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Examiners' Report
June 2022

GCSE Chemistry 1CH0 2F

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Introduction

This is the second of the two papers for GCSE Chemistry at foundation tier.

Six of the questions in this paper form one of the GCSE Combined Science foundation tier papers. The final question(s) in this paper are also found in the equivalent higher tier papers.

This is the first GCSE Chemistry examination sat under normal conditions since summer 2019. The papers were set and marked as usual, although an Advance Notice was issued giving some information about the topics that would and would not appear in the paper to support candidates in their revision for the examination.

The setting of grade boundaries was adjusted under Ofqual rules so that the standards were midway between 2019 and 2021 examination series.

Question 1 (a)(i)

Many candidates gave a reasonable answer to the question, commonly saying that plastic does not react with water, or saying that it was unreactive or waterproof. However, a lack of suitable scientific vocabulary was a significant issue, sometimes using language more suited to metals, not plastics, such as 'plastics do not corrode'. Some candidates did not direct themselves to the question and talked about plastic disposal.

Common errors:

- Plastic does not rust / corrode / rot / decay / break easily
- Plastic is tough / durable / malleable/ long lasting / cheap
- Plastic manufacture releases carbon dioxide / when plastics are burned they release carbon dioxide

This is a response that was awarded zero marks.

(a) The toothbrush handles are made of plastic (polymer).

(i) Give a reason why plastic is a suitable material to make a toothbrush handle.

(1)

cheap and hard so it keeps its shape once made.

ResultsPlus Examiner Comments

In a question, such as this, candidates should be encouraged to think of relevant properties.

ResultsPlus Examiner Tip

Cost is almost never an acceptable answer.

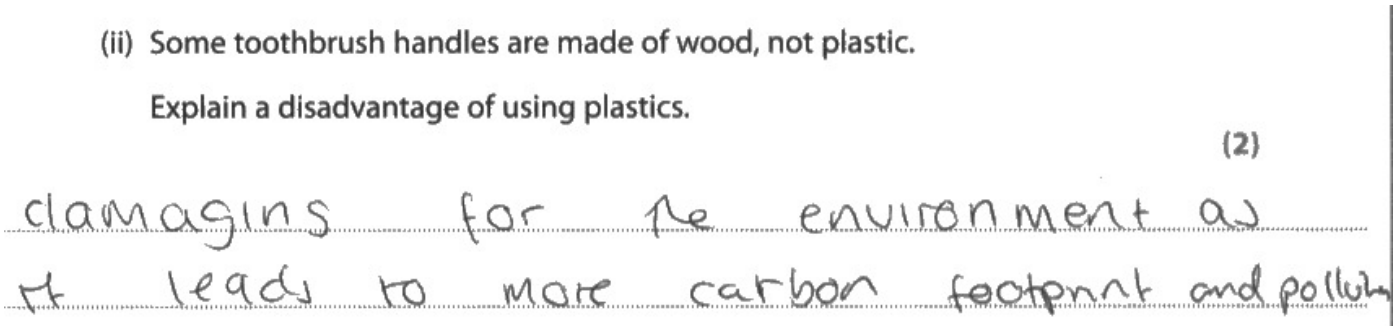
Question 1 (a)(ii)

Many candidates stated a suitable disadvantage of plastics, most commonly that they were non-biodegradable. However, only a few of the better response gave a reason why this was a disadvantage. The most common correct reason being that the plastic would fill up landfill.

Some of the weaker responses made vague references to plastics being bad for the environment.

Unfortunately, there were a few disappointing responses where the candidates had not read the question carefully and referred to wood rather than plastic.

This is a response that was awarded zero marks.



(ii) Some toothbrush handles are made of wood, not plastic.

Explain a disadvantage of using plastics.

(2)

damagins for the environment as it leads to more carbon footprint and pollu

ResultsPlus Examiner Comments

Vague responses such as '*damaging to the environment*' will not score.

ResultsPlus Examiner Tip

Answer should say why plastics are damaging to the environment and how they cause pollution.

Question 1 (d)

This was a standard calculation question. The majority of candidates were only awarded 1 mark for this question. This was very often for finding the percentage of water being 40%.

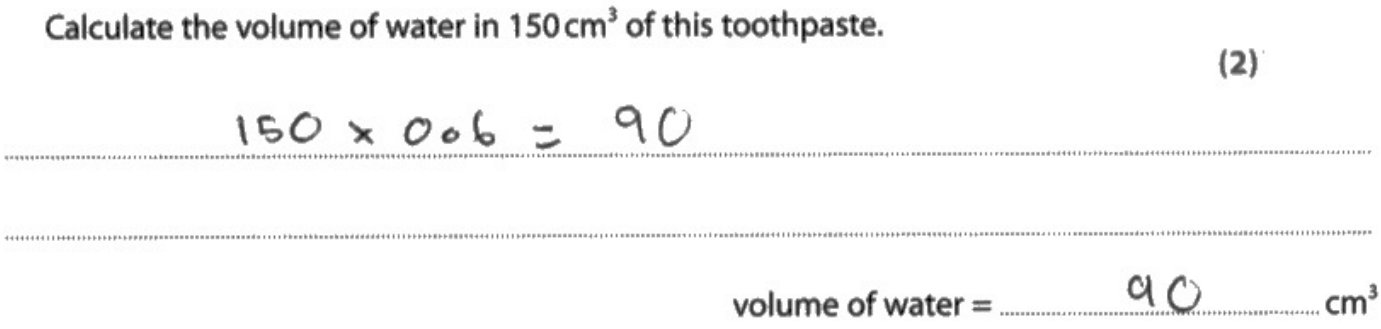
It was interesting to see how many candidates calculated the percentage of water as 60%. However, if they clearly showed their workings and then calculated 60% of 150, this error was followed through by the examiner and 1 mark was awarded.

Some candidates used the alternative route of 60% of 150cm^3 = 90, then 150 – 90 = 60cm^3

Common errors:

- Calculating the percentage of water as 60%
- As it was a pie chart, using 360 in place of 150
- Some candidates had not noticed that their calculated volume of water was bigger than the volume of toothpaste
- 150-(35+25)

This is a response that was awarded zero marks.


