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Examiners' Report
June 2025

GCSE Combined Science 1SC0 1CF

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June 2025

Publications Code 1SC0_1CF_2506_ER

Introduction

1SC0_1CF is the first Chemistry paper in the Combined Science Foundation Tier suite. Some of the later questions in the paper also appear in the 1CH Higher Tier paper. The Combined Science questions are a subset of the 1CH0_1F paper, comprising of six of the ten questions in that paper.

Candidates that did well this series were familiar with the practical aspects of the qualification and could apply their understanding to a range of practical contexts. More able candidates could explain the use of apparatus and what was happening in terms of the chemistry in the scenarios given. They were able to substitute values in equations and evaluate them correctly, converting units and giving their answers to the correct number of significant figures or decimal places as requested by the question. Candidates were able to recall key ideas and use them to explain their answers carefully, using key scientific vocabulary and conventions where necessary.

Question 1(b)

The first question of the paper gave candidates the scenario of a student investigating the thermal decomposition of zinc carbonate.

Candidates were given a diagram of the apparatus used in the reaction. Part (b) of the question asked candidates to state what piece of apparatus should be used to heat the zinc carbonate. It was pleasing to see that the vast majority of candidates attempted the question, with the majority scoring the mark for knowing that a Bunsen burner should be used.

(b) State what apparatus should be used to heat the zinc carbonate in Figure 1.

(1)

buncent burner

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Examiner Comments

This example scored the mark.

(b) State what apparatus should be used to heat the zinc carbonate in Figure 1.

(1)

~~themome~~ themometer

ResultsPlus
Examiner Comments

In some cases, candidates did not read the question carefully and named other pieces of equipment, as in this example.

(b) State what apparatus should be used to heat the zinc carbonate in Figure 1.

(1)

water bath

ResultsPlus
Examiner Comments

This example shows a common incorrect answer seen, water bath and other non-laboratory methods of heating were not accepted.

Question 1(c)

In part (c) of the question, candidates were given the word equation for the reaction. They were told that the carbon dioxide was bubbled through the limewater shown in Figure 1. They were asked what would be seen when carbon dioxide bubbles through the limewater.

Candidates found this more challenging with a smaller percentage of candidates scoring than in part (b). Candidates that were familiar with the test for carbon dioxide correctly stated that the limewater would turn cloudy / milky.

(c) The word equation for the reaction that occurs when zinc carbonate is heated is

zinc carbonate → zinc oxide + carbon dioxide

The carbon dioxide bubbles through the limewater.

State what is seen when carbon dioxide bubbles through the limewater.

(1)

It changes colour

ResultsPlus
Examiner Comments

Some candidates were not precise with their answers and simply stated that the limewater would change colour. This was too vague and therefore ignored and no marks awarded.

(c) The word equation for the reaction that occurs when zinc carbonate is heated is

zinc carbonate $\rightarrow$ zinc oxide + carbon dioxide

The carbon dioxide bubbles through the limewater.

State what is seen when carbon dioxide bubbles through the limewater.

(1)

fizzing

ResultsPlus
Examiner Comments

Many candidates lost marks as they repeated the stem of the question and stated that the limewater would bubble or fizz. This was ignored.

ResultsPlus
Examiner Tip

Candidates should be taught not to repeat information from the stem of the question as it will gain no credit.

(c) The word equation for the reaction that occurs when zinc carbonate is heated is

zinc carbonate → zinc oxide + carbon dioxide

The carbon dioxide bubbles through the limewater.

State what is seen when carbon dioxide bubbles through the limewater.

(1)

limewater turns cloudy / milky

ResultsPlus
Examiner Comments

This example scored the mark.

Question 1(d)i

Part (d)(i) gave candidates some results of an experiment that another student carried out, where they measured the mass of an empty test tube and the mass of a test tube containing zinc carbonate. They were asked to calculate the mass of zinc carbonate. A good proportion of candidates were able to subtract the mass of the empty test tube from the mass of the test tube containing zinc carbonate to find the mass of zinc carbonate as 3.21. Where candidates did not score, it was often because they added, rather than subtracted the values.

(d) Another student investigates the change in mass that takes place when zinc carbonate is heated.

(i) Figure 2 shows the results the student records at the start of the investigation.

mass of empty test tube	14.62 g
mass of test tube + zinc carbonate	17.83 g

Figure 2

Using the results in Figure 2, calculate the mass of zinc carbonate in the test tube.

17.83 - 14.63 = 3.2 **(1)**

mass of zinc carbonate = 3.2 g

ResultsPlus
Examiner Comments

In some cases, candidates rounded the answer, this was not accepted and this answer scored no marks.

(d) Another student investigates the change in mass that takes place when zinc carbonate is heated.

(i) Figure 2 shows the results the student records at the start of the investigation.

mass of empty test tube	14.62 g
mass of test tube + zinc carbonate	17.83 g

Figure 2

Using the results in Figure 2, calculate the mass of zinc carbonate in the test tube.

(1)

17·83
14·62
3·21

mass of zinc carbonate = 3·21 g

ResultsPlus
Examiner Comments

This example scored the mark.

Question 1(d)ii

In the last part of Q01, candidates were asked what the student should do next to make sure that all the zinc carbonate had reacted completely. Candidates found this quite challenging with only the most able gaining both marks for understanding that the test tube should be reheated until the mass stopped changing or became a constant mass. Common incorrect answers suggested examining the contents to see if any zinc carbonate remained or mixing the contents of the tube. A noticeable number of candidates did not attempt the question.

(ii) The student then

- heats the test tube containing the zinc carbonate for five minutes
- places the hot test tube on a bench mat to cool
- finds the mass of the test tube and contents.

Describe what the student should do next to make sure that all the zinc carbonate has reacted completely.

(2)

Heat Zinc carbonate again to see if it reacts again

(Total for Question 1 = 6 marks)

ResultsPlus
Examiner Comments

This example scored 1 mark for showing an understanding that the zinc carbonate needs to be heated again, but they do not describe how they would know that all the zinc carbonate had reacted completely.

(ii) The student then

- heats the test tube containing the zinc carbonate for five minutes
- places the hot test tube on a bench mat to cool
- finds the mass of the test tube and contents.

Describe what the student should do next to make sure that all the zinc carbonate has reacted completely.

(2)

The student should heat the zinc carbonate for a further 5 minutes and measure the mass of the test ~~t~~ tube and contents to see if the mass has decreased any further. If so, not all the contents had reacted.

(Total for Question 1 = 6 marks)

ResultsPlus
Examiner Comments

This example scored both available marks. The candidate states that the zinc carbonate should be heated for a further five minutes to gain the first mark. They show an understanding that if the mass has continued to decrease then not all of the contents have reacted. This was sufficient for the second mark.

Question 2(b)i

Question 2(b) showed candidates a fractional distillation apparatus used to separate a mixture of ethanol and water. Two parts of the apparatus were labelled Q and R. In part (b)(i) candidates were asked the name of the piece of apparatus labelled R. Whilst it was clear that candidates knew the purpose of the pieces of apparatus, candidates found naming it much more difficult.

(b) Figure 4 shows the apparatus that can be used to separate a mixture of ethanol and water by fractional distillation.

