates should ensure that they read the question carefully and could consider highlighting or underlining the reagents and products in the stem of the question to help them to ensure they have them all in their balanced equation.

Write the balanced equation for the reaction.

(3)

$2KMnO_4 + 16HCl \longrightarrow 2MnCl_2 + 2KCl + 5Cl_2 + 8H_2O$

ResultsPlus
Examiner Comments

A fully correct balanced equation that scored full marks.

Write the balanced equation for the reaction.

(3)

$4KMnO_4 + 32HCl \rightarrow 4MnCl_2 + 4KCl + 10Cl_2 + 16H_2O$

ResultsPlus
Examiner Comments

Some candidates gave multiples, as in this example, which had doubled the number of moles of all substances. This was allowed and the full 3 marks awarded.

Question 7 (a)(i)

Question 7 focused on three organic compounds. In part (a)(i), candidates were asked to circle the alkane functional group in propene.

Just over half were able to circle the correct functional group.

Of those that did not score, common errors were to circle the CH_3 or to include all of the hydrogens around the carbon-carbon double bond.

The term "functional group" was poorly understood by many candidates, leading to confusion over whether to include the carbons or just the double bond in the functional group.

7 Figure 12 shows the structure of the molecules of three organic compounds.

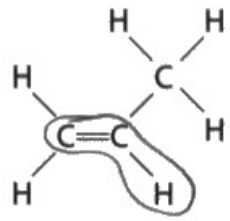
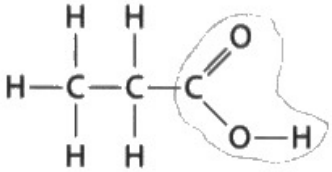
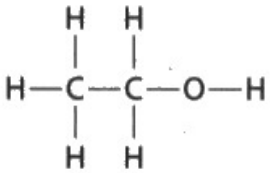
propene	propanoic acid	ethanol
		

Figure 12

(a) (i) Each molecule in Figure 12 contains a different functional group.

Circle the alkene functional group in **propene**.

ResultsPlus
Examiner Comments

Inclusion of the hydrogen meant that this answer did not score.

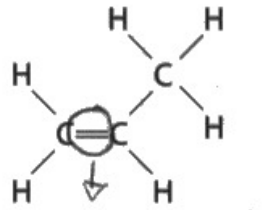
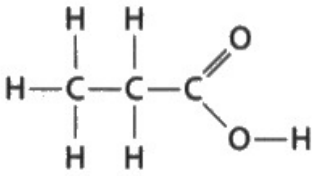
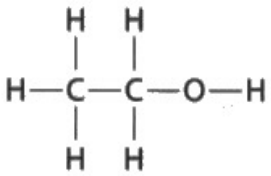
propene	propanoic acid	ethanol
 functional group		

Figure 12

(a) (i) Each molecule in Figure 12 contains a different functional group.

Circle the alkene functional group in **propene**.

ResultsPlus
Examiner Comments

The carbons have not been included in this example and so the mark was not awarded.

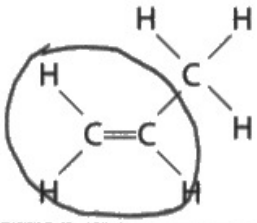
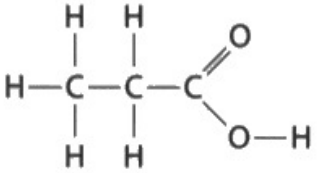
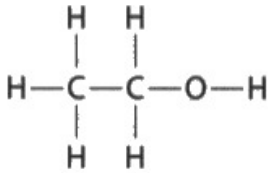
propene	propanoic acid	ethanol
		

Figure 12

(a) (i) Each molecule in Figure 12 contains a different functional group.

Circle the alkene functional group in **propene**.

ResultsPlus
Examiner Comments

A common incorrect answer which scored no marks.

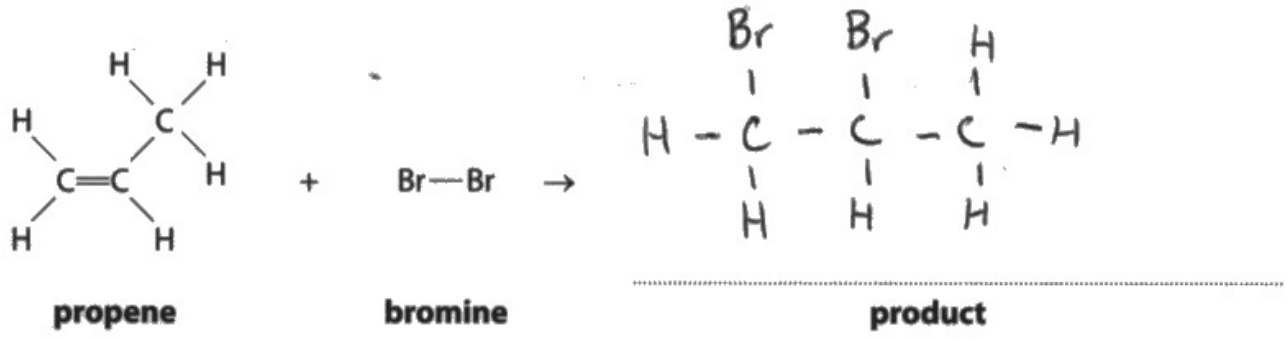
Question 7 (a)(ii)

In part (ii), candidates were required to draw the structure of a molecule of the product of the reaction between propene and bromine. Candidates found the question quite difficult. A common error was to retain the double bond. This meant that one of the two marks was awarded for the bromines being in the correct place. Others still had the Br attached to the other Br while also bonding to the carbon, this scored no marks. Another common error was where candidates failed to place the bromine atoms on neighbouring carbon atoms. If the rest of the molecule was correct, this scored one mark.

