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Examiners' Report
June 2022

GCSE Chemistry 1CH0 1F

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Introduction

This is the first 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)

Question 1a was generally well answered with the majority of candidates being able to name the two elements as phosphorous and potassium. In some cases, candidates did not follow the instructions and neglected referring to the periodic table, as advised, and so found the question more challenging.

Question 1 (b)(i)

Many candidates were able to score the mark for recalling that the industrial process used to produce ammonia is the Haber process.

Question 1 (b)(ii)

The vast majority of candidates were able to recall the meaning of the reversible symbol to gain the mark. Some candidates stated that it represented a dynamic equilibrium which was accepted and gained 1 mark.

(ii) State the meaning of the ⇌ symbol in the equation.

(1)

reversable

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Examiner Comments

This is a response that was awarded the mark.

Question 1 (c)

Overall, candidates were able to use the information in the stem of the question to write the word equation. In some cases, candidates lost the mark on the left-hand side of the equation as they wrote nitrogen rather of nitric acid. Some lost marks on the right-hand side of the equation as they referred to the production of ammonia nitrate rather than ammonium nitrate, even though this was in the stem of the question.

(c) Ammonia reacts with nitric acid to produce ammonium nitrate.

Write the word equation for this reaction.

(2)

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Examiner Comments

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

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Examiner Tip

Candidates should take care when writing the names of chemical substances to ensure that they are naming them correctly.

This is a response that was awarded zero marks.

(c) Ammonia reacts with nitric acid to produce ammonium nitrate.

Write the word equation for this reaction.

(2)

NH_3 + NA_2 → NH_3 NA_2

ResultsPlus
Examiner Comments

The candidates did not read the question properly and attempted to write a symbol equation rather than a word equation. This is a much harder skill and the few candidates that attempted this approach gained the mark. However, although some candidates used the NH_3 from part (iii), it was very rare for them to also recall the formula of the nitric acid or ammonium nitrate.

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Examiner Tip

Candidates should look carefully at the stem of the question to see if a word or a symbol equation is required. If asked for a word equation, candidates should not attempt a symbol equation as this is a significantly harder skill.

Question 2 (a)

Candidates found it hard to put into words a difference in arrangement and movement of particles between a solid and a liquid. When marks were awarded, it was often for stating that the particles in a liquid move.

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

(a) Describe the differences in the arrangement and movement of the particles in a solid and in a liquid.

(2)

difference in arrangement of particles

In a solid the particles are in a fixed structure touching together and they do not move.

difference in movement of particles

In a liquid they move around in an area but bounce off each other continuously and are not fixed.

ResultsPlus
Examiner Comments

Some candidates did not use the scaffolding given in the question and wrote their answer in different places on the answer page. However, this was accepted and marks awarded.

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

(a) Describe the differences in the arrangement and movement of the particles in a solid and in a liquid.

(2)

difference in arrangement of particles

The arrangement in a solid is regular and particles are touching while in particles in a liquid has a random set structure

difference in movement of particles

Particles in solids vibrate next to eachother. Particles in a liquid moves around eachother

ResultsPlus
Examiner Comments

Only one comparative point was required for each mark to be awarded, although most candidates gave both halves of the comparison, as in this example. This was accepted, as long as the answers were not contradictory.

Question 2 (c)

Candidates performed well in this question with many scoring the mark for stating that the melting point of the metal is too high.

The following is an example of a response that was awarded the mark.

(c) Give a reason why the metal spoon has not changed state during the experiment.

(1)

Because the melting point is alot higher than chocolate.

ResultsPlus Examiner Comments

The candidate has correctly stated that the melting point is higher than that of chocolate.

This is a response that was awarded zero marks.

(c) Give a reason why the metal spoon has not changed state during the experiment.

(1)

Because it has a high boiling point

ResultsPlus Examiner Comments

The candidate has referred to the boiling point of the metal.

Question 2 (d)

In general, most candidates made a good attempt at question 2d, with many scoring at least 1 mark for stating that the egg white had turned to a solid. This was followed up with the understanding that change is irreversible or permanent to score the second marking point.

Question 3 (a)(ii)

Question 3a(ii) was answered well by candidates with many showing an understanding that chlorine is added to kill bacteria to gain the mark.

(ii) State the reason why chlorine is added during the water treatment.

(1)

to Rill bacteria

ResultsPlus Examiner Comments

This is a response that was awarded the mark. It was a common answer to this question.

This is a response that was awarded zero marks.

(ii) State the reason why chlorine is added during the water treatment.

(1)

chlorine will kill any impurities in the water so you are able to ~~them~~ it drink it.

ResultsPlus Examiner Comments

The candidate stated that the chlorine would kill impurities which was considered too vague and did not gain the mark.

This is another response that was awarded zero marks.

(ii) State the reason why chlorine is added during the water treatment.

(1)

To clean it and make it safe

To clean it and make it safe.

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Examiner Comments

The candidate lost the mark because they stated that the chlorine is added to 'clean' the water, which was not creditworthy.

Question 3 (a)(iii)

Candidates found describing how sedimentation is carried out very challenging.

The following is a response that was awarded zero marks.

(iii) Describe how sedimentation is carried out.

(2)

sedimentation is when the water is passed through a funnel and the sand and any bits are removed so the water is on its way to being safe to drink.

ResultsPlus
Examiner Comments

The candidate has described the process of filtration rather than sedimentation, which was not creditworthy .

ResultsPlus
Examiner Tip

In other responses, candidates described large objects being removed which also was not an accepted answer.

This was another response that was awarded zero marks.

(iii) Describe how sedimentation is carried out.

(2)

Sedimentation is occurs second in the process to Firstly, the substance is heated. Then, sedimentation removes any excess molecules.

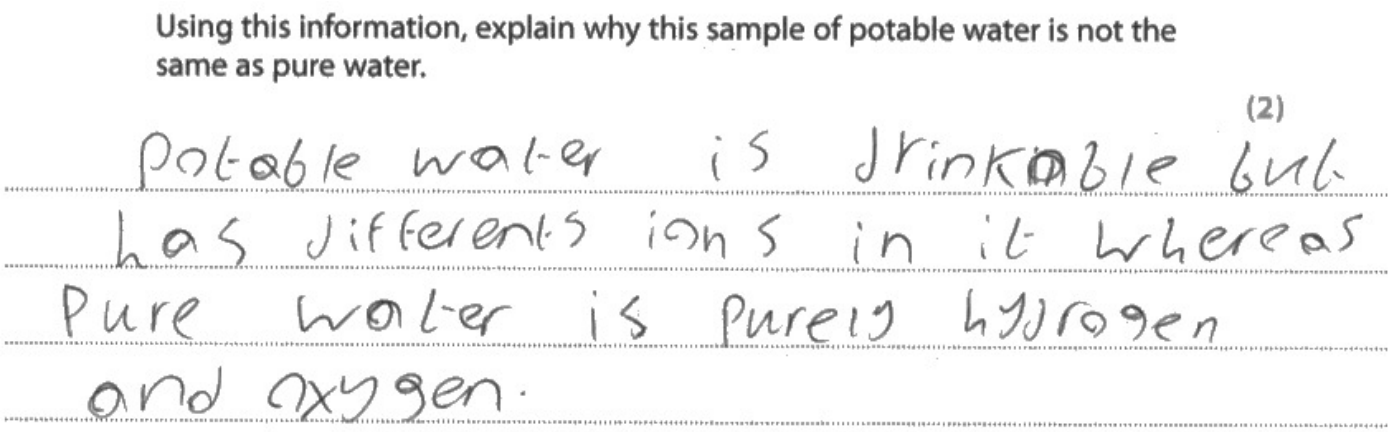
ResultsPlus
Examiner Comments

Another common misconception seen was that sedimentation involved heating the water.

