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June 2022

GCSE Combined Science 1SC0 2CF

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Introduction

This paper is the second of two Chemistry papers in the suite of six papers for Combined Science. The paper comprises of a total of six questions which are taken from the foundation tier GCSE Chemistry paper – Paper 2. 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)

This question was generally well answered with the majority of candidates being able to give the symbol of another element in group 1. The majority of candidates gave the answer Rb. However, some candidates did not read the question carefully and named the element rather than giving the symbol, which was not creditworthy.

The following is a response that was awarded the 1 mark.

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

(1)

Rb

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Examiner Comments

This is an example of the most commonly correct answer seen.

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 candidate did not read the question carefully and gave the name of the element rather than the symbol, which was not a creditworthy response.

Question 1 (a)(ii)

In part (ii) of question 1, candidates were asked to give the atomic number of lithium. A good proportion of candidates could give the correct atomic number of 3. However, many candidates confused the atomic number with the relative mass and gave an answer of 7.

(ii) Give the atomic number of lithium.

(1)

3

ResultsPlus
Examiner Comments

This is an example of a response with the correct answer which was awarded the 1 mark.

This is a response that was awarded zero marks.

(ii) Give the atomic number of lithium.

(1)

7

ResultsPlus
Examiner Comments

The candidate lost the mark for giving the relative mass rather than the atomic number.

Question 1 (a)(iii)

In this question, candidates were generally successful in describing the trend in melting points of the alkali metals in figure 1 to gain both marks.

Where candidates did not score, it was often because they discussed the trend in reactivity rather than melting point. In some cases, the candidates gave the reverse argument and stated that the melting point increased up the group, which was accepted and both marks awarded. Some candidates also referred to the melting point decreasing as the atomic number increased, which was also accepted and marks awarded.

(iii) Describe the trend in the melting points of the elements in Figure 1.

(2)

The higher the atomic number the lower the melting point.

ResultsPlus
Examiner Comments

Candidates that linked the increasing atomic number to the decreasing melting points gained both marks, as in this example.

(iii) Describe the trend in the melting points of the elements in Figure 1.

(2)

Melting point decreases as you go down the group

ResultsPlus
Examiner Comments

This example scored 2 marks.

(iii) Describe the trend in the melting points of the elements in Figure 1.

(2)

As you go ~~down~~ up the group, the melting point increases. Lithium has the highest melting point.

ResultsPlus
Examiner Comments

The candidate gave the reverse argument (ORA). This was accepted and both marks awarded.

(iii) Describe the trend in the melting points of the elements in Figure 1.

(2)

The melting points are decreasing.

ResultsPlus
Examiner Comments

Some candidates scored just 1 mark for giving part of the trend. If they had stated that the melting points were decreasing down the table, this could have scored the second mark.

Question 1 (b)(i)

Candidates performed well in this question with the majority scoring the mark for giving the name of the container as a test tube. In some cases, candidates stated just 'tube' alone, which was not accepted. Where candidates lost the mark, it was because they gave names of other laboratory equipment, such as flask.

Give the name of the container shown in Figure 2.

(1)

Tube

ResultsPlus
Examiner Comments

Tube alone did not score the mark.

Give the name of the container shown in Figure 2.

(1)

flask

ResultsPlus
Examiner Comments

Flask was a commonly seen incorrect answer. This gained no marks.

ResultsPlus
Examiner Tip

You must ensure that you are aware of the names and uses of all the standard laboratory equipment used in experiments.

Question 1 (b)(ii)

In this question, candidates were asked to explain changes that would make the experiment safer. Many candidates were able to explain a change to step 2, showing an understanding that using less sodium would cause the reaction to be smaller. However, some weaker responses repeated the stem by stating that using less sodium would make the reaction less vigorous, rather than explaining that it would cause a smaller or less of a reaction. Fewer candidates were able to state a change to step 3. A common incorrect answer was to add just 1 drop of water. Weaker responses suggested safety precautions, such as wearing goggles, gloves or standing back rather than making a change to the method. Another common incorrect response was to add a lid to the container.

This is a response that was awarded the full 3 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

make the cube of sodium smaller for a weaker reaction

step 3: change and explanation

put more water into a bigger container.

ResultsPlus
Examiner Comments

It was very rare to find candidates explaining the second change. However, this answer scored for the change and explanation in step 2 and the change in step 3.

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

You could change the cutting of the sodium to 1cm x 1cm x 1cm.

step 3: change and explanation

You could put two drops of water in, instead of a few drops.

ResultsPlus
Examiner Comments

Some candidates gave measurements that should be used for the sodium. This was accepted and the mark for the change in step 2 awarded.

In this response, the candidate has given no explanation as to how this would make the reaction safer for the second mark in step 2. Adding two, or fewer drops was a common incorrect answer for step 3. Therefore, this response scored 1 mark.

ResultsPlus
Examiner Tip

When asked for an explanation, remember to make your point and then give the reason why for the second mark.