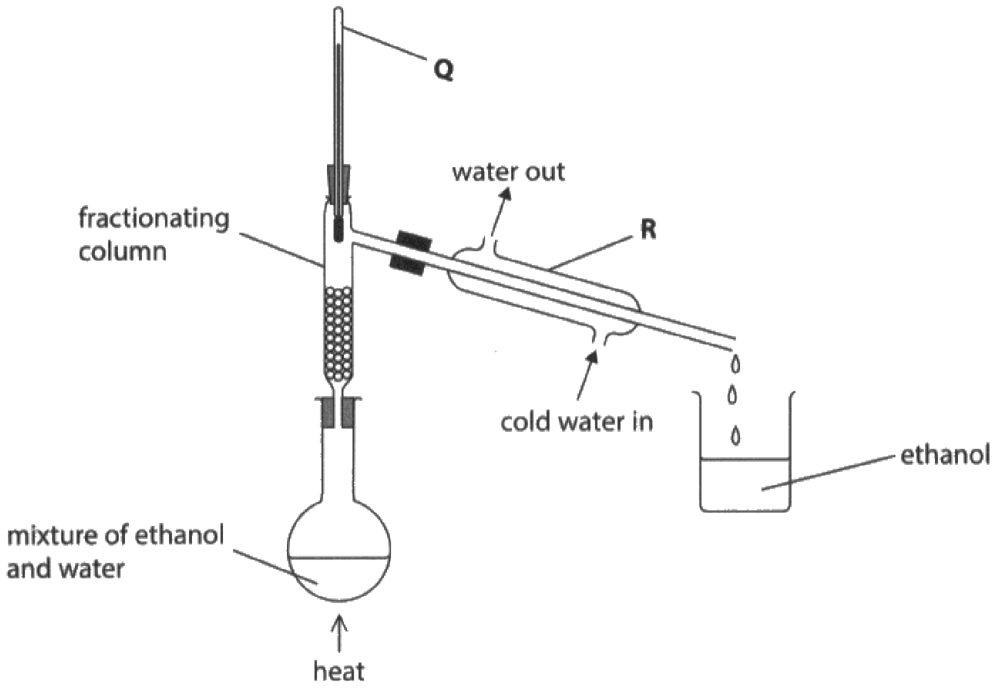

Figure 4

(i) Name the piece of apparatus labelled **R** in Figure 4 ~~used to record~~ the temperature.

(1)

Condenser

ResultsPlus
Examiner Comments

This example scored 1 mark for correctly naming the condenser.

(b) Figure 4 shows the apparatus that can be used to separate a mixture of ethanol and water by fractional distillation.

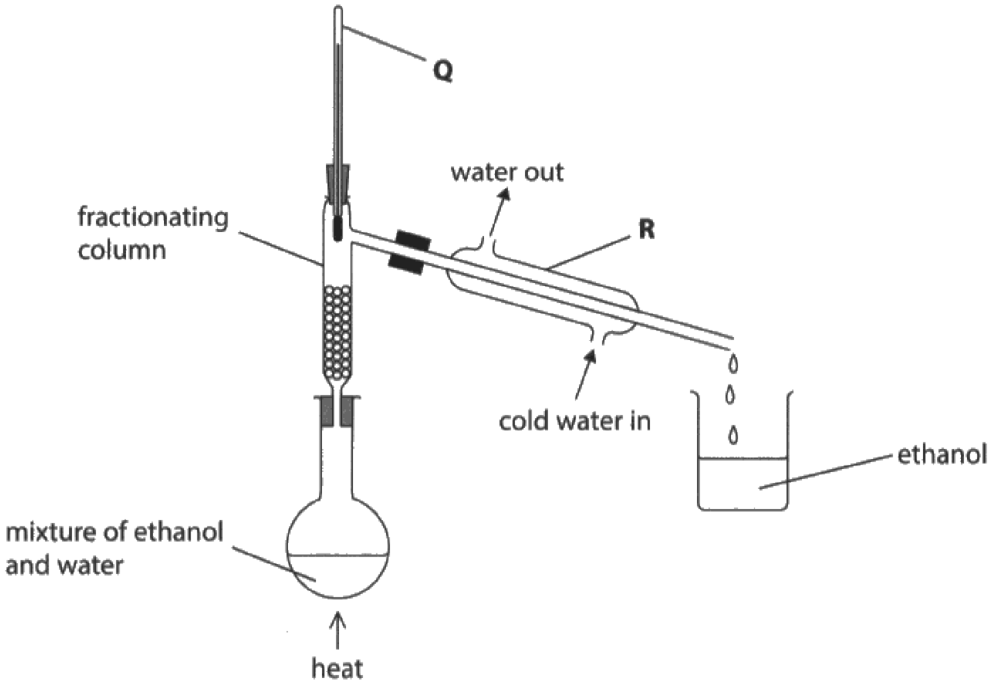

Figure 4

(i) Name the piece of apparatus labelled **R** in Figure 4 ~~used to record the temperature.~~

(1)

a cooling tube

ResultsPlus
Examiner Comments

Cooling tube or other descriptions of the function of the condenser were not allowed and so no marks were awarded.

ResultsPlus
Examiner Tip

Candidates should be familiar with the names and uses of common laboratory apparatus, particularly those that are required for any core practicals, techniques and practical ideas detailed in the specification.

Question 2(b)ii

In part (b)(ii) candidates were asked to explain the purpose of the piece of apparatus labelled Q in Figure 4. Candidates performed much better in the question with the majority of candidates scoring on the question and a good number scoring both marks available. The two marks were most often scored for understanding that the piece of apparatus is a thermometer and that its purpose is to show the temperature. Few candidates explained that the temperature is measured to identify the fraction or gas that was being condensed.

(ii) Explain the purpose of the piece of apparatus labelled **Q** in Figure 4.

(2)

the thermometer measures the temperature of the vapour being evaporated

ResultsPlus
Examiner Comments

This example scored both marks for understanding that the piece of equipment was a thermometer and it is there to show the temperature.

(ii) Explain the purpose of the piece of apparatus labelled **Q** in Figure 4.

(2)

. to make sure that the ethanol ~~nothing~~ doesnt escapes through the hole.

ResultsPlus
Examiner Comments

Where candidates did not score, it was often because they misunderstood the diagram. A common misunderstanding seen was that the apparatus was a bung, rather than a thermometer, and that it was there to stop the gas escaping, as in this example.

ResultsPlus
Examiner Tip

When carrying out practicals in the classroom, candidates should always be looking at the apparatus used and thinking about the purpose each part plays in the experiment or investigation.

(ii) Explain the purpose of the piece of apparatus labelled **Q** in Figure 4.

(2)

thermonator to check the heat of it.

ResultsPlus
Examiner Comments

In this example the candidate gained 1 mark for understanding that the piece of apparatus is a thermometer. They state that the thermometer is there to measure heat, this was rejected and the second mark was not awarded.

Question 2(c)i

Part (c) of Q02 gave candidates a diagram of a chromatogram produced by a student who is investigating food dyes used to make the colours in four different sweets. In part (i), candidates were asked to use the information in the figure to state which colour is made of only two food dyes. It was pleasing to see that the vast majority of candidates attempted the question with a large degree of success, stating that W was the colour made of two food dyes.

(c) A student investigates the food dyes used to make the colours **W**, **X**, **Y** and **Z** in four different sweets.

Figure 5 shows the chromatogram produced.

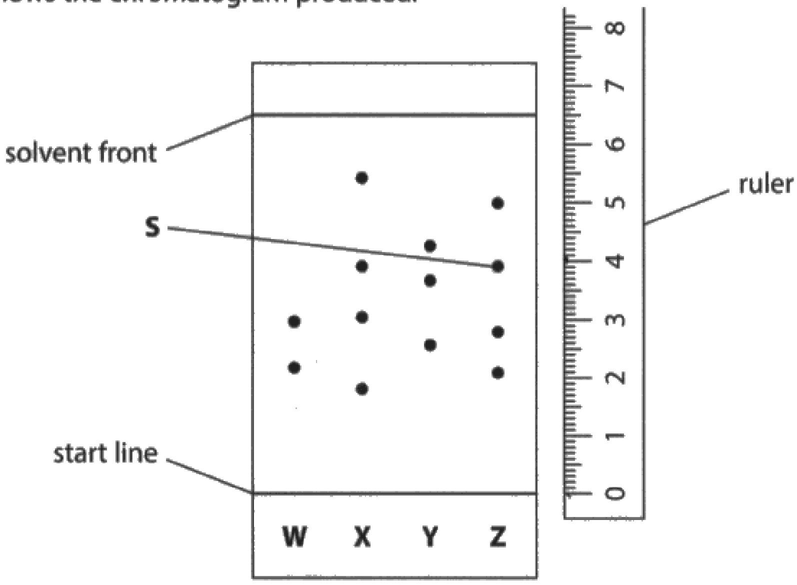

Figure 5

The solvent front shows how far the solvent moves during the investigation.

