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Examiners' Report
June 2018

GCSE Chemistry 1CH0 2F

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Introduction

This paper was the first paper two of the new Chemistry specification, graded 9-1.It consisted of ten questions, worth 100 marks.60 of these marks were on the Foundation Tier for Combined Science.The paper also has questions in common with Higher Tier Combined Science and Higher Tier Chemistry.

Candidates that did well were able to apply their scientific knowledge, understand and describe practical contexts, use scientific terminology correctly and balance equations.

The level of knowledge of some candidates was low. Whilst some candidates could explain some areas of knowledge, their response was not always directed to the question being asked. Some candidates could not interpret the question terminology – describe, explain, explain how/why - and need to know the differences between them in order to answer appropriately. Candidates' application of knowledge to new situations is a challenge for many, and another area that caused difficulty was questions regarding practical work, including the specified required practicals.

Question 1 (a)

The first question on this paper was answered well with the vast majority able to write the steps for the method of the experiment in the correct order to gain both marks.

Question 1 (c)

Most candidates identified a measuring cylinder as a more suitable measuring instrument.Some suggested pipette or burette, which wereallowed.

Answers that did not score included measuring jug, measuring cup, repeating the experiment or 'weigh the water'.

Question 1 (d) (i)

(d) Figure 2 shows a cold pack.

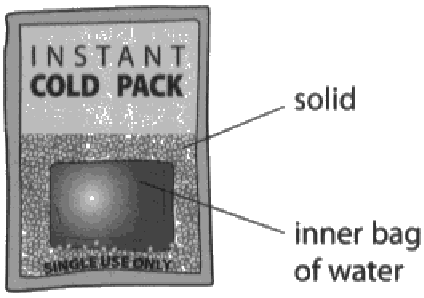

Figure 2

When the pack is squeezed hard the inner bag bursts.
Then the pack goes cold.

(i) Explain why the pack goes cold.

(2)

The water bag pops which produces a ~~reaction~~ endothermic reaction between the solid and water. The endothermic reaction means that it takes in heat energy rather than release it.

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A well explained answer.

(d) Figure 2 shows a cold pack.

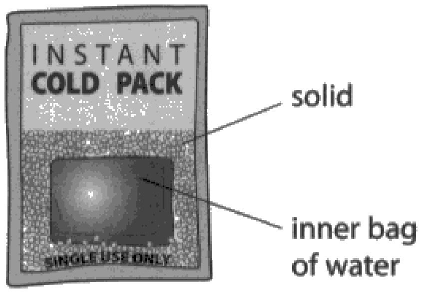

Figure 2

When the pack is squeezed hard the inner bag bursts.
Then the pack goes cold.

(i) Explain why the pack goes cold.

(2)

Because an endothermic reaction is taking place, instead of giving heat, it takes it.

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Examiner Comments

This answer states that there is an endothermic reaction, but does not relate this to the context and talk about the water/solid.

Question 1 (d) (ii)

Most candidates made a good response to this part, although their language was sometimes unclear.The use of the key term ‘irreversible’ was not common but aided the examiner in easily awarding the mark. It was common to use an alternative and state that once the bag had been burst it could not be burst again.

Some simply restated that question, stating that the pack could only be used once.

Question 2 (b) (i)

It was very surpising that, even though the limewater test was given, only about half of candidates could name carbon dioxide.

Question 2 (b) (ii)

This part of the question was very poorly answered with almost no correct answers.

Question 2 (c) (i)

Candidates showed a good level of skill in plotting the point here, in almost all cases this was shown clearly with a cross.There was some leeway for the plotted point, and it should be emphasized that points do not have to be on an axis line. It was pleasing to see that for the second mark, the vast majority drew a ruled line (drawing the line by hand did not score). Of those that did not score, most lost the mark for a poor choice of gradient of their best fit line. Candidates are reminded that a firm pencil line should be drawn so that it is legible.

(c) A flame photometer can be used to measure the concentration of potassium ions in a solution.

Figure 4 shows the photometer readings for three different concentrations of potassium ions in solutions.

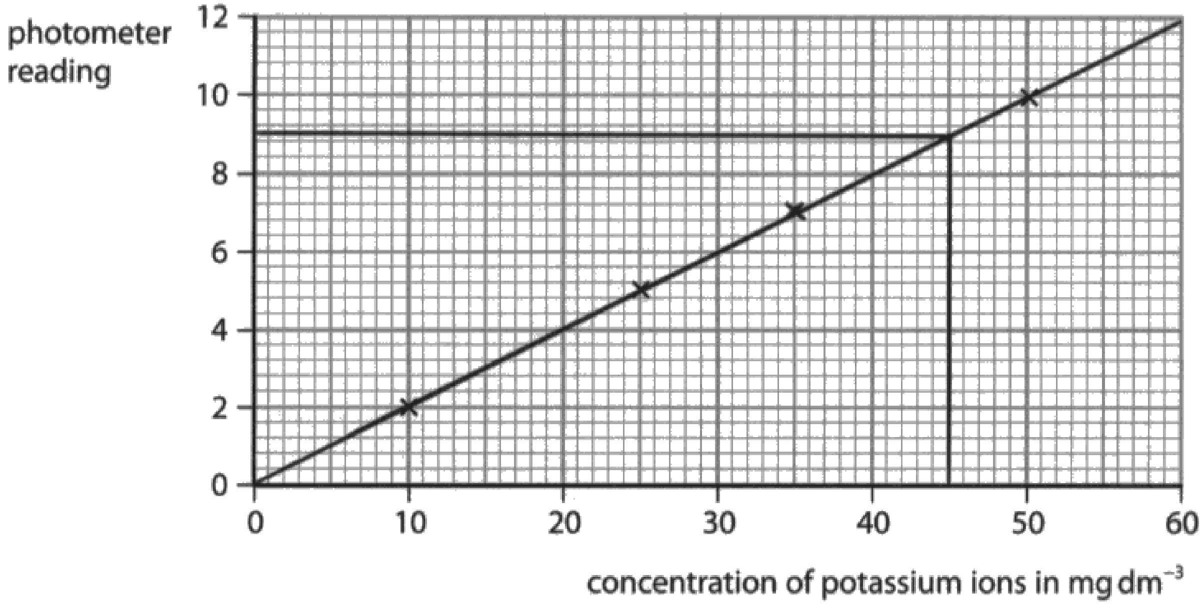

Figure 4

(i) A solution containing a concentration of potassium ions of 35 mg dm^{-3} is placed in the photometer.
The photometer reading is 7.0.