The following 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

Use a ~~lower con~~ smaller amount of Sodium.

step 3: change and explanation

use a less reactive metal like copper

ResultsPlus
Examiner Comments

A smaller amount of sodium scored in step 2. Changing the type of metal was not accepted.

Question 2 (b)(i)

Many candidates were successful at recognising that apparatus A, or the thermometer, was used to measure the temperature to gain the mark.

The following is a response that was awarded the 1 mark.

(i) Give the letter of the piece of apparatus, **A**, **B**, **C** or **D**, in Figure 3 that is used to measure the temperature.

(1)

Thermometer

ResultsPlus
Examiner Comments

Some candidates gave the name rather than the letter for the apparatus. This was accepted and scored the mark, as in this example.

(i) Give the letter of the piece of apparatus, **A**, **B**, **C** or **D**, in Figure 3 that is used to measure the temperature.

(1)

A

ResultsPlus
Examiner Comments

This correct answer scored 1 mark.

Question 2 (b)(ii)

The majority of candidates were able to name correctly the apparatus B as a beaker. However, common incorrect answers given were measuring cylinder, conical flask and jug.

The following is a response that was awarded zero marks.

(ii) Give the name of the piece of apparatus **B** shown in Figure 3.

(1)

FLASK.

ResultsPlus
Examiner Comments

Many candidates could not name the piece of apparatus. Flask was a common incorrect answer, as in this example.

(ii) Give the name of the piece of apparatus **B** shown in Figure 3.

(1)

measuring cup

ResultsPlus
Examiner Comments

The candidate has given the incorrect answer as measuring cup. No marks were awarded.

ResultsPlus
Examiner Tip

You should ensure that you are aware of the names and uses of common laboratory equipment. In particular, 'jug' and 'cup' are household items and are not acceptable alternatives for beaker.

This is another response that was awarded zero marks.

(ii) Give the name of the piece of apparatus **B** shown in Figure 3.

(1)

Mesuring Cylinder

ResultsPlus
Examiner Comments

Measuring cylinder was another commonly seen incorrect answer, as in this case.

Question 2 (b)(iii)

A good proportion of candidates knew that polystyrene is a better insulator than glass with many stating that the polystyrene would trap heat, which was accepted for the mark.

Some confused the terms insulator and conductor and stated that polystyrene was a good conductor of heat, and so did not score the mark.

Of those that did not get the mark, the most common incorrect answer was that the glass might break or shatter and so polystyrene would be a safer alternative. In addition, a noticeable proportion of candidates thought that the polystyrene would not melt or had a higher melting point than glass.

(iii) The piece of apparatus labelled **C** is made from polystyrene.

State why polystyrene is a better material than glass for this piece of apparatus.

(1)

because polystyrene won't shater during an experiment, like glass can.

ResultsPlus
Examiner Comments

This is an example of a common answer that did not score.

(iii) The piece of apparatus labelled **C** is made from polystyrene.

State why polystyrene is a better material than glass for this piece of apparatus.

(1)

because polystyrene is an insulator.

ResultsPlus
Examiner Comments

This answer scored 1 mark for understanding that polystyrene is an insulator.

Question 2 (b)(iv)

Despite candidates understanding that they needed to calculate the difference between both temperatures in this question, the majority did not pay attention to which temperature corresponds to the beginning and the end of the experiment to see that the temperature had decreased. Therefore the most common answer seen was 2.5°C which scored 2 marks or 2.5 alone which scored 1 mark.

A small number of candidates made an error when calculating the temperature change but were still able to gain 1 mark for the unit.

Figure 4

Calculate the change in temperature.

Give a sign and a unit in your answer.

18.6
16.1 = 2.5

(3)

2.5 Drops -2.5°C

ResultsPlus
Examiner Comments

This response was awarded the full 3 marks. – 2.5°C is the correct answer.

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

18.6
− 16.1
02.5

Figure 4

Calculate the change in temperature.

Give a sign and a unit in your answer.

(3)

temperature change = 2.5 °C

ResultsPlus
Examiner Comments

Some candidates did not show an understanding that the temperature had decreased during the reaction so scored 2 marks, eg, 1 mark for 2.5 and 1 mark for the unit, as in this example.

Question 2 (b)(v)

Candidates found giving the formula and the name of the solid formed from NH_4^+ and NO_3^- ions very difficult with few candidates scoring. A noticeable number of blank responses were seen showing little understanding of this skill. In some cases, candidates gave the formula $N_2H_4O_3$ which was accepted for the mark. It was pleasing to see that those candidates that did get the correct formula, few lost the mark for incorrect capitalisation of letters or non-subscripts. A common answer that did not score was where candidates simply placed a + sign in between the two ions, eg, $NH_4^+ + NO_3^-$

Nitrogen hydroxide and sodium were commonly seen incorrect names.

(v) The solid used in this experiment contained only NH_4^+ ions and NO_3^- ions.

Give the formula and the name of the solid.