(i) Using the information in Figure 5, state which colour is made of only two food dyes.

(1)

W

ResultsPlus
Examiner Comments

This example gained the mark.

(c) A student investigates the food dyes used to make the colours **W**, **X**, **Y** and **Z** in four different sweets.

Figure 5 shows the chromatogram produced.

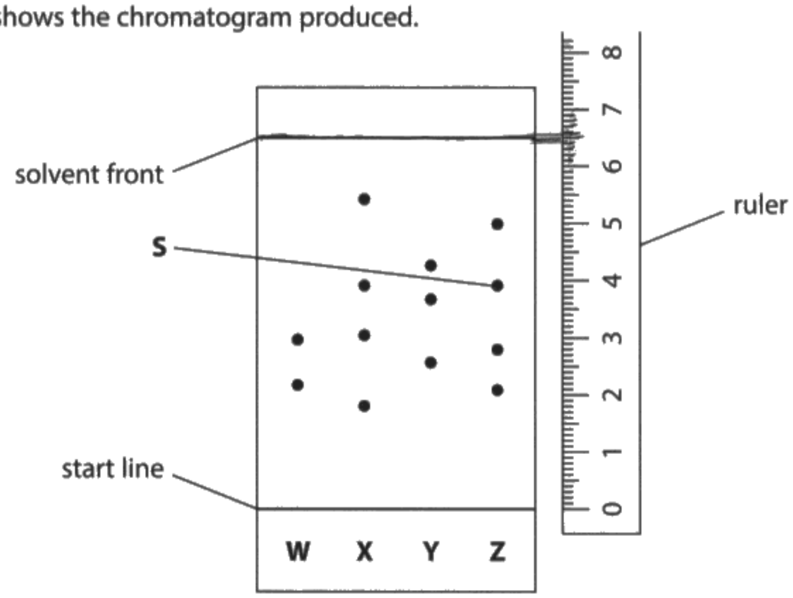

Figure 5

The solvent front shows how far the solvent moves during the investigation.

(i) Using the information in Figure 5, state which colour is made of only two food dyes.

(1)

Blue

ResultsPlus
Examiner Comments

Where candidates did not score, it was often because they did not use the information in the figure and gave the name of a colour that they knew from their general knowledge contained two colours, as in this example, which scored 0 marks.

Question 2(c)ii

Candidates found calculating the Rf value of the spot on the chromatogram more difficult, with fewer candidates scoring and only the more able scoring all three marks.

Of those candidates that did not score full marks, many scored two marks for correctly reading the distance moved by dye S and the distance moved by the solvent front and then putting these values into the equation given. Fewer candidates were then able to correctly evaluate their answer to two decimal places. A noticeable number of candidates incorrectly rounded their answer 0.615 to 0.61.

In some cases, candidates inverted the equation to come to an answer of 1.63, whilst these candidates lost the mark for correctly substituting the values into the equation given, they were still able to access the first marking point for measuring the values and then, if they correctly evaluated their fraction to decimal places, they gained the third mark also.

(ii) The R_f value of a spot on the chromatogram can be calculated using the equation

$$R_f = \frac{\text{distance moved by the food dye}}{\text{distance moved by solvent front}}$$

Using the information in Figure 5, calculate the R_f value of the food dye labelled **S**.

Give your answer to 2 decimal places.

(3)

$R_f = \frac{4}{6.5} = 0.6153846154$

or 0.62

R_f value of food dye **S** = 0.62

(Total for Question 2 = 9 marks)

ResultsPlus
Examiner Comments

This well laid out example scored the full 3 marks.

(ii) The R_f value of a spot on the chromatogram can be calculated using the equation

$$R_f = \frac{\text{distance moved by the food dye}}{\text{distance moved by solvent front}}$$

Using the information in Figure 5, calculate the R_f value of the food dye labelled **S**.

Give your answer to 2 decimal places.

(3)

$\frac{3.9}{2.5} = 1.56$

$\frac{4}{6.5} = 0.61$

$\frac{4}{2.5}$ 1.6

R_f value of food dye **S** = ...

(Total for Question 2 = 9 marks)

ResultsPlus
Examiner Comments

This example scored no marks. Although the candidate has a creditworthy calculation on the page, as they have given a list of calculations, it is not clear which they think is the correct answer and so the marks cannot be awarded.

ResultsPlus
Examiner Tip

If you are trying different methods of calculating a value, ensure you cross out any incorrect attempts that you write in the answer space and write what you think is the correct answer on the answer line to ensure you gain the marks.

(ii) The R_f value of a spot on the chromatogram can be calculated using the equation

$$R_f = \frac{\text{distance moved by the food dye}}{\text{distance moved by solvent front}}$$

Using the information in Figure 5, calculate the R_f value of the food dye labelled **S**.

Give your answer to 2 decimal places.

(3)

$R_f = \frac{4}{6.5} = 0.6153 = 0.61$

R_f value of food dye **S** = 0.61

(Total for Question 2 = 9 marks)

ResultsPlus
Examiner Comments

This example scored two marks; they have correctly measured the values within the accepted ranges and have substituted them into the equation correctly. Unfortunately, they have incorrectly rounded their answer to 0.61 rather than 0.62.

ResultsPlus
Examiner Tip

When practicing calculations, practice rounding your answers to different numbers of significant figures and decimal places, ensuring you understand the difference between the two.

Question 3(a)

Question 3 was about metals and their reactions with acids. Part (a) of the question gave candidates a table of elements and asked them to place ticks in the boxes to show which elements in the table are metals.

They were told to use the periodic table to help answer the question. Candidates accessed the question well with the majority attempting and scoring at least one mark.

3 This question is about metals and their reactions with acids.

(a) Place ticks (✓) in boxes to show which elements in the table are metals.

Use the periodic table to help you answer this question.

(2)

element	(✓)
phosphorus, P	
rubidium, Rb	
rhodium, Rh	✓
strontium, Sr	✓
tellurium, Te	

ResultsPlus
Examiner Comments

In this example, the candidate correctly selected rubidium and strontium as metals and therefore scored 1 of the 2 marks available.

3 This question is about metals and their reactions with acids.

(a) Place ticks (✓) in boxes to show which elements in the table are metals.

Use the periodic table to help you answer this question.

(2)

element	(✓)
phosphorus, P	✓
rubidium, Rb	✓
rhodium, Rh	✓
strontium, Sr	✓
tellurium, Te	

ResultsPlus
Examiner Comments

In this example, the candidate correctly selected the 3 metals in the table, unfortunately they also selected phosphorus as an answer and so just 1 mark was awarded.

3 This question is about metals and their reactions with acids.

(a) Place ticks (✓) in boxes to show which elements in the table are metals.

Use the periodic table to help you answer this question.

(2)

element	(✓)
phosphorus, P	
rubidium, Rb	✓
rhodium, Rh	✓
strontium, Sr	✓
tellurium, Te	

ResultsPlus
Examiner Comments

This example correctly identified all three metals and scored both marks.

Question 3(b)i

In part (b) candidate were shown a diagram of four different metals reacting with dilute sulfuric acid. They were asked to place the metals in order of reactivity from most reactive to least reactive. Again, this was well answered by candidates with the vast majority scoring the full two marks. Where candidates gained just one mark it was often because they had metals F and E in the wrong order.

(i) Arrange the metals **E**, **F**, **G** and **H** in order of reactivity.

(2)

metal	
H	most reactive
E	
F	
G	least reactive

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Examiner Comments

This example scored both marks.

Question 3(c)i

Part (c)(i) asked candidates to calculate the relative formula mass of zinc nitrate. Candidates found this much more challenging with only the more able candidates being able to score both marks.

Common errors seen were where candidates misinterpreted the subscripts as squared or cubed in the calculation, multiplied the values for O and N by 65 as Zn was outside the bracket, multiplied the value for O by 5 rather than 6 or multiplied rather than added the atomic masses. If the candidate showed their working and made just one small slip, one of the two marks were awarded.

Some candidates misunderstood the question and attempted an empirical formula calculation.

(c) When zinc reacts with very dilute nitric acid, zinc nitrate is formed.