(ii) Propene reacts with bromine water.

Complete the equation for the reaction of propene with bromine by drawing the structure of a molecule of the product.

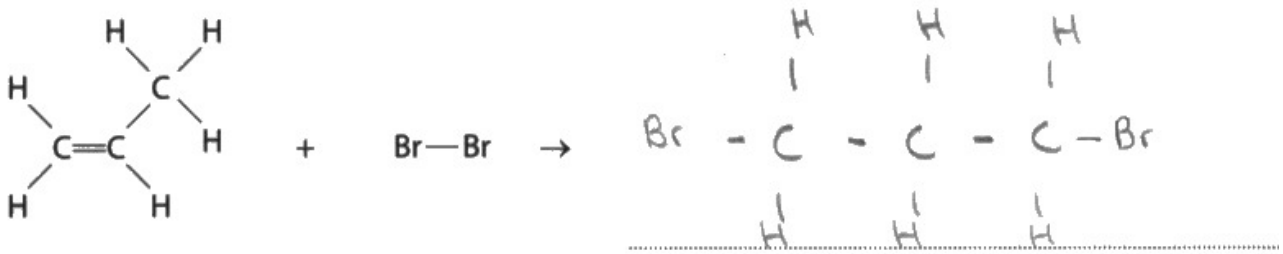
(2)



propene **bromine** **product**

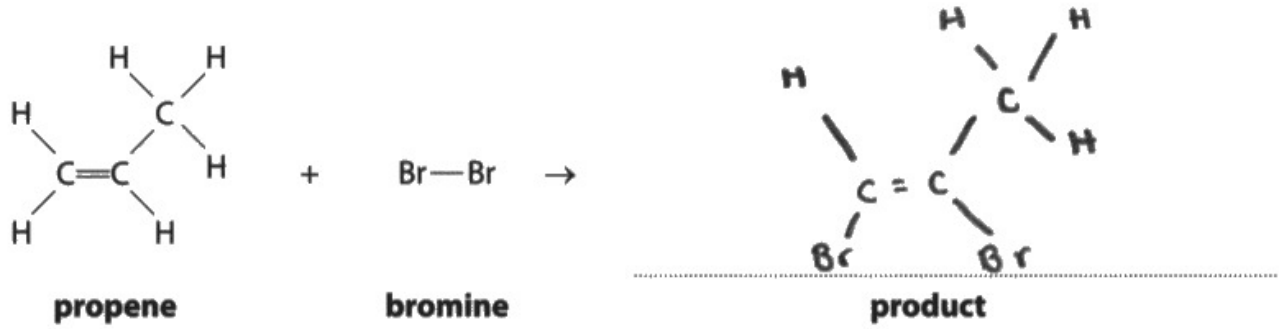
ResultsPlus
Examiner Comments

A good answer that gained both marks.



ResultsPlus
Examiner Comments

The two bromine atoms are not on neighbouring carbons. The rest of the molecule is, however, correct and so 1 mark was awarded.



ResultsPlus
Examiner Comments

The candidate has forgotten to remove the double bond. The molecule is otherwise correct and so 1 mark was awarded.

ResultsPlus
Examiner Tip

When drawing the structure of carbon containing structures, candidates should remember to check the number of bonds drawn from atoms, especially the carbon atoms.

Question 7 (a)(iii)

Part (iii) of the question was generally well answered with a good proportion gaining both marks for giving the products of the reaction between propanoic acid and calcium carbonate as carbon dioxide and water. Some candidates lost a mark as they gave hydrogen as a product instead of water or carbon instead of carbon dioxide.

(iii) Propanoic acid reacts with calcium carbonate, $CaCO_3$, to form calcium propanoate, $Ca(C_2H_5COO)_2$, and two other products.

Name the **two** other products.

(2)

product 1 Carbon dioxide

product 2 water.

ResultsPlus
Examiner Comments

A good answer that gained both marks.

product 1 Carbon

product 2 Hydrogen

ResultsPlus
Examiner Comments

The candidate has given carbon instead of carbon dioxide and hydrogen instead of water so no marks were scored.

Question 7 (b)

Question 7 part (b) was the first of the two 6-mark questions on the paper which has a levels-based mark scheme. Candidates made a good attempt at the question, showing a good understanding of the topic, with the vast majority scoring and a good distribution of marks seen.

