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Examiners' Report
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GCSE Chemistry 1CH0 1F

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Introduction

This examination paper was the second paper of the 9-1 Chemistry specification, graded 9-1. This paper, like all the Separate Science examinations, consists of ten questions, giving a total of 100 marks. Six of these questions, 60 marks in total, also appear on the Combined Science Foundation tier paper.

This paper also has Combined Science Chemistry questions in common with Higher tier Combined Science and Higher tier Separate Chemistry paper, totalling 16 marks. These overlap items are the first seven items of question 8 and the first four items of question 9. There are also 11 marks of Separate Chemistry questions in common with the Separate Chemistry Higher tier paper. These overlap items are the whole of question 10.

The paper made use of a variety of question types suitable for candidates at this level; multiple choice, calculations and short answer questions being the frequent types. The paper contained two extended open-response questions (6-marks). As with the other Chemistry papers, a minimum of 20% of the marks were for maths, a minimum of 15% for testing practical skills and a maximum of 15% on knowledge in isolation (recall) questions.

Question 1 (b) (i)

This question was not well answered on the whole with just over half of the responses scoring the 1 mark available.

Although many candidates were able to read the value of the time when the gas started to form a liquid, namely 2 minutes (point B on the graph), many simply gave other values, such as 0, 6 or 8 minutes.

Question 1 (b) (ii)

This question was not well answered on the whole with the majority of responses not scoring the 1 mark available.

Although, some candidates were able to use the graph to calculate the time taken for the gas to condense, namely 6-2(= 4) minutes, the majority of incorrect responses stated 6 minutes (point C on the graph) which is the time at which the gas was completely liquid.

As with the preceding question, Q01bi, it is worthwhile emphasising that when learning about changes of states candidates need to practise interpretation of cooling or heating curves.

Question 1 (c) (i)

This question was well answered on the whole with most responses scoring the 1 mark available.

Most candidates were able to interpret the table of data of melting points and boiling points to identify the solid, namely substance Z.

Question 1 (c) (ii)

This question was well answered on the whole with most responses scoring the 1 mark available.

Most candidates were able to interpret the table of data of melting points and boiling points to identify the liquid, namely substance Y.

Question 1 (d)

This question was very well answered on the whole with most responses scoring the 2 marks available.

Most candidates were able to correctly link the two substances solid zinc metal and hydrogen gas to their respective particle diagram.

Of those candidates who scored 1 mark only, the majority identified the structure of zinc solid. However, often they linked hydrogen to the third diagram, showing a mixture of gases, which indicated some knowledge of particle diagrams of gases. In very few cases, candidates drew more than one line from each of the two substances, despite clear instructions in the question and this being a tried and established question style in this and in many of the previous examination series.

Question 2 (a)

This question was well answered on the whole with most responses scoring 2 of the 3 marks available.

Most candidates referred to the fact that stainless steel does not rust to score 1 mark. Fewer candidates referred to stainless steel being stronger than iron.

Commonly seen incorrect responses referred to stainless steel being 'cheaper' than iron, 'not staining' or 'cheap'. Other common errors included linking to 'malleability', namely stainless steel being more or less malleable than iron.

Question 2 (b)

This question was poorly answered on the whole with the majority of responses scoring not scoring the 1 mark available.

Few candidates were able to correctly explain the reason for using brass rather than copper for the pins of an electric plug, namely than pins made from brass do not bend. The most commonly seen incorrect responses referred to the fact that the brass would be 'less likely to break'.

Question 2 (c) (i)

This question was well answered on the whole, with the majority of candidates scoring at least 2 or more of the 3 marks available.

The majority of responses correctly compared the properties of the two substances from the table provided, using correct comparative terms, such as lower, stronger or higher, when comparing density, strength and resistance to corrosion respectively.

In the responses scoring 1 or 2 marks only, candidates often only discussed one or two properties, not all three.

In those responses which did not score, often properties were simply quoted from the table in the stem of the question, with no comparison made between the two substances. In many incorrect responses, the term 'better' was seen when comparing properties - this term is vague and would need qualifying to be of credit.

(c) Magnalium is an alloy of magnesium and aluminium.
It is often used for aircraft parts.

(i) Figure 4 shows information about pure aluminium and magnalium.

substance	density in g cm^{-3}	relative strength	resistance to corrosion
aluminium	2.7	low	high
magnalium	2.0	high	very high

Figure 4

Explain, using the information in Figure 4, why magnalium, rather than pure aluminium, is used for aircraft parts.

(3)

Magnalium is used because it has a high & relative strength and a very high resistance to corrosion where as aluminium has low relative strength and high resistance to corrosion.

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Examiner Comments

This is typical of a response which did not score.

Two of the properties from the table have been discussed, namely relative strength and resistance to corrosion. However, the data has been quoted and comparative terms not used, such as higher relative strength and higher resistance to corrosion.

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Examiner Tip

With questions requiring a comparision of properties from a table, make sure comparative terms, such as 'stronger', 'higher', are used to compare substances. Avoid simply stating information from the table.

Explain, using the information in Figure 4, why magnalium, rather than pure aluminium, is used for aircraft parts.

(3)

Magalium is chosen over aluminium as Magalium has a higher relative strengh and a higher resistance to corrosion meaning it is less likely to get damaged. Magnalium also has a lower density meaning it weighs less than aluminium.

ResultsPlus
Examiner Comments

A typical example of a fully correct response which scored the 3 marks available.

All three properties, namely relative strength, resistance to corrosion and density, have been correctly compared, using comparative terms.

ResultsPlus
Examiner Tip

Comparing properties of substances is commonly asked for in chemistry. Remember to use comparative terms, such as higher, lower, when making comparisons.

Question 2 (c) (ii)

This question was very well answered well on the whole, with the majority of responses scoring the 2 marks available, for the answer, 5.0% as the correct percentage of magnesium in the magnalium alloy.

Of those candidates who scored 1 mark only, most incorrectly inverted the fraction in the percentage calculation, arriving at a value of 2000 which was credited as an error carried forward.

Question 3 (b)

This question was not well answered on the whole with the majority of responses not scoring the 2 marks available.

Very few candidates scored both marks for two correct observations, namely that 'a colourless solution forms', 'a solid forms' or 'magnesium disappears'.

It was clear that few candidates could recall the observations of commonly asked for displacement reactions.

The most commonly seen responses scoring 1 mark only simply referred to 'turns colourless'.