(i) The formula of zinc nitrate is $Zn(NO_3)_2$

Calculate the relative formula mass of ~~magnesium~~ zinc nitrate, $Zn(NO_3)_2$

(relative atomic masses: Zn = 65, N = 14, O = 16)

(2)

65 + 14 + 16 = 95

relative formula mass = 95

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Examiner Comments

In this example, the candidate added the relative atomic masses stated in the stem of the question without looking at the formula to see how many of each atom is present in the formula, this was one error and so no marks were awarded.

(c) When zinc reacts with very dilute nitric acid, zinc nitrate is formed.

(i) The formula of zinc nitrate is $Zn(NO_3)_2$

Calculate the relative formula mass of ~~magnesium~~ zinc nitrate, $Zn(NO_3)_2$

(relative atomic masses: Zn = 65, N = 14, O = 16)

(2)

65 + (14×2) = 93

93 + (16×6) = 189

relative formula mass = 189

ResultsPlus
Examiner Comments

This well laid out example gained both marks.

(c) When zinc reacts with very dilute nitric acid, zinc nitrate is formed.

(i) The formula of zinc nitrate is $Zn(NO_3)_2$

Calculate the relative formula mass of ~~magnesium~~ zinc nitrate, $Zn(NO_3)_2$

(relative atomic masses: Zn = 65, N = 14, O = 16)

(2)

~~65+65~~ Zn: 65+65 = 130

N: 14+14 = ~~27~~ 28 130+28+96 = 254

O = 16+16+16+16+16+16 = 96

relative formula mass = 254

ResultsPlus
Examiner Comments

In this example, the candidate has calculated the correct numbers for oxygen and nitrogen but has not done so for zinc, as they have doubled the relative atomic mass of zinc, yielding an incorrect calculation and answer of 254. This represents just one error and so a mark of 1 was awarded.

Question 3(c)ii

The last part of question 3, part (c)(ii) showed candidates a reaction between a metal and a dilute acid, they were shown the apparatus at the start and at the end of the reaction. Candidates were then asked to state two ways that the student would know that the reaction had ended.

A good proportion of candidates scored on this question, with many recognising that the lack of bubbles and the fact that the metal had gone meant that the reaction had finished to gain both marks.

References to the balance staying the same were seen less frequently. Some candidates simply said the mass had gone down or mass had changed, stating what happened during the reaction rather than what happened at the end, some stated that the mass went up, all of these examples did not score.

(ii) A student investigates the reaction between a metal and a dilute acid using the apparatus shown in Figure 7.

Cotton wool is placed in the top of the apparatus as shown, to stop any acid from spraying out.

The total mass of the apparatus is shown at the start of the reaction and after the reaction has ended.

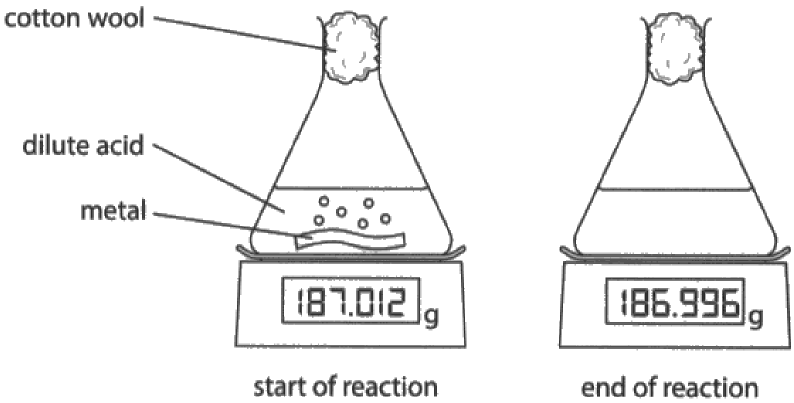

Figure 7

State **two** ways the student would know that the reaction has ended.

(2)

1 the weight dosent change and stops

2

(Total for Question 3 = 9 marks)

ResultsPlus
Examiner Comments

Fewer candidates referred to the mass of the reaction, but where they did weight was accepted for mass and examples such as this one scored the mark.

(ii) A student investigates the reaction between a metal and a dilute acid using the apparatus shown in Figure 7.

Cotton wool is placed in the top of the apparatus as shown, to stop any acid from spraying out.

The total mass of the apparatus is shown at the start of the reaction and after the reaction has ended.

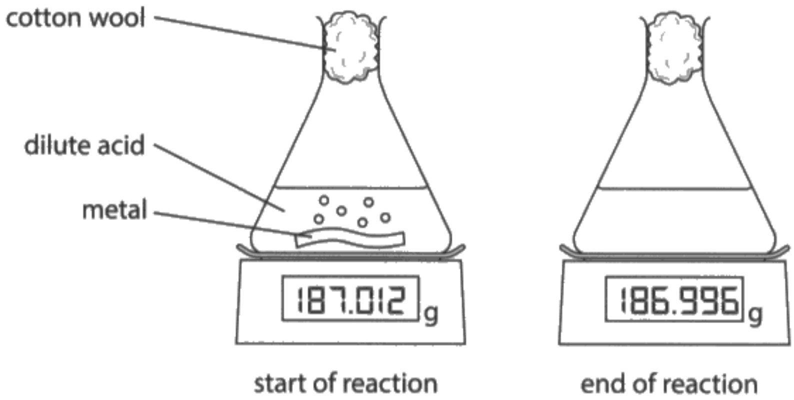

Figure 7

State **two** ways the student would know that the reaction has ended.

(2)

1 The metal would be disolved and no longer present

2 There would be no more bubbles present.

(Total for Question 3 = 9 marks)

ResultsPlus
Examiner Comments

This example scored 2 marks. The candidate has said no more bubbles which scored, they have also said that the metal is 'no longer present' which gained a mark. Many candidates stated that the metal would be dissolved, this was accepted but as the candidate had already gained two marks, no further credit was awarded.

Question 4(a)ii

Question 4 looked at the reactivity series of metals. In part (a)(ii) candidates were asked to name one metal from the reactivity series shown in Figure 8 that is normally extracted by electrolysis. Around half of all candidates were able to correctly select sodium, magnesium, aluminium or zinc.

(ii) Name **one** metal in Figure 8 that is normally extracted by electrolysis. **(1)**

Nickol

ResultsPlus
Examiner Comments

Some candidates did not read the question carefully and gave metals that were not given in Figure 8, as in this example that did not score.

(ii) Name **one** metal in Figure 8 that is normally extracted by electrolysis.

(1)

magnesium

ResultsPlus
Examiner Comments

Spelling errors were not penalised when it was clear what element the candidate was referring to and this example gained the mark.

Question 4(b)

Part (b) of the question asked candidates to calculate the percentage of iron in an ore of iron. They were given the equation to calculate the percentage. Candidates performed well in the question with the vast majority scoring the two marks available.

(b) 25 000 kg of an ore of iron was found to contain 10 050 kg of iron.

Calculate the percentage of iron in this ore of iron.

$$\text{percentage of metal} = \frac{\text{mass of metal}}{\text{mass of metal ore}} \times 100$$

(2)

$$\frac{10\,050}{25000} \times 100 = 42\,\%$$

percentage of iron in ore = 42 %

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Examiner Comments

Where candidates did not score full marks, it was often because they substituted the values correctly into the equation, but they did not evaluate their calculation correctly, as in this example which scored 1 mark for the substitution.

(b) 25 000 kg of an ore of iron was found to contain 10 050 kg of iron.

Calculate the percentage of iron in this ore of iron.

$$\text{percentage of metal} = \frac{\text{mass of metal}}{\text{mass of metal ore}} \times 100$$

(2)

$$\frac{10050}{25000} = 0.402$$

$$\times 100$$

$$= 40.2$$

percentage of iron in ore = 40%

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Examiner Comments

In this example the candidate has rounded their answer, the rounding is correct and both marks were awarded.

(b) 25 000 kg of an ore of iron was found to contain 10 050 kg of iron.

Calculate the percentage of iron in this ore of iron.

$$\text{percentage of metal} = \frac{\text{mass of metal}}{\text{mass of metal ore}} \times 100$$

(2)

$\frac{10050}{25000} \times 100$

percentage of iron in ore = ...