Some candidates provided excellent responses with high-quality diagrams, easily scoring 6 marks. However, there were also answers that mostly repeated the question. Some candidates attempted to explain the processes rather than describe them, indicating a need for teachers to discuss with candidates what the command words mean.

In the fermentation, it was common to see the use of yeast, correct temperatures, anaerobic conditions or references to airlocks and detail of filtering off the yeast often indicated. In some cases, candidates failed to mention yeast and instead used terms like 'fungi,' 'enzyme,' or 'bacteria' instead.

Whilst detailed responses about fermentation were often given, the fractional distillation was often less well attempted with some only mentioning 'distillation' without further explanation. Of those that did give extra detail, it was common to see candidates incorrectly discussing water evaporating before ethanol in the process.

*(b) Glucose, $C_6H_{12}O_6$, is a carbohydrate.

A dilute solution of ethanol can be produced from glucose by fermentation.

The dilute solution of ethanol can then be processed to form a concentrated solution of ethanol.

Describe how the fermentation of glucose is carried out and how the dilute solution of ethanol produced can then be processed to form a concentrated solution of ethanol.

$CH_3 = 2$ C_2H_5OH

You may include diagrams in your answer.

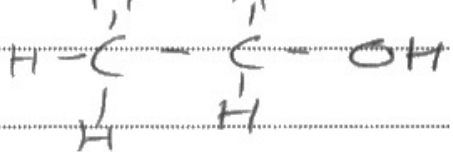
(6)

Glucose $C_6H_{12}O_6$ contains everything required for ethanol (C_2H_5OH) meaning when fermented the Glucose will produce 2 ethanol and 2 CO_2: Glucose $\longrightarrow$ 2 Ethanol + 2 Carbon dioxid

$C_6H_{12}O_6 \longrightarrow 2[H-\underset{H}{\overset{H}{C}}-\underset{H}{\overset{H}{C}}-OH] + 2(CO_2)$

$2(C_2H_4OH)$

The dilute ethanol can be processed to separate the excess Carbon and Oxygen atom (CO_2) making just Ethanol.



ResultsPlus
Examiner Comments

This answer scored no marks. The candidate has tried to give some equations for the fermentation of glucose to ethanol. They have stated that the ethanol can be processed, but have not described how the fermentation or the processing can be carried out and so no marks can be awarded.

The glucose is added to the yeast and then heated. It needs to be heated around 40°c, as this is the optimum temperatures that the enzymes in the yeast work best at. Otherwise the enzyme will denature.

The ethanol is kept away and is not exposed to any oxygen, otherwise it will produce a carboxylic acid like ethanoic acid in this case.

ResultsPlus
Examiner Comments

In this example, the candidate has given a basic description of the fermentation only, detailing the use of yeast and a temperature of 40°C, they describe keeping oxygen away from the ethanol produced, not during the fermentation. There is no description of how the ethanol can be concentrated. Therefore, a mark at the top of Level 1–2 marks was awarded.

(6)

A dilute solution of ethanol is carried out using enzymes. Seeds are collected from fruits and they naturally contain sugars. Sugars belong to the carbohydrate group. Enzymes break down these sugars into starch. This does not use oxygen, so it is anaerobic respiration. This mixture of glucose must be kept close to trap anything escaping/entering the jar. It must also be kept at a warm temperature of about 30°. This is the optimum temperature of the enzymes so they can break down the sugars the fastest.

This dilute solution can be processed into a much more concentrated solution using a process called fractional distillation. The liquid should be placed under a bunsen burner and let to burn. As the

boiling points of ~~these~~ the water is different to the boiling point of ethanol, the ethanol will ~~can~~ evaporate much more quickly and condense to form a more concentrated solution after passing the condenser.

