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Examiners' Report
June 2019

GCSE Combined Science1SC0 1CH

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June 2019
Publications Code 1SC0_1CH_1906_ER

Introduction

This examination paper was the second of this series for the Combined Science Chemistry Higher tier. This paper, like all the Combined Science examinations, contains six questions giving a total of 60 marks. These 6 questions also appear on the Chemistry Higher tier paper. This paper contains items worth 16 marks that also appear on the Foundation paper. The paper was targeted at grades 9 to 4, with about half the marks for grades 6 to 4.

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 only one extended open response question (6-mark). 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 (a) (i)

Candidates performed well on this first question with the majority being able to identify the position of two non-metals.

1 In Figure 1, the letters **A**, **E**, **G**, **J**, **X** and **Z** show the positions of six elements in the periodic table.

These letters are not the symbols of the atoms of these elements.

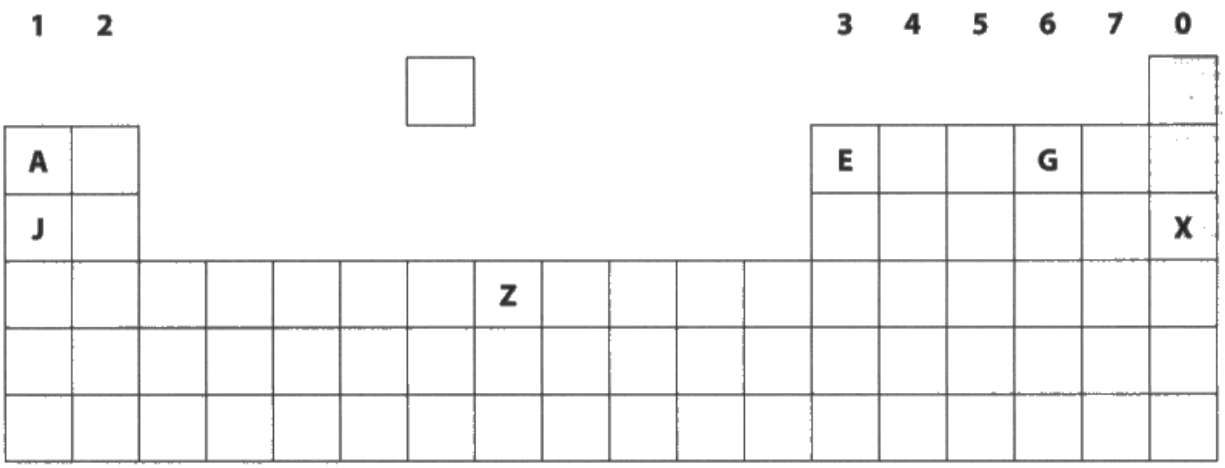


Figure 1

(a) Using the letters **A**, **E**, **G**, **J**, **X** and **Z**

(i) give the letters of the **two** elements that are non-metals

(1)

G and X

ResultsPlus
Examiner Comments

A correct answer that gained the mark.

Question 1 (a) (ii)

Candidates found part (ii) of question 1a much more difficult with many not being able to correctly identify the position of period 2 in the periodic table.

(ii) give the letters of **two** elements in period 2 **(1)**

Lithium Boron

ResultsPlus
Examiner Comments

In some cases the formula or names of the elements were given rather than the letter, this was accepted and the mark still awarded.

(ii) give the letters of **two** elements in period 2 **(1)**

G

ResultsPlus
Examiner Comments

In some cases, candidates that did correctly identify period, did not gain the mark as they only gave the letter of one element rather than 2.

ResultsPlus
Examiner Tip

Candidates should read the question carefully and if two responses are required for 1 mark, they must ensure that they give 2 responses.

(ii) give the letters of **two** elements in period 2

(1)

J and X

ResultsPlus
Examiner Comments

J and X was the most common incorrect answer, where the candidate has not included the first period.

Question 1 (a) (iii)

Candidates performed significantly better in 1aiii than in 1aii with the majority being able to give the letter of an element that normally forms an ion with a charge of +1.

(iii) give the letter of an element that normally forms an ion with a charge of +1. **(1)**

A

ResultsPlus
Examiner Comments

A correct response that gained the mark.

Question 1 (b) (i)

The majority of candidates were able to score at least 1 mark, this was usually for showing an understanding that an isotope has a different number of neutrons. Fewer were able to also state that the number of protons remain unchanged to gain the second marking point.

(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)

an isotope ~~is a different~~ has a different number of neutrons than the normal element.

ResultsPlus
Examiner Comments

A common problem was that candidates only gave one half of the explanation, stating that the isotope has a different number of neutrons but then did not refer to the number of protons so scored just 1 mark.

(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)

An isotope is another version of an element with the same number of protons and a different number of neutrons.

ResultsPlus
Examiner Comments

A good answer that scored both marks.

Question 1 (c)

It was pleasing to see that the majority of candidates were able to state the electronic configuration of the atom with the atomic number of 18.

(c) Element **X** has an atomic number of 18.

State the electronic configuration of an atom of element **X**.