ResultsPlus
Examiner Comments

In this example, the candidate has substituted the values correctly but unfortunately, they have not carried out and calculated their answer and so did not gain the second mark.

Question 4(c)i

Part (c) of question 4 asked candidates about the reaction of copper oxide and carbon.

In part (i) of the question, candidates were given the reactants and products of the reaction and asked to write the word equation.

Around half of the candidates were able to correctly write the word equation to gain the mark.

(c) When copper oxide is heated with carbon, the products are copper and carbon dioxide.

(i) Write the word equation for this reaction.

(1)

$CuO + C = Cu + CO_2$

ResultsPlus
Examiner Comments

In this example the candidate has not read the question carefully and has tried to give the symbol equation rather than the word equation asked for. If candidates had tried to do this, it was accepted but the symbol equation had to be correct to score. Although the = sign would be accepted in a word or a symbol equation for the arrow, this example was not correctly balanced and so did not score.

ResultsPlus
Examiner Tip

Ensure that you are aware what is required when asked for a word equation or a symbol equation. When asked for a word equation, do not attempt to write a balanced symbol equation as it is much harder to get this completely correct to score any marks.

(c) When copper oxide is heated with carbon, the products are copper and carbon dioxide.

(i) Write the word equation for this reaction.

(1)

Copper oxide + oxygen → copper + Carbon dioxide

ResultsPlus
Examiner Comments

In this example the candidate has shown oxygen as a reactant rather than carbon and so the mark was not awarded even though the rest of the equation was correct.

Question 4(c)ii

In part (c)(ii) candidates were asked to state the type of reaction when copper oxide loses oxygen. Candidates found it very challenging to use the correct scientific name, reduction, for the reaction with only the most able scoring the mark.

(ii) In this reaction, copper oxide loses oxygen.

State the type of reaction when copper oxide loses oxygen.

(1)

deoxidization

ResultsPlus
Examiner Comments

A common incorrect answer seen was deoxidation, as in this example, this was rejected and no marks were scored.

(ii) In this reaction, copper oxide loses oxygen.

State the type of reaction when copper oxide loses oxygen.

(1)

Reduction

ResultsPlus
Examiner Comments

This example scored the mark.

Question 4(c)iii

Part (iii) of question 4(c) asked candidates to calculate the mass of copper formed in g when 238.5 g of copper oxide is reacted with excess carbon.

Candidates found the calculation challenging with only the most able being able to score marks and a noticeable proportion leaving the question blank.

Subtraction calculations were frequently seen with the answer 159 - 127 = 32, 238.5 - 32 = 206.5 being common, this gained no credit.

(iii) In one reaction, 159.0 g of copper oxide was heated with excess carbon to produce 127.0 g of copper.

Use this information to calculate the mass of copper formed, in g, when 238.5 g of copper oxide is reacted with excess carbon.

(2)

$159 \div 127 = 1.25 \quad 238.5 \times 1.25 = 298.6$

mass of copper = 298.6 g

ResultsPlus
Examiner Comments

In this example, the candidate has the correct first step, but then unfortunately multiples rather than divides their answer and so did not score the second mark.

ResultsPlus
Examiner Tip

It is important to show your working in calculation questions, so method marks can be awarded, as in this case.

(iii) In one reaction, 159.0 g of copper oxide was heated with excess carbon to produce 127.0 g of copper.

Use this information to calculate the mass of copper formed, in g, when 238.5 g of copper oxide is reacted with excess carbon.

(2)

~~[illegible]~~

$127 \div 159 = (0.7987\ldots \times 238.5) = 190.5$

mass of copper = 190.5 g

ResultsPlus
Examiner Comments

This example shows a well laid out answer that scored both marks available.

ResultsPlus
Examiner Tip

When carrying out multi-step calculations, when you round your answer, do this at the final step. If you round at any other step, ensure that you round the step rather than truncating the answer given in your calculator.

(iii) In one reaction, 159.0 g of copper oxide was heated with excess carbon to produce 127.0 g of copper.

Use this information to calculate the mass of copper formed, in g, when 238.5 g of copper oxide is reacted with excess carbon.

(2)

$159 - 127 = 32$

$238.5 - 32 = \frac{413}{2} = 206.5$

mass of copper = 206.5 g

ResultsPlus
Examiner Comments

This example shows a subtraction calculation that gained no marks.

Question 4(c)iv

In part (iv) of the question, candidates were asked why the reaction uses an excess of carbon. In was clear that many candidates understood that the copper oxide was reacting with the carbon, and some talked about displacement, but few understood the importance of the excess carbon to be needed to complete the reaction. This was another question where a noticeable number of candidates left it blank.

(iv) State why this reaction with copper oxide uses excess carbon.

(1)

to ensure all copper oxide has reacted

ResultsPlus
Examiner Comments

This example scored the mark.

Question 4(d)

The last part of question 4 asked candidates to calculate the concentration of a solution of zinc sulfate given the mass and volume and the equation to calculate the concentration.

They were asked to give their answer to two significant figures.

Most candidates successfully substituted mass and volume into the concentration formula, earning 1 mark. However, few candidates remembered to convert cm^3 to dm^3 or expressed their final answer to two significant figures to score full marks.

(d) A solution of zinc sulfate was made by dissolving 23.8 g of the compound in water and was made up to a total volume of 250 cm^3 with water.

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

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

Give your answer to 2 significant figures.

(3)

$250 \div 1000 = 0.25$

$23.8 \div 0.25 = 95.2 = 95$

concentration = 95 g dm^{-3}

(Total for Question 4 = 12 marks)

ResultsPlus
Examiner Comments

This example shows a well laid out answer which gained all 3 marks.

(d) A solution of zinc sulfate was made by dissolving 23.8 g of the compound in water and was made up to a total volume of 250 cm^3 with water.

Calculate the concentration of this solution in g dm^{-3}.
2

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

Give your answer to 2 significant figures.

(3)

$\frac{23.8}{250\ cm^3} = 0.0952$

concentration = 0.095 g dm^{-3}

(Total for Question 4 = 12 marks)

ResultsPlus
Examiner Comments

In this example, the candidate has correctly worked out the concentration in g/cm^3 rather than g/dm^3. The candidate has however correctly put this answer to 2 sig. fig, so scored 2 marks.

ResultsPlus
Examiner Tip

When calculating concentrations always check the units, ensuring that you convert to the correct units where required. In this example, the volume given was in cm^3 therefore to covert to dm^3 there was a need to divide the 250 by 1000.

(d) A solution of zinc sulfate was made by dissolving 23.8 g of the compound in water and was made up to a total volume of $250\,cm^3$ with water.

Calculate the concentration of this solution in $g\,dm^{-3}$.

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

Give your answer to 2 significant figures.

(3)

$$\frac{23.8}{250}$$

concentration = 0.10 $g\,dm^{-3}$

(Total for Question 4 = 12 marks)

ResultsPlus
Examiner Comments

In this example, the candidate has substituted the values into the equation correctly. They have tried to round the answer but as the question asked to round to 2 significant figures this did not gain the evaluation mark and just 1 mark was awarded for the correct substitution.

ResultsPlus
Examiner Tip

In this example, the candidate gained the mark as they had shown their working. If this working had not been shown, they would not have gained the mark. This highlights the importance of showing your working when carrying out calculations in exams.

Question 5(a)i

Question 5, part (a) focused on the subatomic particles in atoms of neon.

Part (i) asked candidates to complete a table to show the relative charge of a proton and an electron and the relative mass of a neutron. A good proportion of candidates scored on the question with around a third gaining the full three marks available.

5 (a) Atoms of neon are made up of subatomic particles.

(i) Figure 9 shows some information about the subatomic particles in neon atoms.

Complete Figure 9 with the missing information.

(3)

subatomic particle	relative charge	relative mass
proton	+ 1	1
neutron	0	0
electron	- 1	negligible

Figure 9

ResultsPlus
Examiner Comments

Where candidates did not score full marks, it was often because they re-stated the charge of the neutron, rather than giving the mass of the neutron, as in this example which scored 2 marks.