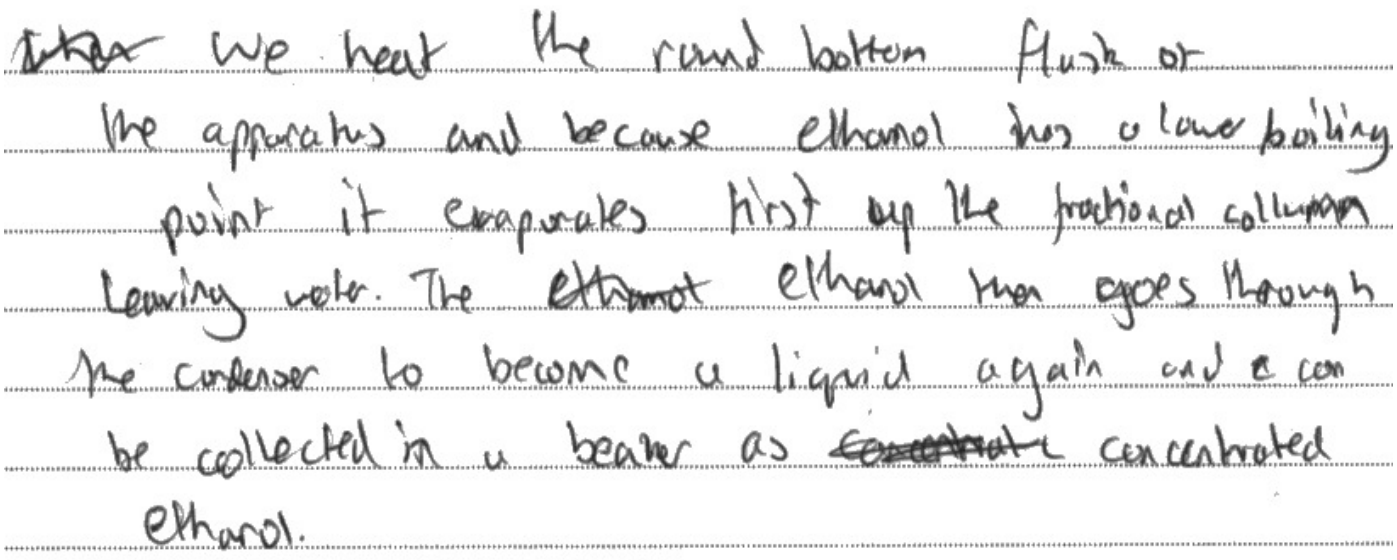
ResultsPlus
Examiner Comments

This answer scored 4 marks. The candidate has given a basic description of how to carry out the fermentation. They know that it needs to be kept at 30°C and that an enzyme is needed. They understand that oxygen needs to be excluded from the reaction mixture. The candidate goes on to give a basic description of the process to concentrate ethanol. They state that the process is called fractional distillation and give some basic information about the process. As the candidate has given a basic description of both the fermentation and the process to concentrate the ethanol, the answer was awarded full marks in Level 2.

Glucose is fermentated to form ethanol + water

Glucose $\xrightarrow{\text{yeast}}$ ethanol + water.

in order for glucose to form ethanol yeast is needed as yeast contains enzymes for a biological catalysts. It also needs to be in a sealed container so no oxygen can be present for anaerobic respiration otherwise the ethanol would oxidise to form ethanoic acid which is vinegar. The container needs to be warms at 30°c - 40°c as in yeast it is the optimum temperature for yeast anything more will cause the enzymes to be denatured. The reaction would then stop around 10% to 20% concentration of ethanol in solution as the ethanol starts to kill the yeast cells which collect at the bottom. The ethanol and water solution should then be collected from the top. In order to distill the ethanol. we use fractional distillation.



ResultsPlus
Examiner Comments

This last response gains the full 6 marks. The candidate has given a description of how to ferment the glucose, they describe adding the yeast and the fact that oxygen should be excluded from the reaction mixture. They say that the mixture should be warmed to 30-40 degrees and how to get the ethanol from the yeast. The candidate goes on to describe the process to concentrate the ethanol as fractional distillation with some detail and so the answer scored full marks in Level 3.

Whilst the answer scored full marks, the candidate has given a large amount of extra detail, explaining why each part of the process was needed. This was not required to answer the question and, although it did not detract from the answer given, it was ignored and would have taken up time in the exam.

ResultsPlus
Examiner Tip

Centres should ensure that candidates are aware what is required by different command words, so that time is not wasted explaining details when only a description is needed.

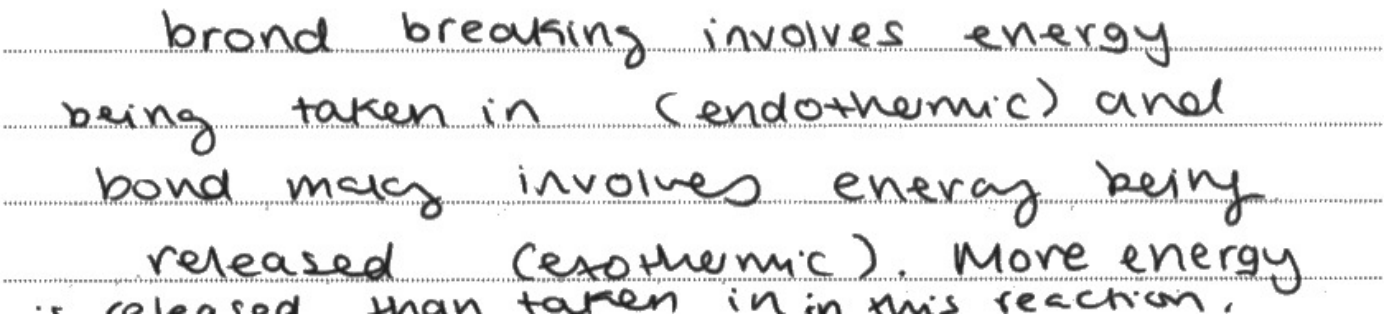
Question 8 (b)(ii)

Candidates found describing what the reaction profile shows about the energy involved in bond breaking and bond making in part (b)(ii) of Question 8 difficult with the vast majority not scoring.

Many candidates mistakenly thought that bond formation required energy and many lost marks by contradicting themselves, stating things like "the energy used to break bonds is less than what was used to make bonds." Others who correctly stated that breaking is endothermic and making is exothermic often didn't achieve full marks as they failed to specify which process involved more or less energy.

(ii) Describe what the reaction profile shows about the energy involved in bond breaking and bond making in this reaction.