(1)

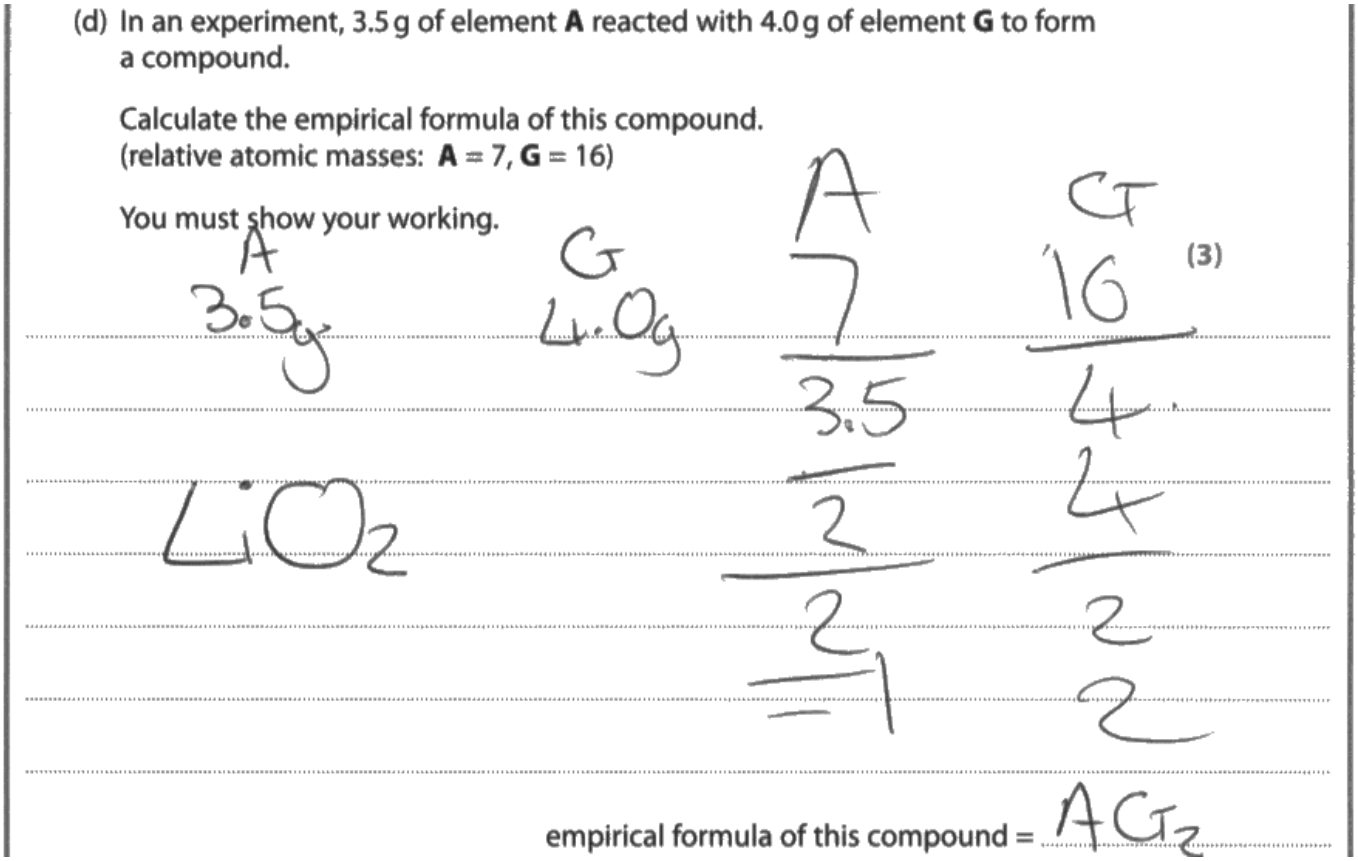
2,8,8

ResultsPlus
Examiner Comments

The correct answer that scored the mark.

Question 1 (d)

This question was generally well answered with a good proportion of candidates demonstrating a good understanding of how to calculate an empirical formula.



(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.

A 3.5g G 4.0g

A: 7, 3.5, 2, 2, =1

G: 16, 4, 4, 2, 2

(3)

empirical formula of this compound = AG_2

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Examiner Comments

In some cases, an error was made in the first step of the calculation for inverting the mole calculation. With error carried forward, examples such as these still gained 2 marks.

ResultsPlus
Examiner Tip

It is vital that working is shown for calculations, in cases such as these where the answer on the answerline is incorrect, two marks could still be awarded for the working shown. If this working had not been present then no marks could have been awarded.

(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)

$\frac{3.5}{7} = 0.5$ $\quad \frac{0.5}{0.25} = 2$ $\quad \frac{4}{16} = 0.25$ $\quad \frac{0.25}{0.25} = 1$

A_2G

empirical formula of this compound = A_2G

ResultsPlus
Examiner Comments

The correct answer, with well laid out working that scored 3 marks.

(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)

Lithium 3 — 16 oxygen 8

You must show your working.

(3)

(A)	(G)
L	O
3.5	4.0
7	16
0.5	0.25
0.25	0.25
0.5	0.25
0.25	0.25
= 2	= 1

empirical formula of this compound = Li_2O

(Total for Question 1 = 10 marks)

ResultsPlus
Examiner Comments

In some cases, candidates used the formula for the symbols taken from earlier in the question to obtain a formula of Li_2O. This was accepted and full credit was awarded.

Question 2 (a) (i)

This question was very well answered with the majority of candidates being able to score 1 mark for understanding that when a sample of hydrogen is mixed with air and ignited it would make a squeaky pop or that water formed.

2 (a) Water, acidified with sulfuric acid, is decomposed by electrolysis.
The water is decomposed to produce hydrogen and oxygen.

(i) A sample of hydrogen is mixed with air and ignited.

State what would happen.

(1)

A squeaky pop would be emitted
A flame would be produced
water would be produced

ResultsPlus
Examiner Comments

A correct answer that gained the mark.

2 (a) Water, acidified with sulfuric acid, is decomposed by electrolysis.
The water is decomposed to produce hydrogen and oxygen.

(i) A sample of hydrogen is mixed with air and ignited.

State what would happen.

(1)

A A glowing Splint would react
with the Oxygen and would then
relight.

ResultsPlus
Examiner Comments

Where candidates did not score, it was often because they did not read the question carefully and gave the test for oxygen rather than for hydrogen.

Question 2 (a) (ii)

Candidates found this data analysis question difficult. A good proportion were able to give the quantitative relationship and stated that there was double the hydrogen produced compared to oxygen to gain mark point two, fewer though gave the simple trend that as time increased so did the volume of hydrogen and/or oxygen.

(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 2.