5 (a) Atoms of neon are made up of subatomic particles.

(i) Figure 9 shows some information about the subatomic particles in neon atoms.

Complete Figure 9 with the missing information.

(3)

subatomic particle	relative charge	relative mass
proton	+ 1	1
neutron	0	1
electron	− 1	negligible

Figure 9

ResultsPlus
Examiner Comments

This example scored the full 3 marks.

Question 5(a)ii

Part (ii) asked candidates to describe what information about the subatomic particles can be obtained from the atomic number of neon.

Candidates found this harder than part (i) with fewer scoring full credit.

The connection of atomic number to number of protons seemed to be more well known with fewer candidates understanding that the atomic number could also tell you the number of electrons in an atom.

Some candidates did not read the stem of the question carefully and gave suggestions of how to calculate numbers of neutrons.

(ii) All atoms of neon have an atomic number of 10.

Describe what information about the number of subatomic particles can be obtained from the atomic number of neon.

(2)

Protons = 10 $^{20}_{10}Ne$

Electrons = 10

Nectrons = 10

ResultsPlus
Examiner Comments

This example scored 2 marks for stating that the number of protons is 10 and the number of electrons is 10. Any references to the number of neutrons was ignored.

(ii) All atoms of neon have an atomic number of 10.

Describe what information about the number of subatomic particles can be obtained from the atomic number of neon.

(2)

neon has 10 protons

ResultsPlus
Examiner Comments

In this example the candidate gained 1 mark for understanding that there would be 10 protons, there was no reference to the number of electrons for the second mark.

Question 5(a)iii

Part (iii) of the question asked candidates to explain why atoms of neon are electrically neutral. Candidates found this challenging with only the most able scoring both marks available.

Where candidates scored, it was often as they knew that the numbers of protons and electrons were the same. The second mark proved more challenging with few candidates being able to explain that the charges cancel.

Many candidates did not read the question carefully and answered in terms of the lack of reactivity.

(iii) Explain why atoms of neon are electrically neutral.

(2)

They have same number of protons with a positive charge and electrons with a negative charge so they cancel out.

ResultsPlus
Examiner Comments

This answer showed a good understanding and gained both marks.

(iii) Explain why atoms of neon are electrically neutral.

(2)

Because the positive charge of protons and negative charge of electrons cancell each other out.

ResultsPlus
Examiner Comments

This example scored 1 mark. Whilst they knew that the charges cancel out, as they did not state that the number of protons and electrons were the same, they did not gain the first mark.

(iii) Explain why atoms of neon are electrically neutral.

(2)

They have the same number of protons and electrons

ResultsPlus
Examiner Comments

This example shows a common answer that scored 1 mark. The candidate understands that there are the same number of protons and electrons but does not explain how this means that the atom was electrically neutral.

Question 5(b)

The last part of question 5 was the six-mark question with a levels-based mark scheme. The question gave candidates the first 12 elements in the periodic table and their atomic number. They were then asked to use these elements to explain how the structure of the periodic table is linked to the electronic configurations of the atoms of the elements and how the arrangement of the elements is linked to their electronic configuration.

Where candidates scored, they were often familiar with the idea of groups representing electrons on outer shell, but the link to periods was less commonly seen, candidates that did well used examples from the 12 elements given to exemplify their answers.

Where candidates did not score, it was often because they misinterpreted or misread the question with discussions of Mendeleev’s periodic table seen frequently in answers. Others gave general descriptions of the periodic table based on metals and non-metals, talked about how reactivity changed within the periodic table or started to explain how elements bond ionically.

*(b) The structure of the periodic table and the position of the elements in the periodic table are linked to the electronic configuration of the elements.

Figure 10 shows the structure of the periodic table and the first 12 elements with their atomic numbers.

group - electrons on outer shell
period - number of shells
atomic number - number of protons

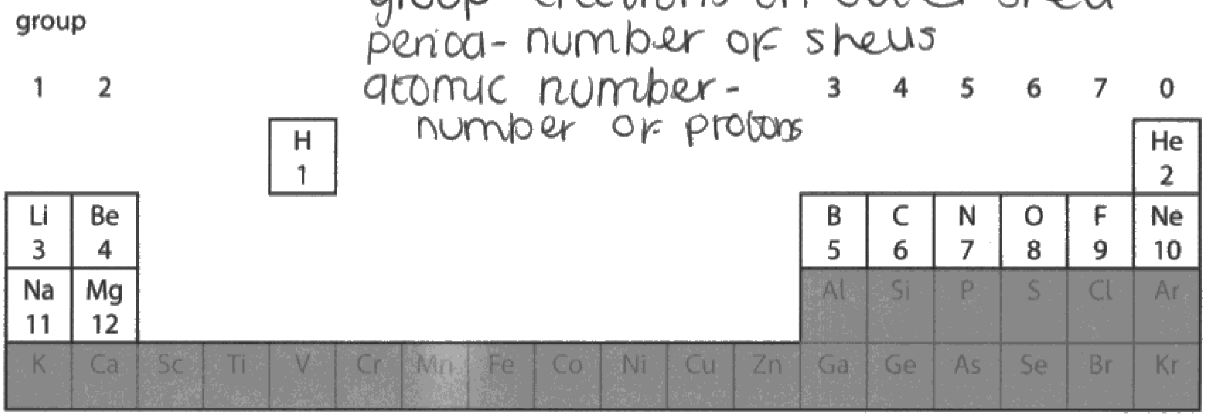


Figure 10

Use the first 12 elements shown in Figure 10 to explain

- how the structure of the periodic table is linked to the electronic configuration of the atoms of the elements
- how the arrangement of the elements is linked to their electronic configuration.

(6)

the structure of the periodic table tells you wether its a metal or a non metal. Metal are on the left and non metal are on the right side. Non metals have ~~lesse~~ more electrons ~~on the outershells~~ because they are less reactive. and the electrostatic forces are weaker. Howevr metals tend to have less electrons because the less electrons, the closer to the nucleus. The period numbers on the table tells you the

amount of shells the atom has.
The group numbers tell you the amount of electrons on the outer shell.
The relative atomic masses tell you the number of protons and neutrons in the configuration.
The atomic number placed under each atom tells you the number of electrons it has.
Along every period of the periodic table, the number of electrons increase from left-right.

(Total for Question 5 = 13 marks)

ResultsPlus
Examiner Comments

This example scored 2 marks in Level 1. The candidate gives some generic statements about the link between the group and period with the electronic configuration of an element; they also state that the number of electrons increases from left to right. The candidate does not use the elements given in the stem to exemplify their answer.

*(b) The structure of the periodic table and the position of the elements in the periodic table are linked to the electronic configuration of the elements.

Figure 10 shows the structure of the periodic table and the first 12 elements with their atomic numbers.

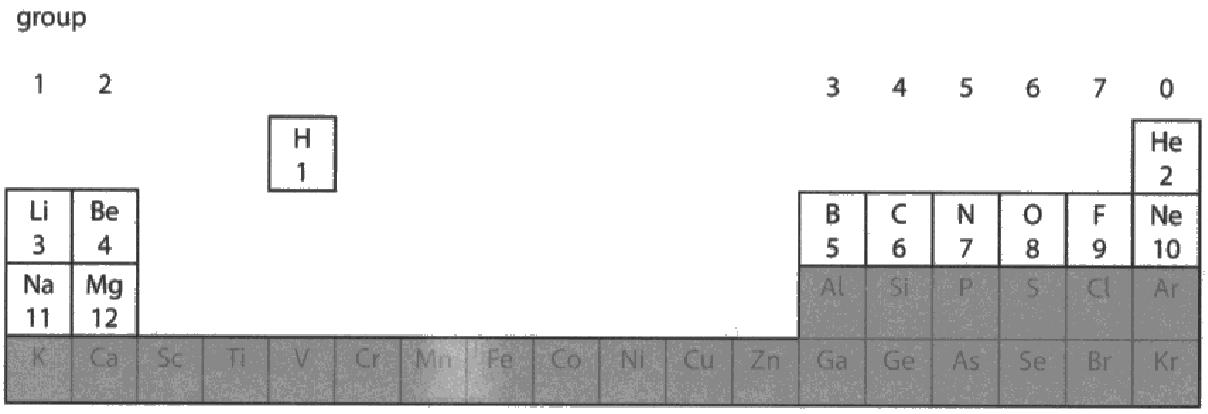


Figure 10

Use the first 12 elements shown in Figure 10 to explain

- how the structure of the periodic table is linked to the electronic configuration of the atoms of the elements
- how the arrangement of the elements is linked to their electronic configuration.

