Examiners' Report
March 2013

GCSE Chemistry 5CH2F 01

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# Introduction

This was the third examination that had been set for paper 5CH2F 01 and there was a considerable increase in the number of candidates. This unit is externally assessed through a one-hour, 60-mark written paper consisting of six questions. The Foundation Tier paper assesses grades G to C. Candidates were challenged by a mixture of question styles, including multiple choice, short items, calculations, word and balanced equations, graph plotting and extended writing questions.

Many candidates coped well with this examination and had developed their skills in answering the different styles of question.

Successful candidates:

- read the questions carefully and answered the questions they were set
- could write a word equation and balance an equation where the formulae were given
- could carry out simple calculations
- could describe how to carry out experiments
- had a good knowledge of atomic structure and bonding
- could plot points on a graph, draw a line through them and read a value from the line.

Some answers were of a lower standard. Less successful candidates:

- did not read the questions carefully and gave answers that were related to the topic being tested, but did not answer the question
- did not understand the meaning of key scientific words and phrases
- did not understand atomic structure and bonding
- could not carry out calculations
- were unable to describe how to carry out experiments similar to ones they had seen or carried out themselves during the course.

This report provides exemplification of candidates' work, together with tips and/or comments for a selection of questions. The exemplification will come mainly from questions that required more complex responses from candidates.

## Salts

### *Question 1(a)(i)*

The majority of candidates knew that the lead nitrate had to be in solution, although a few thought that it was a gas.

### *Question 1(a)(ii)*

A significant number of candidates thought that lead iodide formed as a solid metal.

### *Question 1(a)(iii)*

The majority of candidates knew that the mixture needed to be filtered to separate the solid lead iodide.

### *Question 1(a)(iv)*

The majority of candidates knew that the solid is dried after washing it.

## Question 1(b)(i)

Some candidates gave clear descriptions of what can be seen when zinc carbonate reacts with dilute hydrochloric acid. Many others ignored the word '**seen**', even though it was in bold type, and just wrote the word equation as a sentence.

The most common answer was 'fizzing' or 'bubbles of gas formed', scoring only 1 mark as candidates omitted to note that the zinc carbonate powder disappears and a colourless solution is formed.

Common incorrect observations included: 'a precipitate forms'; 'it goes cloudy'; 'there is a colour change'; 'heat is given off and a gas is formed' (without explaining how they can see that a gas is formed).

(b) Solid zinc carbonate reacts with dilute hydrochloric acid.

The word equation for the reaction is

zinc carbonate + hydrochloric acid → zinc chloride + carbon dioxide + water

(i) Describe what is **seen** during this reaction.

(2)

The two elements mix together and react, giving of carbon dioxide gas and zinc chloride and ~~the~~ water.

**ResultsPlus**
**examiner comment**

This candidate has written the names of the products but has not given any details of what they would **see** during the reaction. So, this does not score any marks.

**ResultsPlus**
**examiner tip**

Carbon dioxide gas is produced during this reaction but you cannot **see** it as it is colourless. You do **see** bubbles or fizzing when any gas is produced.

(b) Solid zinc carbonate reacts with dilute hydrochloric acid.

The word equation for the reaction is

zinc carbonate + hydrochloric acid → zinc chloride + carbon dioxide + water

(i) Describe what is **seen** during this reaction.

(2)

The reaction causes a fizzing & creates carbon dioxide.

**ResultsPlus**
**examiner comment**

This candidate has correctly stated that they would **see** fizzing, scoring 1 mark.

(b) Solid zinc carbonate reacts with dilute hydrochloric acid.

The word equation for the reaction is

zinc carbonate + hydrochloric acid → zinc chloride + carbon dioxide + water

(i) Describe what is **seen** during this reaction.

(2)

it fizzes then disolves.

**ResultsPlus**
**examiner comment**

This candidate has given two correct observations so scores 2 marks.

**ResultsPlus**
**examiner tip**

When you see 2 marks for a question, try to give two separate points in your answer.

## Question 1(b)(ii)

Many candidates are familiar with the use of limewater for testing for carbon dioxide. However, it was disappointing to see many other candidates stating as a test for the gas that a lighted splint is extinguished by carbon dioxide. Although this is a correct observation, many other gases also extinguish a lighted splint so this cannot be used as a test for a particular gas. The only acceptable test for carbon dioxide is that it turns limewater milky or cloudy. Some candidates assumed that carbon dioxide turns any solution milky or cloudy, including water, and others knew a gas test but described the tests for hydrogen or oxygen.

(ii) Describe a test to show that the gas produced is carbon dioxide.

(2)

You have a tube running from one test tube to (The limewater) another. The gas will go through to the lime water. If $CO_2$ is present it will turn cloudy

**(Total for Question 1 = 8 marks)**

**ResultsPlus**
**examiner comment**

This is a good answer, scoring both marks.

**ResultsPlus**
**examiner tip**

When you are asked to describe a test to identify a substance, you should also include the result of the test.

(ii) Describe a test to show that the gas produced is carbon dioxide.

(2)

You could show that it was carbon dioxide by bubbling the gas into limewater, it will go cloudy if the gas is carbon dioxide

**(Total for Question 1 = 8 marks)**

**ResultsPlus**
**examiner comment**

This is a very clear answer that scored both marks.

(ii) Describe a test to show that the gas produced is carbon dioxide.

(2)

Using a conical flask and a bun the reaction of zinc carbonate ~~with~~ will take place, the bun with a tube attached will be used because the tube will be put in lime water and then if carbon dioxide is present, will change colour. you could also use water and bubbles will be present also.