(2)

formula NH_4NO_3

name Ammonium nitrate

ResultsPlus Examiner Comments

This correct answer was awarded both marks.

(v) The solid used in this experiment contained only NH_4^+ ions and NO_3^- ions.

Give the formula and the name of the solid.

(2)

formula $NH_4^+ + NO_3^-$

name sodium

ResultsPlus Examiner Comments

A common error was to write the ions into an equation with a + in the middle. Sodium was a commonly seen incorrect answer. This is an example of a response that was awarded no marks.

Question 3 (a)(i)

In general, this question was well answer with the majority of candidates gaining both marks for knowing that carbon and hydrogen are present in the compound shown.

Where candidates did not score, it was often as they confused carbon for chlorine or copper.

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

(2)

Hydrogen

Carbon

ResultsPlus
Examiner Comments

This example scored both marks.

This is a response that was awarded 1 mark.

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

(2)

Chlorine

hydrogen

ResultsPlus
Examiner Comments

Where candidates did not score, it was often as they confused carbon with chlorine.

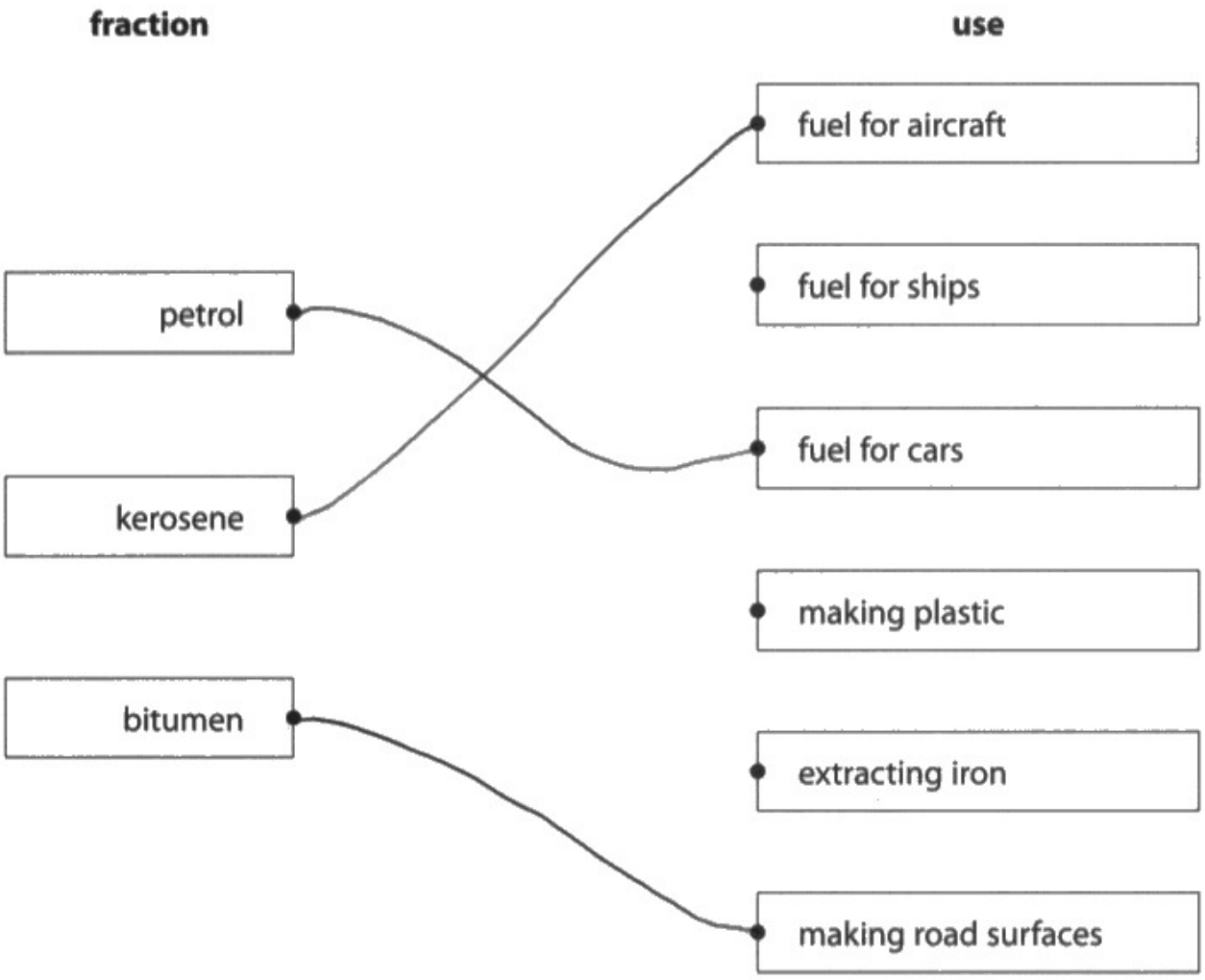
Question 3 (b)

Candidates performed well in this question with the majority scoring. The better responses stated the use of petrol and then bitumen. It was pleasing to see that the majority of candidates followed the instructions from the stem of the question and only drew one straight line from each fraction to each use.