(2)



ResultsPlus
Examiner Comments

A good answer which scored both marks.

It Shows the energy involved to break bonds is higher than the energy involved to make bonds..

ResultsPlus
Examiner Comments

Stating the energy 'involved' in breaking bonds or in making bonds is too vague as it does not make it clear if energy is being taken in or given out and so no marks were awarded.

Making bonds is ~~endothermic~~ exothermic, while bond breaking is endothermic, because during making bonds, energy is released, while breaking bonds, energy is used.

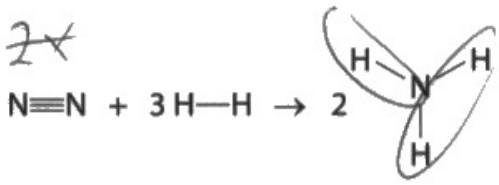
ResultsPlus
Examiner Comments

'Making bonds is exothermic' and 'bond breaking is endothermic' are creditworthy. There is no reference to the total energy change and so full credit was not awarded and the answer gained 1 mark.

Question 8 (b)(iii)

Candidates found calculating the energy change in the reaction much more straightforward with the majority scoring 3 or 4 marks with correct answers showing clear and logical working indicating a good understanding of how to apply bond energies to calculate the enthalpy change for the synthesis of ammonia. Where candidates did not score full marks, they often scored for giving +76 as their answer. Candidates that did not give – 76 or +76 often scored with error carried forward when they had miscalculated the energy required to break bonds with a common errors such as multiplying a bond energy by the correct integer derived from the equation.

The equation for the reaction between nitrogen and hydrogen to form ammonia is



Calculate the energy change, in kJ mol^{-1}, for this reaction.

(4)

944 + (3 × 436) ~~-~~ 2(388 + 436) =

2252 kJmol^{-1} → 1648 kJmol^{-1}

~~2252 - 1648 =~~ ~~+6~~ 1648 - 2252 = -604 kgmol = energy change

energy change = -604 kJ mol^{-1}

ResultsPlus
Examiner Comments

The candidate has correctly calculated the sum of the bond energies of bonds broken gaining 1 mark. The second mark is not scored as the sum and value are not correct for bond energies of bonds made. With error carried forward, the third mark can be scored for the difference between their two numbers for bond energies is given. The fourth point is not scored as they have unfortunately taken the value for bonds broken away from their value for bonds made.

So two marks were awarded.

944 + 3(436) → 2(388 × 3

2252 → 2 (164

2252 → 2328

1380 →

energy change = 76 kJ mol^{-1}

ResultsPlus
Examiner Comments

+76 gains 3 marks.

The first mark is scored for the sum of the bonds broken. The second mark is scored for the correct sum of bonds made. The third mark is scored because they have found the difference between the two numbers. Unfortunately, their sum of bonds made – bonds broken is the wrong way round so gives the wrong sign and the last mark is not awarded.

944 + 3(436) → 2(3 × 388)

2252 − 2328

2252 − 2328 = −76

1 exothermic

energy change = −76 kJ mol^{-1}

ResultsPlus
Examiner Comments

A clear answer with logical working which gained the full 4 marks.

Question 8 (c)

Candidates found it very hard to explain why the boiling points of ammonia and silicon dioxide are so different with many showing confusion and misconceptions.

Whilst the weak intermolecular forces in ammonia were often discussed, many thought that silicon dioxide has strong ionic bonding or treated it as a simple molecular compound, discussing breaking strong intermolecular bonds. Those that got the bonding incorrect often managed to pick up at least one mark for the correct comparison of the amount of energy required to break the attractions in silicon dioxide with the amount of energy to break the attractions in ammonia.

(c) Ammonia, NH_3, and silicon dioxide, SiO_2, are both compounds that are made of two non-metallic elements.

Ammonia has a boiling point of –33 °C.
Silicon dioxide has a boiling point of 2230 °C.

Explain why the boiling points of ammonia and silicon dioxide are so different.

(3)

A very small amount of energy is required to overcome the intermolecular forces of ammonia meaning the boiling point is significantly lower.
Much more heat energy is required to overcome the intermolecular forces of silicon dioxide as it has a boiling point of 2230 °C

ResultsPlus
Examiner Comments

This answer scored 1 mark. The first mark was not awarded because there is no mention of intermolecular forces being weak in ammonia. The second mark was not awarded because there is no mention of strong covalent bonds in silicon dioxide. Although the first two mark points were not scored, the last mark was still awarded for the correct comparison of the amount of energy required to break the attractions in ammonia vs the attractions in silicon dioxide.

Ammonia is a simple covalent structure that has low boiling point due to weak intermolecular forces which require little energy to break

Silicon dioxide is a giant covalent structure that has ~~strong covalent bond~~ high boiling point ~~that~~ due to strong covalent bonds that require lots of energy to break.

ResultsPlus
Examiner Comments

A good answer that scored all 3 marks.