Calculate the volume of water in 150 cm^3 of this toothpaste.

(2)

150 x 0.6 = 90

volume of water = 90 cm^3

ResultsPlus
Examiner Comments

The candidate has calculated the percentage of water as 60%, rather than 40%.

It was acceptable to use decimal versions of percentages in the workings.

Question 2 (a)(i)

The majority of candidates responded very well to this question, although some answers did not give a symbol, but a name.

This is a response that was awarded zero marks.

(i) Give the symbol of **another** element in group 1.

(1)

Rubidium

ResultsPlus
Examiner Comments

The question must be read carefully. In this question, a symbol was required in the answer.

Question 2 (a)(ii)

This was a very successful question for the majority of candidate. However, the most common error was to give the relative atomic mass as 7.

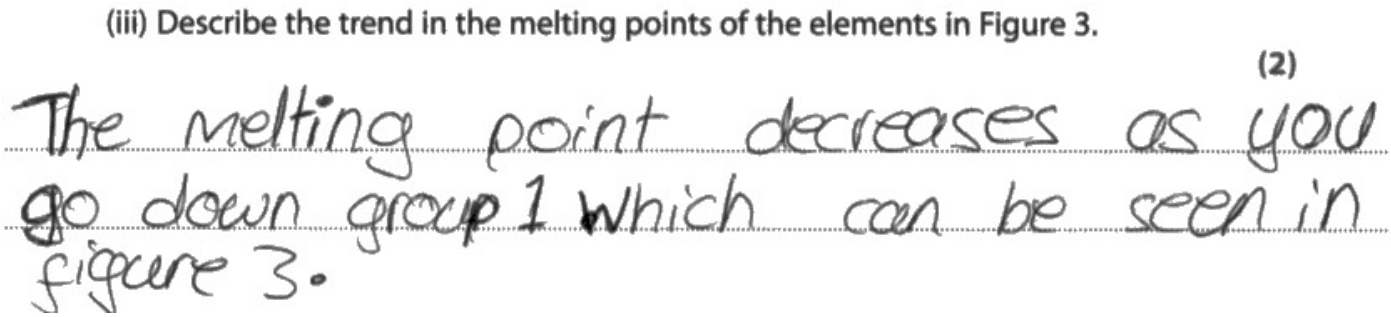
Question 2 (a)(iii)

Most candidates were awarded the full 2 marks for this question by giving the trend down the group. However, a few candidates mentioned, 'higher up the table, higher the melting point goes', which also was awarded 2 marks.

Common errors:

- Some candidates referred to lithium having the highest melting point but did not link this to the other elements.
- Giving a trend in reactivity.
- Stating the trend in reverse.
- Giving a trend in boiling point.
- Saying that there was a decrease but not adding 'down the group'.

This is a response that was awarded the full 2 marks.


(iii) Describe the trend in the melting points of the elements in Figure 3.

(2)

The melting point decreases as you go down group 1 which can be seen in figure 3.

ResultsPlus
Examiner Comments

The candidate has given a very clearly expressed answer.

ResultsPlus
Examiner Tip

When describing a trend, two aspects must be mentioned. For example, in this question, the melting point and the position in group 1.

(iii) Describe the trend in the melting points of the elements in Figure 3.

(2)

As ~~the~~ you go down the table, the boiling points get lower.

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Examiner Comments

This is a response that was awarded zero marks.

ResultsPlus
Examiner Tip

Candidates must carefully read the question and check their answers.

Question 2 (b)(i)

Overall, candidates responded very well to this question.

This is a response that was awarded zero marks.

Give the name of the container shown in Figure 4.

(1)

Test tube/bung

ResultsPlus Examiner Comments

The candidate has not included a bung in the diagram.

ResultsPlus Examiner Tip

Avoid giving a list of answers if only one answer is required for the question. By writing a list, you will not get the mark if some answers in the list are incorrect.

Question 2 (b)(ii)

In this question, candidates were asked to explain changes that could be made to step 2 and to step 3 in the experiment that would make the method safer.

The majority of candidates suggested correctly in step 2 by suggesting the use of a smaller piece of sodium. However, not all candidates gave a good explanation for this suggestion.

In step 3, the majority of candidates stated, '*use less water/single drop of water*'. However, some of the weaker response suggested using a larger container/trough but without an explanation. Non-scoring responses generally focused on suggesting safety procedures or improving accuracy or measurements.

This is a response that was awarded zero marks.

(ii) A teacher says that the method is not safe because the reaction is too vigorous.

Explain changes that could be made to step 2 and to step 3 that would make the method safer.

(3)

step 2: change and explanation

put on protective gloves aswell so your hands dont become exposed to sodium when cutting

step 3: change and explanation

use a pipette to put the water in this will help with accuracy

ResultsPlus
Examiner Comments

The candidate has not demonstrated an understanding of the errors in the steps in the experiment.

This is a response that was awarded 1 mark.

(ii) A teacher says that the method is not safe because the reaction is too vigorous.

Explain changes that could be made to step 2 and to step 3 that would make the method safer.

(3)

step 2: change and explanation

Cut a 1cm x 1cm x 1cm cube of sodium. which will be safer as there is less sodium to react with.

step 3: change and explanation

use less water which mean the wont be as much water for the sodium to react with.

ResultsPlus
Examiner Comments

The candidate has correctly suggested using a smaller piece of sodium. However, the candidate did not develop the answer further by saying that this makes the reaction less violent.

Using less water was a common error in the second part of this question.

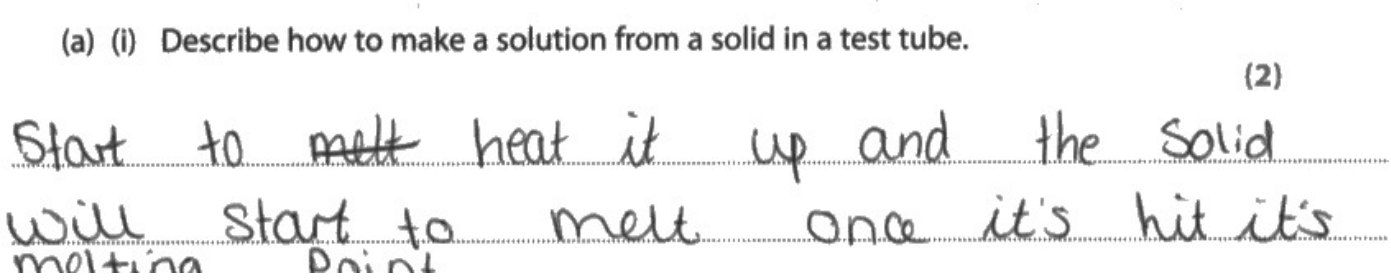
Question 3 (a)(i)

In this question, candidates were asked to describe how to make a solution from a solid in a test tube.