Question 3 (a)(iv)

Question 3a(iv) was also challenging for most candidates. However, many candidates were able to score 1 mark for identifying that the potable water contains ions, or naming one of the ions present.

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


Using this information, explain why this sample of potable water is not the same as pure water.

(2)

Potable water is drinkable but has differents ions in it whereas Pure water is purely hydrogen and oxygen.

ResultsPlus Examiner Comments

The candidates was awarded the second mark for stating that water contains hydrogen and oxygen only.

ResultsPlus Examiner Tip

Candidates should address the command word in this question. A simple statement will not gain full credit.

Using this information, explain why this sample of potable water is not the same as pure water.

(2)

This sample of potable water is not the same as pure water because the sample has many different ions in it, whereas pure water is exclusively H_2O without anything else in it.

ResultsPlus
Examiner Comments

This is another response that was awarded the full 2 marks for a good answer.

Question 3 (b)(i)

Candidates found naming the delivery tube challenging. Many candidates were not awarded the mark for a variety of incorrect answers ranging from scientific equipment, a condenser to filtration tube, to common words, such as water straw.

Question 3 (b)(ii)

Most candidates understood that the water vapour was escaping. However fewer candidates knew the correct terminology to describe the bung that should be used to overcome the problem. References to using a lid, or cover, were frequently seen and did not gain credit.

The following is a response that was awarded zero marks.

(ii) The student made an error when setting up the equipment in Figure 6. This error meant no water could be collected in the test tube.

Explain what the student needs to do so water can be collected.

(2)

the tube transporting the water needs to actually be touching the water, so it can travel through the tube.

ResultsPlus
Examiner Comments

The candidate has incorrectly stated that the tube should be moved down so it touched the water, showing a clear misconception of the process of distillation.

ResultsPlus
Examiner Tip

Candidates should be aware of the names and uses of basic laboratory equipment in required practicals.

Question 4 (a)

Overall, candidates struggled to suggest a reason why the student carried out a rough titration before the two accurate titrations.

The following is a response that was awarded zero marks.

(a) Suggest why the student carried out a rough titration before the two accurate titrations.

(1)

To practise using the equipment correctly.

ResultsPlus
Examiner Comments

The candidate has suggested to practice using the equipment, which was not creditworthy.

This is another response that was awarded zero marks.

(a) Suggest why the student carried out a rough titration before the two accurate titrations.

(1)

to get ~~tt~~ accurate results.

ResultsPlus
Examiner Comments

Many candidates suggested that by doing the rough titration would make the experiment more accurate, which was not creditworthy.

ResultsPlus
Examiner Tip

For core practicals, candidates should be able to show an understanding of every part of the practical in question. They should understand how and why each part of the practical is carried out.

Question 4 (c)

In this question, candidates were successful at describing how the rough titration should be carried out, with many accessing a range of marks.

In some cases, candidates did not read the question carefully and described the preparatory part of the experiment, such as cleaning the equipment, filling the burette and pipette and adding the indicator. This was not creditworthy as it had been stated in the question that this part had already been completed.

The most common marking point awarded was for adding the acid to the alkali. Some candidates discussed adding it dropwise, but as this was describing a rough titration, this was not accepted.

The next most common marking point was for watching for the end point or, more commonly seen, 'until the indicator changes colour'. Some better responses discussed 'swirling' the mixture. However, candidates were less successful reading the initial volume, or final volumes, from the burette.

The following is an example of a response that was awarded the full 4 marks.

(c) Describe how the rough titration should be carried out once the dilute hydrochloric acid, lithium hydroxide solution and indicator are placed in the apparatus in Figure 7.

(4)

- tap on burrett should be opened
- stir conical flask whilst the hydrochloric acid drips into it.
- wait for a sharp colour change to occur.
- once colour change occurs, turn off tap.
- measure the amount of hydrochloric acid left and take it away from the initial amount.

The candidate has given a well-structured answer.

When being asked to describe a method, structuring your answer in this way by showing the steps that you would carry out in a logical way, and in the order that you would carry them out, shows clearly your understanding of the method and makes it easy for the examiner to see your understanding.

Question 4 (e)

Most candidates found this question challenging. Some of the better responses were able to explain what type of reaction was taking place in the titration.

The following is a response that was awarded 1 mark.

(e) During the titration the dilute hydrochloric acid, HCl, is reacting with the lithium hydroxide solution, LiOH.

Explain what type of reaction is taking place in the titration.

(3)

The type of reaction taking place is ~~reaction~~. neutralisation.

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Examiner Comments

As in this example, the majority of candidates gained one mark for stating that the reaction was a neutralisation reaction.

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

(e) During the titration the dilute hydrochloric acid, HCl, is reacting with the lithium hydroxide solution, LiOH.

Explain what type of reaction is taking place in the titration.

(3)

A neutralisation reaction is occurring as the dilute hydrochloric acid contains H^+ ions and the lithium hydroxide contains OH^- ions which both cancel each other out neutral using each other creating water.

ResultsPlus
Examiner Comments

Candidates that scored the first mark were often able to develop their response by explaining that the H^+ ions react with OH^- ions, or more commonly seen, that the acid reacts with the base or alkali. However, only a few candidates realised that this was a neutralisation reaction and were awarded the 3 marks, as in this example.

Question 5 (a)

Most candidates scored at least one mark for being able to give either the number of electrons, neutrons or protons in the aluminium atom as 13, 14 and 13 respectively.

Candidates often knew that two numbers had to be the same and it was common to see numbers the same, but these were not always the electrons and protons.

5 (a) An atom of aluminium has an atomic mass of 27.

Aluminium has an atomic number of 13.

State the number of electrons, neutrons and protons in this atom.

(3)

number of electrons = 14

number of neutrons = 14

number of protons = 13

ResultsPlus
Examiner Comments

This is a response that was awarded 2 marks.

This is a response that was awarded 1 mark.

5 (a) An atom of aluminium has an atomic mass of 27.

Aluminium has an atomic number of 13.

State the number of electrons, neutrons and protons in this atom.

(3)

number of electrons = 27

number of neutrons = 27

number of protons = 13

ResultsPlus
Examiner Comments

The most common mark awarded was for understanding that the atomic number gave the number of protons.

Question 5 (b)

Candidates found calculating the empirical formula of aluminium bromide difficult with the majority scoring zero on this question and many simply leaving the question blank.

Of those that did attempt the question, it was pleasing to see that the vast majority did show their workings, so intermediate marks and error carried forward could be applied.

Candidates that knew the first step of the calculation and showed their workings in a logical way were often successful and carried on to gain full marks.

Another common error seen was where candidate had inverted the initial calculation. Where candidates had shown their workings, two marks could still be obtained for correctly determining the whole number ratio and then converting this to a formula.

The following is a response that was awarded the full 3 marks.

(b) Aluminium reacts with bromine to form aluminium bromide.
A sample of aluminium bromide contains 1.35 g of aluminium atoms and 12.00 g of bromine atoms.

Calculate the empirical formula of this sample of aluminium bromide.

(relative atomic masses: Al = 27.0, Br = 80.0)

(3)

Al
1.35 g
27.0
= 0.05

Br
12.00 g
80.0
= 0.15

1 : 3

1 : 3

empirical formula = $AlBr_3$

ResultsPlus
Examiner Comments

In this example, the candidate has set their work out in a logical way.