The most common misconception was that 'fizzing or bubbling' or that ' colour change' would be seen. Many responses recognised that copper would be formed, given in the stem of the question, but did not state 'solid' forms as the observation.

(b) Copper is a transition metal.

Magnesium reacts with copper sulfate solution to form copper and a solution of magnesium sulfate.
Magnesium sulfate solution is colourless.

Describe **two** changes you would **see** during this reaction.

(2)

1 there will be a precipitate forming

2 the magnesium will dissolve

ResultsPlus
Examiner Comments

This response scored 1 mark only for 'magnesium would dissolve'. Although, the correct observation would be 'disappears', the use of term 'dissolve' was allowed.

The used of the term 'precipitate forming' was not credited since it was not qualified with the correct colour 'red-brown'.

(b) Copper is a transition metal.

Magnesium reacts with copper sulfate solution to form copper and a solution of magnesium sulfate.
Magnesium sulfate solution is colourless.

Describe **two** changes you would **see** during this reaction.

(2)

1 magnesium loose its colour

2 Copper Sulphate Change colour .

ResultsPlus
Examiner Comments

This response is typical of those that did not score.

There is an incorrect reference to 'magnesium losing its colour'. Also, the reference made to 'copper sulfate change colour' is not specific enough to be credited.

ResultsPlus
Examiner Tip

When describing what is seen in a chemical reaction, make sure you give the specific colour changes. It is worthwhile stating both the starting and final colours.

Question 3 (c) (i)

This question was very well answered on the whole, with most responses scoring the 1 mark available for recalling 'oxygen' as the other substance, besides water, being needed for iron to rust.

In incorrect responses, 'salt', 'iron', other gases, such as 'hydrogen', 'carbon dioxide' or nitrogen were seen by examiners.

Question 3 (c) (ii)

This question was very well answered on the whole with the majority of responses scoring 2 or 3 of the 3 marks available for the description of a simple experiment of comparison of rusting.

The most frequently seen correct responses, credited with all 3 marks, referred to placing iron nails into test tubes of water and sea water respectively. This was often followed by leaving the tubes for a stated period of time and then comparing the appearance of nails in the tubes.

Very few responses referred to the need to 'clean the nails'.

In those responses which did not score, the main misconception, was not describing an experiment, but simply discussing the rate of rusting, as given in the stem of the question.

(ii) The rate of rusting can be increased by using sea water.

Describe a simple experiment to compare how much an iron nail rusts in sea water when compared to water.

(3)

It will rust in sea water because it has got like
Salt in there and probley something else in there
as well because water and iron wold not rust.

ResultsPlus
Examiner Comments

A typical example of an incorrect response where the candidate has simply discussed rusting in sea water and water.

A simple method has not been described, as required in the question.

ResultsPlus
Examiner Tip

Remember to read the question carefully. The requirement to describe experiments or devise a method, often based on Core practicals, is a required skill of this specification.

Question 3 (c) (iii)

This question was not well answered on the whole with about half of responses scoring the 1 mark available.

The candidates simply were required to multiply the two values given in the question to calculate the mass of zinc needed to coat an iron bucket.

Many candidates either incorrectly divided or subtracted the two numbers given in the question. A common misconception was to square the value of the surface area '0.68'

Question 4 (b) (i)

This question was poorly answered on the whole with the majority of responses not scoring the 1 mark available.

It was clear to examiners that very few candidates really understood the need for presence of the thermometer in the distillation apparatus, namely to measure the temperature of the water vapour passing into the condenser. This is an area of the specification frequently examined.

Many incorrect responses stated: measuring the temperature of the water or ink, or that thermometer would get too hot or that the thermometer was a barrier to the water vapour escaping.

Question 4 (b) (ii)

This question was very well answered on the whole, with the majority of responses scoring the 1 mark available.

The most commonly seen correct responses correctly referred to the beaker in the diagram not being under the condenser exit, with fewer responses referring the incorrect water flow in the condenser.

In those responses which did not score, it was often clear that candidates confused the 'water out' labelled on the condenser with the condenser exit.

(ii) State **one** other mistake in Figure 5.

(1)

The beaker needs to be under the part labelled "water out" so it can catch the water.

ResultsPlus
Examiner Comments

This response did not score since the candidate has incorrectly referred to the 'water out' on the condenser, rather than the exit of the condenser.

ResultsPlus
Examiner Tip

It is worthwhile learning the set up for distillation and the correct labels. It is a commonly tested area of the specification.

(ii) State **one** other mistake in Figure 5.

(1)

The water in and water out are the wrong way, the water enters through bottom tube.

ResultsPlus
Examiner Comments

This is a good example of a correct response where the candidate has recognised from the diagram that the water flow in the cooling of the condenser is the wrong way round.

Question 4 (c) (i)

This question was very well answered on the whole with the majority of responses scoring the 2 marks available.

It was clear to examiners that candidates could clear clearly recall the correct sequence of steps in a paper chromatography experiment.

In the few cases where responses only scored 1 mark, it was for identifying just two correct steps and those steps being adjacent to each other.

Question 4 (c) (ii)

This question was very well answered on the whole with the majority of responses scoring the 2 marks available.

The majority of correct responses identified mixture T and correctly explained this in regard to it having the greater number of spots.

Those responses where only 1 mark was credited, often gained the first mark for identifying mixture T, but simply repeated the stem of the question in their explanation, namely 'contains the greatest number of coloured substances'.

Question 4 (c) (iii)

This question was well answered on the whole with the majority of responses scoring at least 1 of the the 2 marks available.

It was clear that some candidates were unable to recall the correct formula for calculating the R_f value for a spot from the chromatogram and giving their answer to the required two significant figures, namely 0.29.

Of those candidates scoring 1 mark only, this was often for giving the correct ratio but then failing to given their final answer to 2 significant figures.

Question 5 (a) (ii)

This question was very well answered on the whole with the majority of responses scoring at least 1 of the 2 marks available.

Most commonly correct responses referred to keeping the' amount or volume of acid' the same and keeping the 'concentration of acid' the same. Often incorrect references to time were made which was ignored by the examiners.

(ii) State **two** variables, apart from the mass of the metals, that should be controlled in this investigation.

(2)

1 how much metal we but in the reactivity.

2 and the time.

ResultsPlus
Examiner Comments

A typical example of response which did not score.

The amount of metal has been mentioned but, while true, this is repeating the stem of the question, so did not score. The time is ignored.