**(Total for Question 1 = 8 marks)**

**ResultsPlus**
**examiner comment**

This candidate has described the use of limewater to test for carbon dioxide but has just stated that it 'will change colour'. This is not clear enough for the second mark.

**ResultsPlus**
**examiner tip**

When you describe a test to identify a substance, you must also include the correct observation for the result of the test.

(ii) Describe a test to show that the gas produced is carbon dioxide.

(2)

The Squeeky pop. you lite a splint put it under a test tube and if then it makes a squeaky pop Carbon dioxide is present.

**ResultsPlus**
**examiner comment**

This candidate has described the test for hydrogen so has not scored any marks.

**ResultsPlus**
**examiner tip**

Learn the tests for the gases in the specification.

(ii) Describe a test to show that the gas produced is carbon dioxide.

(2)

Collect some $CO_2$ in a test tube, hold it upside down and put a lit splint in. The splint should be extinguished if it is $CO_2$

**ResultsPlus**
**examiner comment**

This was a common wrong answer.

Carbon dioxide does extinguish a lighted splint but so do some other gases. This cannot be used as a test to identify carbon dioxide.

**ResultsPlus**
**examiner tip**

Learn how to use limewater to test for carbon dioxide.

# Atomic structure

## *Question 2(a)(i)*

The majority of candidates correctly labelled the neutron and electron in the diagram. A small number labelled the electron as ‘outer shell’ as they had not read the word ‘particles’ in the question.

## *Question 2(b)(ii)*

The majority of candidates knew the relative mass of a proton is 1.

## *Question 2(c)(i)*

Many candidates were able to explain why lithium and sodium are both in group 1. Common errors included referring to the two electrons in the first shell and carelessly writing about protons or neutrons in the outer shell. A few candidates wrote about ‘the last number is a one’ rather than explaining what the number meant. Candidates should be encouraged to write about shells rather than rings or circles.

(c) The electronic configuration of lithium is 2.1.
The electronic configuration of sodium is 2.8.1.

(i) Explain, in terms of their electronic configurations, why lithium and sodium are both in group 1 of the periodic table.

(2)

They are both in group one of the periodic table as they are both alkalis and sodium is 8 away from lithium hence the 8 in sodiums electronic configuration.

**ResultsPlus**
**examiner comment**

This candidate has not explained why both metals are in group 1. They have not written anything that is incorrect, but what is written does not answer the question. This answer was not awarded any marks.

**ResultsPlus**
**examiner tip**

Read the question carefully and try to check that you have answered it correctly.

(c) The electronic configuration of lithium is 2.1.
The electronic configuration of sodium is 2.8.1.

(i) Explain, in terms of their electronic configurations, why lithium and sodium are both in group 1 of the periodic table.

(2)

Because they have the same amount of electrons in the outer shell therefor have ~~the~~ similar properties.

**ResultsPlus**
**examiner comment**

This candidate has realised the importance of the outer shells but 'the same amount of electrons' is not clear enough for why they are in group 1. This answer was given 1 mark.

(c) The electronic configuration of lithium is 2.1.
The electronic configuration of sodium is 2.8.1.

(i) Explain, in terms of their electronic configurations, why lithium and sodium are both in group 1 of the periodic table.

(2)

because they both have 1 electron in their outer shell, this also makes them fairly reactive as they only need to lose 1 electron for a full outer shell

**ResultsPlus**
**examiner comment**

This is an excellent answer, giving both marking points.

## Question 2(c)(ii)

Many candidates were able to explain why lithium is in period 2 and sodium is in period 3 because they knew the link between the number of shells and the period number. However, many candidates did not refer to the electronic configurations given at the start of the question.

Quite a few candidates partially answered the question by stating that sodium has more shells of electrons than lithium or even just more electrons. Some candidates wrote about two or three 'outer shells' but they should realise that each atom has only one outer shell and all others are inner shells.

Some candidates did not read the question carefully and stated that sodium has more protons than lithium or a higher relative atomic mass. The question clearly asks for an explanation in terms of the electronic configurations.

(ii) Explain, in terms of their electronic configurations, why lithium is placed in period 2 and sodium is placed in period 3 of the periodic table.

**(2)**

Because Sodium has 3 electrons on its outer shell and litium only has two.

**ResultsPlus**
**examiner comment**

This candidate has realised the importance of the 2 and 3 but has confused number of shells with electrons on the outer shell. The electronic configurations of 2.1 and 2.8.1 were given at the start of the question. This answer was given no mark.

**ResultsPlus**
**examiner tip**

Check your answers to make sure that they make sense and use the information given in the question.

(ii) Explain, in terms of their electronic configurations, why lithium is placed in period 2 and sodium is placed in period 3 of the periodic table.

(2)

because lithium has two outer shells and sodium has three outer shells.

**ResultsPlus**
**examiner comment**

This candidate was given 1 mark for relating the number of shells to the period number but has incorrectly stated that they are all outer shells so was not given the second mark.

**ResultsPlus**
**examiner tip**

Atoms only have one outer shell. All the other shells of electrons are inner shells.

(ii) Explain, in terms of their electronic configurations, why lithium is placed in period 2 and sodium is placed in period 3 of the periodic table.

(2)

lithium is placed in period 2 as it has two shells and sodium in period 3 as it has 3 shells.

**ResultsPlus**
**examiner comment**

This is an excellent answer, scoring both marks for this question.