Question 9 (a)(ii)

In Question 9(a)(ii), candidates were asked to explain the trend in viscosity of the fractions that was given in the stem of the question. A large number of candidates simply re-stated the trend with few explaining the trend. Of those that did try to explain the trend, many knew that the increase in viscosity was due to the increase in length of the carbon chain. Very few were then able to explain this in terms of an increase in intermolecular forces.

(ii) **Explain the trend in the viscosity of the fractions.**

(2)

The ~~visco~~ viscous increases as you go down the fractionating column - bitumen has the highest viscous. This is because the bitumen molecules are the longest, so will not spread and flow as easily as for example petrol would, as its molecules are much smaller.

ResultsPlus
Examiner Comments

This example scored 1 mark. The first mark was scored stating that the bitumen had the highest viscosity because it is the longest. There was no reference to intermolecular forces for the second mark.

viscosity increases as you go down the fractions. Bitumen is the most viscous and gases are the least viscous.

ResultsPlus
Examiner Comments

This example scored 0 marks. No credit was given for re-stating trend as it was given in the stem of the question.

Bitumen at the bottom has the highest viscosity due to it being made up of longer hydrocarbon chains which stick together more because there are more intermolecular forces to break. As you go up towards gases the viscosity decreases. They have shorter hydrocarbon chains.

ResultsPlus
Examiner Comments

A good answer that scored 2 marks.

Question 9 (b)

In Question 9(b), candidates were asked to determine the formula of hydrocarbon X. The question was generally well answered by most candidates with many scoring the full 4 marks available. Those who got full marks set out their working in a clear and logical manner to reach the correct formula.

In some cases, candidates gave their answer as $C_{10}H_{22}$ but did not show any working and so just scored 1 mark.

(b) Hydrocarbon **X** was cracked to form one molecule of hexane, C_6H_{14}, and one molecule of alkene **Y**.

$$\mathbf{X} \rightarrow C_6H_{14} + \mathbf{Y}$$

The relative formula mass of **Y** is 56.
The empirical formula of **Y** is CH_2.

Deduce the molecular formula of hydrocarbon **X**.

Show your working.

(relative atomic masses: H = 1.0, C = 12)

(4)

RFM = 56
EF = CH_2
EFM = 12 + 2(1)
= 14

RFM / EFM
= 56 / 14
= 4

$CH_2 \times 4$
= C_4H_8

molecular formula of **X** = C_4H_8

ResultsPlus
Examiner Comments

In this example, the candidate has calculated the formula of Y. Unfortunately, they have forgotten to add it to C_6H_{14} to gain the last marking point so gained 3 rather than 4 marks.

$CH_2 = 12 + (1 \times 2) = 12 + 2 = 14$

$56 \div 14 = 4$

C_4H_8

$X \rightarrow C_6H_{14} + C_4H_8$

$C_{10}H_{22}$ $\quad 6+4$ / $8+14$

molecular formula of **X** = $C_{10}H_{22}$

ResultsPlus
Examiner Comments

In this example, the candidate has shown clear, logical working to gain the full 4 marks.

Y = C_4H_8

X = $C_{10}H_{22}$

molecular formula of **X** = $C_{10}H_{22}$

ResultsPlus
Examiner Comments

This example scored 2 marks. The candidate has given the correct formula of Y. However, even though prompted in the question to do so, they have not shown any working and so marking points one and two could not be awarded. They have given the formula of X, so the final mark was awarded.

ResultsPlus
Examiner Tip

It is important that you show your working in these type of questions so that full marks can be awarded.

Question 9 (c)

The second 6-mark question on the paper was also well attempted by candidates with many being able to give good explanations to score the full 6 marks available and with a good distribution across the rest of the marks seen.

The majority of candidates demonstrated a good understanding of complete and incomplete combustion and the harm associated with the products of the two types of combustion. The harmful effects of carbon monoxide and soot were well-known, but some candidates incorrectly stated that carbon dioxide had no harmful effects, overlooking its significance as a greenhouse gas. Water was often missed as a product of both complete and incomplete combustion and some answers missed mentioning water as a greenhouse gas as well.

In some cases, candidates commented at length on the environmental issues of methane itself, rather than the products of combustion of methane. This was ignored. In other cases, candidates mistakenly thought that a closed air-hole meant more oxygen, assuming oxygen couldn't 'escape', or that an open-air hole allowed methane to escape, rather than letting oxygen in.

Many candidates made reference to the colours of the flame produced. These were not required and were ignored whether they were correct or otherwise.

Explain the effect of opening and closing the air-hole of the Bunsen burner on the products of combustion of methane and the harm that using large quantities of methane as a fuel can cause.

(6)

Opening the air hole constantly will allow ~~O_2~~ air to come into the combustion reaction. O_2 is useful for combustion. Hydrogen + O_2 → CO_2 + H_2O. This is a complete ~~combution~~ combustion, however air isn't pure O_2 and ~~co~~ is a compound. This will mess up the combustion reaction. If it does react with the air sparks may fly and depending on much methane there is it could explode as hydrocarbons are volatile. ~~and~~ Therefore, we must be careful and use safety ~~preg~~ ~~precautions~~ ~~tik~~ precautions like gloves.