Some candidates described adding water, although 'liquid' was also allowed. However, only a few candidates went on to say 'shake' for an addition mark, but 'stir' and 'mix' were also credited.

In the majority of the weaker responses, candidates demonstrated a confusion between a pure liquid and a solution with many answers referring to melting the substance to make it a liquid. Other incorrect response referred to steps 2 and 3 (test for chloride), in the flow chart.

This is a response that was awarded zero marks.


(a) (i) Describe how to make a solution from a solid in a test tube.

(2)

Start to ~~melt~~ heat it up and the solid will start to melt once it's hit it's melting Point

ResultsPlus Examiner Comments

This is an example of a common error in this question.

ResultsPlus Examiner Tip

'Melting' and 'dissolving' are not the same. The difference should be carefully learned.

Question 3 (a)(ii)

In this question, candidates were asked to give the name of an apparatus that should be used to add a few drops of silver nitrate solution to the test tube.

Overall, candidates responded very well to this question as the answer of 'pipette' or 'dropper' were very well known.

Question 3 (b)(i)

This question tested candidates' knowledge and understanding of a precipitate.

Overall, this question proved challenging for candidates. Common mistakes referred to bubbling, fizzing or colour changes.

(b) (i) When one compound is tested, a precipitate is seen.

State what you **see** when a precipitate forms.

(1)

The would be a change in colour.

ResultsPlus
Examiner Comments

This is a response that was awarded zero marks.

ResultsPlus
Examiner Tip

The precipitate formed may have a colour, but it is necessary to identify it as a solid, either by saying a solid forms or that the mixture goes cloudy.

Question 3 (b)(ii)

In this question, candidates were asked to name the ion in the compound that causes a cream precipitate.

Overall, candidates were successful in this question and were awarded the mark.

This is a response that was awarded zero marks.

(ii) Using Figure 5, name the ion in the compound that causes a cream precipitate.

(1)

ion bromine

ResultsPlus
Examiner Comments

This error was not uncommon in weaker responses.

ResultsPlus
Examiner Tip

When non-metal atoms form ions, they change their name to '-ide'.

Question 3 (c)(i)

In this question, candidates were asked to name the compound that is formed after a compound of potassium is tested.

Overall, candidates scored correctly in this question.

This is a response that was awarded zero marks.

(c) A compound of potassium is tested.
It forms a white precipitate.

(i) Using Figure 5, name the compound.

(1)

Chloride

ResultsPlus
Examiner Comments

When an ionic compound is needed, both the positive and the negative ion are needed. In this answer the potassium is missing.

Question 3 (c)(ii)

The majority of candidates responded well to this calculation question and were able to achieve the full 2 marks.

However, some of the weaker responses made the mistake of not multiplying 0.2 by 4, adding 10 + 1 + 0.2 and getting 11.2g.

This is a response that was awarded the full 2 marks.

(ii) 10.0 g of the solution of the compound of potassium are tested.
1.0 g of dilute nitric acid is added.
4 drops of silver nitrate solution are added, each with a mass of 0.2 g.

Calculate the mass of the mixture at the end of the test.

(2)

0.2×4=0.8 10.0g+1.0g=11.0+0.8=11.8

mass = 11.8 g

ResultsPlus
Examiner Comments

In this response, the candidate has clearly shown the workings for this calculation.

ResultsPlus
Examiner Tip

Always show workings in calculation questions. If you make a mistake, you might still get some marks from the workings.

This is a response that was awarded zero marks.

(ii) 10.0 g of the solution of the compound of potassium are tested.
1.0 g of dilute nitric acid is added.
4 drops of silver nitrate solution are added, each with a mass of 0.2 g.

Calculate the mass of the mixture at the end of the test.

(2)

10.0 + 1.0 + 0.2 = 10.2

mass = 10.2 g

ResultsPlus
Examiner Comments

This is an example of a common mistake in this question where only one drop of silver nitrate has been used.

ResultsPlus
Examiner Tip

It is likely that all of the information in a question will be needed. In this case, there are 4 drops of silver nitrate, but the workings do not include 4, so it is incorrect.

Question 4 (b)(i)

In this question, candidates were tested on their knowledge of the names of apparatus that are used in experiments, as given in the question.

Overall, candidates were very successful in their response to the question to identify the name of the apparatus used to measure the temperature.

Question 4 (b)(ii)

This question was a continuation of the previous question to identify the names of apparatus used in experiments.

Overall, candidates were very successful in their response to write the name of the specific piece of apparatus used in the experiment as it well-known to candidates.

Question 4 (b)(iii)

In this question, candidates were asked to state why polystyrene is a better material than glass for this piece of apparatus.

The majority of candidates understood the point of using polystyrene, often preferring to describe the effect of using polystyrene (retaining heat), rather than simply stating it is a good insulator. However, there was some confusion as to whether the beaker should conduct heat or be a heat insulator, possibly confusing this experiment with heating water by burning alcohols.

Some of the weaker responses confused the terms ‘insulator’ and ‘conductor’, or referred to safety, ie, the glass cracking and being fragile. In addition, there was a lot of contradiction, eg, keeping heat in as a good heat conductor.

Question 4 (b)(iv)

In this calculation question, the majority of candidates correctly subtracted to get 2.5 and added the unit to get 2.5^{o}C for 2 marks. However, fewer responses were developed further to gain the final mark for the minus sign.

Candidates need to take care with writing symbols. For example, '^{o}C' was often incorrectly written as – 2.5^{oC} or – 2.5^{o} or – 2.5C.