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 2

Describe, using the data in Figure 2, what the results show about the volumes of hydrogen and of oxygen produced in this experiment.

(2)

The results show that as the time increases, so does the volumes of hydrogen and oxygen. However, the volume of oxygen is produced is half the amount of hydrogen produced.

ResultsPlus
Examiner Comments

A good answer that gained two marks, the candidates gives the overall trend and then states the quantitative trend that the volume of oxygen is half the amount of hydrogen which was fine for the second marking point.

Describe, using the data in Figure 2, what the results show about the volumes of hydrogen and of oxygen produced in this experiment.

(2)

The ~~o~~ volume of hydrogen produced, there is always half of the amount of oxygen produced.

ResultsPlus
Examiner Comments

Many candidates gave the quantitative relationship to gain the second marking point, however they did not give the simple increase for the first mark.

Describe, using the data in Figure 2, what the results show about the volumes of hydrogen and of oxygen produced in this experiment.

(2)

The volume of both hydrogen and oxygen increases as time goes on, eg hydrogen at 2 minutes is 4cm^3 when measured at 4 minutes its 8cm^3. Hydrogen increases by 4cm^3 in two minutes according to the ~~data~~ data. Oxygen increases by 2cm^3 every two minutes according to the data.

ResultsPlus
Examiner Comments

In some cases, candidates simply copied values from the table, this was not sufficient for either mark point. In this case the candidates scored just 1 mark for stating that the volume of oxygen increased with time.

ResultsPlus
Examiner Tip

Candidates should be aware that no credit is awarded for repeating information from the stem of the question with no interpretation, this includes data in tables.

Question 2 (c)

A large proportion of candidates scored at least 1 mark on this question for understanding that nitrates are soluble and carbonate are insoluble. Fewer were then able to take this further to explain that it is the movement of the ions that enabled the calcium nitrate to behave as an electrolyte.

(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)

Calcium nitrate is soluble and calcium carbonate isn't, Calcium nitrate ~~is~~ ~~Aq~~ has delocalised electrons whilst Calcium Carbonate doesn't.

ResultsPlus
Examiner Comments

A common misconception was that the calcium nitrate has delocalised electrons that are free to move in solution rather than ions, this did not gain credit, however this did not detract from the first sentence regarding the solubility and the first mark was awarded.

Calcium nitrate is soluble in water so therefore the ions are free to move and therefore can carry electrical current. Calcium carbonate is not soluble in water, so the ions aren't free to move, so cannot carry an electrical current as an electrolyte

ResultsPlus
Examiner Comments

A good answer that scored both marks. Although the candidate has given the argument in terms of the calcium nitrate and the calcium carbonate the first sentence would have been sufficient to gain both marks.

Question 2 (d)

Candidates found writing this half equation very difficult with few gaining full marks. Common mistakes were to include chlorine in the equation, subtracting electrons rather than adding them and adding electrons with a 2- charge to balance the 2+ charge on the zinc ion.

(d) When molten zinc chloride is electrolysed, zinc ions, Zn^{2+}, form zinc atoms.

Write the half equation for this reaction.

(2)

$Zn^{2+} + 2e \longrightarrow Zn^{-}$

ResultsPlus
Examiner Comments

Although the zinc ion on the right hand side is incorrect, this example still scored 1 mark for the correct zinc ion on the left hand side gaining electrons forming on an ion.

(d) When molten zinc chloride is electrolysed, zinc ions, Zn^{2+}, form zinc atoms.

Write the half equation for this reaction.

(2)

$Zn + 2e^{-} \rightarrow Zn^{2+}$

ResultsPlus
Examiner Comments

Even though the species were given in the stem of the question, this example gained 0 marks as the zinc atom and zinc ion are the wrong way around.

ResultsPlus
Examiner Tip

Candidates should use the information in the stem of the question to help them answer the question.

(d) When molten zinc chloride is electrolysed, zinc ions, Zn^{2+}, form zinc atoms.

Write the half equation for this reaction.

(2)

$Zn^{2+} + 2e^- \rightarrow Zn$

ResultsPlus
Examiner Comments

A good example that gained two marks.

Question 3 (a) (i)

This question was generally well answered with a good proportion of candidates scoring the full three marks available for calculating the percentage by mass of nickel compounds in the ash. Where learners were not able to gain full marks, often 1 mark was scored for converting 1kg to g.

3 (a) One way to extract metals from land contaminated with metal compounds is phytoextraction.
When plants grow they absorb metal ions through their roots.
The plants are harvested, dried and burned forming an ash.
The ash contains metal compounds.

Plants were grown in a piece of ground contaminated with nickel compounds.

(i) 1 kg of the ash from these plants contained 142.0 g of nickel compounds.

Calculate the percentage by mass of nickel compounds in the ash.

(3)

1000 g = 1Kg

1000 − 142 = 858

$\frac{858}{1000} \times 100 = 85.8$

percentage by mass = 85.8%

ResultsPlus
Examiner Comments

In this example, the candidate calculated the percentage of non-nickel compounds in the ash rather than the nickel compounds and therefore scored a mark of 2 rather than 3.

mass. 1Kg = 1000g

concentration x volume 1000 ÷ 142 = 7.04

percentage by mass = 7.04%

ResultsPlus
Examiner Comments

This example scored just 1 mark for the conversion of 1Kg to 1000g.

$\frac{142}{1000} \times 100 = 14.2\%$ 1 kg = 1000 g

percentage by mass = 14.2

ResultsPlus
Examiner Comments

A good answer that scored all three marks available.

Question 3 (a) (ii)

This question about the advantages of phytoextraction was very poorly answered by candidates with the majority scoring 0 marks.

Many candidates lost marks as they stated that phytoextraction was more environmentally friendly or that it was cheaper or used less energy all of which did not score. Where candidates did score it was often for the idea that phytoextraction allowed conservation of nickel ore.

(ii) Nickel is extracted from nickel compounds.