# Investigating a reaction

## *Question 3(a)*

The majority of candidates were able to write the correct word equation for the reaction. Some candidates ignored the instruction and tried to write the balanced equation but they did not score the mark unless all of the formulae were correct, which was rarely seen. Candidates should be encouraged to write word equations when these are asked for, rather than attempt the more difficult balanced equations. Candidates should write a '+' between the reactants and the products, rather than 'and'.

A number of candidates ignored the mention of hydrogen in the question and wrote water and/or carbon dioxide as a product.

A few candidates did not read the question carefully and wrote the equation for zinc carbonate reacting with hydrochloric acid.

Some candidates did not copy 'hydrochloric' correctly; 'hydrolic acid' was a common incorrect answer.

**3** Zinc is a metal.

Zinc reacts with dilute hydrochloric acid to produce zinc chloride and hydrogen.

(a) Write the word equation for the reaction of zinc with dilute hydrochloric acid.

(1)

Zinc + hydrochloric acid → Zinc chloride + hydrogen.

**ResultsPlus**
**examiner comment**

This is an example of a correct equation. It is not necessary to include the word 'dilute' in front of hydrochloric acid, as it is just a description of the concentration.

**3** Zinc is a metal.

Zinc reacts with dilute hydrochloric acid to produce zinc chloride and hydrogen.

(a) Write the word equation for the reaction of zinc with dilute hydrochloric acid.

(Zn) Zn (H) **(1)**

zinc + dilute hydroxide → zinc chloride + Hydrogen

**ResultsPlus**
**examiner comment**

This candidate has not looked carefully at ‘hydrochloric acid’ and has copied it as ‘dilute hydroxide’ so has not scored a mark.

**ResultsPlus**
**examiner tip**

Read the information in the question carefully and copy the names of chemicals exactly as they are written on the paper.

## *Question 3(b)*

Some candidates gave excellent descriptions of how to use the apparatus to obtain the results; others were unsure about how it is used and suggested putting the acid or even the zinc in the syringe.

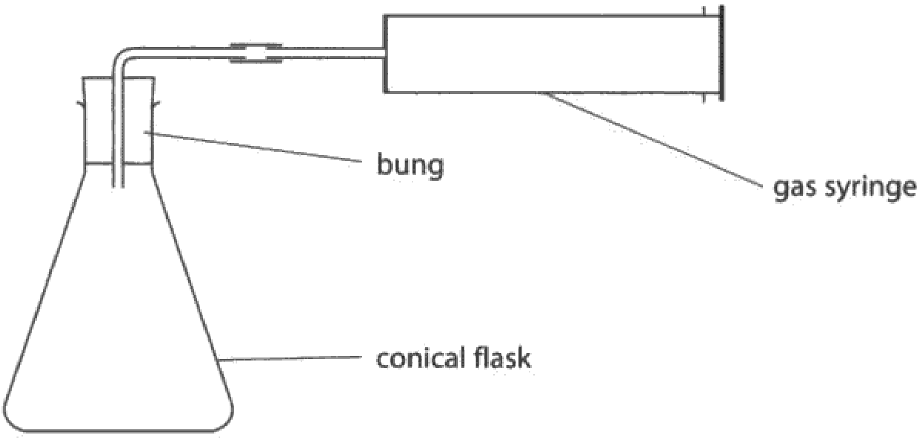
Often candidates did not look carefully at the results, which showed the volume of hydrogen produced at one-minute intervals, and wrote about finding the time taken to collect a certain volume of gas or carry out the experiment three times, the first for 1 minute, the second for 2 minutes, etc.

Some candidates did not describe how to carry out the experiment, simply stating what each piece of equipment is used for, possibly thinking about the apparatus list they gave in the Controlled Assessment Task.

Some candidates misunderstood the question and wrote about further experiments to develop the results: for example, changing the concentration of the acid.

(b) A student wanted to investigate the speed of the reaction between zinc and dilute hydrochloric acid.

Describe how the student could use this apparatus to obtain the results in the table.




| time after start of experiment / minutes | volume of hydrogen produced / $cm^3$ |
|---|---|
| 0 | 0 |
| 1 | 30 |
| 2 | 42 |
| 3 | 50 |

(3)

by placing the Zink into the conical flask that is filled with hydrochloric acid, then putting a bung with a feeder tube in the top of the conical flask. At the ~~end~~ other end of the feeder tube attach a gas syringe. The hydrogen given of will then go through the feeder tube forcing the gas syringe backward, then measure the change using the gradients on the gas syringe.

**ResultsPlus**
**examiner comment**

This candidate has given a good description of how to carry out the experiment. There is no mention of measuring the volume of gas at one-minute intervals, but there is still enough written to score the 3 marks.

They need to place the zinc into the conical flask and then start a stop watch as they then place the hydrochloric acid in with the zinc. They then need to stop the stop watch when a gas is formed in the gas syringe

**ResultsPlus**
**examiner comment**

This candidate has realised the zinc and acid need to be in the conical flask and they need to start a stop watch to measure the time. They would have scored another mark if they had mentioned putting the bung on the flask or measured the volume of gas in the syringe.

put the zinc + hydrochloric acid in the conical flask and wait for reaction, take the gas syringe and put a flame in it and the gas will react.

**ResultsPlus**
**examiner comment**

This candidate has started to describe the experiment by putting the zinc and acid in the flask but they have not mentioned measuring the volume of gas at one-minute intervals. The test for hydrogen was not required in this question.

The studen (3)

Could repeat the test because The student Could work out a average.

Studen could also do more test with a more diluted Hychloric acid.

**ResultsPlus**

**examiner comment**

This candidate has not described the experiment, so has not scored any marks. They have written some general points about experiments – repeating it, taking an average and finding the effect of changing the concentration of the acid, but these do not answer the question.