This is a response that was awarded the full 3 marks.

(iv) The results of the experiment are given in Figure 7.

temperature of liquid at start in °C	18.6
temperature of products at end in °C	16.1

Figure 7

Calculate the change in temperature.

Give a sign and a unit in your answer.

(3)

18.6 − 16.1 = 2.5

temperature change = − 2.5°C

ResultsPlus
Examiner Comments

This is a good example where the candidate has calculated the correct answer.

ResultsPlus
Examiner Tip

The answer line should be used to give the final answer.

This is a response that was awarded 2 marks.

(iv) The results of the experiment are given in Figure 7.

temperature of liquid at start in °C	18.6
temperature of products at end in °C	16.1

Figure 7

Calculate the change in temperature.

Give a sign and a unit in your answer.

(3)

18·6 - 16·1 = 2·5 °C

temperature change = 2·5°C

ResultsPlus
Examiner Comments

In this response, the candidate has carried out the subtraction the wrong way round. A temperature fall is shown as a negative temperature change.

Question 4 (b)(v)

In this question, candidates were asked to give the formula and the name of the solid used in the experiment.

Overall, candidates found this question very challenging and there were many incorrect answers. The common mistakes included:

- NH4+ + NO3-
- capital and lowercase letters incorrectly used
- 4, 3 numbers not subscript
- Ions with wide gaps: NH4 NO3

The name of the solid was equally poorly answered. The common errors included:

- ammonia nitrate
- nitric acid
- nitrogen hydroxide

Question 5 (a)(i)

In this question, candidates were given a diagram of a molecule of a compound obtained from crude oil. Candidates were asked to identify the names of two elements in the molecule.

Overall, candidates responded very well to this question and it was well answered.

This is a response that was awarded 1 mark.

(i) Give the names of the **two** elements in this molecule.

(2)

Helium

Carbon

ResultsPlus
Examiner Comments

In this response, the candidate has identified one of the elements as helium, instead of the correct answer, hydrogen.

ResultsPlus
Examiner Tip

Candidates should make good use of the periodic table that is given as part of the exam paper material.

Question 5 (b)

In this question, candidates were given the different fractions of crude oil and asked to identify the use of the fraction from the options given.

Overall, the majority of candidates scored for the use of petrol but the other fractions were less well known.

Question 5 (c)

In this question, candidates were tested on their knowledge and understanding of a practical experiment.

Overall, candidates responded well to this question but only a few were awarded the full 3 marks. Candidates were more familiar with HCl than sulfur dioxide, with many stating that the litmus paper would turn red, but fewer linking this to acidity.

Some of the weaker responses explained the merging of the two gases together.

However, some of the common errors included:

- Describing the test for chlorine gas (litmus bleaching).
- Giving a red colour change without an explanation.
- When one solution was identified as acid, often the other was believed to be an alkali.
- Many candidates took from the question the understanding that there would be a colour change, but listed unsuitable colours, eg, yellow/green/orange.
- SO2 was commonly referred to as alkali and therefore blue/purple.
- Some gave UI colours.

This is a response that was awarded zero marks.

(c) Hydrogen chloride gas and sulfur dioxide gas are dissolved in separate test tubes of water.
Blue litmus paper is dipped into each test tube.

State and explain the colour change you would observe in each test tube.

(3)

When chlorine gas is present in a reaction, blue litmus paper would turn red in the test tube and then be bleached white.

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Examiner Comments

The candidate has incorrectly indicated that any compound containing chlorine will act as chlorine.

Question 6 (b)(i)

In this question, candidates were asked to write the word equation for iron chloride.

Overall, candidates responded well to this question and the majority of responses were awarded the full 2 marks.

However, candidates should be aware that only the names of substances are used in word equations, and not words like 'wool' (although this was ignored in this instance in marking), or 'heat'. Some candidates used the equals sign which should be discouraged.

In some of the common errors in this question, candidates:

- had an additional product such as oxygen.
- gave a symbol equation which inevitably contained errors, most often because the formulae were incorrect.
- used words and symbols.
- used iron chlorine instead of iron chloride.

Question 6 (b)(ii)

In this question, candidates were asked to name the halogen from the information given that is most reactive with iron.

Overall, candidates were very successful with their response to this question.

Question 6 (b)(iii)

In this calculation question, candidates were asked to calculate the mass of iron and the mass of chlorine in 125g of iron chloride.

Candidates coped very well this question with the majority of candidates correctly calculating the masses from percentages. However, where candidates went wrong, they:

- used the wrong value of 34% instead of 34.4%
- calculated mass of chlorine as 125 – 34.4
- tried to calculate an empirical formula.
- divided by 125 rather than by 100.
- used a chunking method which led to errors more often than that done with a calculator.

This is a response that was awarded the full 3 marks.

(iii) 34.4 % of the mass of iron chloride is iron.

Calculate the mass of iron and the mass of chlorine in 125 g of iron chloride.

(3)

34.4% x 125g = 43g → iron

125g - 43g = 82g → chlorine

mass of iron = 43 g mass of chlorine = 82 g

ResultsPlus Examiner Comments

The candidate has correctly answered the question and the response is well set out with workings.

This is another response that was awarded the full 3 marks.

(iii) 34.4% of the mass of iron chloride is iron.

Calculate the mass of iron and the mass of chlorine in 125 g of iron chloride.

(3)

10% = 12.5g 37.5g 125 − 43 = 82

1% = 1.25g 5

0.1% = 0.125 0.5

mass of iron = 43 g mass of chlorine = 82 g

ResultsPlus
Examiner Comments

The candidate has answered the question correctly and the response has been well set out showing workings.

However, the answer uses the chunking method but it would have been quicker to use a calculator.

Question 6 (c)

In this gap-fill question, candidates were tested on their knowledge and understanding of how alkenes react with halogens by completing the written summary using the information given in the question.

Most candidates deduced that iron chloride was a catalyst, but fewer knew that a catalyst's mass does not change in a reaction.

Question 7 (b)

In this question, candidates were asked to state why the compound given in the question is described as an unsaturated hydrocarbon.