State an advantage of extracting nickel by phytoextraction rather than from its ore.

(1)

4 Saves amount of high grade ores which are ~~limited~~ finite.

ResultsPlus
Examiner Comments

This example gained one mark for the idea that nickel ores are preserved.

Less expensive and less pollution is caused.

ResultsPlus
Examiner Comments

Less expensive or less pollution were both deemed too vague to gain credit and this answer scored 0 marks.

ResultsPlus
Examiner Tip

Candidates should be aware that 'cheaper' and 'pollution' are vague terms and will often not gain credit. They should instead be more specific with their responses stating why it would be cheaper or what type of pollution might be caused such as noise pollution due to mining or less carbon dioxide release into the atmosphere.

Question 3 (b) (i)

Candidates found writing this balanced equation quite difficult showing a lack of understanding of common chemical formula.

Many candidates did not score the first marking point as they gave the formula of oxygen as O rather than O_2. They also found it difficult to write the formula of sulfur dioxide. Often the formulae for nickel oxide and nickel sulfide were incorrect even though it had been stated in the question.

(b) Some nickel ores contain nickel sulfide.

(i) In the first stage of extracting nickel from nickel sulfide, the nickel sulfide, NiS, is heated in air to form nickel oxide, NiO, and sulfur dioxide.

Write the balanced equation for this reaction.

(2)

NiS + O → NiO + SO

NiS + O → NiO + S

ResultsPlus
Examiner Comments

A common error was to write oxygen as O rather than O_2.

$2NiS + 3O_2 \rightarrow 2NiO + 2SO_2$

ResultsPlus
Examiner Comments

A correct response that gained 2 marks.

Question 3 (c)

In general, this question was well answered with a good proportion of candidates gaining at least 2 of the three marks available. Where candidates lost marks, it was often as they forgot to state that as part of the distillation process the mixture had to be heated.

A common error occurred when the candidates did not read the stem carefully and started to try to describe electrolysis as a method to separate the two liquids.

(c) In a different method of obtaining nickel, the process produces a mixture of the liquids nickel tetracarbonyl and iron pentacarbonyl.

The boiling point of nickel tetracarbonyl is 43 °C.
The boiling point of iron pentacarbonyl is 103 °C.
These two liquids mix together completely.

Describe the process used to separate these two liquids.

(3)

fractional distillation

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Examiner Comments

Fractional distillation gained a mark, but unfortunately no other description of the method was offered so just 1 mark was scored.

Simple distillation requires two liquids in a mixture that have different boiling points. Using a Bunsen burner, heat the mixture, when the boiling point of nickel tetracaborgl is reached, it will pass through the liebig which has a cooling jacket of water, the liquid condenses. Leaving the iron pentacarborgl in the original beaker and the nickel in the new beaker in liquid

(Total for Question 3 = 10 marks)

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Examiner Comments

A good clear description that gained all three marks available.

Question 4 (a)

Candidates found devising an experiment to test the reversibility of this reaction a challenge with only the best being able to gain the full four marks available and a large proportion of weaker candidates not scoring at all.

It appeared that candidates did not use the information in the stem of the question to help them with their answers. Of those that did, it was clear that some were not familiar with the terms hydrated and anhydrous.

Where candidates did score, it was often for describing a method for the decomposition reaction. Stating that the hydrate copper sulfate should be heated and that the often scored a second mark for stating that they solid would turn white. They found it much harder to describe the reverse reaction, with some thinking that the anhydrous copper sulfate should then be frozen.

In some cases, candidates gave the tests but not the results of the tests.

A large proportion of candidates did not read the question carefully and instead of devising an experiment gave an explanation as to what a reversible reaction was and started to describe Le Chatelier principle.

4 (a) Hydrated copper sulfate, $CuSO_4.5H_2O$, is a blue solid.
Anhydrous copper sulfate, $CuSO_4$, is a white solid.

Heat energy is needed to convert hydrated copper sulfate to anhydrous copper sulfate.
This is a reversible reaction.

$$CuSO_4.5H_2O \rightleftharpoons CuSO_4 + 5H_2O$$

Devise an experiment to show that this is a reversible reaction.

(4)

~~Mix~~ Heat Hydrated Copper Sulfate So it turns to Anhydrous Copper Sulfate. once the first reaction is finished, Put the Anhydrous copper Sulfate in Water and it will change to hydrated Copper Sulfate.

ResultsPlus
Examiner Comments

In this example, the candidate has stated how to test for the decomposition and the reverse reaction but has not stated the results of each test to gain the second and fourth marking points.

ResultsPlus
Examiner Tip

Candidates should remember that when they give a test for a substance or to show something has taken place, they should also give the result of that test.

~~React hydrated copper sulfate with~~ Heat the ~~hydrated~~ copper sulfate ~~in a closed container~~ with a bunsen burner. ~~This way none of the gas is released.~~ The hydrated copper sulfate will become anhydrous copper sulfate as it will turn into a white solid when cooled. Then add water to the anhydrous copper sulfate and cool it and it will turn back to a blue solid.

ResultsPlus
Examiner Comments

A good answer that gained all four marks available.

Question 4 (b)

The vast majority of candidates found this question about the equilibrium between hydrogen, iodine and hydrogen iodide very difficult with very few gaining the full two marks available. Candidates showed a lack of understanding of equilibrium and the understanding of the fact that the equilibrium reaction will not go to completion was missing. Very few candidates realised that the hydrogen and iodine would still be present with a large proportion of candidates giving the answer that the mixture would become colourless due to the production of the hydrogen iodide.

Of those that did understand that the mixture would be a lighter purple, very few were able to explain this is terms of there being less iodine present.

(b) Hydrogen reacts with iodine to form hydrogen iodide.
Iodine gas is purple and hydrogen iodide gas is colourless.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

Hydrogen and iodine are placed in a sealed container.
The container is left until equilibrium is reached.