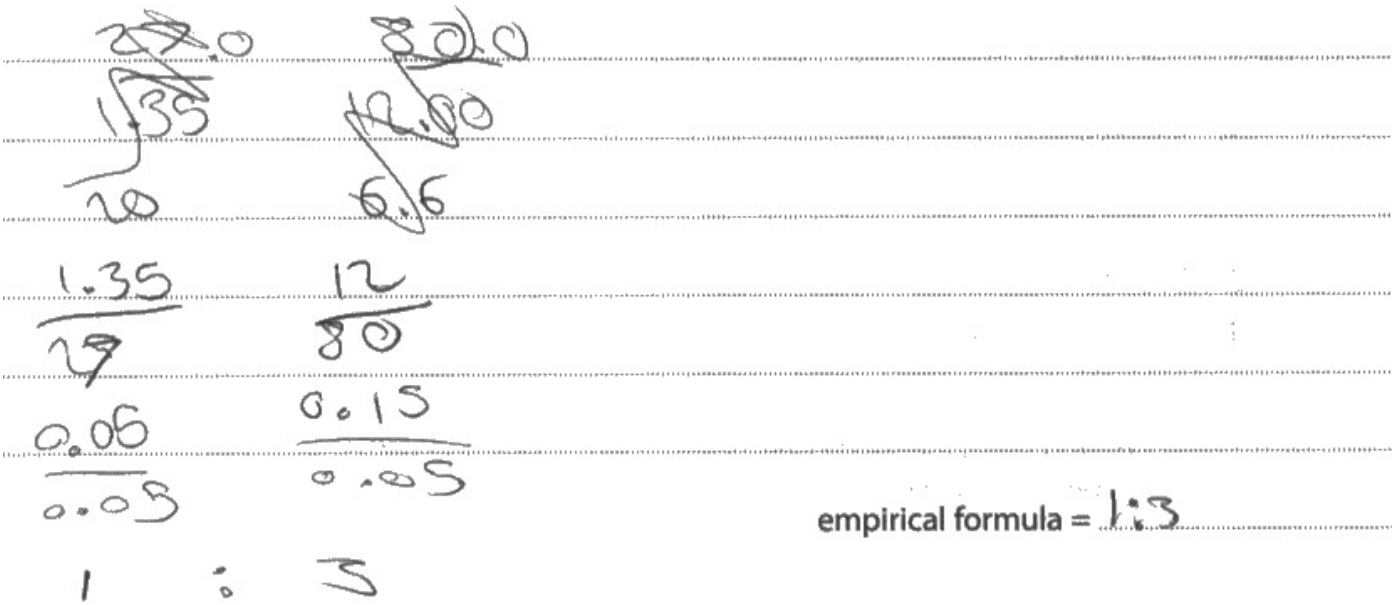
This is a response that was awarded 2 marks.

(b) Aluminium reacts with bromine to form aluminium bromide.
A sample of aluminium bromide contains 1.35 g of aluminium atoms and 12.00 g of bromine atoms.

Calculate the empirical formula of this sample of aluminium bromide.

(relative atomic masses: Al = 27.0, Br = 80.0)

(3)



ResultsPlus
Examiner Comments

It was not uncommon to see candidates calculate the correct ratio of aluminium to bromine but then either forget to convert this to the formula, or reverse the numbers to end up with a formula of Al_3Br rather than $AlBr_3$, therefore losing the last mark.

In this example the candidate has forgotten to convert the ratio to a formula and so did not score the third marking point.

Question 5 (c)(i)

Question 5c(i) was well attempted by the vast majority with many scoring both marks for understanding that gallium can be found in group 3 and in period 4.

Some candidates did not take the advice from the question stem to refer to the periodic table and made guesses, such as group 7 or 1.

It was pleasing to see that few reversed the numbers showing that the majority did know the difference between a group and a period.

The following is a response that was awarded 1 mark.

(c) Gallium is in the same group in the periodic table as aluminium and in the same period in the periodic table as bromine.

(i) State in which group and period of the periodic table gallium can be found.

You may want to refer to the periodic table.

(2)

group = 3

period = 3

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Examiner Comments

A common incorrect answer was that gallium was in both group 3 and period 3, not taking into account the first period and, therefore, gaining just 1 mark for the group, as in this example.

Question 5 (c)(ii)

Candidates found putting into words how Mendeleev predicted the properties of gallium challenging, with many misinterpreting the question and stating that Mendeleev left gaps.

.

The following is a response that was awarded zero marks.

Describe how Mendeleev predicted these properties of gallium.

(2)

carrying out experiments and calculating the Statistics

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Examiner Comments

A few candidates suggested that Mendeleev did experiments on the undiscovered elements, which demonstrated that they had either misread the question or did not understand the term undiscovered.

Question 6 (a)

In this question, candidate performed well and they were able to calculate the concentration of the copper sulfate solution successfully. Many candidates were awarded at least 1 mark and a good proportion scored both marks.

The following is a response that was awarded 1 mark.

6 (a) 3.14 g of solid copper sulfate was dissolved in water and made up to 250 cm^3 of solution.

$$\text{concentration } (g\,dm^{-3}) = \frac{\text{mass of solid (g)}}{\text{volume of solution } (dm^3)}$$

Calculate the concentration of this copper sulfate solution in g dm^{-3}.

(2)

$\frac{3.14}{250} = 0.01256$

concentration = 0.01256 g dm^{-3}

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Examiner Comments

Many candidates were able to substitute into the equation but forgot to convert the units. Therefore their answers were given as 0.01256 which scored 1 mark.

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Examiner Tip

When carrying out calculations, remember to check the units that are required in the answer by checking the stem and answer line and, if necessary, converting. For example, in this response, the volume from cm^3 to dm^3 by multiplying the answer by 1000 or dividing the initial volume by 1000.

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

6 (a) 3.14 g of solid copper sulfate was dissolved in water and made up to 250 cm^3 of solution.

$$\text{concentration } (g\,dm^{-3}) = \frac{\text{mass of solid (g)}}{\text{volume of solution } (dm^3)}$$

Calculate the concentration of this copper sulfate solution in g dm^{-3}.

(2)

$g\,dm^{-3} = \frac{3.14}{0.25}$ 12.56 g dm^{-3} 250 ÷ 1000 = 0.25 cm^3 concentration

concentration = 12.56 g dm^{-3}

ResultsPlus
Examiner Comments

The candidate has set out their answer in a logical way, showing their workings, and gained both marks.

Question 6 (b)(i)

Candidates found this question challenging by having to state what would be seen when a precipitate of copper hydroxide is formed in a solution of sodium sulfate. Unfortunately, candidates often lost marks as they did not read the question carefully, and repeated the stem by stating that a precipitate would be seen.

The following is a response that was awarded zero marks.

(b) Sodium hydroxide solution was added to a solution of copper sulfate.
A precipitate of copper hydroxide and a solution of sodium sulfate were formed.

(i) State what would be **seen** in the reaction.

(1)

fizzing

ResultsPlus
Examiner Comments

A common incorrect answer was that 'bubbles' or 'fizzing' would be seen, even though no gas was formed in the reaction.

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

(b) Sodium hydroxide solution was added to a solution of copper sulfate.
A precipitate of copper hydroxide and a solution of sodium sulfate were formed.

(i) State what would be **seen** in the reaction.

(1)

The two chemicals would have seperated causing 2 precipitates.

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Examiner Comments

This candidate repeated the stem by stating that a precipitate would be seen and scored no marks.

ResultsPlus
Examiner Tip

Marks will not be awarded for repeating information from the stem of the question. In this question you are told that the reaction forms a precipitate, so no credit will be awarded for stating that a precipitate is formed.

Question 6 (b)(ii)

It was pleasing that the majority of candidates were able to complete the balanced equation by adding a 2 in front of the sodium hydroxide.

Question 6 (b)(iii)

Candidates found describing how to obtain a pure, dry sample of the precipitate difficult. Few candidates realised that the mixture needed to be filtered to remove the copper hydroxide, with many instead discussing heating the mixture of the two substances.

Of the small proportion of candidates who did describe filtering, a smaller proportion discussed warming to dry the precipitate. The better responses included washing the copper hydroxide to remove any remaining sodium sulfate.