(b) Crude oil can be separated into different fractions.

Draw **one** straight line from each fraction to a use of that fraction.

(3)



ResultsPlus
Examiner Comments

This answer scored the full 3 marks.

Question 3 (c)

This question asked candidates to state and explain the colour change of litmus paper when hydrogen chloride gas and sulfur dioxide gas are dissolved in separate test tubes of water.

A large proportion of candidates confused hydrogen chloride with chlorine and so gave the result of testing chlorine with litmus paper rather than the solution of hydrogen chloride.

However, the marking points were independent so if candidates understood that the hydrogen chloride solution was acidic, then the second marking point would have been awarded.

Where candidates knew that the hydrogen chloride solution would turn the litmus red because it was acidic, they often then thought that the sulfur dioxide would have to be the opposite effect, and vice versa, therefore limiting marks to 2.

The better responses stated that both gases would produce an acidic solution and therefore turn the litmus paper red.

(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 blue litmus paper is dipped into hydrogen Chloride it will change colour to red because it is an acid. when it is dipped into Sulfur dioxide it will go purple because it is an alkali.

ResultsPlus
Examiner Comments

This answer gained 2 marks and was a very common response.

Candidates that knew that one gas was acidic, often thought incorrectly that the other gas must be alkaline.

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)

The litmus would, over time, change into a red / pink / purple colour.

ResultsPlus
Examiner Comments

The candidate has stated that the litmus paper would change red, whilst this is correct. However, they have also given pink and purple as a response. Pink would be allow but any other colours are rejected, so no marks were awarded.

ResultsPlus
Examiner Tip

When asked for a colour change, avoid giving a list of colours as the incorrect answers will negate the correct colour.

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)

In hydrogen chloride the litmus paper would turn white because it reacts. bleach will have bleached the litmus paper

ResultsPlus
Examiner Comments

Hydrogen chloride bleaching the litmus was a common incorrect answer that was rejected for the first marking point.

The marking points were independent, so if the candidate had gone on to state that the gas was acidic, this could have gained the second marking point.

Question 4 (b)(i)

This question asked candidates to write the word equation for the reaction of forming iron chloride when iron wool is heated with chlorine.

The majority of candidates wrote the word equation as 'iron wool + chlorine'. Iron wool was accepted as a reactant and the mark for the left-hand side of the equation was scored.

In some cases, candidates tried to write a symbol equation. This was often unsuccessful as it had to be fully correct to score the marks.

The following is a response that was awarded 2 marks.

(b) Bromine, chlorine and iodine all react with heated iron wool.

Figure 6 shows the speed of these reactions.

halogen	description of reaction with heated iron wool
bromine	reacts quickly
chlorine	reacts very quickly
iodine	reacts slowly

Figure 6

(i) When iron wool is heated with chlorine, iron chloride is formed.

Write the word equation for this reaction.

(2)

Iron Wool + Chlorine = Iron Chloride

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Examiner Comments

Iron wool was allowed for iron. The equals sign was allowed in place of the arrow.

This is an example of a response that was awarded zero marks.

(b) Bromine, chlorine and iodine all react with heated iron wool.

Figure 6 shows the speed of these reactions.

halogen	description of reaction with heated iron wool
bromine	reacts quickly
chlorine	reacts very quickly
iodine	reacts slowly

Figure 6

(i) When iron wool is heated with chlorine, iron chloride is formed.

Write the word equation for this reaction.

(2)

Fe + Cl → FeCl

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Examiner Comments

Some candidates tried to write a symbol equation even though the question asked for a word equation.

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Examiner Tip

When asked for a word equation, do not try to attempt a symbol equation as this is a difficult skill and, therefore, much harder to score the marks.

Question 4 (b)(ii)

In part (ii), candidates were successful in selecting chlorine as the halogen in figure 6 that is the most reactive with iron.

The weaker responses that did not score were often related to candidates not reading the information in the table carefully and stating bromine, as it was at the top of the table.

(ii) Give the name of the halogen in Figure 6 that is the most reactive with iron.

(1)

bromine

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Examiner Comments

This is an example of a common incorrect answer that scored no marks.

(ii) Give the name of the halogen in Figure 6 that is the most reactive with iron.

(1)

chlorine

ResultsPlus
Examiner Comments

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

Question 4 (b)(iii)

Candidates attempted a range of different methodologies to calculate the mass of iron and mass of chlorine in the sample, which were largely successful and with many scoring the full 3 marks.

A number of candidates chose to use 'chunking' to calculate the percentage. However, this method sometimes led to an incorrect value, as some candidates forgot to add the 0.4 to their chunked 34. A commonly seen incorrect value was 4300g for the mass of iron, suggesting that a large number of candidates did not understand percentages.

(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%.

125g = 100%.