The conditions are changed favouring the forward reaction.

Explain what you would **see**.

(2)

the gas will become less purple.

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Examiner Comments

This answer gained just 1 mark for understanding that the gas would be lighter purple.

They would see the purple gas turn colourless as the hydrogen iodide gas is colourless and the iodine is a purple gas.

ResultsPlus
Examiner Comments

A large proportion of candidates thought that the gas would turn colourless, this gained no marks.

Question 4 (c)

Calculating the number of atoms combined in one mole of copper iodide proved very challenging for candidates. Very few scored, showing a lack of understanding of how to use Avogadro's number.

A very common error was to multiply the relative formula mass of the copper iodide rather than the number of atoms.

(c) Calculate the number of atoms combined in one mole of copper iodide, CuI_2.
(Avogadro constant = 6.02×10^{23})

(2)

$3 \times 6.02 \times 10^{23} = 1.806 \times 10^{24}$

number of atoms = 1.806×10^{24}

ResultsPlus
Examiner Comments

The correct answer that scored the two marks.

A_r of Cu = 63.5 , A_r of Iodine = 127

$M_r = 63.5 + 127 + 127 = 317.5$

mass = A_r . mol $317.5 \times 6.02 \times 10^{23} = 1.91135 \times 10^{26}$

number of atoms = ~~317~~ 1.91135×10^{26}

ResultsPlus
Examiner Comments

A very common error was to multiply the relative formula mass of the copper iodide rather than the number of atoms. This gained no marks.

Question 5 (a)

Although it was clear from the answers given that candidates understood what was happening in the reaction, candidates found scoring more than 1 mark on this question very difficult. Although the word see was emboldened in the question stem, many candidates did not give an answer that stated observations that would be seen. Instead many candidates often tried to explain what was happening in terms of displacement reactions.

Many candidates stated that effervescence or bubbles would occur. Answers that included this incorrect observation were limited to 1 mark.

Where candidates did score, they often gained 1 mark for stating that the solution was colourless, few scored 2 marks.

Oxidation loss Reduction gain

5 Pieces of zinc react with copper sulfate solution.
Zinc sulfate solution is colourless.

$$Zn(s) + CuSO_4(aq) \rightarrow ZnSO_4(aq) + Cu(s)$$

(a) Describe what you would **see** when an excess of zinc is added to copper sulfate solution and the mixture left until the reaction is complete.

(2)

You would see a gold/orange solid (copper) and a colourless liquid (zinc sulfate) when the reaction is completed.

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Examiner Comments

A good answer that scored for the orange solid and the colourless iquid.

as there is excess zinc, the equation wasn't balanced meaning the solid zinc will be left over in the liquid after the reaction ends.

ResultsPlus
Examiner Comments

Whilst it is clear in this example that the candidate understands what is happening in the reaction, they have not answered the question what would you see and so does not gain the mark.

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Examiner Tip

Candidates should be careful when they read the question to ensure that they address what has been asked of them and if asked for what is seen they should state the observations that would be seen rather what is happening in the reaction.

Question 5 (b)

A good proportion of candidates demonstrated a good understanding of oxidation as loss of electrons and reduction as gain of electrons but knowing which metals were oxidised and which were reduced was less well demonstrated. Many candidates answered with the metals the wrong way around but were still able to gain marks for the correct understanding of oxidation and reduction in terms of movement of electrons.

In some cases, candidates referred to the sulfate ions being oxidised or reduced, this did not gain credit.

It was pleasing to see a good proportion of candidates gave a very good answer that scored the full four marks available.

(b) This reaction is described as a redox reaction.

Explain, in terms of electrons, which particles have been oxidised and which particles have been reduced in this reaction.

(4)

Oxidation is loss of electrons.
Reduction is gain of electrons.
Zinc has gained electrons and has been reduced whereas copper lost electrons and has been oxidised.

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Examiner Comments

A common answer that scored two marks, the candidate has the metals the wrong way around but were still able to gain the marks for the correct understanding of oxidation and reduction in terms of movement of electrons.

On this reactin the Copper hao bean deduced and the Zink has been oxidised.

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Examiner Comments

Another common two mark answer, although the candidate has correctly identified which metal has been oxidised and which has been reduced, there is no reference to the movement of electrons for the second and fourth marking points.

- Zinc has been oxidised and has lost electrons.
- Copper has been reduced and has gained electrons.

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Examiner Comments

A clear concise answer that gained the full four marks available.