**ResultsPlus**

**examiner tip**

If you are asked to describe how to carry out an experiment, try to give a step-by-step method that someone else could follow. It would be acceptable to give a list of numbered points or bullet points for a question like this. For example:

- Put the zinc in the flask.
- Add the acid to the zinc.
- Put a bung in the flask.
- Start a stop watch.
- Measure the volume of hydrogen every minute.

## Question 3(d)

Many candidates found this question difficult. Quite a few candidates did realise that zinc powder has a larger surface area than the larger pieces of zinc but they struggled to get a second mark. Many candidates thought that the powder had a smaller surface area than the larger pieces of zinc and some just stated that the powder was 'more spread out'. Many candidates also thought there would be more particles in the zinc powder but they did not make it clear whether they meant more atoms or more smaller pieces. Only a small number of candidates mentioned the collisions between the particles; those who did often stated that 'particles collide more easily' rather than referring to more collisions.

(d) When zinc powder is used, instead of larger pieces of zinc, the reaction is faster.

Explain, using ideas about particles, why the reaction is faster when zinc powder is used.

(2)

Because zinc powder has a bigger surface area and the particles are more exposed to react. Bigger pieces have a smaller surface area

(e) The reaction is exothermic

**ResultsPlus**
**examiner comment**

This candidate has scored 1 mark for the bigger surface area of the zinc powder.

It will be faster when zinc powder is used because it has a larger surface area, the powder is small particles. Large pieces of zinc are bigger and will take longer it has a smaller surface area.

**ResultsPlus**
**examiner comment**

This is a good answer as the candidate has stated that the zinc powder has smaller particles and a larger surface area.

## Question 3(e)

Many candidates were able to describe how they could prove that a reaction is exothermic. Others just gave the meaning of 'exothermic' and did not state how they could show this during a reaction. Those who did include the use of a thermometer simply mentioned taking the temperature rather than specifying before and after the reaction and stating that it increases. Some candidates confused exothermic and endothermic reactions and thought that since heat is given out in an exothermic reaction, the temperature falls.

(e) The reaction is exothermic.

Describe how you could prove that this reaction is exothermic.

(2)

~~by using~~ by testing it with a thermometer.

**ResultsPlus**
**examiner comment**

This candidate knows that a thermometer is used to find out if a reaction is exothermic, but they have not explained what will happen to the temperature, so was given 1 mark.

**ResultsPlus**
**examiner tip**

When you see that there are 2 marks available for a question, try to write a little more detail.

An exothermic reaction is a reaction that produces heat so it can be tested for by measureing the tempreture every so often and if it increases it is a excothermic reaction.

**ResultsPlus**
**examiner comment**

This is a good answer as it describes measuring the temperature change during the experiment and that the temperature will increase for an exothermic reaction.

# Reactions with oxygen

## *Question 4(b)*

The majority of candidates were able to calculate the mass of oxygen that combined with the copper in the experiment. A few candidates added the masses of copper and copper oxide.

(b) What mass of oxygen combined with 3.2 g of copper in this experiment?

(1)

0·4

mass oxygen = ~~0·4~~ 0·8 g

**ResultsPlus**
**examiner comment**

This candidate has written the correct answer of 0.4 on the first line but has then crossed it out and written 0.8 g on the answer line so was not awarded the mark.

**ResultsPlus**
**examiner tip**

If you leave two different answers, the examiner will not select the correct answer and give you a mark.

## Question 4(c)

It was pleasing to see that many candidates could calculate the percentage yield of an experiment. Some candidates got the fraction the wrong way round and ended up with a yield of 111%. Candidates should realise that it is not possible to produce more than 100% yield and should go back and check their working. Other candidates worked out the correct fraction but forgot to multiply it by 100 to convert it to a percentage. A few candidates subtracted 3.6 from 4.0 g then multiplied by 100.

(c) The theoretical yield for Rosie's experiment was 4.0 g of copper oxide.

She only obtained 3.6 g of copper oxide.

Calculate the percentage yield of Rosie's experiment.

**(2)**

$3.6 \div 4.0 = 0.9 \quad 0.9 \times 100 = 90$

percentage yield 90

**ResultsPlus**
**examiner comment**

This is a good answer that shows the correct working as well as the final percentage yield.

[illegible] = $3.6 \div 4.0 = 0.9$

[illegible]

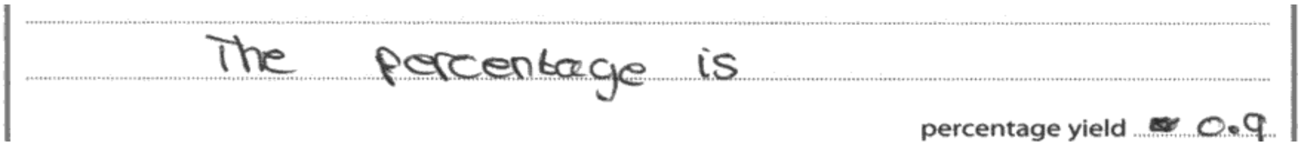
percentage yield 0.9

**ResultsPlus**
**examiner comment**

This candidate has completed the first part of the calculation correctly by dividing the yield by the theoretical yield so scores 1 mark. They should have multiplied the 0.9 by 100 to convert it to a percentage.

**ResultsPlus**
**examiner tip**

Always show how you worked out your answer. Even if your final answer is wrong, you may still score some marks for the working.