43g = 34.4%.) 0.344

125 - 43

= 82

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

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Examiner Comments

This candidate has calculated the values correctly. However the answers were incorrectly transferred to the answer lines. This was a common error in this question and, in this case, a mark of 2 rather than 3 was awarded.

(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 125 = 43

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

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Examiner Comments

The candiadte has calculated the correct value for iron to gain 2 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)

125 ÷ 100 = 1.25 x 34.4 = 43.

125 − 43

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

ResultsPlus
Examiner Comments

This is an example of a response that was awarded the full 3 marks for the correct answer.

Question 4 (c)

This gap-fill question in part (c) was well attempted with a reasonable number of candidates scoring both marks.

A good proportion knew that iron chloride was a catalyst. Where candidates did not score both marks, it was often because they thought that the mass of the iron chloride would be higher.

The iron chloride speeds up the reaction because it is a catalyst

After the reaction, the mass of iron chloride is higher

ResultsPlus Examiner Comments

This answer scored 1 mark for 'catalyst'.

The iron chloride speeds up the reaction because it is a catalyst

After the reaction, the mass of iron chloride is unchanged

ResultsPlus Examiner Comments

This is an example of a response that was awarded the full 2 marks for the correct answer.

Question 5 (a)(i)

In this question, candidates were asked to name a piece of equipment that would be better to measure the volume of gas produced, and to state a reason.

The majority of candidates found this question very challenging and only a few referred to using a smaller measuring cylinder or gas syringe for the first marking point. However, for the second marking point, very few candidates referred to smaller graduations or a higher resolution. Some of the better responses were awarded the second marking point for stating that the gas syringe would be more accurate.

Many inappropriate pieces of equipment for measuring volumes of gas were suggested, such as a ruler, balance, stopwatch, thermometer and jug. The better responses correctly stated using a gas syringe. However, many of these responses stated that it would be better as no gas would escape, which was not accepted and just 1 mark was awarded for the use of a gas syringe.

The following is a response that was awarded the full 2 marks.

Give a reason for your answer.

(2)

name of apparatus

A gas syringe.

reason

It can measure gas much more accurately and is more appropriate.

ResultsPlus
Examiner Comments

In this response, 'gas syringe' was awarded the first mark and 'more accurate' gained the second mark.

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

water condenser

reason

it traps all the gas so its easier to calcuate

ResultsPlus
Examiner Comments

This is an example of a candidate not reading the question carefully and describing the use of condensers, which would change the gas to a liquid.

This is another 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

gas themometer

reason

gives a more accurate result.

ResultsPlus
Examiner Comments

The second marking point was dependent on the first. Therefore, as the candidate stated that a thermometer should be used, they could not score the second marking point for stating that this would be 'more accurate'.

(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

ruler

reason

so you can look at the measurements more clearly and accurately

ResultsPlus
Examiner Comments

This answer scored no marks.

Question 5 (a)(ii)

In part (ii), candidates were asked to calculate the mean rate of production of hydrogen over the first 90 seconds in cm3 per second.

The majority of candidates found this a challenging question. However, some candidates were able to use the graph to find the volume of gas at 90 seconds, but then took this no further to calculate the mean rate. A number in the range of 28-30 was allowed. A few candidates tried to incorrectly calculate a mean average for a series of volumes.

Candidates that did take the calculation forward, a large proportion inverted the calculation and divided the time by the volume rather than volume by time and lost the second mark. However, with error carried forward, the third mark was scored and so these answers scored 2 of the 3 marks available.

The following 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)

29 ÷ 90 = 0.32

rate = 0.32 cm^3 per second

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Examiner Comments

Using 29 as the value from the graph, the candidate has correctly calculated the mean rate to gain all three marks.

This is a response that was awarded 2 marks.

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

(3)

90 seconds = 28 cm^3

90 ÷ 28 = 3·2

rate = 28 . 3 3·2 cm^3 per second

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The candidate gained marking point 1 for reading the volume as 28 from the graph. The fraction was inverted and so marking point 2 was not awarded. However, with error carried forward, the third marking point was awarded.

This is a response that was awarded 1 mark.

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

(3)

~~150~~ 5 minute and a half equals to 29.5

rate = 29.5 cm^3 per second

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The candidate has read the value as 29.5, which was within the allowable range. However, as the candidate did not carried out any further workings to calculate the mean rate of production, only 1 mark was awarded.

Question 5 (a)(iii)

In part (iii), most candidates knew that the measurements could be stopped at 9 minutes because the volumes had stopped rising, or were constant. Many candidates stated that the volume of hydrogen changes, which gained the mark. However, many of the weaker responses stated that the reaction had stopped, that the line was straight or that the graph had reached its highest point, all of which were not acceptable answers.

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

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

(1)

The volume of hydrogen stayed constant

ResultsPlus
Examiner Comments

This is an example of a response that was awarded 1 mark.

This is another response that was awarded zero marks.

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

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

(1)

Because the reaction has stopped.

ResultsPlus
Examiner Comments

The candidate stated that the reaction had stopped, which was not an accepted answer.