(6)

- Period tells us how many shells it has e.g. H in period 1 has 1 shell.
- Group tells us how many electrons it has on its outer shell e.g. Carbon has 6 electrons on its outer shell.
- the atomic number tells you how much protons it has so then from that you can decifer how many electrons it has since there always the same

(Total for Question 5 = 13 marks)

ResultsPlus
Examiner Comments

This example gained 4 marks in Level 2, the candidate explains how the electronic configuration is linked to the number of shells of electrons and gives an example. They also explain how the number of electrons in the outer shell is linked to the group number. Unfortunately, the example they have used is incorrect and so cannot be credited, therefore a mark in Level 2 was awarded.

*(b) The structure of the periodic table and the position of the elements in the periodic table are linked to the electronic configuration of the elements.

Figure 10 shows the structure of the periodic table and the first 12 elements with their atomic numbers.

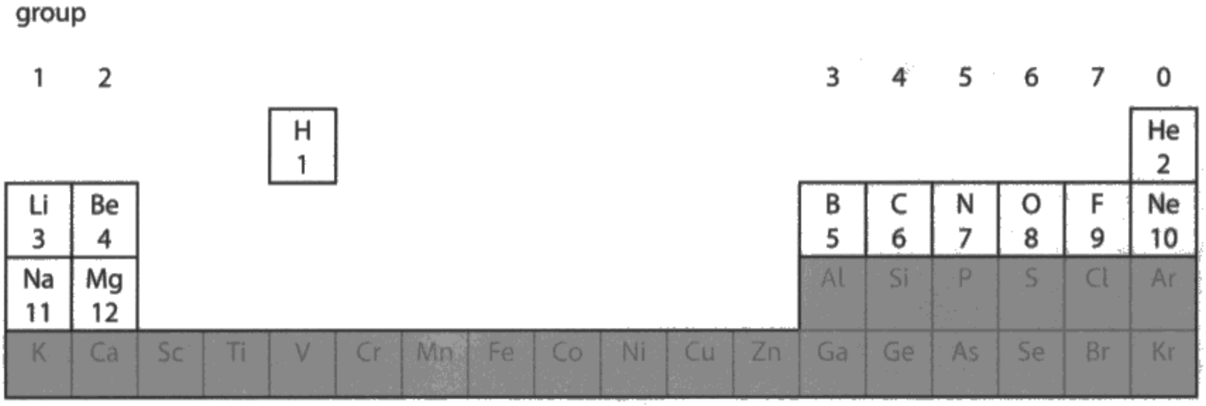


Figure 10

Use the first 12 elements shown in Figure 10 to explain

- how the structure of the periodic table is linked to the electronic configuration of the atoms of the elements
- how the arrangement of the elements is linked to their electronic configuration.

(6)

The arrangement of the element are the they ordered in atomic number and the group number tells you how many electrons are in the last shell e.g Lithium is in group one because there is one electron on the last outer shell and the period tells you how ~~may~~ many shells there are e.g Lithium is in period 2 because it has 2 shells. Group goes does the column and period goes across. Atomic number is how many protons there are and electrons e.g Lithium 3 protons and electrons while Helium has 2 protons and electrons. The old periodic table used to be structured in atomic mass and left gaps as some elements weren't discovered. Group 0 has a full outer shell it is unreactive these are noble gases.

(Total for Question 5 = 13 marks)

ResultsPlus
Examiner Comments

This example scored 5 marks in Level 3. The candidate has fully explained how groups are linked to the electronic configuration of the elements by explaining that the group number shows many electrons are in the last shell. They give an example of lithium being in group 1 as there is 1 electron in the outer shell. They also fully explain how periods are linked to the electronic configuration by telling us that the period number tells us how many shells there are and gives an example of lithium being in period 2 as there are 2 shells of electrons. The answer has not given the overall electronic configuration of the atom and so a mark of 5 was awarded.

*(b) The structure of the periodic table and the position of the elements in the periodic table are linked to the electronic configuration of the elements.

Figure 10 shows the structure of the periodic table and the first 12 elements with their atomic numbers.

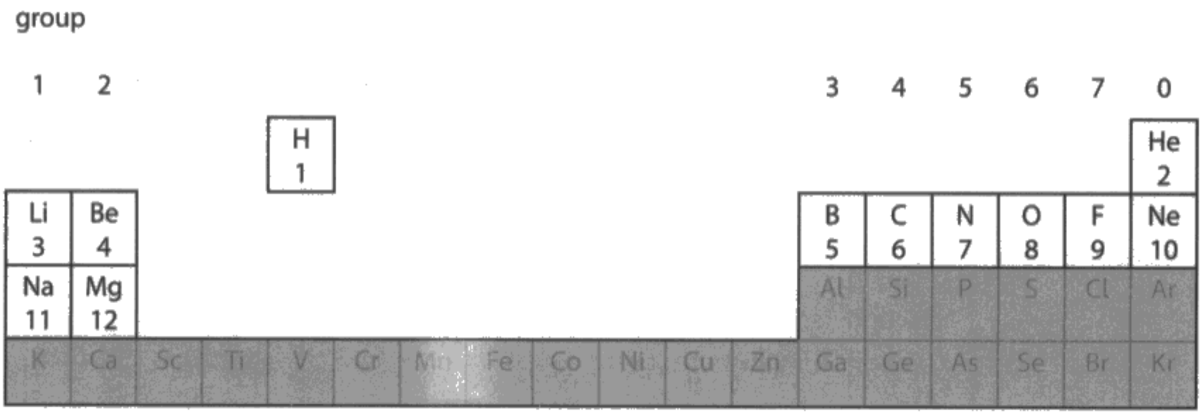


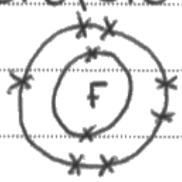
Figure 10

Use the first 12 elements shown in Figure 10 to explain

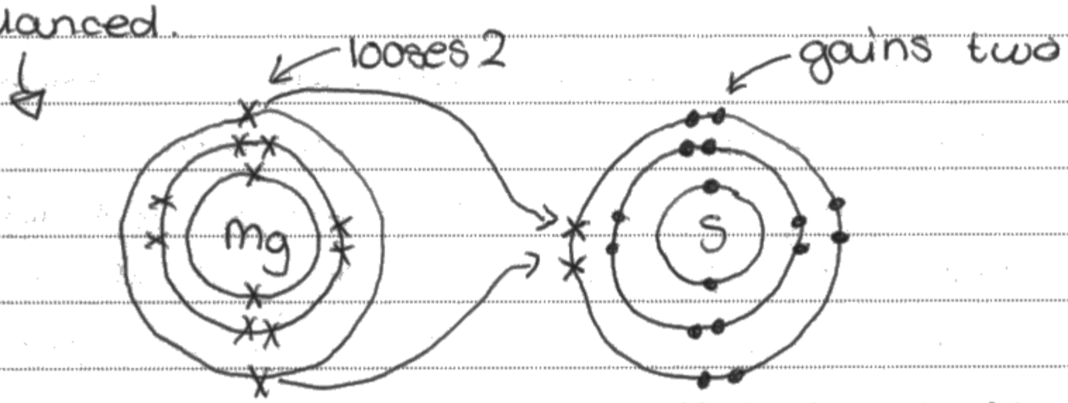
- how the structure of the periodic table is linked to the electronic configuration of the atoms of the elements
- how the arrangement of the elements is linked to their electronic configuration.