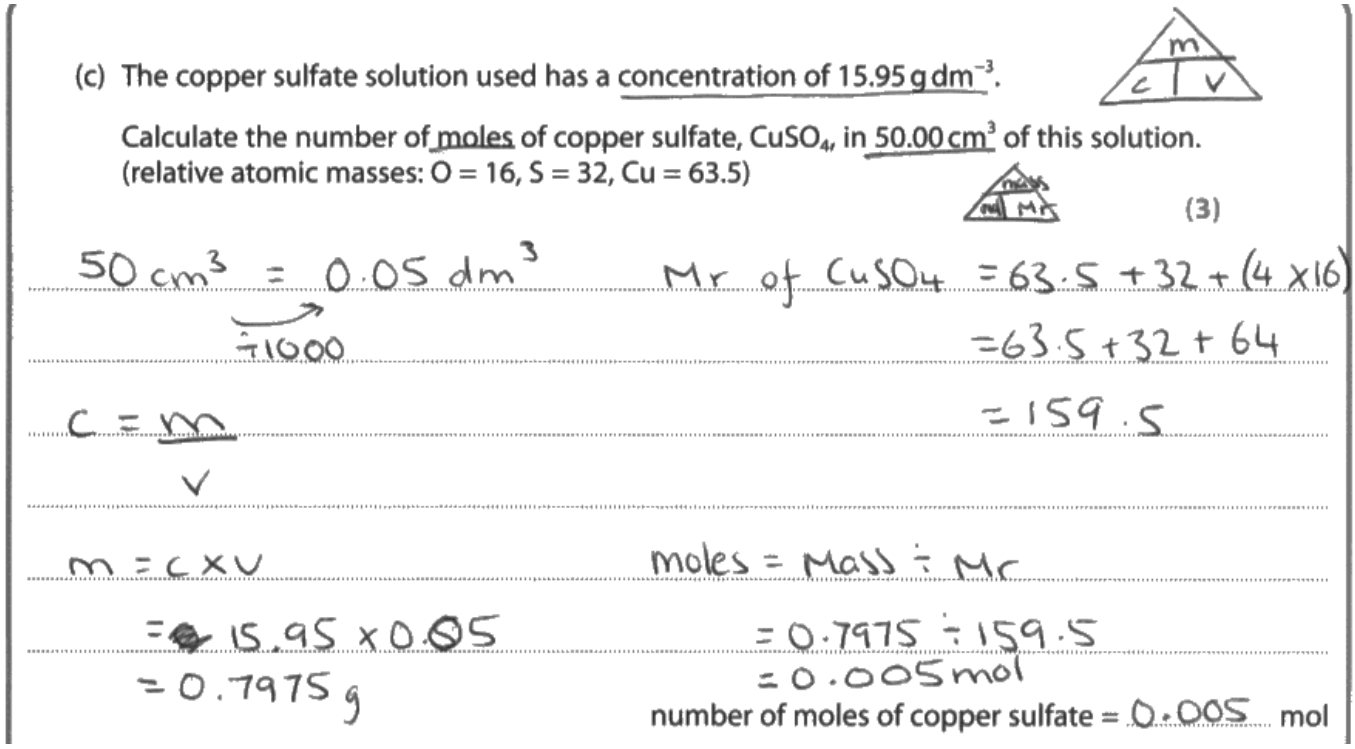
Question 5 (c)

Calculating the number of moles of copper sulfate correctly to gain full marks in this question was again quite test for candidates with only the best gaining the full three marks available.

Many were able to score at least one mark for calculating the relative formula mass of the copper sulfate. Of those, far fewer were able to take this further to calculate the number of moles.

A common answer error was to forget to convert the volume leading to an answer of 5.

Some were able to calculate the concentration but then did not take this to the last step to gain the last mark.



ResultsPlus
Examiner Comments

The correct answer that scored the three marks available.

moles = mass / Mr

(c) The copper sulfate solution used has a concentration of 15.95 g dm^{-3}.

Calculate the number of moles of copper sulfate, $CuSO_4$, in 50.00 cm^3 of this solution.
(relative atomic masses: O = 16, S = 32, Cu = 63.5)

(3)

63.5 + 32 + 64

2 159.5

$\frac{15.95}{159.5}$ = 0.1

0

number of moles of copper sulfate = 0.1 mol

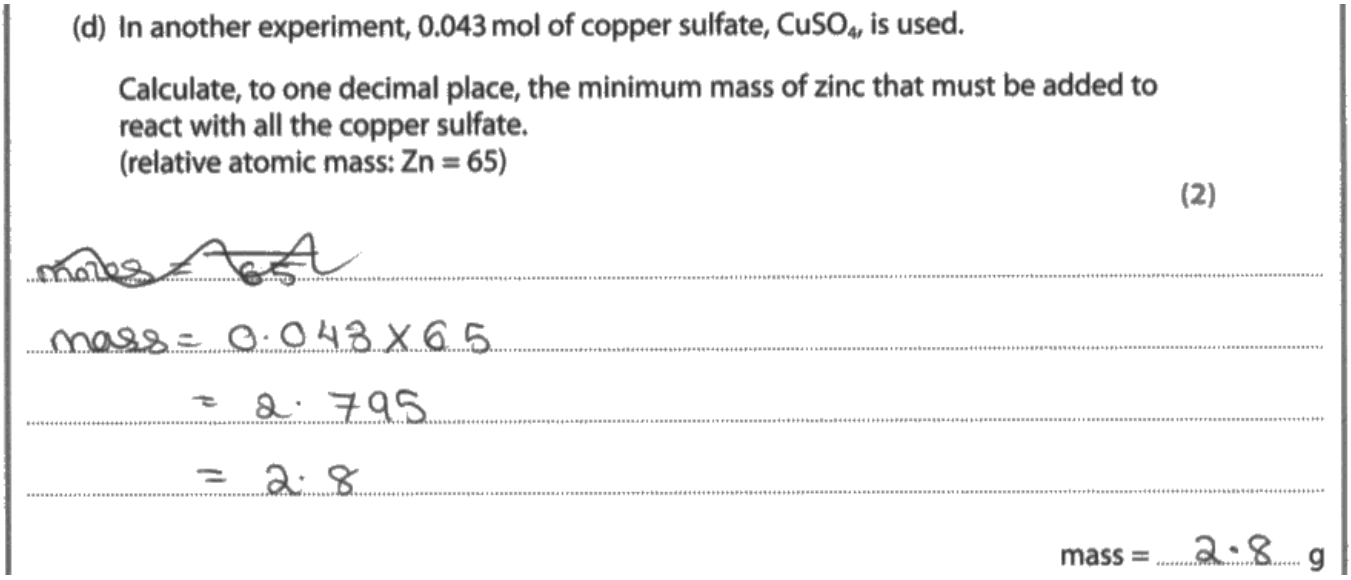
ResultsPlus
Examiner Comments

In this example the candidate has calculated the relative formula mass of the copper sulfate and the concentration but has not carried out the last step for calculating the number of moles for the final mark.

Question 5 (d)

Many candidates did not gain more than 1 mark on this question due to the lack of rounding to one decimal place, therefore getting an answer of 2.795 or 3.

A common error seen was to multiply the relative formula mass of the copper sulfate by the number of moles or dividing the relative atomic mass of copper by the number of moles rather than multiplying it. If the answer to this calculation was given to one decimal place and working was shown, one mark was still awarded for the understanding of one decimal place.