The following is a response that was awarded 2 marks.

(iii) Describe how to obtain a pure, dry sample of the precipitate of copper hydroxide from the reaction mixture.

(3)

- first you would filter the solution to remove the solid from the solution
- then it would be washed to remove any left over solution in or on the solid.
- then it would be dryed to get a dry sample of the copper hydroxide crystals

ResultsPlus Examiner Comments

The candidate has given a good answer using a logical step by step approach to describe a method. The candidate describes filtering the mixture and then washing the precipitate. The response is further developed by saying that the precipitate then needs to be dried. However, the candidate does not say how, and so missed the last marking point.

ResultsPlus Examiner Tip

Setting out your method in a logical way will help you remember which step should come next, and help to you achieve a higher mark.

This is a response that was awarded zero marks.

(iii) Describe how to obtain a pure, dry sample of the precipitate of copper hydroxide from the reaction mixture.

(3)

place near window to let the solution evaporate after a few days. or, put in an oven to dry.

ResultsPlus
Examiner Comments

The candidate discusses drying the mixture but has not filtered it first, so it would not produce a pure sample.

Question 6 (c)(i)

Most candidates were able to select the ions that would be attracted to the negative electrode by circling the $H^+$and Na^+ions.

Question 6 (c)(ii)

It was clear that a large proportion of candidates did not know what is meant by the term 'inert'.

Only a small percentage of candidates understood that the electrodes needed to be inert because they would otherwise react with the solution being electrolysed.

(ii) State why it is important that the electrodes are inert.

(1)

they dont react with Sodium sulfate solution

ResultsPlus
Examiner Comments

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

This is a response that was awarded zero marks.

(ii) State why it is important that the electrodes are inert.

(1)

they conduct electricity

ResultsPlus
Examiner Comments

A common incorrect answer related to the electrodes being able to conduct electicity, with many candidates stating that the electrodes needed to be inert to be able to conduct electricity.

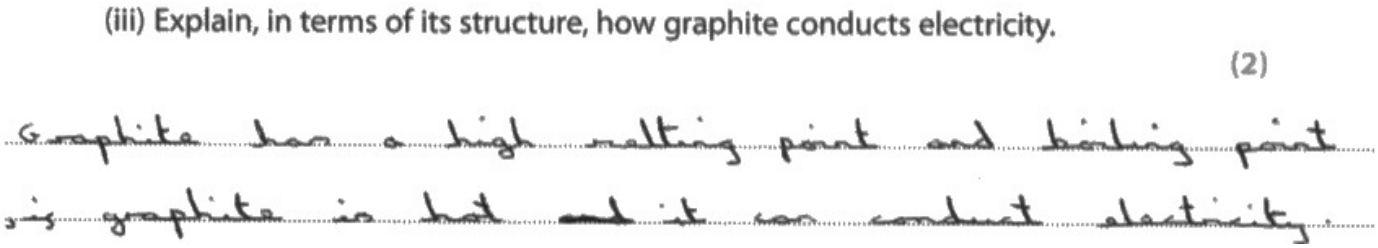
Question 6 (c)(iii)

The last part of question 6 on electrolysis asked candidates to explain how graphite conducts electricity.

This was another challenging question for most candidates with only the better responses achieving both marks for stating that graphite contained delocalised electrons.

Some candidate gave other properties of graphite, often stating that it had sliding layers, that it was a lubricant or that it has a high melting point, all of which were not relevant to the question and not creditworthy.

The following is a response that was awarded zero marks.


(iii) Explain, in terms of its structure, how graphite conducts electricity.

(2)

graphite has a high melting point and boiling point is graphite is hot and it can conduct electricity.

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Examiner Comments

A common incorrect response was to give other properties of graphite, rather than explaining how graphite can conduct.

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Examiner Tip

If you have time at the end of the exam, re-read through all the questions followed by your answers to check that you have answered the questions as set.

(iii) Explain, in terms of its structure, how graphite conducts electricity.

(2)

Graphite can conduct electricity because the delocalised electrons can freely move through its sliding layers.

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

Question 7 (b)(i-bii)

Overall, candidates performed well in part (i) of question 7 with the large majority being able to read off accurately from the apparatus. Some of the better responses showed the use of the data to determine the percentage decrease in the volume of gas in the measuring cylinder. Unfortunately, many candidates did not show their workings in this question as the answer may have appeared straightforward.

(b) A piece of damp iron wool was placed in a measuring cylinder with 50 cm^3 of air, as shown in Figure 12.

Figure 13 shows the apparatus one week later.

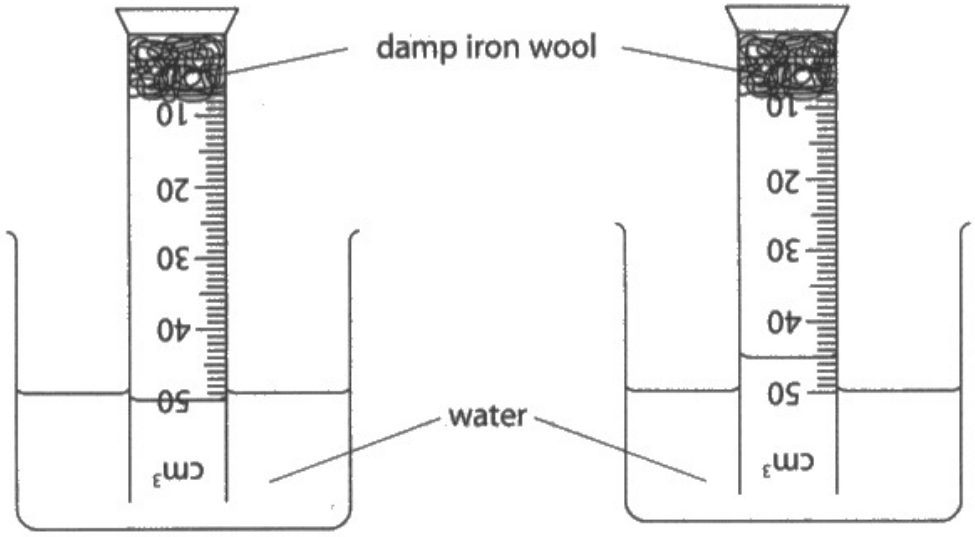

Figure 12 **Figure 13**

(i) Complete the table of results.

(1)

volume of gas in Figure 12 in cm^3	50
volume of gas in Figure 13 in cm^3	45

(ii) Use these results to calculate the percentage decrease in the volume of gas in the measuring cylinder after one week.

(3)

$\frac{5}{50} \times 100$

percentage decrease in volume of gas = 10

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Examiner Comments

This is an example of a response that gained 1 mark for part (i) and 3 marks for part (ii)

This is a response that was awarded zero marks for part (i) and 3 marks for part (ii).

(b) A piece of damp iron wool was placed in a measuring cylinder with 50 cm^3 of air, as shown in Figure 12.

Figure 13 shows the apparatus one week later.