(ii) State **two** variables, apart from the mass of the metals, that should be controlled in this investigation.

(2)

1 how much ~~of~~ hydrochloric acid is used

2 And the concentration of the ~~hydrochloric~~ hydrochloric acid.

ResultsPlus
Examiner Comments

A typical example of a fully correct answer.

Keeping the amount and concentration of the acid are the two variables that should be kept the same.

Question 5 (a) (iii)

This question was well answered on the whole with most responses scoring the 1 mark available.

The majority of correct responses referred to 'copper not reacting' to score the mark.

Often in those responses which did not score, answers incorrectly referred to copper being a 'transition metal' or 'not having enough electrons', showing little understanding of the reactivity series of metals.

Question 5 (a) (iv)

This question was very well answered on the whole with most responses scoring at least 1 of the 2 marks available.

Most candidates were able to recall the correct state symbols for the two products in the given word equation. Although, lower case symbols are expected, the use upper case symbols was credited.

Question 5 (b) (i)

This was very poorly answered with exceptionally few candidates scoring the 1 mark available.

Candidates clearly struggled with this task requiring the writing the formula of a ionic compound, potassium sulfate, given the formulae of the constituent ions, $K^+$and SO_4^{2-} respectively.

The majority of incorrect responses simply stated, KSO_4, failing to understand the need for two potassium ions to balance the charge of the sulfate ion.

Question 5 (b) (ii)

This question was very well answered on the whole with most responses scoring the 2 marks available.

The majority of candidates were able to calculate the mean value for the mass of potassium sulfate, namely 0.22g.

In the few cases where 1 mark only was scored, this was invariably for not correctly rounding the final answer to two decimal places or incorrectly rounding up, giving 5.23g.

(ii) Equal volumes of a solution of potassium carbonate were reacted separately with an excess of dilute sulfuric acid solution.
Pure dry samples of potassium sulfate were obtained from the resulting solutions.

The experiment was repeated three times using the same conditions.

The masses of potassium sulfate obtained were

experiment 1 = 5.22 g
experiment 2 = 5.24 g
experiment 3 = 5.21 g

Calculate the mean mass of potassium sulfate obtained, giving your answer to two decimal places.

(2)

5.22 + 5.24 + 5.21 ÷ 3 = [illegible] 5.223 =
5.23

mean mass of potassium sulfate = 5.23 g

ResultsPlus
Examiner Comments

An example of a response scoring only 1 mark.

Although the calculation shown is correct, the final answer has been incorrectly rounded.

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Examiner Tip

Rounding answers to a specified number of decimal places or significant figures is a required mathematical skill in the specification. Take care when the rounding of the final answer to calculation is a requirement for a particular question. This requirement will always be clearly stated in the question.

Question 6 (b) (i)

This question was well answered on the whole with most responses scoring the 2 marks available.

The majority of responses gave both zinc oxide and carbon as the reactants and also zinc and carbon dioxide as the correct products. The stem of the question gave the candidates all the names of the species involved in the reaction.

Commonly seen errors and omssions included: giving only one product and not both, giving a mixture of names and formulae, giving additional products such as 'water' and 'zinc carbonate', or mixing up reactants and products.

In several responses examiners noted that candidates were unsure of the conventions for writing word equations, namely incorrectly writing the word 'and' between the products or reactants rather than the correct '+' sign.

(b) Zinc can be extracted by heating zinc oxide with carbon.

The products are zinc and carbon dioxide.

(i) Write the word equation for this reaction.

(2)

~~Zinc oxide + carbon →~~

Zinc oxide + carbon dioxide → Zinc carbonate

ResultsPlus
Examiner Comments

A typical example of a response that did not score.

Although zinc oxide is correctly shown on the reactants side of the equation, carbon dioxide has also been incorrectly included. The 'zinc carbonate' has been incorrectly shown as the only product.

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Examiner Tip

Writing word equations is a common feature of the chemistry specification. Use the information, namely the names of the reactants and products, in this case all names are given in the stem, to help you write the word equation.

Question 6 (b) (ii)

This question was poorly answered on the whole with most responses not scoring the 1 mark available.

The use of the term 'reduction' to describe the type of reaction when an oxide loses oxygen was rarely seen in responses.

Typically incorrect responses included references to 'oxidation' or 'de-oxidisation'.

Question 6 (c) (i)

This question was well answered on the whole with most responses scoring the 1 mark available.

The majority of responses correctly gave the correct number of ions in the formula Al_2O_3, namely five.

In many incorrect responses, 2 was the given number, suggesting that candidates were giving the number of different elements in the formula rather than number of ions.

In a few cases, candidates had misinterpreted the question and had correctly calculated the formula mass for aluminium oxide.

Question 6 (c) (ii)

This question was well answered on the whole with most responses scoring at least 1 of the 2 marks available.

Many candidates gave both correct balancing numbers, 4 and 3 respectively, in the spaces of the balanced equation provided. This is an equation commonly seen in this area of the specification and appeared to be well understood by candidates .

Question 6 (d) (i)

This question was very well answered on the whole with the majority of responses scoring the 2 marks available.

It was clear to examiners that candidates could clearly recall the correct sequence of stages in a life-cycle assessment.

In the few cases where responses only scored 1 mark, it was for identifying just two correct stages and those stages being adjacent to each other.

Question 6 (d) (ii)

This question was poorly answered on the whole with most responses not scoring any of the 2 marks available.

Very few responses gave creditworthy responses for advantages of obtaining aluminium by recycling waste rather than by mining the raw material and extraction.

The main issue noted by examiners was the lack of detail or vagueness in the candidates' responses. Commonly seen responses included: 'better for the environment', 'less pollution', 'quicker', 'easier' and 'less waste'. Only in few cases were these qualified, eg 'less waste metal goes to landfill' and gained credit.

Again, this area of the specification, commonly examined in both this series and many previous series, was poorly understood by candidates.

(ii) Aluminium can be obtained by recycling aluminium waste.

Give **two** advantages of obtaining aluminium by recycling aluminium waste rather than mining the raw material and extracting aluminium from that raw material.

(2)

1 Cheaper

2 quicker to use

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Examiner Comments

A typical example of those responses commonly seen by examiners which did not score.

The terms 'cheaper' and 'quicker to use' are vague and not qualified, so are not creditworthy.

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Examiner Tip

Practise examples of questions requiring both advantages and disadvantages, there are plenty of examples in examination papers of the previous specification.

(ii) Aluminium can be obtained by recycling aluminium waste.