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

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

(1)

The graph reached a straight line

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Examiner Comments

This response was awarded zero marks for the incorrect answer.

ResultsPlus
Examiner Tip

When describing a graph, stating that a line is 'straight' is not sufficient. Candidates should describe the line in more detail, eg, in this case, saying that it had 'plateaued', was 'flat' or that it had 'levelled off' would have gained the mark.

Question 5 (b)(i)

Candidates found it very hard to explain why the rate of reaction increased when the concentration of acid increased. A few candidates referred to more particles being present and fewer referred to more frequent collisions. Some candidates did not attempt this question.

Some of the weaker responses referred to just 'more collisions' or simply restated the stem of the question that an increased concentration means a faster reaction. A commonly seen incorrect answer was that there was more acid.

A large proportion of candidates seemed confused and incorrectly referred to the acid as a catalyst, or that the increased concentration of the acid had higher kinetic energy.

Candidates were often successful at scoring 1 mark for stating that there were more particles rather than for more frequent collisions.

(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)

higher reactivity, more energy in the particles to move creating more successful collisions.

ResultsPlus
Examiner Comments

This is an example of a response that was awarded zero marks.

(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)

because there are more particles that can collide with each other as the concentration has increased.

ResultsPlus
Examiner Comments

This is a response that was awarded 1 mark. The candidate has referred to more particles but has not understood that the collisions are more frequent for the second mark.

(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)

because ~~the~~ with more particuls in the higher concentration acid there is more of a chance that the particuls will bump together, causing a reaction.

ResultsPlus
Examiner Comments

This is a response that was awarded the full 2 marks. The candidate has stated that there are more particles for the first marking point. The candidate was awarded the second marking point for stating that there is 'more chance that the particles will bump together' as an acceptable alternative to 'more chance of collisions'.

This is a response that was awarded zero marks.

(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 acid is a catalyst

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Examiner Comments

This is an example of a very commonly seen incorrect answer that the acid is a catalyst.

Question 5 (c)

This question focused on marble chips and candidates were asked to describe how the student could make small and medium sized marble chips from large chips.

It was clear that many candidates had limited knowledge and understanding of marble chips as many referred to cutting the chips with a knife or melting them together.

Some of the better responses stated that the marble chips could be crushed or broken, although only a few described how this should be done.

(c) The apparatus in Figure 7 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)

They can acheive this by crushing them with something such as a pestel and ~~mot~~ mctar.

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Examiner Comments

This is an example of a good answer that was awarded the full 2 marks.

(c) The apparatus in Figure 7 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)

You can make the larger chips smaller by cutting them down into smaller pieces.

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Examiner Comments

This is an example of a very commonly seen incorrect answer that did not score. The candidate has stated that the marble chips could be cut to make them smaller.

This is a response that was awarded zero marks.

(c) The apparatus in Figure 7 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)

The Students could melt the marble chips and reshape them into a smaller, medium and large chips

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Examiner Comments

This is an example of a candidate who is not familliar with marble chips. The candidate has described melting them together to form different sized chips.

Question 6 (c)

This question required candidates to carry out a simple calculation to find the mass of carbon dioxide that has been released when a sample of calcium carbonate was heated, and give their answer to three significant figures.

A good proportion of candidates subtracted the numbers to gain the first marking point, but of these, few were able to give their answer to three significant figures.

Where candidates made an error in the initial calculation, if they had used numbers from the question, and their answer was given to three significant figures, then error carried forward was applied and the second mark for significant figures was awarded.

(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 = 2.20

mass of carbon dioxide = 2.20 g

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Examiner Comments

This is an example of the correct answer, with clear workings, that scored both marks.

(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)

5.000g - 2.800g = 2.200

mass of carbon dioxide = 2.200 g

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Examiner Comments

The candidate has the correct calculation but not to the correct number of significant figures, so 1 mark was scored.

(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)

$\frac{5.000}{2.800} = 1.78657$

mass of carbon dioxide = 1.79 g

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Examiner Comments

This answer gained the second mark for the 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)

mass of carbon dioxide = 14 g

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Examiner Comments

In this example, the candidate has clearly multiplied the numbers in the question. However, no workings are shown and the answer has been given to 2 significant figures, so no marks were awarded.

Question 6 (d)(i)

Candidates found explaining why helium is inert difficult with few scoring full marks.

Candidates that scored 1 mark often did so for stating that helium had a full outer shell. However, it was rare to see candidates mention a lack of electron transfer, sharing loss or gain for the second mark.

Many candidates referred to the fact that helium equal numbers of subatomic particles, possibly misunderstanding the term inert. In addition, many candidates just stated the fact that helium is a noble gas/in group 0

(i) Explain, using Figure 9, why helium is inert.

(2)

This is because helium has a full outer shell so does not need to share or gain electrons so it has lack of reactivity.

ResultsPlus Examiner Comments

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

(i) Explain, using Figure 9, why helium is inert.