(6)

- An elements group number identifies ~~a~~ ~~is~~ the number of electrons in its outer shell. For example, fuluorine is in group ~~7~~ 7, so has 7 elecrons in its outershell.
- Also, ~~an~~ ~~elements~~ the period an element is in identifies ~~thei~~ how many shells they have, fuluorine is in period 2 so has 2 shells. Therefore, fuluorine looks like this:



- This also shows that fuluorine is not balanced as it doesn't have a full outer shell
- The arrangment of the elements is linked to their electronic configurations ~~as~~ because, as you go ~~up~~ along the periodic table (from hydrogen to radon) the atomic number increases.
- This means that as the periodic table goes up, the amount of shells and electron do too.
- From this we can decifer how the elements bond together from their group. For example, ~~carbon has 4~~ sulfur has 6 electrons in its outer shell, so needs 2 more to become balanced, and, magnesium has 2 electrons in its outer shell so needs to loose 2 to become balanced, therefore, sulfur and magnesium can ionic bond in order to be balanced.



(Total for Question 5 = 13 marks)

ResultsPlus
Examiner Comments

This example scored the full 6 marks in Level 3. The candidate has fully explained how the group and period are linked to the electronic configuration of the element, they exemplify their answer by giving a correct example for both using fluorine and also giving the correct electronic configuration. Although the answer starts to deviate towards ionic bonding, this does not contradict any creditworthy content so was ignored.

Question 6(a)i

The last question on the paper focused on the ionic compounds silver nitrate and potassium chloride. Part (a)(i) asked candidates to complete the equation for the reaction of silver nitrate solution with potassium chloride solution. Candidates found this challenging with few completing both gaps correctly. Where one mark was scored, it was often for the correct formula of potassium nitrate. However, the correct state symbol was often omitted, reflecting limited understanding of physical states in chemical reactions. Candidates that did not score often missed the mark as they did not give the correct formula or they did not write the formula using the correct scientific conventions, such as capitals for the first letter of symbols of elements and subscripts for numbers.

6 Silver nitrate and potassium chloride are ionic compounds that are soluble in water.

(a) When potassium chloride solution is added to a solution of silver nitrate, a white precipitate forms.

(i) Complete the equation for this reaction, including the missing state symbol.

(2)

silver nitrogen oxide + potassium chloride → silver chloride +

$AgNO_3(aq) + KCl(g) \rightarrow AgCl(s) + KNO_3(aq)$

ResultsPlus
Examiner Comments

In this example, the candidate has written the formula for potassium nitrate correctly, unfortunately they have given the wrong state symbol for the silver nitrate solution giving it as a gas rather than a solution.

6 Silver nitrate and potassium chloride are ionic compounds that are soluble in water.

(a) When potassium chloride solution is added to a solution of silver nitrate, a white precipitate forms.

(i) Complete the equation for this reaction, including the missing state symbol.

(2)

$AgNO_3(aq) + KCl(aq) \rightarrow AgCl(s) +$ ....KNO_3.... (aq)

ResultsPlus
Examiner Comments

This example showed a good answer that gained both marks.

Question 6(a)ii

Part (ii) asked candidates to name the white precipitate that was formed in the reaction. Candidates found this very challenging with only the most able scoring the mark for identifying the precipitate as silver chloride. Many candidates repeated the formula from the stem of the question, AgCl. This gained no credit.

(ii) Give the name of the white precipitate that forms.

(1)

Potassium nitrate

ResultsPlus
Examiner Comments

The majority of candidates stated that the precipitate would be potassium nitrate, as in this example which did not score.

(ii) Give the name of the white precipitate that forms.

(1)

Silver chloride

ResultsPlus
Examiner Comments

This example showed a good answer which scored the mark.

Question 6(a)iii

In part (iii) of the question, candidates were asked to state and explain how the white precipitate can be separated from the reaction mixture. Candidates that scored were often able to state that filtration was used to separate the mixture. Fewer were able to explain that the precipitate was left behind in the paper whilst the liquid went though.

Where candidates did not score, it was often because they gave other techniques such as crystallisation, evaporation, electrolysis and fractional distillation.

(iii) State and explain how the white precipitate can be separated from the reaction mixture.

(3)

because you can ~~[illegible]~~ use
giltration to seperate them

ResultsPlus
Examiner Comments

This example scored 1 mark as they have understood that filtration is the technique that should be used to separate the precipitate from the reaction mixture.

(iii) State and explain how the white precipitate can be separated from the reaction mixture.

(3)

Filter it through a funnel. Use filter paper to wrap it round a funnel. ~~&~~ then allow the solution to funnel through leaving the precipitate behind

ResultsPlus
Examiner Comments

This example shows a good answer that scored all 3 marks.

(iii) State and explain how the white precipitate can be separated from the reaction mixture.

(3)

filtration
distillation
chlorogitation

ResultsPlus Examiner Comments

This example gained no marks. Although the candidate has stated filtration as they have also given 2 other incorrect techniques the mark was not awarded.

ResultsPlus Examiner Tip

When asked to state one technique do not give a list as any contradicting answers will negate the correct one.

Question 6(b)

Part (b) of question 6 asked candidates to describe how silver nitrate solution conducts electricity and how silver conducts electricity. Very few candidates demonstrated understanding of how silver nitrate solution and solid silver conduct electricity. The role of ions in the solution was rarely mentioned. Where marks were awarded, it was typically for describing delocalised electrons in solid silver. Some candidates wrongly assumed that because silver is present, both substances conduct electricity, without explaining the differing mechanisms. Others gave unscientific explanations, such as "particles have space between them to let electricity through". Only the most able candidates were able to describe ions moving in the solution and delocalised electrons moving in the metal to gain all 3 marks.

(b) Silver nitrate solution conducts electricity.
Solid silver also conducts electricity.

Describe how silver nitrate solution conducts electricity and how solid silver conducts electricity.

(3)

Both have delocalised electrons, free flowing electrons that are able to move around, and when a cell ~~of~~ or battery is added delocalised electrons always move to the positively charged side of a cell or battery.

ResultsPlus
Examiner Comments

This example scored 2 marks. The candidate has an understanding that charged particles, delocalised electrons, move to gain a mark and they correctly apply this to the silver metal. They do not show an understanding it is ions that move in the solution to gain the third mark.

Question 6(c)ii

The last question on the paper, Q06(c)(ii) showed candidates two hazard symbols and asked them to state a safety step that should be taken when using the unknown solution.

In general candidates performed well in the question with a large proportion gaining the mark for being able to give a step to gain the mark. The most common correct answers were to wear goggles or gloves. Where candidates did not score, it was often because they gave vague answers such as wear PPE, or gave generic lab rules such as tie your hair up.

(ii) State a safety step that should be taken when using the unknown solution.

(1)

Wear a mask and make sure you dispose of it the safest way and don't tip it down the sink/toilet.

(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 60 MARKS

ResultsPlus
Examiner Comments

This example scored 1 mark, the reference to mask was ignored and the mark scored for disposing of the substance safely.

(ii) State a safety step that should be taken when using the unknown solution.

(1)

vsing well ~~proste~~ ~~prot~~ proteded gear

(Total for Question 6 = 11 marks)

TOTAL FOR PAPER = 60 MARKS

ResultsPlus
Examiner Comments

This answer was too vague and did not score.

ResultsPlus
Examiner Tip

When asked for a safety precaution or step, ensure that your answer relates specifically to the example being set and not just a generic safety rule.

Paper Summary

Based on their performance on this paper, candidates should:

- Ensure that you use clear, accurate and precise scientific language and avoid vague or general statements.
- Know the difference between the different types of equation such as word equations and symbol equations including writing formulae using the correct scientific conventions and the use of state symbols.
- Practice common calculations from the specification, always showing your working.
- Practice rounding your answers to calculation questions to specific numbers of significant figures and decimal places and ensure you know the difference between the two.
- Ensure that when carrying out experiments in class, that you are aware of the names and purpose of the apparatus used.
- Ensure that you are clear on key terms from the specification and when to use them.
- Practice writing chemical formula using correct scientific conventions.
- Practice past papers, ensuring that you understand what is required from different command words, such as explain and describe and remembering not to repeat the stem of the question as your answer.

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