Most candidates know that hydrocarbons contained carbon and hydrogen, although not all of the better responses indicated that these were the only elements in this type of compound. Other candidates confused atoms, compounds and molecules, eg, '*hydrocarbons contain molecules of carbon and hydrogen*'.

However, candidates were less successful at defining 'unsaturation', sometimes confusing this with a saturated solution or getting wet. Other candidates stated that there was an equal sign between two carbons instead of a double bond.

This is a response that was awarded the full 3 marks.

(b) The compound in Figure 10 is an unsaturated hydrocarbon.

State why the compound is described as an **unsaturated hydrocarbon**.

(3)

unsaturated There is a double bond between 2 of the carbons in the hydrocarbon.

hydrocarbon Molecule containing only hydrogen and carbon.

ResultsPlus
Examiner Comments

The candidate has given a concise and accurate answer.

This is a response that was awarded 1 mark.

(b) The compound in Figure 10 is an unsaturated hydrocarbon.

State why the compound is described as an **unsaturated hydrocarbon**.

(3)

unsaturated Sparse in bonds, not the most possible bonds there could be.

hydrocarbon carbon and hydrogen bonded together.

ResultsPlus
Examiner Comments

The candidate has not used the correct terminology of 'double bond', so does not score. In defining a hydrocarbon, the answer does not say that these are the only elements.

Question 7 (c)(ii)

In this calculation question, candidates were asked to calculate the mass of a molecule from the information given in the question.

The majority of candidates scored the full 2 marks for their answers, but a significant number of candidates did not attempt the question.

Common errors in this question included:

- Having an incorrect power.
- Writing down the answer with no power.
- Having the correct answer in the working space but writing a different answer on the answer line.

Question 7 (d)

In this 6-mark short-answer question, candidates were asked to discuss the complete and incomplete combustion of the alkanes from the information given, and the trend in the energy changes they produced. Candidates were also required to give word equations in their answer.

Whilst there were some good responses to the question, many candidates showed a lack of understanding of the difference between complete and incomplete combustion. It was common to say that methane had combusted incompletely because it had the lowest temperature change.

Unfortunately, there were a significant number of candidates who did not attempt the question.

A typical level 1 response described the trend from the table. However, some of the weaker response only selected the highest/lowest temperature change, or just listed all of the data without giving a trend.

A typical level 2 response described the trend and identified products of complete or incomplete combustion, either in words or in an equation (partly correct equations were credited for the information they gave). Water was often omitted as a product.

A typical level 3 answer described the trend and identified products of complete and incomplete combustion.

Some common errors:

- Giving irrelevant information about the effects of carbon monoxide.
- Methane and ethane must have been incomplete combustion due to lower temperature changes.
- Butane and propane complete combustion due to higher temperature change.
- Relating temperature change to incorrect properties, such as reactivity or melting point.
- Incorrect incomplete combustion products.
- Confusion over exothermic and endothermic.
- Listing everything about hydrocarbons, which was often irrelevant to the question.

A few candidates listed the formulae/number of carbon/hydrogen atoms in each alkane, but they did not make the connection between this and the temperature change.

This is a response that was awarded 2 marks.

Discuss the complete and incomplete combustion of these alkanes and the trend in the energy changes they produced.

You should give word equations in your answer

(6)

The more hydrogen and Carbon bonds the higher the temperature change. Shown as butane has more bonds than propane, ethane and methane.

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Examiner Comments

The candidate has not clearly expressed their answer. There is only a reference that butane has the highest temperature change. In addition, many aspects of the question have not been addressed, for example, complete and incomplete combustion have not been mentioned.

This is another response that was awarded 2 marks.

*(d) Alkanes can be burned in air.
Different products can be formed as the combustion of alkanes can be complete or incomplete.

An investigation was carried out to compare the energy released when the first four alkanes in the homologous series were burned.
Equal amounts of these alkanes were burned to heat 100 cm^3 of water.
The temperature change for each alkane is shown in Figure 12.

	alkane	temperature change in °C
CH_4 →	methane	9
C_2H_6 →	ethane	16
C_3H_8 →	propane	22
C_4H_{10} →	butane	29

Figure 12

Discuss the complete and incomplete combustion of these alkanes and the trend in the energy changes they produced.

You should give word equations in your answer.

(6)

a Complete combustion occurs when there is enough oxygen present to complete the reaction. An incomplete combustion reactions happens when there is not enough oxygen present and ~~earth~~ carbon monoxide is produced as a by-product. Both propane and butane are complete combustion ~~reaction~~ reactions since the temperature change only decreased by 71°c

(Butane) and 78°C (Propane)
Reactions - C_3H_8 - Propane
and C_4H_{10} for Butane. The
significant temperature change in
Alkanes methane - CH_4 and ethane
C_2H_6 - show that they are
incomplete combustions e.g
methane + H_2O -> carbon monoxide.
carbon monoxide is produced
from the lack of oxygen.
as well as that, carbon
monoxide also reduces the
temperature change in the reaction.
Proving that this is a incomplete
combustion reaction since the
~~temperature~~ temperature change
is small. compared to the
change in the complete
combustion reaction.

ResultsPlus
Examiner Comments

In this response, the candidate has correctly identified why complete and incomplete combustion occur. However, the analayis of the table is not correct, for example, reference to a temperature decrease.

Question 8 (a)(i)

In this question, candidates were asked to name a piece of apparatus that would be better to measure the volume of gas instead of the measuring cylinder mentioned in the question. Candidates were required to name the apparatus and give a suitable reason.

Overall, this was a challenging question and only a few candidates were able to identify an appropriate piece of equipment, and some gave a gas syringe. Some of the incorrect responses mentioned a conical flask, beaker, pipette or burette.

If a gas syringe was stated, the most common reason given was to make the reading more accurate. Incorrect reasons were that the gas syringe was 'easier to read' or 'made to collect gas', or that 'gas cannot escape'.

This is a response that was awarded zero marks.

(i) Name a piece of apparatus that would be better to measure the volume of gas produced, instead of the 250 cm^3 measuring cylinder.

Give a reason for your answer.

(2)

name of apparatus

burette.

reason

gives a more accurate measurement.

ResultsPlus
Examiner Comments

Unfortunately, a burette would not be large enough for the volume required.