ResultsPlus
Examiner Comments

This example scored 2 marks. The candidate has given some basic ideas linking complete combustion to the open air-hole and to the production of carbon dioxide and water. Whilst the explanation is not perfect, these linkages about the complete combustion are sufficient for full credit at Level 1.

When the air hole is open it allows oxygen to enter creating complete combustion. This produces a powerful hot blue flame which is used during experiments. When the bunsen burner isn't being used the air hole is closed for safety. This prevents oxygen from entering and causes incomplete combustion. It is used for safety as the flame is far more visable.

Opening the air hole during combustion of methane will mean it's complete combustion and the combustion will be quick and will produce carbon dioxide and water plus methane gas. When the air hole is open methane gas will still be produced but instead of just carbon dioxide and water it's also carbon monoxide and soot. The combustion will also not happen as quick.

Using large quantities of methane poses a threat to the environment. Methane is a greenhouse gas which causes damage to the environment. The combustion of methane would cause a dramatic increase in the volume of methane in the atmosphere which will cause damage to the planet and the Atmosphere.

ResultsPlus
Examiner Comments

This example scored 4 marks. The candidate has explained the effect of opening and closing the air-hole on the complete and incomplete combustion of the methane. The candidate then states that methane is a greenhouse gas rather than the harmful effects of the products of the combustion of methane. This was ignored.

The good explanation of the two types of combustion scored a mark of 4 at the top of Level 2.

methane - CH_4

opening the air hole allows oxygen to flow in and react in excess with the methane resulting in the complete combustion of methane

$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

carbon dioxide (CO_2) is a pollutant and contributes is a greenhouse gas - in large quantities ~~would~~ could contribute to global warming

~~and~~ leading to changes in climate destroying animal habitats leading to the ~~as~~ extinction of some species

closing the air hole would result in the incomplete combustion of methane due to a lack of oxygen producing carbon monoxide a toxic odorless and colorless gas that binds to haemoglobin in red blood cells preventing them from absorbing oxygen and can lead to death.
carbon deposits as soot which in large quantities can absorb sunlight preventing plants from doing photosynthesis, leading to their death.

ResultsPlus
Examiner Comments

This last example scored 6 marks. The candidate has given a good explanation of the effect of opening and closing the air-hole on the products of complete and incomplete combustion. They have also explained the harmful effects of carbon dioxide, carbon monoxide and soot. This therefore scored 6 marks at the top of Level 3.

Question 10 (a)(i)

Question 10 part (a) focused on a flame test carried out by a student on a sample of potassium chloride. In part (i), candidates found it hard to explain an improvement to the method that the student could make to obtain a valid conclusion.

Where candidates scored both marks, it was usually for explaining that a nichrome/wire loop should be used. Those who correctly mentioned using a wire loop often went on to explain that it wouldn't burn like wood, thus not affecting the flame colour.

Where candidates didn't score, it was often for suggesting the use of hydrochloric acid rather than water. However, they then often mistakenly gave the reason for this being to remove impurities from the wooden splint or to sterilize the wooden splint. Other common incorrect answers included don't add it to water as water contains ions, use a yellow flame, holding it above the roaring flame, and use of a photometer.

Explain **one** improvement that the student could make to their method to obtain a valid conclusion.

(2)

improvement

use a flame photometer

reason

this is because many ions produce simular colour and so a flame photometer can detect the ion it is.

ResultsPlus
Examiner Comments

Although a flame photometer can be used to identify the metal ion in a sample, this would not be an improvement to the method that the student used and so did not gain credit.

improvement

use a nichde wire loop rather than a wooden splint

reason

the wire will not burn

ResultsPlus
Examiner Comments

A good answer that scored both marks.

Question 10 (b)

Candidates were asked to describe the test for chloride ions in part (b). Again, candidates found this hard with just under half of candidates not scoring.

A common error was to describe the test for chlorine rather than chloride ions and so gained no credit. Some candidates incorrectly mentioned that the solution turns white instead of the production of a white 'precipitate' and so lost the last mark.

(b) A sample of the potassium chloride was also tested for chloride ions.

Describe the test for chloride ions. = Mix with NaOH?

(3)

Place on damp ~~ee~~ blue litmus paper. Chloride ions should turn this red and then white as it bleaches the litmus paper.

ResultsPlus
Examiner Comments

The candidate has given the test for chlorine gas rather than chloride ions and so no marks were scored.

Describe the test for chloride ions.

(3)

The solution containing chloride ions has nitric acid added to it (to remove carbonate and sulfate ions that affect the result) and then silver nitrate added, which, if chloride is present, forms AgCl, a white precipitate, so the solution will turn white as chloride ions are present.

ResultsPlus
Examiner Comments

A good answer that scored the 3 marks. Explanations have been given, but were not required for the mark.

ResultsPlus
Examiner Tip

When asked to describe a test, remember that explanations for each step are not needed.

Describe the test for chloride ions.

(3)

nitric acid

Add ~~HCl~~ to the sample then add silver nitrate ~~bromide chloride~~ to the solution if the solution turns white in colour chloride ions are present.

ResultsPlus
Examiner Comments

This example scored 2 marks. Adding nitric acid and then silver nitrate scores 2 marks.