(2)

Because it has an equal number of protons, and neutrons and electrons

ResultsPlus Examiner Comments

This is an example of a commonly seen incorrect answer that scored no marks.

Question 6 (d)(ii)

Part (ii) of this question also proved very difficult for candidates with many not attempting the question.

Candidates often lost marks for demonstrating a lack of subject specific terminology as they referred to the gas being lighter than air, or that the gas floats, rather than less dense.

Other candidates stated that helium was a gas, that it was non-toxic or that it was unreactive, all of which were not acceptable responses.

(ii) Helium is used to fill balloons.

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

least reactive halogen (TIE) (1)

ResultsPlus Examiner Comments

References to reactivity were not accepted. This response was awarded zero marks.

(ii) Helium is used to fill balloons.

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

It has a lower density than air ✓ (1)

ResultsPlus Examiner Comments

This is an example of a response that was awarded the mark for the correct answer.

(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)

lighter than air

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Examiner Comments

This is an example of a commonly seen incorrect answer that did not score.

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Examiner Tip

Ensure that you use your scientific knowledge rather than common knowledge to answer questions.

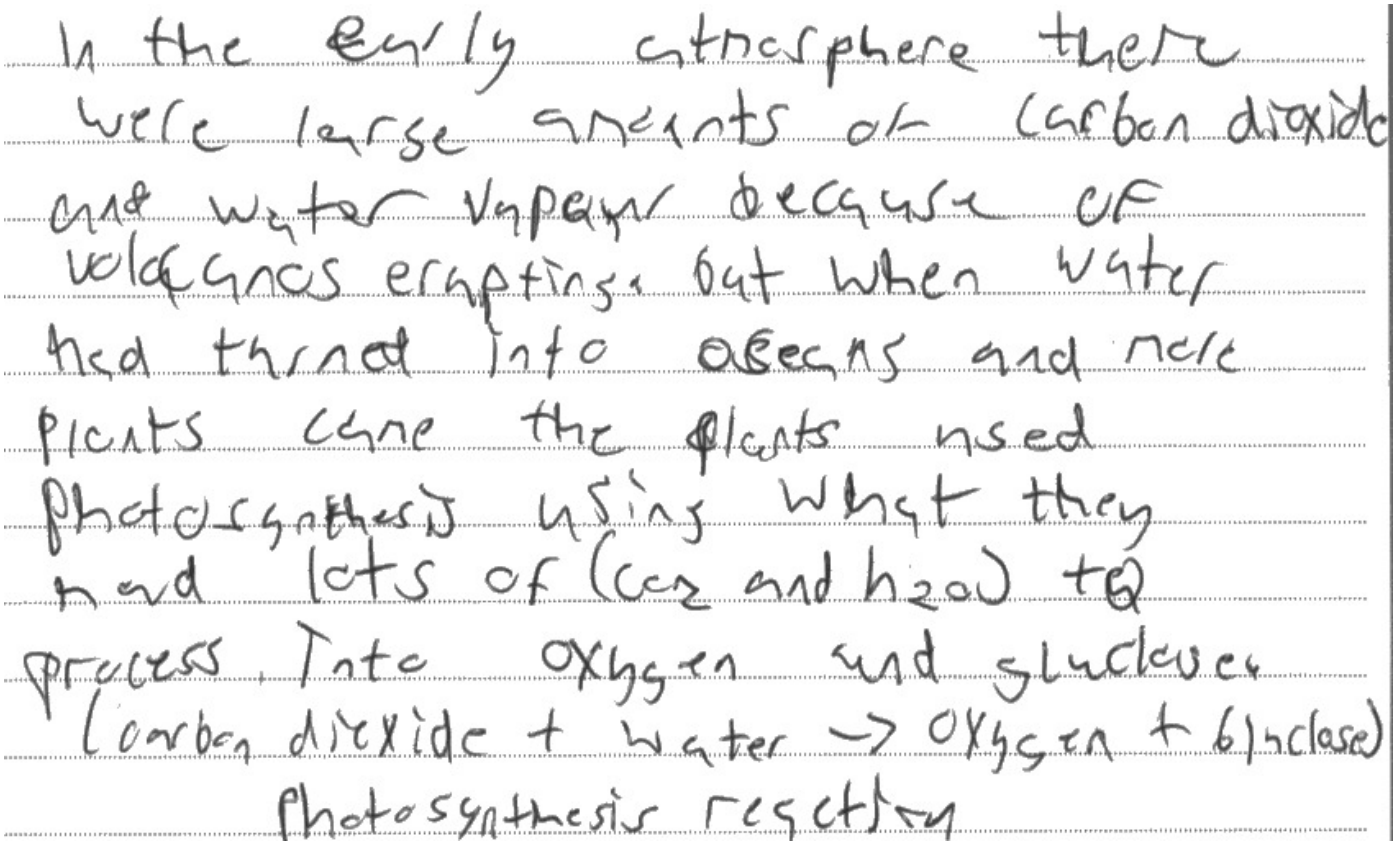
Question 6 (e)

Part (e) of this question is the 6-mark, extended open response question. The question asked candidates to consider a table of information about three gases in the atmosphere and explain how the relative amount of each of the gases has increased or decreased over time.