Question 8 (a)(ii)

In this calculation question, candidates were asked to calculate the mean rate of production of hydrogen using the information given in the question.

Unfortunately, only a few candidates understood that to get the mean rate they needed to divide the total volume by 90. Some candidates read off several volumes up to 90 seconds and then found the mean of these volumes, rather than mean rate.

Common errors included inverting the fraction, or using 1.5 minutes rather than 90 seconds. It was also noted that many candidates did not round correctly which may have cost them a mark.

This is a response that was awarded the full 3 marks.

(ii) Calculate the mean rate of production of hydrogen over the first 90 seconds, in cm^3 per second.

(3)

30 . 90 seconds is 30 of hydrogen in cm

30 ÷ 90 = 0.3

rate = 0.3 cm^3 per second

ResultsPlus
Examiner Comments

The candidate has calculated that in 90 seconds there are $30cm^3$ of gas and has given the rate correctly.

ResultsPlus
Examiner Tip

In this example, it is very hard to read the 9 (it looks similar to an 8). Candidates are advised to write clearly.

Question 8 (a)(iii)

In this question, most candidates recognised from the graph that the reaction had finished at 9 minutes, but fewer included evidence of this in their responses. Common errors included that the graph was a 'straight line' (rather than a flat line), or that the rate of reaction is constant. Weaker responses included reference to maximum/optimum volume, rather than constant volume.

(iii) The student measured the volume of gas for 10 minutes.

State why the measurements could have been stopped at 9 minutes.

(1)

volume of hydrogen does not increase after 9 minutes (nothing enanges)

ResultsPlus
Examiner Comments

This is a response that was awarded the 1 mark. The candidates has given a clearly stated answer to the question.

ResultsPlus
Examiner Tip

Where you are given information, in this case the volume of gas, use it in your answer and interpret it, for example, '...does not increase'.

Question 8 (b)(i)

In this question, most candidates were able to provide an answer but often poor phrasing led to incorrect science. Some candidates realised that there would be more particles but many seemed unable to link higher concentration to more particles (in the same volume).

In this experiment, there will be the same number of successful collisions until the reaction is over, but these collisions happen more frequently. Therefore, a reference to 'more frequent collisions' was required to score the second mark rather than just 'more collisions'.

Weaker answers referred to the acid acting as a catalyst, or simply stated what had happened but not explaining why it happened. For example, 'the more concentrated acid, the faster the react of reaction', which was a repetition of the question.

(b) The experiment was repeated, but with acid of a higher concentration.

The rate of reaction was faster.

(i) Explain why the rate of reaction increases when the concentration of acid is increased.

(2)

In a higher concentration of acid there is more particles meaning that there would be more successful collisons ~~thrwing~~ striking up the rate of reaction.

ResultsPlus
Examiner Comments

This is a response that was awarded 1 mark for the correct answer.

ResultsPlus
Examiner Tip

The successful collisions will be more frequent – there are not more of them in total.

(b) The experiment was repeated, but with acid of a higher concentration.

The rate of reaction was faster.

(i) Explain why the rate of reaction increases when the concentration of acid is increased.

(2)

The higher the concentration the seronger the reaction give to the ~~reacts~~ amoune of acid use therefore it is faster.

ResultsPlus
Examiner Comments

This is a response that was awarded zero marks. The candidate has given a repetition of the question.

ResultsPlus
Examiner Tip

To answer questions like this, talk about particles and their collisions.

Question 8 (c)

In this question, it was apparent that many candidates do not know what a marble chip is and, therefore, that cutting it, eg, with scissors, was not a sensible method of forming smaller chips.

Some candidates referred to the idea of breaking or crushing the marble chips but did not give a suitable tool (any sensible laboratory method was allowed), or how to end up with both small and medium-sized chips.

Some intriguing answers broke down the marble chips with a little acid to get medium-sized chips, and then further to get smaller chips, which may not be the best method but was credited for scientific understanding.

(c) The apparatus in Figure 13 can be used to measure the rate of the reaction between marble chips and hydrochloric acid.

The student needs different sized marble chips.

Describe how the student can make small and medium sized marble chips from large chips.

(2)

By cutting larger chips in half and half of the cut ones, cut again to make small sized, cut equally

ResultsPlus Examiner Comments

This is a response that was awarded 1 mark. The reference to 'cutting' was a common error.

Question 9 (c)

In this question, most candidates calculated the mass of carbon dioxide correctly. However, many candidates did not round correctly to 3 significant figures with many common errors being 2.2 and 2.200.

(c) When calcium carbonate is heated it decomposes.

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$$

When 5.000 g of calcium carbonate is heated, the mass of solid remaining is 2.800 g.

Calculate the mass of carbon dioxide that has been released.

Give your answer to three significant figures.

(2)

5.000 - 2.800

= 2.200

mass of carbon dioxide = 2.200 g

ResultsPlus
Examiner Comments

This is a response that was awarded 1 mark. The candidate has correctly calculated the answer, with workings shown, but the final answer has four significant figures.

(c) When calcium carbonate is heated it decomposes.

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$$

When 5.000 g of calcium carbonate is heated, the mass of solid remaining is 2.800 g.

Calculate the mass of carbon dioxide that has been released.

Give your answer to three significant figures.

(2)

5.000 - 2.800 = 3.200

mass of carbon dioxide = 3.200 g

ResultsPlus
Examiner Comments

This is a response that was awarded zero marks.

ResultsPlus
Examiner Tip

Candidates are advised to always check their calculations.

Question 9 (d)(i)

In this question, many candidates recognised that helium has a full outer shell, but fewer scored the second mark by stating there was no need to lose/gain electrons. A very common error was the suggestion that inertness was due to equal numbers of protons, neutrons and electrons.

(d) A diagram of an atom of helium is shown in Figure 15.

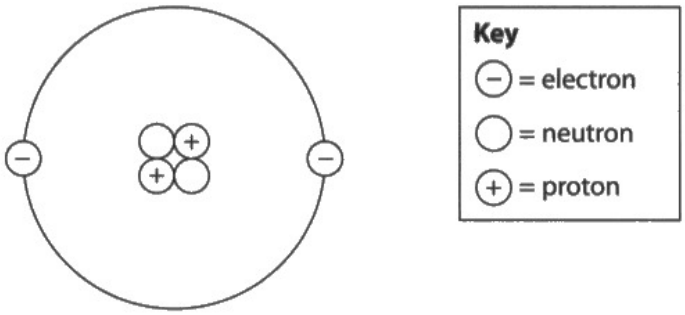

Figure 15

(i) Explain, using Figure 15, why helium is inert.