Give **two** advantages of obtaining aluminium by recycling aluminium waste rather than mining the raw material and extracting aluminium from that raw material.

(2)

1 Saves money and energy as it takes alot of energy to extract a metal from its ore

2 good environmental impact

Mines wont need to be created thus habitats wont need to be destroyed.

(Total for Question 6 = 11 marks)

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Examiner Comments

This is an example of a response which scored 2 marks.

The correct ideas of less energy required and less damage to habitats have been conveyed.

Question 7 (a) (i)

This question was not well answered on the whole with less than half of responses scoring the 1 mark available.

Correct responses referred in similar frequency to either phosphorus, potassium or nitrogen.

Commonly seen incorrect responses frequently referred to other incorrect elements, such as 'oxygen', or gave the names of fertilisers rather than specific elements.

Question 7 (a) (ii)

This question was not well answered on the whole with less than half of responses scoring the 1 mark available.

Although, there were many fully correct responses, many candidates were unable to write the correct formula of potassium nitrate, or were unable to recognise that water is the other product in this neutralisation reaction.

Examiners noted that many candidates simply repeated the formula of the reactant, KOH, also as the product.

(ii) Potassium nitrate is present in some fertilisers.

Potassium nitrate is formed by the reaction of potassium hydroxide solution with nitric acid.

Complete the balanced equation for this reaction.

(2)

$KOH + HNO_3 \rightarrow$ $3KNO_3$ + water

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Examiner Comments

This response scored 1 mark only.

The correct formula of one the products, KNO_3, has been given. However, although water has been identified as a product, its formula has not been given. Also, there is an incorrect attempt at balancing, so even had the formula of water been correctly stated, the response would have been limited to 1 mark.

(ii) Potassium nitrate is present in some fertilisers.

Potassium nitrate is formed by the reaction of potassium hydroxide solution with nitric acid.

Complete the balanced equation for this reaction.

(2)

$KOH + HNO_3 \rightarrow$ KNO_3 + H_2O

ResultsPlus
Examiner Comments

An example of a fully correct response. Both the formulae of the correct products, KNO_3, and H_2O, have been given.

Question 7 (b) (i)

This question was very well answered on the whole with most candidates gaining the 1 mark available.

Responses mainly referred to the required specific term 'reversible', and less freqently 'equlibrium' was seen by examiners.

Commonly seen incorrect responses incorrectly stated 'reversed' which is not specific enough to score. In a few cases the incorrect terms 'equal', 'mutual', 'opposite', 'reduction' were seen.

Question 7 (b) (ii)

This question was very poorly answered with very few correct responses seen for the 1 mark available.

Very few candidates were able to recall the formulae for ammonia, namely NH_3. Often this was left blank by candidates. This was surprising since ammonia and its formation, in relation to the fertilisers, is a frequently tested part of the specification and also in the previous specification.

The most commonly seen errors in those who attempted this question were NH_2 and NH_4.

Question 7 (b) (iii)

This question was extremely well answered with a significant majority of responses scoring the 1 mark available.

Most candidates were able to state the overall trend in the graph shown, namely that world ammonia increases over time.

The only thing that was highlighted by examiners was that many responses gave a lot more detail than necessary for the 1 mark avialable.

Question 7 (c)

This question was poorly answered on the whole with only about a third of the responses scoring the 1 mark available.

It was evident from responses that very few candidates could recall 'water' as the product of the hydrogen-oxygen fuel cell.

The most commonly seen incorrect responses mentioned 'hydroxide', 'oxygen' or 'hydrogen' as products.

Question 7 (d)

This extended open-response question showed a wide range in the level of candidate responses seen. Of those responses which scored, invariably they scored only a Level 1 or Level 2, namely 1-4 marks.

This area of the specification, the preparation of crystals of a salt and carrying out a titration, is a frequently tested part of this specification and also of the previous specifications and a Core practical.

Examiners noted that in the majority of the responses seen there was confusion over terminology for key pieces of apparatus eg burette and in the sequencing of steps required. Many candidates simply wrote ‘heat the solution with a Bunsen burner’ to describe crystallisation. There were a wide range of indicators chosen across the cohort – but in the main they stated the correct colour change for the one they mentioned.

Responses scoring lower level marks, at Level 1, often focused on either the titration or the crystallisation method. In those responses scoring at Level 2, candidates often referred to both the titration and the crystallisation method but not always with complete clarity. In those responses scoring at Level 3, the candidates stated everything required but just missed out repeating without the indicator. This being said, many examiners noted that there were many responses awarded the full 6 marks available - this suggests that they had a clear understanding of the practical procedures involved.

*(d) Ammonia solution and dilute sulfuric acid are used to prepare pure, dry ammonium sulfate crystals.

In an experiment a titration is carried out to determine the volumes of ammonia solution and dilute sulfuric acid that react together.
Then an ammonium sulfate solution is prepared from which the pure, dry crystals are obtained.

Describe in detail, using suitable apparatus, how this experiment should be carried out.

(6)

In order to obtain pure dry crystals you must carry out titration and then crystallisation.

① ~~Using a the~~ Make sure you have taken all safety precautions e.g. goggles, hair tied back, gloves etc.

② Using a beurette measure out and record the ammonia solution volume. and add to beaker along with a few drops of indicator (methyl orange). ~~To~~

③ Now using a pippette measure how much sulpuric acid you will use.

④ Using the dial slowly add the sulpuric acid to the ~~beaker~~ ammonia solution and indicator in the beaker.

⑤ Stop when you see a colour change. Methyl orange ~~sh~~ will turn yellow to red once ammonia solution has been neutralised.

⑥ ~~Repeat this pra~~ Record the amount of volume left in pippette. Ie: Your table should look like this:

Sulpuric acid		Titre 1	Titre 2	Titre 3	Titre 4
	Initial vol				
	Final vol				
	Change in vol				

⑦ Repeat the practical at least 3 times.

⑧ Once you have all data recorded you must calculate the mean volume of the ~~a~~ volume of acid added by adding the ~~2 most closest numbers~~ 2 further numbers and dividing by 2. = Mean volume.

(9) Now repeat titration without indicator using mean volume of acid.

(10) Now using crystallisation filter solution using filter paper then in a petri dish pour mixture of ammonium sulfate and heat until boiling over bunsen burner using tripod, ~~and~~ heat mat and mesh. This will evaporate excess water.