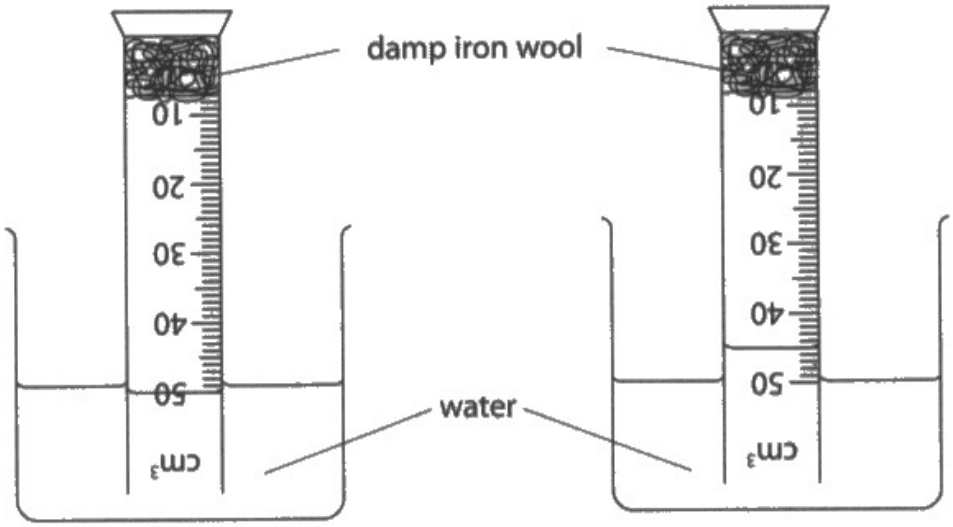


Figure 12 **Figure 13**

(i) Complete the table of results.

(1)

volume of gas in Figure 12 in cm^3	50
volume of gas in Figure 13 in cm^3	40·5

(ii) Use these results to calculate the percentage decrease in the volume of gas in the measuring cylinder after one week.

(3)

~~final - initial~~ inital - final / initial ×100

~~40·5~~ $\frac{50 - 40{\cdot}5}{50} \times 100 = 19$

percentage decrease in volume of gas = ~~10~~ 19%

Candidates that made an error in the initial reading, from workings shown in their answer, this error was carried forward and candidates were still able to gain full marks in part (ii), as in this example.

Always show your workings, even if you think the answer is straightforward. Errors carried forward can be applied and any intermediate marks for workings can be awarded in case of an error in your method.

(b) A piece of damp iron wool was placed in a measuring cylinder with 50 cm^3 of air, as shown in Figure 12.

Figure 13 shows the apparatus one week later.

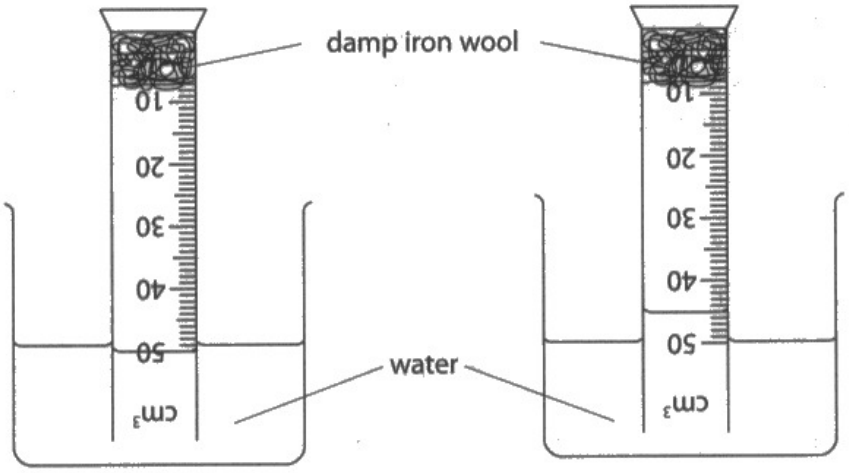


Figure 12 **Figure 13**

(i) Complete the table of results.

(1)

volume of gas in Figure 12 in cm^3	50
volume of gas in Figure 13 in cm^3	45

(ii) Use these results to calculate the percentage decrease in the volume of gas in the measuring cylinder after one week.

(3)

$\frac{(\text{final} - \text{initial})}{\text{initial}}$ $\frac{(45-50)}{50} \times 100$

percentage decrease in volume of gas = 10%

ResultsPlus
Examiner Comments

This example, with clear workings, gained 1 mark for part (i) and 3 marks for part (ii)

Question 7 (b)(iii)

In this question, most candidates struggled to give a reason why not all of the oxygen had reacted with the iron. Some of the better responses suggested that the reaction had not been left long enough or that there was insufficient iron, both of which gained credit.

(iii) Not all of the oxygen in the air in the measuring cylinder has reacted with the iron.

Give a reason why.

(1)

because it takes time to get all the iron to react so it has to be left for longer.

ResultsPlus
Examiner Comments

This is a response that was awarded the mark.

This is a response that was awarded zero marks.

(iii) Not all of the oxygen in the air in the measuring cylinder has reacted with the iron.

Give a reason why.

(1)

Some oxygen may have escaped, or reacted with water to form H_2O

ResultsPlus
Examiner Comments

A common incorrect answer was that there was not enough oxygen, or that some had escaped, which showed a misunderstanding of the question. A common misconception was that the oxygen reacted with the water present in the measuring cylinder.

ResultsPlus
Examiner Tip

Read the whole question and use the information to help inform your answer.

Question 7 (c)

This question was the first of the two six-mark levels-based questions. Candidates were asked to explain what alloying and electroplating are and how they can make metals more useful.

On the whole, candidates seemed to engage well with the question and a good range of marks were awarded.

Examiners noted that candidates appeared to be more familiar with alloys than with electroplating.

The following is a response that was awarded the full 6 marks and achieved level 3.

*(c) Pure metals can be made more useful by converting them into alloys or by electroplating them.

Explain what alloying and electroplating are and how they can make metals more useful.

(6)

electroplating is a system using electrolysis and electricity to plate a metal, for example gold - Jewlery is very expensive but gold - plated Jewlery isn't they are both beautiful and wont tarnish but one saves you a fortune. electroplating works by getting a cheap metal such as iron and a more expensive metal like gold but in compound form you can turn the gold compound molten and coat the iron in it this will prevent the iron rusting and can be useful for buildings and Jewlery and large structures like ~~bridges~~ ~~bridges~~ bridges that need to be strong but avoid spending too much money.

Alloying is a process of combining two metals and making them a compound you can take a pure metal and a compound and bind them into a solid structure this makes making large scale things cheaper and helps to break down costs which is very useful they also wont rust and

Will be harder hurt and unable to react so it wont rust or cause anydamage no matter the weather or circumstance water wont rust it. heat wont melt it. Electricty wont react with it.

They are both helpful in reducing cost and helping too keep things attractive and useful.

ResultsPlus
Examiner Comments

In this example, the candidate states that electroplating uses electricity to plate a metal. This is further developed with an explanation that gold-plated jewellery is cheaper and 'beautiful' and, therefore, that electroplating makes metals more useful. The candidate then explains that alloying is a process of combining two metals, which is further qualified by stating that the alloy will not rust.

The candidate has given a detailed description of electroplating with an explanation as to why you would electroplate a metal, including reasons for doing so. The response is further developed with some basic ideas about alloying and why it is done.

This is a response that was awarded 2 marks.

*(c) Pure metals can be made more useful by converting them into alloys or by electroplating them.

Explain what alloying and electroplating are and how they can make metals more useful.

(6)

alloying Something is useful because it makes it stronger and it is when you melt two metals and then put them together to make it more strong

o electroplating Something is when you ~~coo~~ coat an objeft with a solution ~~like~~ ~~$~~ to prevent rusting or corrosion you can do this by painting, oiling or coating with plastic.

ResultsPlus
Examiner Comments

The candidate has given a reason for alloying metals. The response is developed further with an explanation that electroplating is to prevent corrosion of the metal. However, this suggestion is incorrectly linked to coating it with a solution, such as paint, oil or coating with plastic, which are barrier methods of preventing corrosion rather than electroplating. However, the basic ideas about alloying puts this response at level 1 with 2 marks.

This is a response that was awarded 4 marks and achieved level 2

*(c) Pure metals can be made more useful by converting them into alloys or by electroplating them.

Explain what alloying and electroplating are and how they can make metals more useful.