(d) In another experiment, 0.043 mol of copper sulfate, $CuSO_4$, is used.

Calculate, to one decimal place, the minimum mass of zinc that must be added to react with all the copper sulfate.
(relative atomic mass: Zn = 65)

(2)

moles = 65

mass = 0.043 x 65

= 2.795

= 2.8

mass = 2.8 g

ResultsPlus
Examiner Comments

A correct answer, with clear working that gained both marks.

0.043 x 65 = 2.795

mass = 2.795 g

ResultsPlus
Examiner Comments

This example gained just 1 mark as the answer has not been given to one decimal place.

ResultsPlus
Examiner Tip

It is important that working is shown in calculations. If an incorrect answer of 1511.6 was given as a result of dividing rather than multiplying, this answer shown with working can still be awarded 1mark as it is written to 1 decimal place.

Question 6 (a) (i)

Many candidates gained the mark on this question with the most common correct answers given as pH probe or universal indicator to measure the pH.

Common incorrect answers included pH scale, phenolphthalein, litmus and iodine.

6 (a) **X** and **Y** are solutions of two different acids.
The concentration of acid in each solution, in mol dm^{-3}, is the same.
Solution **X** has a pH of 3.40 and solution **Y** has a pH of 4.40.

(i) State what could be used to measure these pH values of 3.40 and 4.40.

(1)

indicator

ResultsPlus
Examiner Comments

Indicator alone was not sufficent to gain the mark.

ResultsPlus
Examiner Tip

Candidates should be taught to be specific with their answers, if the candidate had stated universal indicator then a mark could have been awarded here.

Litmus paper

ResultsPlus
Examiner Comments

A common incorrect answer seen was litmus, this gained no marks.

Question 6 (b) (i)

A good proportion of candidates were able to gain one mark for stating how to change the method, so the amount of hydrochloric acid could be measured more accurately. Candidates found it harder to think of a way to improve the accuracy of the mass of the base. The word accurate threw some candidates with some thinking that using more of the powdered base would make the experiment more accurate.

Many candidates did not use the information in the stem of the question which told them that the base was added with a spatula and assumed that it also was a liquid, therefore suggesting an improvement to be using a pipette or measuring cylinder to measure the base as well as the acid.

In some cases, candidates lost marks as they copied the stem of the question and just stated that the acid and base should be measured but did not state what with. Some stated that the acid or base should be added slowly, this was not creditworthy.

(b) An experiment is planned to record the change in pH as a powdered base is added to 50 cm^3 dilute hydrochloric acid.

The method suggested is

step 1 add dilute hydrochloric acid up to the 50 cm^3 mark on a beaker

step 2 add one spatula of the base and stir

step 3 measure the pH of the mixture

step 4 repeat steps 2 and 3 until the pH stops changing.

(i) State how you could change the method so that the amounts of dilute hydrochloric acid and of the base can be measured more accurately.

(2)

dilute hydrochloric acid use a burette, to add measure acid slower and more accurate.

base Measure how much of the base you want on weighing scales, have constant value.

ResultsPlus
Examiner Comments

This answer gained two marks.

dilute hydrochloric acid use pipete to measure out 50cm3 preisly

base add a drop instead using pipette. and add more spatula

ResultsPlus
Examiner Comments

This answer gained one mark for the use of a pipette for the acid. The second part of the answer for the base is confused with the candidate confused between the base being a liquid and therefore using a pipette and adding more spatulas of the base. Neither of which scored.

dilute hydrochloric acid use a pipet to measure exacly 50cm3

base use a measuring cylinder to measure the amount of base

ResultsPlus
Examiner Comments

This answer gained one mark for the use of a pipette for the acid. The second part of the answer for the base is confused as the candidate thinks that the base is a liquid and therefore using a measuring cylinder, this did not score.

Question 6 (b) (ii)

Candidates found it hard to give the correct colour change from the phenolphthalein to gain the mark, with only the better candidates gaining this mark.

Question 6 (b) (iii)

Explaining in terms of the particles present why the pH increased during the experiment was very hard for candidates with the vast majority not scoring on this question.

A small proportion were able to score 1 mark for the decrease in H^+ ions or the increase in OH^- ions. Fewer still could then explain this change in terms of the hydrogen ions having reacted or being neutralised.

(iii) Explain, in terms of the particles present, why the pH increases during the experiment.

(2)

the concentration $H^+ + OH^- \rightarrow H_2O$ neutralised ? Concentration of H^+ ions decreased and the mixture becomes less acidic. Concentration of OH^- ions increases.

ResultsPlus
Examiner Comments

A good answer that scored both marks.

Question 6 (c)

This levelled based question based on identifying solids given their properties was a good discriminator with a good range of marks seen across the six available marks.

The most common score seen was 3, where learners had managed to identify two solids and given two valid reasons why they have identified the solids as such.

Candidates with good practical experience tended to show and do well in this question.

A common error was to incorrectly identify solid A as copper carbonate and solid D as copper oxide, not understanding the significance of the release of carbon dioxide during the reaction of the solid with sulfuric acid and thus only correctly identifying two solids correctly.

*(c) Some properties of four solids, **A**, **B**, **C** and **D**, are shown in Figure 3.

The solids, in no particular order, are copper carbonate, copper oxide, magnesium metal and sodium hydroxide.

	A	B	C	D
colour of solid	black	silver (Mag)	white (Sodium)	green
observation when solid is added to water	black solid remains	a few bubbles appear on surface of solid	solid dissolves and forms colourless solution	green solid remains
pH of mixture of solid added to water	7	8	13	7
observation when solid is added to dilute sulfuric acid	on warming, solid disappears to form blue solution	effervescence solid disappears to form colourless solution	solid disappears to form colourless solution	effervescence solid disappears to form blue solution

Figure 3

Identify the solids **A**, **B**, **C** and **D**, explaining how the information in Figure 3 supports the identification of each solid.