(2)

only has one outer shell

ResultsPlus
Examiner Comments

This is a response that was awarded zero marks. The answer reveals a common error in understanding of atoms having more than one outer shell.

Question 9 (d)(ii)

In this question, some candidates did not understand that they needed to identify the property which explains why helium is used in balloons, not just to select any property of helium.

Common errors were that helium is 'lighter than air', 'light', a 'lightweight gas', 'will float', is 'lighter than oxygen', is a 'gas'.

(ii) Helium is used to fill balloons.

State one property of helium, apart from it being inert, that makes it suitable for filling balloons.

(1)

Helium is less dense than Air

ResultsPlus Examiner Comments

This is a response that was awarded the mark. The candidate used the correct terminology.

(ii) Helium is used to fill balloons.

State one property of helium, apart from it being inert, that makes it suitable for filling balloons.

(1)

It is very light (lighter than the atmosphere.

ResultsPlus Examiner Comments

This is a response that was awarded zero mark.

Question 9 (e)

In this 6-mark question, candidates were generally successfully with most responses referring to all three gases. However, some of the weakest responses just repeated information in the table and stated that the gases had gone up or down.

A typical level 1 response might have explained how carbon dioxide and water vapour were formed by volcanoes.

A typical level 2 answer might have included information about carbon dioxide being emitted by volcanoes and then photosynthesis causing a reduction in carbon dioxide and an increase in oxygen.

A level 3 answer needed to explain about the origins of the atmosphere from volcanoes, how plants had altered the amount of carbon dioxide and/or oxygen, and then how human processes were leading to more carbon dioxide in more recent times.

The better responses were often limited to 4 marks due to a failure to include human activities in the response. Many candidates correctly described the effect of photosynthesis on CO2 and O2 levels (although some said that plants 'breathe' in/out these gases). The following misconceptions were apparent in a few responses:

- oxygen increased because humans 'needed it'.
- humans had not discovered fossil fuels when the early atmosphere formed.
- human respiration was a reason given for why CO2 levels decreased in the atmosphere.

*(e) Figure 16 shows the relative amounts of three gases in the early atmosphere compared to the composition of today's atmosphere.

gas	relative amount in early atmosphere	composition of today's atmosphere
water vapour	large amount	0% to 4%
carbon dioxide	large amount	less than 0.5%
oxygen	little or none	21%

Figure 16

Natural processes and human activities have altered the relative amounts of these gases in the atmosphere.

Explain how the relative amount of each of the gases in Figure 16 has increased or decreased over time.

(6)

The amount of water vapour and carbon dioxide have decreased since the earths early atmosphere, while the amount of oxygen has increased.

This change may partly be due to the evolution of living organisms on the earth, ↓trees in particular. When trees and plants photosynthesise and respirate they take in carbon dioxide and produce oxygen, directly opposite to what most non-plant organisms due via breathing. Because plants likely evolved before animals, these processes would not be balanced originally, and so the trees would take in more carbon dioxide and release more oxygen that has been produced or used respectively, since there were no animals to take in oxygen and produce carbon dioxide.

Furthermore, the amounts of water vapour in the atmosphere has also decreased. This is due to the recession of the seas during the early days of the earth. The significantly reduced amount of water on the earth surface meant that ~~less of~~ there was less of it to be evaporated, meaning that less water vapour became a part of the atmosphere

Finally, human activity as well as natural processes have had an impact on the relative amounts of gasses in the atmosphere. Due to increased amounts of fires and later machines significantly more particles and atoms have entered the atmosphere. This means that there is essentially less space to be taken up comparatively by the carbon and water vapour than there was in the early days of the earths atmosphere.

ResultsPlus
Examiner Comments

This is a response that was awarded 4 marks. The candidate has explained the role of photosynthesis well. An attempt has been made to explain why water vapour levels decreased, but this is not correct. There is an idea that burning fires and machines have altered the composition of the atmosphere, but this is not correctly linked to fossil fuels or more carbon dioxide.

*(e) Figure 16 shows the relative amounts of three gases in the early atmosphere compared to the composition of today's atmosphere.

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Figure 16

Natural processes and human activities have altered the relative amounts of these gases in the atmosphere.

Explain how the relative amount of each of the gases in Figure 16 has increased or decreased over time.

(6)

• in the earliest years on earth volcanic erruption caused a high amount of CO^2 in the atmosphere

• when oceans where formed, alot of the CO^2 in the atmosphere was absorbed, and water vapour levels increased

• when algae in plants where formed, there way of creating energy (photosynethesis) took in an certain amounts of CO^2 and produced oxygen. decreasing levels of CO^2 and increasing levels of oxeygen

• Plants and algae could only store certain

amounts of CO^2, so when they died layers of sedimentary rock formed over top of them, to trap the stored CO^2 from being released, further maintaining low CO^2 levels.

ResultsPlus
Examiner Comments

This is another response that was awarded 4 marks and achieved level 2. The candidate has explained well the emission of carbon dioxide from volcanoes, its absorption into oceans (the comment about water vapour is incorrect), and the role of photosynthesis. The candidate has mentioned correct details about carbon dioxide and oxygen, but nothing relevant about water vapour, or about recent changes in carbon dioxide levels.

Question 10 (a)(i)

The majority of candidates attempted this question and scored a mark for a relevant safety precaution, although fewer could name the hazard symbol.

Some candidates explained the symbol as 'harmful to skin/irritant', instead of corrosive. A few candidates did not understand the concept of a precaution and they mentioned washing hands if spilled, cleaning up spills quickly and being careful when handling acid.

(i) The acid in Figure 17 can be used in the test for carbonate ions.

Explain, giving the name of the hazard symbol shown, what safety precautions should be taken when using this acid.