The percentage is

percentage yield ~~[illegible]~~ 0.9

**ResultsPlus**
**examiner comment**

This candidate did not score any marks for this question as 0.9 is incorrect. If they had showed that 0.9 was calculated by dividing 3.6 by 4.0, they would have scored 1 mark.

**ResultsPlus**
**examiner tip**

Always show your working for calculations.

## *Question 4(d)*

Many candidates were able to balance the equation correctly. Some candidates thought that the formula for copper oxide was incorrect and changed it to $CuO_2$. Any formulae that are given in examination papers will be correct.

## Question 4(e)

Fewer candidates were able to calculate the percentage of oxygen than were able to calculate a percentage yield. Many candidates were able to calculate the relative formula mass of copper oxide but then were not sure how to continue with the calculation.

(e) Calculate the percentage of oxygen in copper oxide, CuO.

(Relative atomic masses: Cu = 64, O = 16)

(2)

64 + 16 = 80

16 ÷ 80 = 0.2

percentage of oxygen = 0.2%

**ResultsPlus**
**examiner comment**

This candidate calculated the relative formula mass of copper oxide as 80 then worked out that 0.2 of that was oxygen. They just needed to multiply 0.2 by 100 to convert it to a percentage to score both marks.

**ResultsPlus**
**examiner tip**

Always remember to multiply your answer by 100 to convert it to a percentage.

(e) Calculate the percentage of oxygen in copper oxide, CuO.

(Relative atomic masses: Cu = 64, O = 16)

(2)

64 + 16 = 80    16/80 × 100

percentage of oxygen = 20%

**ResultsPlus**
**examiner comment**

This is a good answer, scoring both marks.

(e) Calculate the percentage of oxygen in copper oxide, CuO.

(Relative atomic masses: Cu = 64, O = 16)

(2)

$\frac{16}{64} \times 100 = 25$

percentage of oxygen = 25%

**ResultsPlus**
**examiner comment**

This candidate had the right idea about finding the percentage of oxygen, but they should have divided 16 by the relative formula mass of copper oxide, not the relative atomic mass of copper. This answer was given 1 mark.

## *Question 4(f)*

Some candidates wrote clear explanations about how an oxygen atom becomes an oxide ion, although some mentioned the gain of electrons without specifying how many. Some candidates gave a general description of an ion being formed when an atom gains or loses electrons but they did not apply their answer to an oxide ion. However, quite a few candidates were unsure about what an ion is. There were descriptions about the atom losing electrons, sharing electrons and gaining or losing protons.

(f) Many oxides contain oxide ions, $O^{2-}$.

Explain how an oxygen atom becomes an oxide ion.

(2)

It has gained two electrons because electrons are negative therefore to make it 2- you have to gain 2 electrons.

**ResultsPlus**
**examiner comment**

This is a good explanation, scoring both marks.

(f) Many oxides contain oxide ions, $O^{2-}$.

Explain how an oxygen atom becomes an oxide ion.

(2)

Oxegyn atoms become oxegyn ions whenever they loose an electron

**ResultsPlus**
**examiner comment**

This candidate has not realised that electrons are negative so when an atom loses electrons, it becomes positively charged. This answer was not given a mark.

**ResultsPlus**
**examiner tip**

Revise how positive and negative ions are formed.

# Chromatography

## *Question 5(a)(i)*

The majority of candidates identified that Y and Z contained more than one food colouring.

## *Question 5(a)(ii)*

There were many different ways in which candidates could explain why the drink did not contain food colouring Y. A large number of candidates scored 1 mark for this question but they found it more difficult to score a second mark. Many responses were unclear and referred to 'it' has two colours in it but did not state whether 'it' was the drink or Y.

(ii) Food colouring **Y** is banned.

Explain how Charles can tell that the drink that he tested did **not** contain the banned food colouring.

(2)

The drink that he tasted did not contain the banned food colouring because his drink only contained 1 food colouring and the banned food colouring contained 2.

**ResultsPlus**
**examiner comment**

This is an example of an answer that scored both marks.

**ResultsPlus**
**examiner tip**

To achieve full marks when you are comparing substances, you need to write about both of them. In this question a comment about both the drink and the food colouring Y scored 2 marks.

(ii) Food colouring **Y** is banned.

Explain how Charles can tell that the drink that he tested did **not** contain the banned food colouring.

(2)

Because it th showed more than one food colouring in it therefore containing more than one type of colouring.

**ResultsPlus**

**examiner comment**

This answer was not clear enough to score any marks. The candidate has written that 'it showed more than one food colouring in it' but has not made it clear that this comment applies to food colouring Y.

**ResultsPlus**

**examiner tip**

Try not to start an answer with a 'Because it…' as it is not clear what the 'it' refers to. In this question the examiner would assume that 'it' referred to the drink that is mentioned in the question and the drink does not contain two coloured substances.

## Question 5(a)(iii)

A large number of candidates were not familiar with $R_f$ values. Many candidates did not know how to start this calculation, although a good number did score 1 mark if they referred to the '4' as the distance moved by the colouring in X. Some candidates calculated the correct value of 0.5 but then lost a mark as they converted it to a percentage.

(iii) Calculate the $R_f$ value for the coloured substance in food colouring **X**.

(2)

$R_f$ = 7.2

**ResultsPlus**
**examiner comment**

This candidate has merely written down an incorrect answer with no explanation, so does not score any marks.

**ResultsPlus**
**examiner tip**

Write a little working with your answer and you may score a mark.

(iii) Calculate the $R_f$ value for the coloured substance in food colouring **X**.

(2)

$R_f$ = 4

**ResultsPlus**
**examiner comment**

This candidate was given 1 mark for the 4 that they identified from the chromatogram.