(6)

Alloying is a mixture of two elements Which is used to make a metel stronger look better

electroplating is when layer a duffrent metal over it this is done to Impove apperance or to cover corrosion

ResultsPlus
Examiner Comments

The candidate has given ways that electroplating and alloying can be made more useful. The response starts with an explanation of alloying and electroplating, but there is no detail as to how either process is achieved.

Question 8 (b)(i)

Most candidates were able to name a piece of equipment which could measure the dilute hydrochloric acid more accurately than a measuring cylinder.

However, some of the incorrect responses given were measuring beakers, beakers or test tubes.

(i) Name a piece of equipment which could be used to measure out 50.0 cm^3 of dilute hydrochloric acid more accurately than the measuring cylinder.

(1)

measuring beaker

ResultsPlus
Examiner Comments

This is a response that was awarded zero marks.

(i) Name a piece of equipment which could be used to measure out 50.0 cm^3 of dilute hydrochloric acid more accurately than the measuring cylinder.

(1)

pipette

ResultsPlus
Examiner Comments

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

Question 8 (b)(ii)

Part (ii) of this question was answered better than part (i) with a good proportion of candidates understanding that the universal indictor paper would change colour. Some of the better responses were also able to state that the colour seen should be compared to a pH scale or reference chart.

(ii) Describe how the pH of the mixture is determined when a drop of it is placed on the universal indicator paper.

(2)

The PH will be determined by what colour the universal indicator paper turns. Then using the pH scale to match up the colour will show the pH

ResultsPlus
Examiner Comments

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

Question 8 (b)(iii)

Candidates were less successful in part (iii) of this question with only a few candidates being able to explain why litmus paper would not be a suitable indicator to use in the experiment.

The better responses stated that the litmus would only show if the solution is acidic or alkaline, but only a few of these responses explained that it showed how acidic the solution is, or did not give the pH.

The following is a response that was awarded zero marks.

(iii) In the method, universal indicator paper is used to determine the pH.

Explain why litmus paper would not be a suitable indicator to use in this experiment.

(2)

the colour change isn't as accurate

ResultsPlus Examiner Comments

The candidate has given a common incorrect response that the litmus paper is not accurate, which was not creditworthy.

(iii) In the method, universal indicator paper is used to determine the pH.

Explain why litmus paper would not be a suitable indicator to use in this experiment.

(2)

Litmus paper does not show and tell exact PH, only wether it is a acid or Alkali.

ResultsPlus Examiner Comments

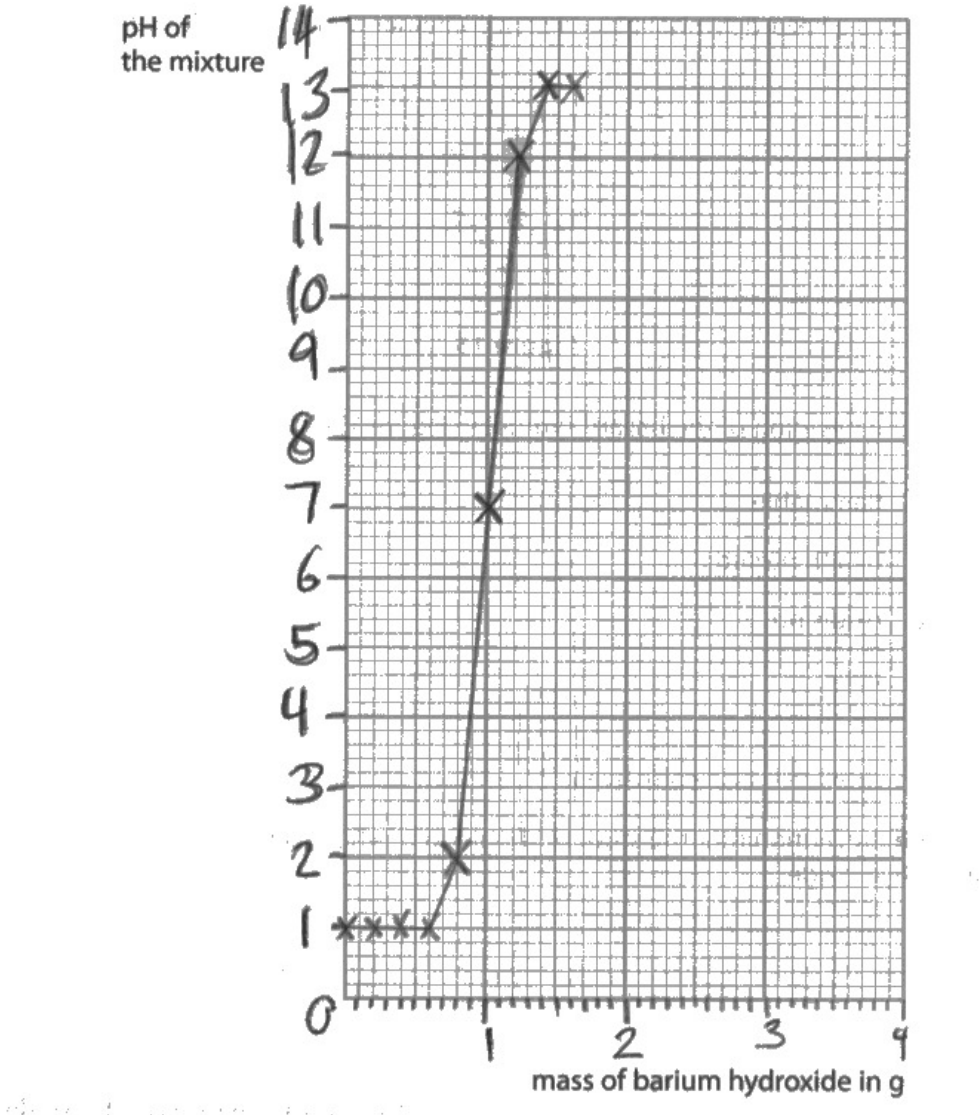
This is a response that was awarded the full 2 marks.

Question 8 (b)(iv)

Candidates performed well in this question with the majority being able to draw a suitable sized graph with linear scales and correct plots.

Some of the weaker responses gave an inappropriate scale for their Y axis, using values directly from the table.

The following is a response that was awarded 2 marks.



ResultsPlus
Examiner Comments

The candidate used less than half of the available space on the graph paper and was not awarded the second marking point.

Question 8 (c)(ii)

It was pleasing to see that the majority of candidates were able to give a suitable precaution when using corrosive barium hydroxide. However, some of the weaker responses gave unsuitable answers, such as wearing PPE or washing hands.

(ii) Barium hydroxide is also corrosive.

Give **one** precaution that the student should take when using barium hydroxide.

(1)

wearing goggles

ResultsPlus
Examiner Comments

This is a response that was awarded the mark.

This is a response that was awarded zero marks.

(ii) Barium hydroxide is also corrosive.

Give **one** precaution that the student should take when using barium hydroxide.

(1)

The student should wear safety equipment to ensure they don't harm themselves when using it.

ResultsPlus
Examiner Comments

The candidate's reference to safety equiment is too vague and does not score.

ResultsPlus
Examiner Tip

When asked for precautions, be specific with your answer and ensure that the precaution you state is relevant to the practical being discussed.

Question 9 (a)(ii)

Candidates found this question challenging with only a few scoring the full three marks. Many of the weaker responses showed a lack of knowledge and understanding of subject specific terms, such as ions, electrons and atoms, which were often used in the wrong context. The better responses stated that magnesium carbonate did not have delocalised electrons, rather than that ions cannot move.

The following is a response that was awarded zero marks.

(ii) Explain why solid magnesium carbonate cannot conduct electricity but solid magnesium can.

(3)

Magnesium carbonate has no free atoms to conduct electricity, unlike magnesium

ResultsPlus
Examiner Comments

The candidate referred to the magnesium carbonate atoms. However, if the candidate had stated that the magnesium had no free electrons, this marking point could have been awarded.