(11) Once bought upto boiling point remove from heat and allow to cool. This is now pure

(12) ~~Now using filter paper, filter solution~~ Once cooled leave in dry heat e.g: sunlight / oven etc for crystals to form.

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Examiner Comments

This response was awarded Level 3 - 6 marks.

The method for the titration is sufficiently developed, although the use of a pipette and a burette are the wrong way round. The method for crystallisation is sufficiently developed. Although filtering is not mentioned, the key process of leaving out the indicator is emphasised. Overall, this is sufficient for Level 3.

Firstly you will need to gather the equipment and things you need to bring. Ammonia solution, dilute sulfuric acid, ~~bunsen bu~~ a beaker.

~~put~~ firstly put some ammonium solution in the beaker after that add the dilute sulfuric acid once both of these solutions have been mixed togethere you have made ammonia sulfate solution. once you have this product leave it to set for ~~a~~ ~~few~~ days at a time and see when ~~sulfa~~ crystals ~~are~~ formed

ResultsPlus
Examiner Comments

This response was awarded Level 1 - 2 marks

This is a low level response with very little detail, but makes simple statements regarding mixing together the reactants in a beaker and a simple method for crystallisation.

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Examiner Tip

This is a frequently asked for procedure. Learn the key steps in the titration and in the production of pure dry crystals.

- Begun by setting up your apparatus consisting of a conical flask, a biruet and a small dish.
- Next put the suggested amount ~~of~~ / volume of ammonia solution into the tube using the biruet. ~~then add the volume of~~ into the conical flask.
- Then wash out the tube with water and add the suggested volume of sulfuric into the tube and stop from flowing into the flask
- Add small amounts of sulfuric acid to the flask of ammonia solution a bit at a time, then mix.
- There should then be a colour change once the solutions mix.
- pour the mixture into the dish and set up a bunsen burner.
- Heat the mixture until boiling and remove it from the bunsen.

- ~~If~~ Leave the mixture to cool and leave for a few days.
- Finally you should observe ammonium sulfate crystals, the take results.

- when carrying this experiment out, ensure protective clothing and goggles are worn to prevent potential harm.

ResultsPlus
Examiner Comments

This response was awarded Level 2 – 4 marks.

The method for the titration is described but not well-developed, namely not mentioning the use of the key apparatus or an indicator. There is also a simple description of the crystallisation.

ResultsPlus
Examiner Tip

This is a frequently asked for procedure. Learn the key steps in a titration, including the apparatus linked to its use, and the key steps in the production of pure dry crystals.

Question 8 (a) (i)

This question was very well answered on the whole with most responses scoring the 1 mark available.

Most candidates could identify which of the featured elements of the periodic table were non-metals. G and X were the most common elements chosen by the candidates, so most candidates knew of the division between metals and non-metals in the periodic table. However, some chose to name non-metals that were outside the elements under consideration in the question; these did not score. Some chose to use the periodic table to 'translate' the lettered elements in the question, so two of either B, O or Ar also scored, but use of the element names was not credited.

Question 8 (a) (ii)

This question was poorly answered on the whole with most responses not scoring the 1 mark available.

Just over a quarter of the candidates could give the letters of the featured elements that were in period 2 – that is two of A, E and G or 'translated' as Li, B or O. The most common errors were giving the letters J and X which were in period 3, or using the periodic table (provided for candidates at the back of the examination paper) to identify two elements in group 2 – usually Mg and Ca.

The main misconception noted by examiners was a confusion about which is period 2 and confusion between the meaning of the terms period and group when associated with the periodic table.

Question 8 (a) (iii)

This question was not well answered on the whole with just over half of responses scoring the 1 mark available.

Of those who scored the 1 mark, this was for giving the letter of an element that normally forms, an ion with a charge of +1, namely, A or J, or 'translated' as Li or Na. The most commonly given incorrect choices were Z followed by G. Again, several candidates did not follow the instructions and several named incorrect elements such as hydrogen or potassium which were not the elements under consideration in the question.

Question 8 (b) (i)

This question was not well answered on the whole with just less than half of responses scoring at least 1 of the 2 marks available.

Despite examiners having seen some flawless answers, few candidates were able to define the term 'isotopes' correctly. In the responses that scored 1 mark, this was often for a correct reference to isotopes having a 'different number of neutrons', with no reference to the number of protons, or alternatively mentioning only 'same number of protons'.

It was clear from responses that many candidates had clearly not read the guidance in the question, namely the important phrase 'in terms of subatomic particles'. stated that isotopes have the 'same atomic number but a different mass number'. This was credited with 1 mark, since it was evident that they knew what isotopes were but had not phrased their answer in terms of subatomic particles.

The main misconceptions in many responses that did not score were the incorrect assumption that isotopes are atoms of different elements, or that isotopes means 'electron transfer', showing some confusion with ionic bonding.

(b) Element **E** has an atomic number of 5.
In a sample of **E** there are two isotopes. One isotope has a mass number of 10 and the other isotope has a mass number of 11.

(i) Explain, in terms of subatomic particles, what is meant by the term **isotopes**.

(2)

The term isotopes means the transfer of electrons.

ResultsPlus
Examiner Comments

This is typical of many responses seen which did not score any of the 2 marks available.

The candidate has confused istopes with electron transfer.

ResultsPlus
Examiner Tip

Learn key definitions of the terms in the specification, namely 'isotopes'.

(i) Explain, in terms of subatomic particles, what is meant by the term **isotopes**.

(2)

~~An~~ atoms that ~~....~~ have the same number of protons but different number of neutrons.

ResultsPlus

Examiner Comments

This response scored both available marks.

There are correct references made to 'same number of protons' and a 'different number of neutrons'.

Question 8 (c)

This question was well answered on the whole, with about two thirds of the responses scoring the 1 mark available.

Most candidates gave the correct electronic configuration as 2.8.8. A small minority of these drew a correct electron shell diagram, instead of writing out the electron configuration in figures, so were credited with the mark.

Question 8 (d)

This question was poorly answered on the whole with most responses not scoring any of the 3 marks available.

Most candidates struggled with this empirical formula calculation.

The most major and regularly seen misconception was that candidates multiplied the masses and relative formula masses, namely stating 3.5 x 7 = 24.5, followed by 4 x 16 = 64 then adding them together and arriving at a final answer of 88.5.

(d) In an experiment, 3.5 g of element **A** reacted with 4.0 g of element **G** to form a compound.

Calculate the empirical formula of this compound.
(relative atomic masses: **A** = 7, **G** = 16)

You must show your working.