(iii) Calculate the $R_f$ value for the coloured substance in food colouring **X**.

**(2)**

$\frac{\text{substance}}{\text{solvent}} = R_f \quad \frac{4}{8} = 0.5$

$R_f =$ 0.5

**ResultsPlus**
**examiner comment**

This is an excellent answer, showing the correct working.

## *Question 5(b)*

Candidates found this the more difficult of the 6-mark questions. There were some excellent descriptions of how to carry out a chromatography experiment, showing that candidates had remembered carrying out this type of experiment themselves. Some candidates did describe their own experiments and referred to using inks or coloured pens instead of the food colourings in the question. Many candidates missed out important experimental details in their accounts, such as not mentioning what type of paper is used, not drawing the line and writing the labels in pencil and not using a solvent to allow the colours to move up the paper. Some candidates gave incorrect details, such as using litmus paper, dipping the paper into the food colouring and using hydrochloric acid as the solvent. Some candidates wrote about how to make the experiment a 'fair test' or how to interpret the chromatogram, instead of describing the experiment.

*(b) **Describe in detail how the experiment should be carried out to produce the chromatogram shown in (a).**

**(6)**

You pour the drink over some litmus paper, this then shows all the colours present in the drink which then can be marked down on a chromatogram like the one to the left. This then makes your results easier to read.

**ResultsPlus**

**examiner comment**

This candidate did not score any marks for this answer. They used litmus paper instead of filter paper or chromatography paper. They also poured the drink over the paper, rather than put a spot of the drink on a line at the bottom, as shown on the diagram in the examination paper.

**ResultsPlus**

**examiner tip**

Use the information given in the question.

*(b) Describe in detail how the experiment should be carried out to produce the chromatogram shown in (a).

(6)

Get a sheet of filter paper and put 3 dots or more of different colours (one dot of each) then put the ~~stick~~ end without the pen on in the water slightly.

**ResultsPlus**
**examiner comment**

This candidate has made a start in describing the experiment so has achieved Level 1. If they had mentioned putting the dots on a pencil line, they would have moved up to Level 2.

**ResultsPlus**
**examiner tip**

Try to include more detail when describing experiments in 6-mark questions.

*(b) Describe in detail how the experiment should be carried out to produce the chromatogram shown in (a).

(6)

Spots of each substance should be put on the bottom line at the beginning of the experiment, then submerge the bottom of the paper (up to the line) in water(?) then wait till the spots start to show. (the water(?) will spread up↑ the paper. Then gives you the results

**ResultsPlus**

**examiner comment**

This candidate has made quite a good attempt at describing the experiment, but has missed out many details. For example, they could have mentioned that the line is drawn in pencil or the water level in the beaker is just below the line of spots. There was enough detail here for this answer to score Level 2.

*(b) Describe in detail how the experiment should be carried out to produce the chromatogram shown in (a).

(6)

To start you should get your chromatography paper and draw a pencil line along the bottom of the paper. Next you would get your substances that you're going to test, in (a) they used food colouring, so make dots of your food colourings along the pencil line. Then you would get the solvent you are going to do the test in, for example you could use water, and then you place it it the water and wait for the substances to rise, to reveal what colours are in the food colouring.

**ResultsPlus**
**examiner comment**

This is an excellent description of the experiment, scoring full marks.

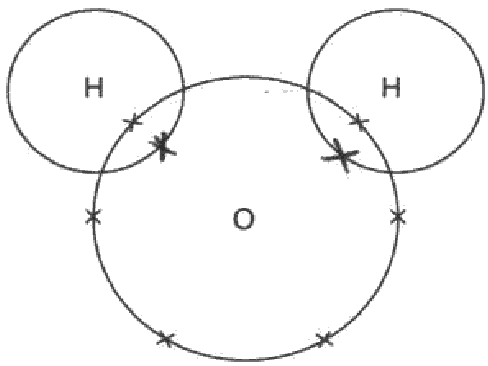
## Question 5(c)

Many candidates were able to add the electrons to the hydrogen atoms in the correct places. Common errors included: adding the electrons to the hydrogen atoms outside the overlap region; adding more hydrogen atoms; adding more electrons to the oxygen atom. Some candidates tried to cross out some electrons they had added but did not always make it clear enough to the examiner which were crossed out and which they wanted to be marked. A few candidates added the two electrons on the inner shell of the oxygen atom, but that was not necessary.

(c) The drink contained water.

Complete the dot and cross diagram for water by adding the electrons of the hydrogen atoms.

**(1)**



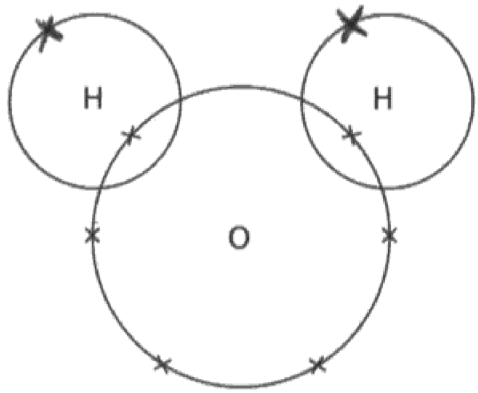

**ResultsPlus**
**examiner comment**

This candidate has added the electrons to the hydrogen atoms in the correct places. Although the question asks for a 'dot and cross' diagram, it is acceptable to represent all the electrons as crosses.

(c) The drink contained water.

Complete the dot and cross diagram for water by adding the electrons of the hydrogen atoms.