This is a response that was awarded 2 marks.

(ii) Explain why solid magnesium carbonate cannot conduct electricity but solid magnesium can.

(3)

Because magnesium carbonate doesn't contain delocalised electrons like solid magnesium has.

ResultsPlus
Examiner Comments

The candidate states that magnesium carbonate has no delocalised electrons for marking point 1, whereas magnesium does, which scored marking point 2. If the candidate had added that the delocalised electrons in magnesium could move then a third marking point could have been awarded.

Question 9 (b)

In this question, candidates were asked to calculate the percentage by mass of magnesium in magnesium carbonate.

Overall, candidates found this question challenging and a noticeable number of candidates did not attempt the question. However, a good proportion of candidates scored on this question with the majority achieving at least 1 mark for working out the relative formula mass of magnesium carbonate. However, many candidates did not take this calculation further to gain the second and third marks. A common error was to calculate the relative formula mass as 52 rather than 84.

The following is a response that was awarded 1 mark.

(b) Calculate the percentage by mass of magnesium in magnesium carbonate, $MgCO_3$.

(relative atomic masses: C = 12.0, O = 16.0, Mg = 24.0)

(3)

$24.0 + 12.0 + (16.0 \times 3) = 84$

percentage by mass of magnesium = 84

ResultsPlus
Examiner Comments

The candidate scored 1 mark for calculating the relative formula mass of magnesium carbonate. The calculation was not taken further to gain any additional marks.

This is a response that was awarded 2 marks.

(b) Calculate the percentage by mass of magnesium in magnesium carbonate, $MgCO_3$.

(relative atomic masses: C = 12.0, O = 16.0, Mg = 24.0)

(3)

$\frac{24}{52} \times 100 = 46.153...$

percentage by mass of magnesium = 46.15%.

ResultsPlus Examiner Comments

The candidate has calculated the relative formula mass as 52 rather than 84.

This error was taken forward and a mark of 2 was awarded for marking points 2 and 3.

This is a response that was awarded 3 marks.

(b) Calculate the percentage by mass of magnesium in magnesium carbonate, $MgCO_3$.

(relative atomic masses: C = 12.0, O = 16.0, Mg = 24.0)

(3)

24+12+48=84 $\frac{24}{84} \times 100 =$ 28.57%

percentage by mass of magnesium = 28.57%

ResultsPlus Examiner Comments

The candidate showed their workings in a logical way and gained the full 3 marks.

Question 9 (c)

Question 9c was the second of the two six-mark extended open responses questions which focused on the reactions of magnesium carbonate and magnesium with sulfuric acid.

The question asked students to explain what would be seen in each reaction and the tests they should carry out to identify the gases produced.

In general, candidates were able to access the question with a good proportion scoring. Weaker responses gave a range of tests, often including the test for oxygen as well as the test for carbon dioxide and hydrogen. In addition, they did not link the tests to the reaction in which they thought each gas was produced.

The better responses gave more than required for full marks, such as observations, products of both of the reactions and both gas tests with the method of testing and the result of the tests.

The following response was awarded 2 marks.

*(c) A student has two separate test tubes containing sulfuric acid.

The student adds a spatula measure of magnesium carbonate, $MgCO_3$, to the first test tube and a piece of magnesium to the second test tube.

Explain what the student would see in each test tube and the tests that they should carry out to identify the gases produced.

Your answer should include word equations for the reactions that would take place.

(6)

As they add a spatula of magnesium carbonate ~~to~~ the test tube they could light a splint and hold it near the ~~test~~ tube opening, if ~~the~~ it produces a squeaky pop then hydrogen gas is being produced, they can also take a glowing splint and hold it near the opening of the ~~test~~ tube, if the splint relights then oxygen is being produced. They can also test for carbon dioxide gas being produced by seeing if ~~it turns~~ the gas turns lime water cloudy, if it does then lime water is present.

ResultsPlus
Examiner Comments

The candidate has given three gas tests, two of which are relevant to the question. There are no observations or word equations for the reactions. For the two tests, the candidate has not stated which would be positive with magnesium carbonate (or magnesium). Therefore, as there is no linking, this response is awarded 2 marks at level 1.

This is a response that was awarded 4 marks.

*(c) A student has two separate test tubes containing sulfuric acid.

The student adds a spatula measure of magnesium carbonate, $MgCO_3$, to the first test tube and a piece of magnesium to the second test tube.

Explain what the student would see in each test tube and the tests that they should carry out to identify the gases produced.

Your answer should include word equations for the reactions that would take place.

(6)

In the test tube containing magnesium carbonate the Sulphuric Acid would react to make magnesium Sulphate (Magnesium Carbonate + Sulphoric Acid → Magnesium Sulphate)

In this test tube the student would see fizzing and bubbles produced. To test this gas the student should use litmus paper which will change colour if the gas is acidic

In the test tube containing just magnesium and Sulphuric Acid - the Sulphuric Acid would react with magnesium to make magnesium Sulphate (Magnesium + Sulphuric Acid → Magnesium Sulphate) A student would see fizzing and gas being produced.

The student could use a glowing splint and hold it over the gas to see if it re-lights it. This is to test for oxygen. A student could also use a test in which they insert a lit splint into a test tube containing gas. If the gas

ignites creating a 'Pop' sound then there is hydrogen present.

ResultsPlus
Examiner Comments

The candidate has given a product (magnesium sulphate) and an observation for magnesium carbonate. The test is wrong and therefore not creditworthy. The candidate has given a product (magnesium sulphate) for magnesium and said it bubbles. Therefore, the candidate has given two tests for the magnesium but has not said which would be positive.

There is not sufficient detail for level 3 but a mark of 4 at the top of level 2 is awarded.

This is a response that was awarded the full 6 marks.

*(c) A student has two separate test tubes containing sulfuric acid.

The student adds a spatula measure of magnesium carbonate, $MgCO_3$, to the first test tube and a piece of magnesium to the second test tube.

Explain what the student would see in each test tube and the tests that they should carry out to identify the gases produced.

Your answer should include word equations for the reactions that would take place.

(6)

(test tube 1) Sulfuric acid + Magnesium carbonate → gas

(test tube 2) Sulfuric acid + Magnesium → Hydrogen + salt

In the first test tube the student should be able to see effervescence (bubbles) as a gas should be produced. The gas should be carbon dioxide. They can check to see is it is carbon dioxide by using a gas syring to collect the carbon dioxide. The student can then do the lime water test to see is carbon dioxide is present. The limewater should go cloudy.

For test tube two hydrogen may be present. The student can do the squeaky pop test by collecting the hydrogen and putting it in a test tube. Then place a lighted splint in the tube and listen to see if there

is a squeak/pop sound. If there is then hydrogen is present. If there isn't then hydrogen is not present.

ResultsPlus
Examiner Comments

The candidate has given a correct observation, gas produced and test for carbon dioxide for the magnesium carbonate. This would have been worthy of 4 marks at level 2. However, the candidate has developed the response further and given the correct gas produced for magnesium and the correct test for the gas. However, there is no observation for the magnesium but there is still sufficient for the full 6 marks to be awarded at level 3.

Question 10 (a)(i)

Part (i) of question 10a asked candidates to state the meanings of the terms 'actual yield' and 'theoretical yield'.

Candidates found this question very challenging with only a few scoring both marks. Candidates that were awarded marks often scored for the 'actual yield' mark for understanding that the actual yield is the mass of product formed in the reaction.

Many candidates lost marks as they restated the stem of the question by stating that the 'actual yield' is the yield that is actually made and that the 'theoretical yield' is the yield made theoretically.

Common incorrect answers seen for the theoretical yield included the 'estimated', 'predicted', 'expected' and 'what you think the answer will be'. Very few candidates understood that it was a calculated yield.