A noticeable number of candidates did not attempt this question. Some of the weaker responses simply restated or described the data in the table instead of giving an explanation. However, some of the better responses gained credit for explaining that plants carry out photosynthesis increasing oxygen levels and decreasing carbon dioxide levels, but nothing further.

There was often little reference to the evolution of the plants and many candidates forgot to explain the impact of human activities on the changes shown in the table.

The following is an example of a response that was awarded the full 6 marks.



Carbon overall had decreased but humans started using machines which burn fossil fuels and release carbon dioxide back into earths atmosphere.

The water vapour mostly all converted into water ~~the~~ making the seas.

Humans also inhale oxygen and convert it into carbon dioxide creating a cycle with of oxygen and CO_2 with plants.

The reason why water vapour was common in the early atmosphere was because earth was much more hotter than it is today having numerous volcanic grounds and storm clouds above but as earth cooled down it rained then creating more plants.

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Examiner Comments

The candidate starts by discussing how the gases were formed by volcanoes and then how water turned into oceans and plants formed. An explanation is given as to how the plants in the ocean photosynthesise and use carbon dioxide to produce oxygen. The reference to glucose is correct but it is irrelevant to the question and it is not credited. The candidate repeats this in a word equation, which would be creditworthy but this has already been considered. At this stage, the answer achieves 4 marks at level 2. However, the candidate then discusses people using machines which burn fossil fuels which produce carbon dioxide. The response is developed further by stating that the Earth cooled causing rain. Overall, the candidate has provided some detail in all three areas and is awarded the full 6 marks.

This is a response that was awarded 2 marks.

*(e) Figure 10 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 10

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 10 has increased or decreased over time.

(6)

Oxygen has increased drastically as plants have grown on the earth. They produce oxygen.

Carbon dioxide has also decreased drastically because of plants using it to grow – and converting it into oxygen.

Water vapour has decreased because the temperature of the earth has heated a lot over time.

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Examiner Comments

The candidate has given some basic ideas, such as 'plants produce oxygen' and 'plants use carbon dioxide to grow'. The last sentence talks about the temperature of the Earth heating, which is not credited. The basic ideas are sufficient for full credit at level 1 and two marks were awarded.

This is a response that was awarded 4 marks.

Over time water vapour has decreased in the atmosphere, this is a result in the earth cooling down. This caused evaporated the water vapour then condensed it, this formed clouds and rain. This led to oceans also being made.

Carbon dioxide has also decreased over time. This is because after the oceans had formed, the carbon dioxide was either absorbed by plants for photosynthesis or dissolved into the oceans. This resulted in

the carbon dioxide dissolving and forming shells on sea creatures like crabs.

Oxegen has increased over time due to plants being formed after the water vapour condensing. The plants photosythisised which means they took in carbon dioxide and gave out oxegen to the atmosphere.

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Examiner Comments

The candidate states that water vapour has decreased as the Earth cooled down and the water vapour condensed and clouds and oceans were formed. They go on to state that carbon dioxide has decreased because it was absorbed by plants in photosynthesis and dissolved in oceans forming shells on sea creatures like crabs. In addition, the candidate states that oxygen has increased over time as plants photosynthesised and took in carbon dioxide and gave out oxygen. Therefore, although there are good explanations for both the origins and evolution, the candidate has not referred to the human effects, and so 4 marks at the top of level 2 was awarded.

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Examiner Tip

When answering 6-mark levels-based questions, ensure that you address all aspects of the question in your answer.

This is a response that was awarded zero marks.

Explain how the relative amount of each of the gases in Figure 10 has increased or decreased over time.

(6)

water vapour - in the early atmosphere had a large amount and today it has 0% to 4%. The amount has decreased over the years.

Carbon dioxide - in the early atmosphere had a large amount and ~~today~~ it had less than 0.5%. The amount has decreased over the years.

oxygen - in the early atmosphere it had little or no and today it has 21%. The amount has increased over the years.

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Examiner Comments

The candidate has restated the information in the table with no explanation how the relative amounts have increased or decreased over time. Therefore, the answer gained no marks.

Paper Summary

Based on their performance in this paper, candidates should:

- Read the questions carefully and, if there is time, re-read the question along with their answer to check that their answer relates to the question set.
- Ensure that they are familiar with common laboratory equipment names and uses, and the equipment specific to core practicals.
- Practice calculations from the specification ensuring that workings are shown in a logical way so that intermediate marks and error carried forward can be applied, where necessary.
- Practice using a graph to find the mean rate of reaction.
- Practice writing word equations of common reactions from the specification.
- Practice writing formulae and naming compounds from given ions.
- Ensure that when answering six-mark questions, all aspects of the question are addressed.

Grade boundaries

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