(3)

A　　　　G

A = 7 / 3.5　　　　16 / 4

2 / 2　　　　4 / 2

1　　　　2

empirical formula of this compound = AG_2

ResultsPlus
Examiner Comments

This response scored 2 marks by error carried forward on the first step in the calculation.

In effect, only one error has been made. The ratios have been incorrectly inverted and the ratio stated. This in turn has been converted into an empirical formula based on the error carried forward.

ResultsPlus
Examiner Tip

Practise laying out empircal formulae calculations - remember to divide the masses by their relative atomic masses.

Calculate the empirical formula of this compound.
(relative atomic masses: **A** = 7, **G** = 16)

You must show your working.

(3)

~~0.5~~ ~~0.25~~

~~7/46~~ ~~7/3.5~~ ~~16/4~~

$\frac{3.5}{7}$ $\frac{4}{16}$

= 0.5 0.25

2 : 1

empirical formula of this compound = ~~Li~~ Li_2O
A_2G

ResultsPlus
Examiner Comments

A example of a fully correct response scoring 3 marks.

The masses have been divided by the relative atomic masses. The ratio has been derived from these which has been correctly translated into the empirical formula. Note that in this particular case, the candidate has actually determined the symbols of the elements, this is not required, but the formula Li_2O would be creditworthy.

ResultsPlus
Examiner Tip

Practise empirical formula calculations - they all follow a particular pattern.

Question 8 (e)

This question was very well answered with over half of responses scoring both marks.

The majority of responses produced a correct dot and cross diagram, namely another shared pair of electrons between the oxygen and the hydrogen atoms and four non-bonding electrons in the shell for oxygen

A further third of the candidates scored 1 mark only for a correct shared pair of electrons between oxygen and the other hydrogen atom, losing the second mark by having too many or too few electrons on the oxygen atom. Some candidates added extra electrons to both hydrogen atoms or added extra hydrogen atoms around the oxygen atom.

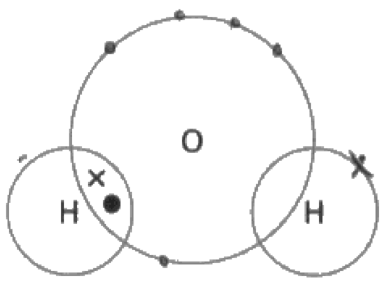
(e) An oxygen atom has six electrons in its outer shell.

A hydrogen atom has one electron in its outer shell.

Complete the dot and cross diagram of a molecule of water, H_2O.

Show outer shell electrons only.

(2)



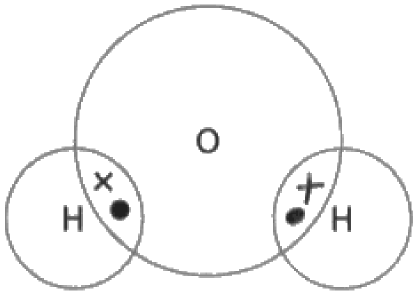
ResultsPlus
Examiner Comments

An typical example of a response that did not score.

A shared pair of electrons has not been drawn between the oxygen and the hydrogen atoms on the right hand side. Also, the outer shell of oxygen has too many electrons, five, drawn and a cross has been incorrectly drawn in shell for the hydrogen atom.

ResultsPlus
Examiner Tip

Practise drawing dot and cross diagrams, particularly for those molecules listed in the specification.



ResultsPlus
Examiner Comments

This response scored 1 mark only.

Only the shared pair of electrons has been shown between the hydrogen and oxygen atoms, with the four non-bonding electrons omitted from the outer shell of oxygen.

Question 9 (a) (i)

This question was well answered on the whole with the majority of responses credited with the 1 mark available.

It was pleasing to note that most candidates scored by referring to '(squeaky) pop' as the correct observation for the test for hydrogen gas.

Very few gave the incorrect response, 'it ignites' as stated in the question. In some cases, this test was confused with the test for oxygen, namely the incorrect result 'relights a glowing splint'.

Question 9 (a) (ii)

This question was well answered overall with the majority of responses scoring at least 1 of the 2 marks available.

Of the responses scoring 1 mark only, most candidates either compared across the table, to show quantitatively that there is twice as much hydrogen as oxygen, or down the table, stating that volume of gas increasing.Very few candidates stated both these patterns together.

Many candidates simply copied numbers from the table which did not score.

(ii) Throughout the experiment the volume of hydrogen and the volume of oxygen are measured at two-minute intervals.

The results are shown in Figure 9.

time in minutes	volume of hydrogen in cm^3	volume of oxygen in cm^3
0	0	0
2	4	2
4	8	4
6	12	6
8	16	8

Figure 9

Describe, using the data in Figure 9, what the results show about the volumes of hydrogen and of oxygen produced in this experiment.

(2)

The volume of ~~oxygen~~ hydrogen is increasing faster than oxygen and ~~is~~ the volume of hydrogen is always double the volume of oxygen.

ResultsPlus
Examiner Comments

This response scored both marking points.

Both the correct ideas of increasing volumes of gas with time and that the volume of hydrogen is twice that of the oxygen have been stated.

Describe, using the data in Figure 9, what the results show about the volumes of hydrogen and of oxygen produced in this experiment.

(2)

hydrogen had twice as much of oxygen.

ResultsPlus
Examiner Comments

This response scored 1 mark only.

The correct quantitative relationship has been stated. However, there is no comment made regarding the increase in volume of gases.

Question 9 (c)

This question was very poorly answered with most responses failing to score either of the 2 marks available.

Candidates struggled to link conductivity and solubility in ionic compounds.

Of those candidates who attempted the question, the majority scored 1 mark with a simple statement regarding the nitrate being soluble and the carbonate being insoluble.

There was some confusion evident from responses regarding key concepts, with many responses mentioning electrons moving rather than ions. If ions were mentioned, they were frequently said to be 'free' rather than free to move. Also, many candidates mentioned reactivity (rather than solubility).

(c) Calcium nitrate and calcium carbonate are both ionic compounds.

Calcium nitrate mixed with water behaves as an electrolyte.
Calcium carbonate mixed with water does not behave as an electrolyte.

Explain, in terms of solubility and movement of ions, this difference in behaviour.

(2)

~~The protons in the nitrate will move to the anode electrode~~ The nitrate reacts well with the anodes and canodes whereas the carbonate doesn't.