(1)




**ResultsPlus**
**examiner comment**

This candidate has added one electron to each hydrogen atom, but the electrons are in the wrong places so did not score the mark. Covalent bonds involve the sharing of a pair of electrons and both electrons must be in the areas where the electron shells overlap.

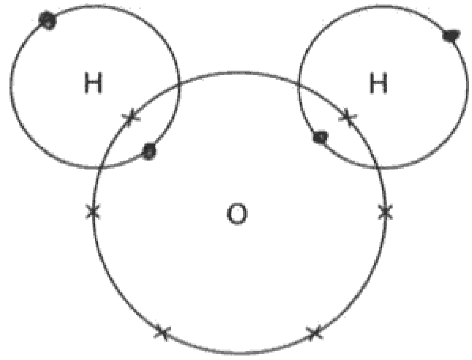
**ResultsPlus**
**examiner tip**

Practise drawing diagrams to represent molecules with covalent bonds.

(c) The drink contained water.

Complete the dot and cross diagram for water by adding the electrons of the hydrogen atoms.

(1)




**ResultsPlus**
**examiner comment**

This candidate has added one electrons in each of the overlap areas between the oxygen and hydrogen atoms, but they have not scored the mark because they have added one extra electron to each hydrogen atom.

## Patterns in the periodic table

### *Questions 6(a)(ii) and (iii)*

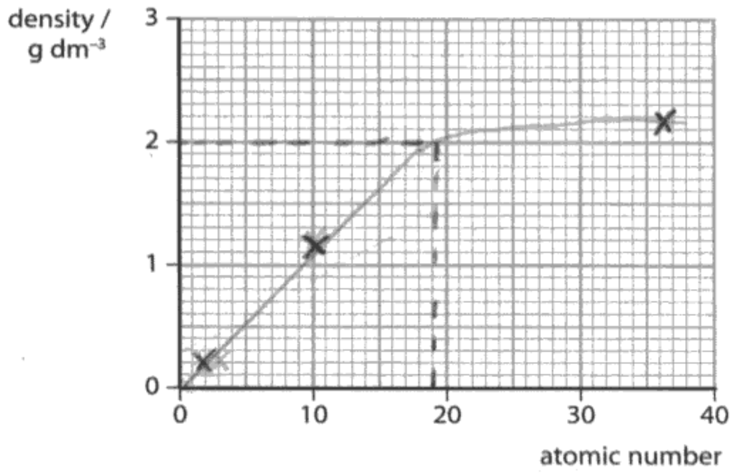
Some candidates found it difficult to plot the points accurately, particularly the first point for helium.

It was disappointing that so few candidates attempted to draw a line through the points. When asked to draw a graph, it is expected that they will plot the points and draw a line for full marks. This particular graph was best with each point joined to the next with a straight line, but best-fit straight lines and curves were also accepted. Candidates should draw thin, single lines.

Some of those who drew a line did not gain the mark for part (iii) as they read off the density inaccurately. A few tried to draw a bar chart but they rarely showed the bars at the correct heights.

(ii) On this grid draw a graph of density against atomic number for the elements helium, neon and krypton.

(3)




(iii) Use your graph to estimate the density of argon.

(1)

density of argon = 2 g dm$^{-3}$

**ResultsPlus**

**examiner comment**

This candidate has plotted the points correctly, within the tolerance of half a square, and drawn an acceptable best-fit curve, but they have used 19 instead of 18 for the atomic number of argon, so have lost the mark for part (iii).

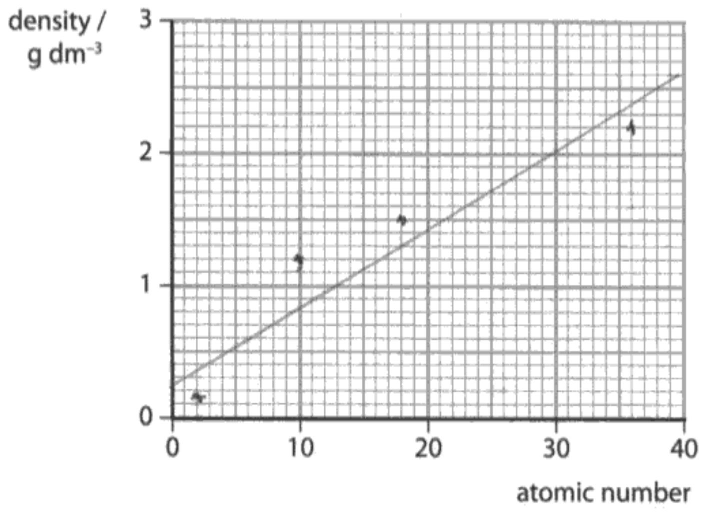
**ResultsPlus**

**examiner tip**

Read the question carefully and use the data given.

(ii) On this grid draw a graph of density against atomic number for the elements helium, neon and krypton.

(3)




(iii) Use your graph to estimate the density of argon.