Some candidates lost marks as they stated that the actual mass was the number of products made rather than the mass of the products made.

The following is a response that was awarded zero marks.

(i) State the meanings of the terms **actual yield** and **theoretical yield**. (2)

actual yield

What the answer really is

theoretical yield

what you think the answer will be

ResultsPlus
Examiner Comments

The candidate's answer for actual yield is not sufficient to be awarded a mark. Many candidates stated that the theoretical yield is 'what you think the answer will be', which was also not sufficient for credit and did not score.

This is a response that was also awarded zero marks.

(i) State the meanings of the terms **actual yield** and **theoretical yield**. (2)

actual yield

the acnal number of products produced

theoretical yield

eshimated amount of product produced

ResultsPlus
Examiner Comments

The 'number of products produced' did not score for actual yield. A common incorrect answer of the estimated amount of product for theoretical yield also did not score.

Question 10 (a)(ii)

In part (ii) of question 10a, candidates were asked to calculate the percentage yield of ethanol in the experiment using the formula given.

Many candidates were able to substitute correctly into the equation to calculate the percentage yield as 15%.

The following is a response that was awarded 1 mark.

(ii) Use the information in Figure 16 to calculate the percentage yield of ethanol in this experiment.

(2)

53.80 ÷ 8.07 x 100 = 666.67.

percentage yield = 666.67.

ResultsPlus
Examiner Comments

The candidate has inverted the initial fraction and so did not score the first marking point. However, as the candidate has shown their working with error carried forward, the second marking point could be awarded.

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

(ii) Use the information in Figure 16 to calculate the percentage yield of ethanol in this experiment.

(2)

$\frac{8.07}{53.80} \times 100$

$= 15$

percentage yield = 15%

ResultsPlus Examiner Comments

The candidate has set out their workings clearly and scores both marks.

This is a response that was awarded 1 mark.

(ii) Use the information in Figure 16 to calculate the percentage yield of ethanol in this experiment.

(2)

$8.07 \div 53.80 = 0.15$

percentage yield = 0.15

ResultsPlus Examiner Comments

In this example, the candidate has the initial fraction correct but has forgotten to multiply by 100 to get the percentage so gained just 1 mark.

Question 10 (a)(iii)

Although directly from the specification, candidates found it hard to recall a reason why the actual yield is usually less than the theoretical yield with many stating that the theoretical yield is just an estimate or guess.

Many candidates stated human error or that they split the product, which was not accepted.

Responses that did score, it was often for stating that there was an incomplete reaction of reactant or the fact that side reactions may have occurred.

The following is a response that was awarded zero marks.

(iii) State **two** reasons why the actual yield of a reaction is usually less than the theoretical yield.

(2)

1 theoretical was just a prediction.

2 the yeio can aways change.

ResultsPlus
Examiner Comments

Many candidates stated that the theoretical yield was just a guess or prediction, which did not score.

(iii) State **two** reasons why the actual yield of a reaction is usually less than the theoretical yield.

(2)

1 side reaction may ~~can~~ occur.

2 not all of the mass reacted.

ResultsPlus
Examiner Comments

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

Question 10 (b)(i)

Part (i) of question 10b was the last calculation question on the paper. Candidates found this question very challenging with the majority scoring zero marks and many candidates not attempting the question.

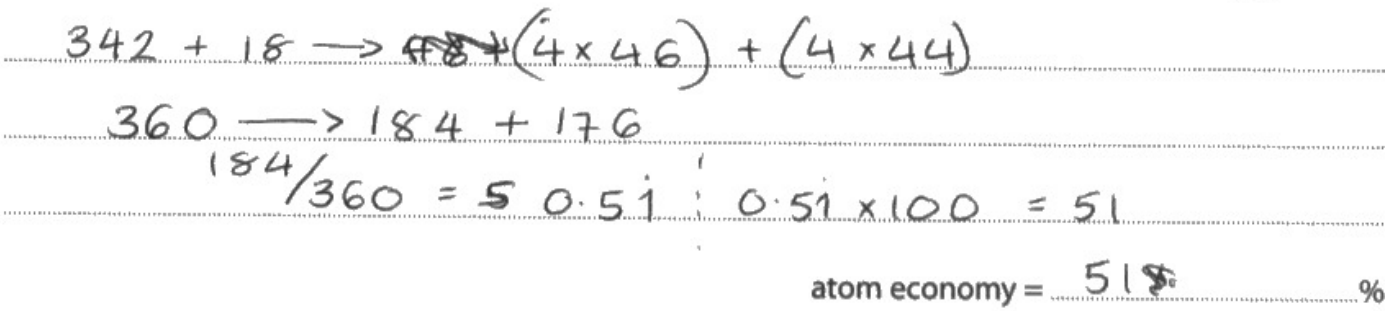
Candidates were more successful at achieving the first marking point showing the total mass of the reactants and the total mass of ethanol. However, only a few candidates were able to use the numbers correctly to calculate the atom economy and then give their answer to 2 significant figures. Some candidates did not give their answer to two significant figures and so scored just 2 marks.

(i) Calculate the atom economy of this reaction to produce ethanol.

Give your answer to two significant figures.

(relative formula masses: $C_{12}H_{22}O_{11} = 342$, $H_2O = 18$, $C_2H_5OH = 46$, $CO_2 = 44$)

(3)



ResultsPlus
Examiner Comments

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

This is a response that was awarded 2 marks.

(b) The balanced equation for the fermentation of sucrose is and so the percentage yeild will be much lower

$$C_{12}H_{22}O_{11} + H_2O \rightarrow 4C_2H_5OH + 4CO_2$$

342 + 18 ⇒ 46x4 + 4x44

(i) Calculate the atom economy of this reaction to produce ethanol.

Give your answer to two significant figures.

(relative formula masses: $C_{12}H_{22}O_{11} = 342$, $H_2O = 18$, $C_2H_5OH = 46$, $CO_2 = 44$)

(3)

342 + 18 ⇒ 46x4 + 4x44

360 184 + 176

360 − 176 = 184

atom economy = 51.1 %

$\frac{184}{360} \times 100 = 51.1\%$

ResultsPlus
Examiner Comments

The candidate calculated the atom economy but did not give their answer to two significant figures to gain the last marking point.

Question 10 (b)(ii)

Part (ii) of question 10b asked candidates to explain the effect on the atom economy if the carbon dioxide produced was used for fizzy drinks.

Some candidates knew that it would increase the atom economy but a only a few explained that this is because the carbon dioxide is then a useful product or no longer a waste product.

(ii) Explain the effect on the atom economy of this reaction if the carbon dioxide produced was used to make fizzy drinks.

(2)

It would increase, as the carbon dioxide produced wouldn no longer be a waste product but a desired product.

ResultsPlus Examiner Comments

This is a response was awarded the full 2 marks.

This response is awarded 1 mark.

(ii) Explain the effect on the atom economy of this reaction if the carbon dioxide produced was used to make fizzy drinks.

(2)

the atom economy would increase

ResultsPlus Examiner Comments

The candidate understands that the atom economy would increase to gain 1 mark. However, there is no reason why this happens to gain the second mark.

Paper Summary

Based on their performance in this paper, candidates should:

- Understand key terms, such as precaution, and use terms in the correct context, such as mass rather than number.
- Read the questions carefully, and if there is time, re-read the question along with their answer to check that it addresses the question set.
- Learn to use information from the stem of the question to inform the answers.
- Ensure that they are familiar with common laboratory equipment names and uses, and equipment specific to core practical experiments.
- When calculations are required, ensure that the full working is shown so that intermediate marks and error carried forward can be applied where necessary.
- When working through calculation questions, try to use a logical approach when setting out the working.
- Try to use a methodological approach when asked for a description of a practical or part of an experiment.
- Take care with key terms, such as atom, ion and electron.

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