The third marking point was not scored as the candidate describes the solution as turning white rather than as a white precipitate forming.

Describe the test for chloride ions.

(3)

- Add Hydrochloric acid
- White precipitate will be formed.

ResultsPlus
Examiner Comments

Some candidates described the use of hydrochloric acid rather than nitric acid and this was rejected for marking point one. This candidate has stated that a white precipitate would be formed, but as there is no reference to the silver nitrate being added, this did not score.

Question 10 (c)(i)

In Question 10(c)(i), candidates were asked to calculate the mass of barium chloride that must be dissolved in water to make a solution of known concentration.

A good proportion of candidates were able to score with a spread of marks seen. Around a third of candidates scored full marks by providing the correct answer to two significant figures.

However, some didn't read the question clearly and so didn't round the answer to two significant figures and therefore lost the last mark. Another common error was not properly converting 25 to 0.025 and so losing the first mark.

(c) (i) A student was asked to test a sample of aluminium sulfate for sulfate ions.

The student needed 25 cm^3 of barium chloride solution of concentration 83 g dm^{-3} for the test.

Calculate the mass of barium chloride that must be dissolved in water to make 25 cm^3 of solution of this concentration.

Give your answer to 2 significant figures.

$c\ m\ v$

(3)

25/1000 = 0.025

0.025 x 85 = 2.125

= 2.1

mass of barium chloride = 2.1 g

ResultsPlus
Examiner Comments

A good answer with clear working and given to two significant figures that scored all 3 marks.

25 ÷ 100 = 0.25

83 × 0.25 = 20.75

mass of barium chloride = 21 g

ResultsPlus
Examiner Comments

It can be seen from the working that the candidate has incorrectly converted the volume by dividing by 100 rather than 1000, so lost the first mark.

With error carried forward marking, points two and three were scored and a score of 2 awarded.

ResultsPlus
Examiner Tip

It is important that you show your working in calculations so that error carried forward can be awarded.

25cm³ = 0.025dm³ mass = concentration × volume

mass = 83 × 0.025

mass = 2.075g

mass of barium chloride = 2.075 g

ResultsPlus
Examiner Comments

The candidate has correctly calculated the correct mass of barium chloride required scoring 2 marks.

Unfortunately, they have forgotten to give this to two significant figures and so did not score the last mark.

Question 10 (c)(ii)

For, the last question on the paper, candidates were given the balanced equation for the reaction between barium chloride and aluminium sulfate and asked to write the ionic equation for the reaction. Candidates found this challenging with three quarters of candidates not scoring and a small percentage scoring the full three marks available.

(ii) When the barium chloride solution was added to the aluminium sulfate solution, a precipitate was formed.

The balanced equation for this reaction is

$$3BaCl_2(aq) + Al_2(SO_4)_3(aq) \rightarrow 3BaSO_4(s) + 2AlCl_3(aq)$$

Write the ionic equation for this reaction.

(3)

$Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$

ResultsPlus Examiner Comments

A good, clear answer that scored all 3 marks.

Write the ionic equation for this reaction.

(3)

$3Ba^{2+} + 3SO_4^{2-} \rightarrow 3BaSO_4$

ResultsPlus Examiner Comments

Answers that included three moles of each species were allowed and scored the full 3 marks.

Write the ionic equation for this reaction.

(3)

$3Ba^{2+} + (SO_4^{2-})_3 \rightarrow 3Ba(SO_4\ 3BaSO_4$

ResultsPlus
Examiner Comments

This example scored 2 marks. The candidate has given the correct formula for the barium ion and the barium sulfate. The brackets around the sulfate group meant that marking point two was not scored.

Write the ionic equation for this reaction.

(3)

$3(Ba^{2+} + 2Cl^-) + 2Al^{3-} + (SO_4^{2-})_3 \rightarrow 3(Ba^{2+} + SO_4^{2-}) + 2(Al^{3+} + 3Cl^-)$

ResultsPlus
Examiner Comments

A common incorrect response was to list all ions present, showing a misunderstanding of the term ionic equation. This scored no marks.

ResultsPlus
Examiner Tip

Centres should ensure that candidates are aware of the different types of equations that could be tested on the specification and what is expected in each type. For example: word equations, balanced equations, ionic equations and half equations.

Paper Summary

Based on their performance on this paper, candidates should:

- Ensure that they are familiar with formula of common elements and compounds in the specification and know which elements are diatomic.
- When working through calculation questions, ensure that a logical approach is used that working is shown so that intermediate marks and error carried forward can be applied where necessary.
- In calculation questions, ensure that they check the units required so that conversions can be included if necessary.
- Ensure that they understand what is required for the different types of equation required by the Chemistry specification. For example, word equations, balanced equations, ionic equations and half equations.
- When drawing carbon containing structures, remember to check the number of bonds drawn from each atom present.
- Ensure that they are familiar with the core practicals in the specification and can explain what is required at each step and why these steps are carried out.
- Ensure that when practical methods and diagrams are given in the stem, that these are considered carefully so that they have a full understanding of the practical before they attempt the questions.

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