ResultsPlus
Examiner Comments

This was a typical incorrect response seen where the candidate has confused solubility and reactivity.

Explain, in terms of solubility and movement of ions, this difference in behaviour.

(2)

because nitrate is ~~[illegible]~~ soluble and carbonate isn't and nitrates have free ions and are able to conduct electricity but carbonate can't.

ResultsPlus
Examiner Comments

This response scored both marking points.

The correct idea of the the carbonate being insoluble and nitrate being soluble has been conveyed. This is coupled with the idea that the ions are free to move in the dissolved nitrate.

Question 9 (d)

This extended open-response question was very poorly answered with the majority of responses not scoring. Of those responses which scored, invariably they scored only a Level 1 answer.

Clearly, this area of the specification, 'electrolysis', is one causing great difficulty conceptually for candidates, despite this being a Core practical and questions having been set regularly in this and the previous specifications.

Many candidates are unable to identify the correct charges of the electrodes and to recognise which ions will be positive and which negative, even with those writing the 'PANIC' mnemonic at the top of the answer. Some gained credit for saying that both electrodes increased in mass, the thought often being that the cathode gained pure copper while the anode gained impure copper. Many thought that the solid appearing under the anode was copper, often impure copper that had fallen from the electrode. Few identified this solid as impurities from the anode. Very few correctly described why the solution does not change in colour. It was very clear that very few candidates indeed had any real understanding of what was going on in this process even though this is a Core practical.

Despite the overall number of poor responses seen, occasionally some very good responses were seen, in which candidates described in some detail the movement of ions and occasionally correctly used half equations.

*(d) Impure copper can be purified using electrolysis.

In this electrolysis

- the anode is made of impure copper
- the cathode is made from pure copper
- the electrolyte is copper sulfate solution.

The apparatus at the start of the experiment is shown in Figure 10.

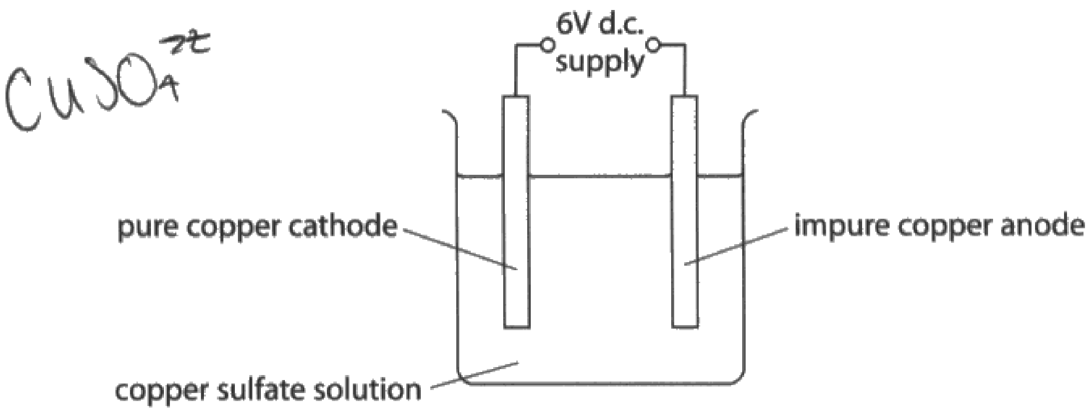


Figure 10

During the electrolysis three observations are made

- the sizes of both the anode and the cathode change
- a solid appears directly beneath the anode
- the colour of the copper sulfate solution does not change.

Explain all three observations.

(6)

During electrolysis, the positively charged ions (Cu) goes to the cathode and the negatively charged ions (SO_4^{2-}) goes to the anode ~~there~~. Therefore, the sizes of both the anode and the cathode changes, as the cathode would gain mass as the copper goes to it. At the end of the anode, a sulfate is formed as negative ions move towards it.
The colour of the sulfate solution does not change, as there is still ~~copper~~ $CuSO_4^{2-}$

ResultsPlus
Examiner Comments

This response was awarded Level 2 - 4 marks.

The correct idea of the movement of positive ions to the cathode and the increase in mass of the cathode due to gaining copper are discussed. This was sufficient for Level 2.

During the electrolysis the size of both the anode and the cathode change this is because the anode which is impure is decreasing in size as it is loosing the copper ions which are travelling through the electrolyte to the cathode which gains mass due to the copper ions. But at the back of the anode there is a solid formed at the base of the anode.

This is due to the impurities in the copper falling to the bottom as the copper ions were lost which is why there was a solid formed as it was the impurities.

Aswell, the colour of the electrolyte has no change as its purpose serves only as a conductor of electricity that is able to carry the copper ions from the anode to the cathode.

ResultsPlus
Examiner Comments

This response was awarded Level 3 - 6 marks

The relative increase in the size of the cathode and decrease in size of the anode have been explained in terms of movement of copper ions from the anode to cathode. The solid beneath the anode has been explained in terms of impurities.

Both the anode and the cathode will ~~&~~ change size as at the cathode, positevely charged cations are attracted and at the anode, negatively charged anions are attracted. A solid will appear ~~directly~~ directly beneath the anode as particle from the copper sulfate ~~an~~ will join up as it is an anode connected to a 6V d.c. supply. Electricity will not make the copper sulfate solution change colour.

ResultsPlus
Examiner Comments

This response was awarded Level 1 - 1 mark only

There is little creditworthy material overall in the response. However, there is the correct idea of the movement of positively charged ions to the cathode which can be credited with 1 mark.

The sizes of both the anode and cathode change due to the anode being positive and the cathode being negative. The positive cations will go to the negative cathode as ~~negative~~ opposite ions attract, making the cathode bigger in size. ~~However instead of~~ The anode also attracts the negative anions as it is positive, although instead of all the ions joining the electrode, some of the ions join together to form the metal underneathe positive anode as metals have a positive charge.
Finally, the colour of the copper sulfate solution does not change as the electrolyte already contains the metal meaning that ~~not~~ non of the ions are ~~absorb~~ dissolved into it.

ResultsPlus
Examiner Comments

This response was awarded Level 1 - 2 marks

The correct idea of the cathode increasing in size and the movement of positive cations, although not copper ions specifically, is sufficient for Level 1.

Question 10 (a)

This question was well answered with the majority of candidates scoring the 1 mark available.

Most candidates were able to correctly subtract the mass of solid remaining from the initial mass of calcium carbonate to arrive at the correct answer 1.787.