(2)

corrosive symbol meaning it can harm and cause damage so wearing gloves and goggles can reduce and stop any possibility / damage caused.

ResultsPlus
Examiner Comments

This is a response that was awarded the full 2 marks. The candidate has given a well explained answer.

Question 10 (a)(ii)

Many candidates could name the acid given in the question, although some candidate gave names not including the word 'acid'.

(ii) Give the name of the acid shown in Figure 17.

(1)

hydrogen nitrate

ResultsPlus
Examiner Comments

This a response that was awarded the mark for a correct answer.

ResultsPlus
Examiner Tip

Candidates must know the names of common substances, including the three laboratory acids.

Question 10 (a)(iii)

This question was generally well answered, although some candidates did not link the container to the specific use of containing an acid, for example, glass being transparent.

Question 10 (b)(i)

In this question, most candidates stated the use of a blue/roaring flame (which was allowed), rather than the expected answer of holding the wire in the flame. In addition, candidates scored less well in explaining the improvement, for example, having a hotter part of the flame. Some candidates suggested turning off the lights, placing more substance on the wire or using clamp stands to hold the wire in position.

(b) A teacher conducts a flame test to identify the metal ions in some unknown solids.

step 1 dip a flame test wire into hydrochloric acid

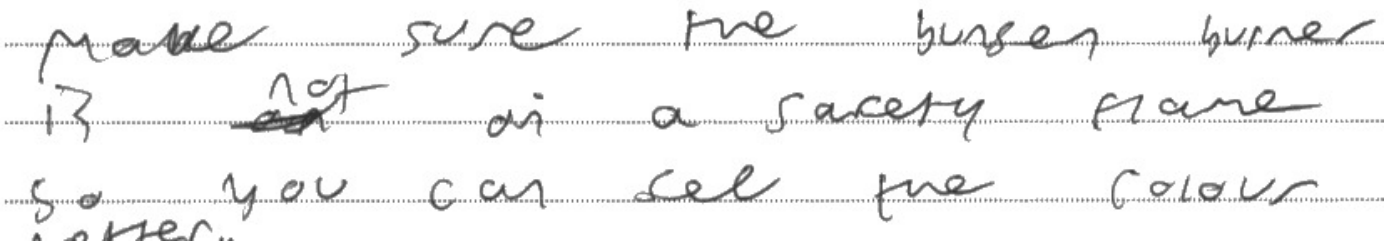
step 2 dip the flame test wire into the unknown solid

step 3 hold the flame test wire above a Bunsen burner flame

(i) This method did not work well.

Explain an improvement that needs to be made to **step 3** to enable a bright flame colour to be produced.

(2)



ResultsPlus
Examiner Comments

This is a response that was awarded zero marks. The candidate should have stated what the flame would be when not on a safety flame.

Question 10 (b)(ii)

In this question, candidates were much better at identifying potassium than the other ions.

Question 10 (c)

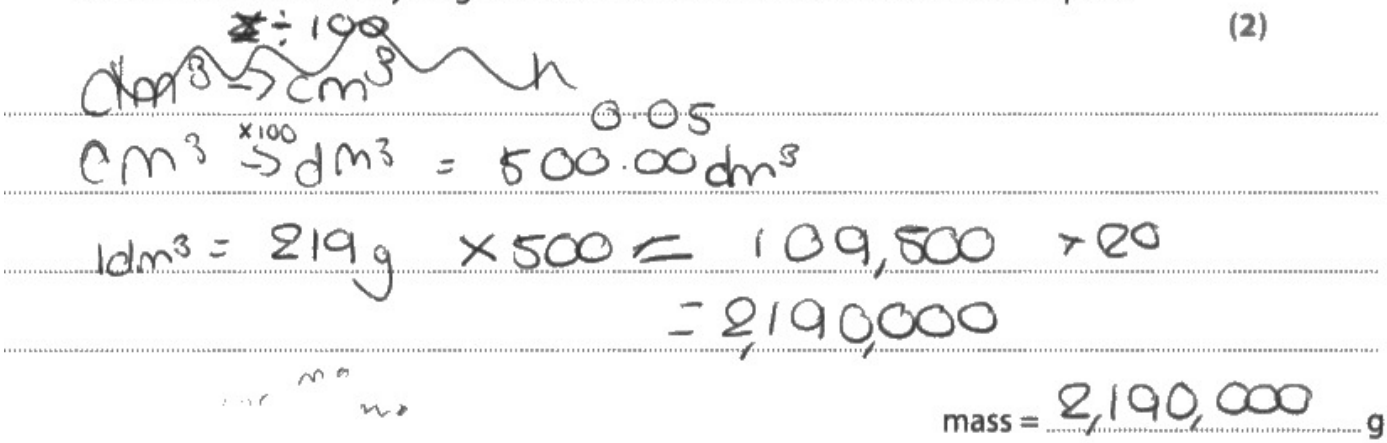
In this calculation question, a good number of candidates showed their workings which made marking points easier to identify (and so part marks could be awarded as not many scored both marks). The most common error was due to the incorrect conversion of cm^3 to dm^3 (or no conversion at all). Other common errors included only multiplying two of the values, for example, 219 x 20 or 219 x 5.

(c) A flame photometer was used to analyse samples of a solution of metal ions.

Each sample was treated with 5.00 cm^3 of dilute hydrochloric acid.
1.00 dm^3 of the acid contained 219 g of hydrogen chloride.

Calculate the mass of hydrogen chloride in the acid used to test 20 samples.

(2)



ResultsPlus
Examiner Comments

This is a response that was awarded 1 mark. The conversion to dm^3 is incorrect, but because the candidate has shown their workings, the examiner could identify that this was the only error, so 1 mark could be awarded.

Paper Summary

Based on their performance in this paper, candidates should:

- Consider all of the practical work they have undertaken, and particularly those mentioned in the specification. Learn the names of the apparatus, and the reasons each step in the procedure is carried out.
- Practice the calculations that have appeared in past papers.
- Learn well the tests for gases and ions.
- Practice structuring six-mark questions so that all aspects of the question are answered.
- Learn the name of common acids and how they react with metals, metal oxides, metal hydroxides and carbonates.
- Practice finding the rate of reaction using data, including a graph.

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