(6)

Solid A will be copper carbonate, this is because it turns blue in Sulfuric acid (as copper) but also because it is black.

Solid B is Magnesium metal. This is because it has a reaction with water and is silver

Solid C is Sodium hydroxide. This is as the substance is white, reacts in water but most importantly leaves a alkaline substance behind as a alkaline metal would

Substance D is copper oxide as it has the same properties as A however is green and has a ~~more~~ larger reaction.

ResultsPlus
Examiner Comments

In this example, the candidate has incorrectly identified solid A as copper carbonate and solid D as copper oxide. They have B and C correct with correct reasoning and therefore scores 3 marks.

*(c) Some properties of four solids, **A**, **B**, **C** and **D**, are shown in Figure 3.

The solids, in no particular order, are copper carbonate, copper oxide, magnesium metal and sodium hydroxide.

copper oxide sodium hydroxide sodium hydroxide copper CO3

	A	B	C	D
colour of solid	black	silver	white	green
observation when solid is added to water	black solid remains	a few bubbles appear on surface of solid	solid dissolves and forms colourless solution	green solid remains
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Figure 3

Identify the solids **A**, **B**, **C** and **D**, explaining how the information in Figure 3 supports the identification of each solid.

(6)

Solid A is copper oxide, because the colour of the solid is black 'powder form'. When added to water, copper is very unreactive, and therefore doesn't react with water and the black solid remains. The pH of the water will still be 7 because it is neutral and the solid hasn't dissolved. When it is added to sulfuric acid, it forms a blue solution, copper sulfate. Solid B is magnesium metal. It is silver, as most metals are. It reacts slightly with water, therefore the pH increase to 8. When reacted to dilute sulfuric acid

the colourless solution is formed ~~and it~~
Solid C is sodium hydroxide because when reacting with water it dissolves, the hydroxide ions increase the pH to 13, and when reacting with dilute sulfuric acid it disappears to form a colourless solution. The hydroxide ions balance out the hydrogen ions in the sulfuric acid.
Solid D is copper carbonate because when copper is held over a flame it turns green. Copper is unreactive and therefore the solid remains and the pH stays at ~~7~~ 7 as water is neutral. When reacting with dilute sulfuric acid the effervescence is the gas bubbling and because it forms a blue solution (copper sulfate) the solid disappears to form a blue solution.

ResultsPlus
Examiner Comments

This answer scores full marks at level 3 for correctly identifying all substances with valid reasons.

*(c) Some properties of four solids, **A**, **B**, **C** and **D**, are shown in Figure 3.

The solids, in no particular order, are copper carbonate, copper oxide, magnesium metal and sodium hydroxide.

Sodium Magnesium

	A	B	C	D
colour of solid	black	silver	white	green
observation when solid is added to water	black solid remains	a few bubbles appear on surface of solid	solid dissolves and forms colourless solution	green solid remains
pH of mixture of solid added to water	7	8	13	7
observation when solid is added to dilute sulfuric acid	on warming, solid disappears to form blue solution	effervescence solid disappears to form colourless solution	solid disappears to form colourless solution	effervescence solid disappears to form blue solution

Figure 3

Identify the solids **A**, **B**, **C** and **D**, explaining how the information in Figure 3 supports the identification of each solid.

(6)

A is Sodium hydroxide because firstly, the ph of hydrogen is neutral which is 7.

metal

B is magnesium because it is silver and insoluble

C is Copper ~~Carbonate~~ oxide because its black when solid

D is Copper ~~oxide~~ Carbonate

ResultsPlus
Examiner Comments

This example gained two marks for two solids correctly identified, magensium and copper carbonate and one, the magensium, with correct reasoning.

ResultsPlus
Examiner Tip

Some candidates were careless when writing out the names of the compounds and therefore lost marks as they referred to sodium and its reaction with water rather than sodium hydroxide. Ensure that when writing names of formula you are careful, being clear with distinctions been -ide, -ine, and -ate and that you write the complete name.

*(c) Some properties of four solids, **A**, **B**, **C** and **D**, are shown in Figure 3.

The solids, in no particular order, are copper carbonate, copper oxide, magnesium metal and sodium hydroxide.

	A	B	C	D
colour of solid	black	silver	white	green
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Figure 3

Identify the solids **A**, **B**, **C** and **D**, explaining how the information in Figure 3 supports the identification of each solid.

(6)

Solid B is magnesium metal. It The colour of the solid is silver and this is the only metal solid. Magnesium metal reacts with water and doesn't change the colour of the solution when added to sulfuric acid. Solid C is calcium carbonate. The calcium would make the solid white and would quickly dissolve when added to water. Solid D is copper oxide. The copper would react with the oxide to form a green coloured

solid. As it is a metal it would not dissolve in the water. Solid A is sodium hydroxide. The solid is black due to the sodium and hydroxide reacting together to make the black colour. It will not react with water which is why a black solid is still left.

ResultsPlus
Examiner Comments

In this example, the candidate has just one solid correctly identified with a correct reason so gains one mark.

Paper Summary

Candidates that did well this session were able to do so as they knew formula of common elements and compounds. They were able to read and analyse information and new contexts and were able to apply their knowledge of chemistry to these new situations. They were able to carry out calculations well, showing their working clearly and concisely to gain the marks. They showed, in their answers, that they had a good experience of practical work.

Candidates that did less well, did so because they lacked basic terminology such as anhydrous and hydrated. Candidates could improve by learning the meaning of different command words such as describe and explain. Also, where a word such as two or see is bolded in the question, candidates should ensure they give two letters for example or if asked for what they would see, candidates should be writing what would be seen in the reaction rather than trying to explain the chemistry.

Candidates should practise reading, interpreting and using the information in the stem of the question to help them form their answer. Too many times, candidates fell short of the correct answer as they had not read or used the information given to them in the stem.

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