Commonly seen errors included: some candidates subtracted incorrectly or divided their correct answer by two.

Question 10 (b) (i)

This question was well answered on the whole with the majority of candidates scoring the 2 marks available.

In most correct responses, candidates gave their final answer to 2 decimal places.

Commonly seen errors included: (5.600-5.450)/5.600 x 100; inverted fraction, which often was not multiplied by 100; multiplying the masses, namely 5.4 X 5.6 (= 30.52%).

It was noted by examiners that some responses failed to gain full credit since candidates were attempting to scale their answers rather than multiplying the fraction obtained. This might indicate the lack of a calculator when doing this calculation.

Question 10 (c) (i)

This question was not well answered overall, with the majority of responses managing to score only 1 of the 2 marks available.

It is worthwhile noting that this question required an explanation but many candidates simply gave a description. Almost all candidates only scored the first marking point since they did not explain the trend but only described it, namely that mass decreases for calcium carbonate. There were very few 2 mark responses seen, suggesting they found it very difficult to describe what happens as a reaction progresses. In several of those responses where an explanation was attempted they usually did not score it as they incorrectly stated evaporation rather than loss of a gas.

(c) Another sample of calcium carbonate is heated and the mass of solid remaining is measured each minute.

The results are shown in Figure 11.

time in minutes	0	1	2	3	4	5	6	7
mass of solid remaining in g	9.0	8.1	7.2	6.4	6.0	5.6	5.3	5.2

Figure 11

(i) Explain the trend shown by the data in Figure 11.

(2)

as the time increases, the mass of the solid remaining decrease.

ResultsPlus
Examiner Comments

This was a commonly seen response scoring 1 mark only.

The correct trend in the data has been described but has not been explained.

Question 10 (c) (ii)

This questiion was very poorly answered with fewer than a quarter of responses scoring the 1 mark available.

It was clear from the responses that few candidates understood the concept of heating to constant mass.

The major misconception was that many candidates thought that the mass of the solid would decrease to zero or simply that there is still some mass left; others incorrectly thought they needed to know the theoretical yield.

(ii) It is impossible to be sure from this data that the reaction is complete.

State why.

(1)

because the reaction kept decreasing in grams and the data ~~to~~ ~~s~~ does not show the point at which the solid stayed at the same mass.

ResultsPlus
Examiner Comments

This response scored the 1 mark available.

The response correctly mentions that the mass is still decreasing and has not reached a point where the mass stays constant.

(ii) It is impossible to be sure from this data that the reaction is complete.

State why.

(1)

because the mass doesn't reach 0 g it finishes at 5.2g

ResultsPlus
Examiner Comments

This response was typical those that did not score.

This highlights the misconception of the majority of candidates where they incorrectly assumed that the mass would eventually go down to zero in the thermal decomposition of the calcium carbonate.

Question 10 (d)

For the first part of the question, Q10di, was well answered with the majority scoring the 2 marks available.

Candidates clearly understood how to use the relative atomic masses of calcium, carbon and oxygen to correctly deduce the relative formula mass of $CaCO_3$ to be 100.

A common error which often led to 1 mark only, often arose when failing to multiply the relative atomic mass of oxygen by three, namely arriving at a value of 68.

The second part of the question, Q10dii, was very poorly answered with a significant majority of responses not scoring either of the 2 marks available.

Very few candidates clearly understood how to calculate the atom economy.

A common answer was 56, which generally did not score since no working was provided. The most commonly seen incorrect answer was 100 - indicating that a surprising number of candidates seemed to think both products were useful and so had an atom economy of 100%. With the relative formula mass of calcium carbonate being 100 (as calculated in part Q10di), the need to both divide by 100 and then multiply by 100 in the same calculation may be a factor that proved most challenging to candidates.

(d) (i) Calculate the relative formula mass of calcium carbonate, $CaCO_3$.
(relative atomic masses: C = 12, O = 16, Ca = 40)

(2)

40 + 12 + (16 × 3)

40 + 12 + 48 = 100

relative formula mass = 100

(ii) Calculate the atom economy for the formation of calcium oxide in this reaction.

$$CaCO_3 \rightarrow CaO + CO_2$$

You must show your working.
(relative atomic masses: C = 12, O = 16, Ca = 40;
relative formula mass: calcium oxide = 56)

(2)

~~100~~ 100 → 40 + 16 + 12 + 32

100 → 100

atom economy = 100 %

ResultsPlus
Examiner Comments

This response scored 2 marks for part Q10di

The relative formula mass for calcium carbonate has been correctly calculated by adding together the relative atomic mass values for all the atoms in its formula.

The response for part Q10dii was not creditworthy.

The candidate has not calculated the atom economy but has simply added together all the relative atomic masses for the atoms in the two products in the equation given in the question.

(d) (i) Calculate the relative formula mass of calcium carbonate, $CaCO_3$.
(relative atomic masses: C = 12, O = 16, Ca = 40)

(2)

relative formula mass = 100

(ii) Calculate the atom economy for the formation of calcium oxide in this reaction.

$$CaCO_3 \rightarrow CaO + CO_2$$

You must show your working.
(relative atomic masses: C = 12, O = 16, Ca = 40;
relative formula mass: calcium oxide = 56)

(2)

$\frac{CaO}{CaCO_3} \times 100 \qquad \frac{56}{100} \times 100 =$

atom economy = 56 %

ResultsPlus
Examiner Comments

This response scored both marks for both parts Q10di and Q10dii.

Although, no working has been shown in Q10di, it is the correct value and is credited with the 2 marks.

With part Q10dii the correct calculation for the atom ecomomy has been shown, namely (56/100) x 100 =56.

Note that had 56 alone been given, ie without working, this would have not been creditworthy.

ResultsPlus
Examiner Tip

It is sensible with all calculations to show all working. Often where there has been a simple arithmetical error in a candidate's method, examiners are able to award marks in a calculation by error carried forward.

Paper Summary

Based on their performance on this paper, candidates are offered the following advice:

- practise interpreting data for changes of state for given substances.
- learn the apparatus and the how they are used for simple separation techniques.
- learn the formulae of simple compounds as used in the specification.
- practise writing and balancing equations.
- be able to describe methods for preparation of pure dry crystals of a given salt and in the Core practical.
- to be to explain observations of the electrolytic processes described in the specification and in the Core practical.
- practise answering extended open-response questions.

To help with the above, there are plenty of examples in examination papers of the previous specification which has similar coverage.

Grade Boundaries

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

http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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