(1)

density of argon = 1.5 g $dm^{-3}$

**ResultsPlus**
**examiner comment**

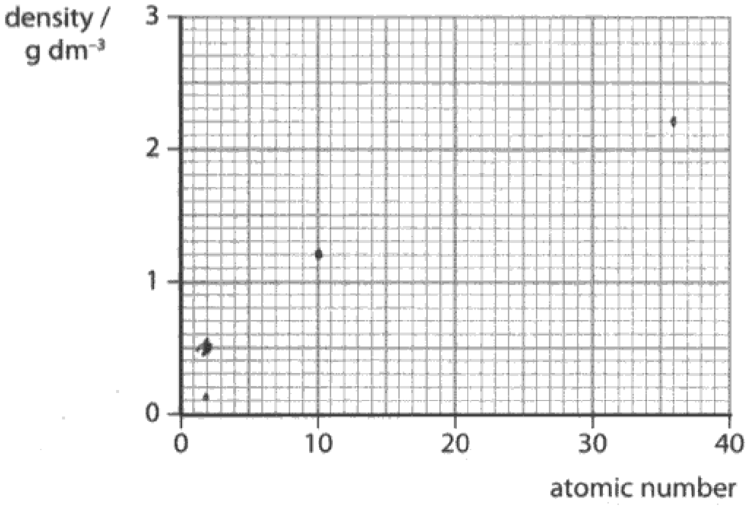
This candidate has plotted the points accurately and drawn an acceptable best-fit straight line. However, they should have read the density of argon from their line and given 1.3 g $dm^{-3}$ as the answer to part (iii).

**ResultsPlus**
**examiner tip**

Read values from the line you have drawn on the graph.

(ii) On this grid draw a graph of density against atomic number for the elements helium, neon and krypton.

(3)




(iii) Use your graph to estimate the density of argon.

(1)

density of argon = 1.8 g dm$^{-3}$

## ResultsPlus examiner comment

This candidate has plotted the points but has not drawn a line through them.

## ResultsPlus examiner tip

When you are asked to draw a graph, always plot the points and draw a line.

## Question 6(b)

Candidates generally found this question more straightforward than Q5(b), possibly because they have seen the reactions of lithium and sodium with water more frequently than chromatography. There were some excellent responses in terms of similarities and differences that scored 6 marks. Some candidates just described similarities so scored fewer marks; others simply wrote about one of the metals, which did not score any marks. The question asked for similarities and differences in what is ‘seen’ and the examiners were looking for a slightly more detailed observation as a difference than just ‘sodium is more reactive than lithium’.

Some candidates did not read the question carefully and just wrote about the similarities and differences in atomic structure and tried to explain why sodium is more reactive than lithium. Unfortunately, these responses could not be given any credit as they did not answer the question.

There were some fairly common incorrect observations and products quoted, including: ‘lithium catches on fire’; ‘the water goes cloudy’; ‘the water goes blue’ (with no mention of indicator added); ‘lithium and sodium oxides formed and carbon dioxide formed’.

*(b) Two elements in group 1 of the periodic table are lithium and sodium.

Very small pieces of lithium and sodium were reacted separately with water.

Describe the similarities and differences in what is seen and in the products of the reactions.

(6)

They both evaporated lithium ignited when put inside the water but when Sodium was put in the water it fizzed around the beaker of water

**ResultsPlus**
**examiner comment**

This candidate knows a little about the reactions with water but has not clearly stated a similarity or a difference between the metals. If they had written that both metals fizz on water, they would have had a Level 1 answer.

**ResultsPlus**
**examiner tip**

When you are asked for similarities between substances, make sure that you mention how they **both** react in the same way.

*(b) Two elements in group 1 of the periodic table are lithium and sodium.

Very small pieces of lithium and sodium were reacted separately with water.

Describe the similarities and differences in what is seen and in the products of the reactions.

(6)

when they are both added to water and mixed they dissolve into the water

**ResultsPlus**
**examiner comment**

This candidate has described one similarity and has written a Level 1 answer.

*(b) Two elements in group 1 of the periodic table are lithium and sodium.

Very small pieces of lithium and sodium were reacted separately with water.

Describe the similarities and differences in what is seen and in the products of the reactions.

(6)

A similarity of the reactions is that they both react very violently. They would both fizz on the surface of the water and produce a gas. Lithium would produce lithium oxide and sodium would produce sodium oxide. They are also both exothermic reactions. A difference between them is that they produce different colours. Lithium produces an orange colour when sodium produces a greeny/blue colour.

**ResultsPlus**
**examiner comment**

This candidate has described two similarities – they both fizz and both are on the surface of the water. This is a Level 2 answer. The difference written here is incorrect.

*(b) Two elements in group 1 of the periodic table are lithium and sodium.

Very small pieces of lithium and sodium were reacted separately with water.

Describe the similarities and differences in what is seen and in the products of the reactions.

(6)

When both elements are put in water they ~~sh~~ both fizz around, creating bubbles are they both act violently when reacting with the water.
If universal indicator is added they ~~should~~ both turn the water a blue/purple colour which ~~should~~ shows theyve changed the waters PH to an alkali.
They also both produce hydrogen when they react with the water.
However, a difference between to two is that sodium acts more violently in the water than lithium does and sodium ~~lithium~~ explodes with a bigger explosions than lithium does because it is further down group 1.

**(Total for Question 6 = 11 marks)**

**ResultsPlus**
**examiner comment**

This is an excellent Level 3 answer as the candidate has written a clear description of similarities and differences in what they can see during these reactions.

**ResultsPlus**
**examiner tip**

When you are asked to describe similarities and differences, you need to write about both of them to achieve the highest level.

## Summary

In future, candidates need more practice in answering questions that involve describing experiments. Some candidates would benefit from revising atomic structure and bonding and others need to practise simple calculations. Some candidates would also benefit from drawing and interpreting graphs.

Based on their performance on this paper, candidates should:

- read the question carefully and make sure that they are answering the question asked and using the information given
- learn the links between the electronic configurations and group numbers and period numbers
- revise ionic and covalent bonding
- practise the calculations in the specification
- practise writing descriptions of carrying out experiments
- practise drawing graphs and interpreting them.

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