Plot this point on the graph and then draw the straight line of best fit.

(2)

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Examiner Comments

This answers has a clearly plotted point, a clear ruled line that goes through all the points (and the lines that show how the next part has been worked out).

Question 2 (c) (ii)

Most candidates read their line of best fit correctly to within 1 mg dm^{-3} (if the tolerance had been only 0.5 mg dm^{-3} more would have lost this mark though; candidates need to very carefully read a graph). Where candidates had drawn construction lines these sometimes went off course by half to one square, often being angled.

(c) A flame photometer can be used to measure the concentration of potassium ions in a solution.

Figure 4 shows the photometer readings for three different concentrations of potassium ions in solutions.

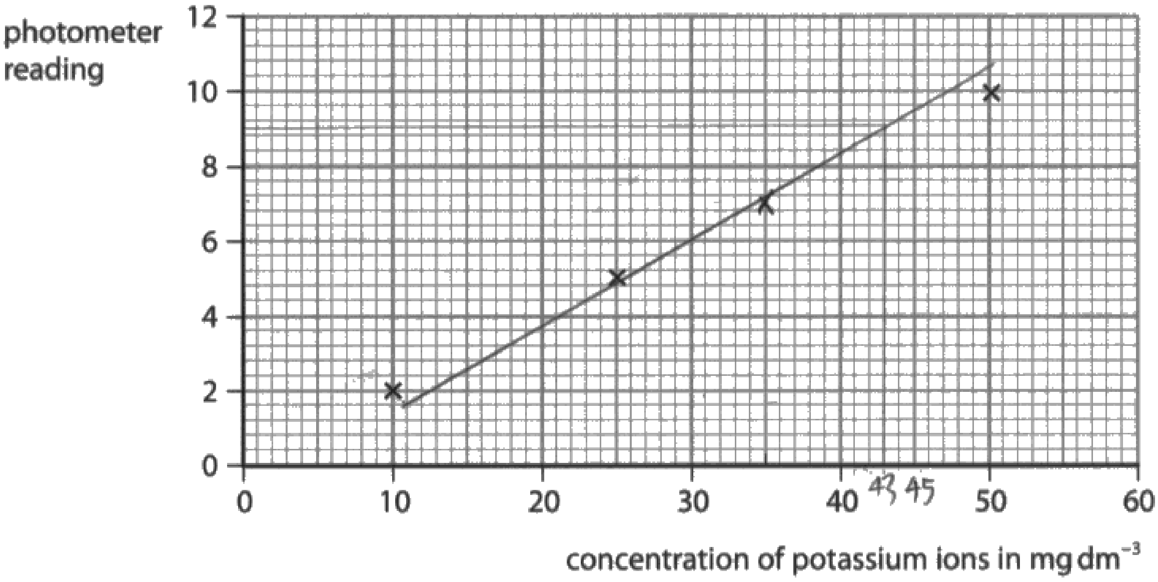

Figure 4

(i) A solution containing a concentration of potassium ions of 35 mg dm^{-3} is placed in the photometer.
The photometer reading is 7.0.

Plot this point on the graph and then draw the straight line of best fit.

(2)

(ii) Another solution of potassium ions gives a photometer reading of 9.0.

Use the graph to find the concentration of potassium ions in this solution.

(1)

concentration = ...43.... mg dm^{-3}

(Total for Question 2 = 6 marks)

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This best fit line did not score, but the candidate has correctly read from their line the answer of 43 so scores this mark.

Question 3 (a)

Stating 'gas syringe' as the piece of apparatus shown in the diagram proved quite difficult for candidates with many giving unsuitable alternatives or leaving a blank.

Question 3 (b)

Many candidates read the question carefully and realised that the gas produced was oxygen, often scoring the mark by simply stating that the splint relights.

However, quite a large proportion thought that the gas produced was hydrogen and therefore gave incorrectly 'squeaky pop'. Some stated that the splint would go out. A few stated that bubbles would be seen.

Question 3 (c) (iii)

Stating a method of increasing the surface area of the lumps of solid catalyst perhaps more difficult than expected, with some candidates stating the solid lumps should be flattened or squashed which was ignored.

Other candidates suggested adding more catalyst or dissolving/melting the catalyst which were not accepted. Some suggested combining the lumps – perhaps thinking of the surface area of one lump rather than the total.

Question 3 (d)

This was found to be more difficult than expected. It was thought that the third line might be more tricky but this did not prove to be so; errors were randomly scattered. Most candidates scored 1 mark.

Question 3 (e)

It was pleasing to see that most were able to score 1 mark for balancing the equation.

Candidates found it much more difficult to add the state symbols to the equation with many losing this mark. The most common error was to use aq for water rather than l.

Some wrote the complete word for the state of the substance rather than using the symbol. A few seemed not to have encountered state symbols and added the names or symbols of other elements into the brackets.

(e) Complete the balanced equation for the reaction and fill in the two missing state symbols.

(2)

$$2\,H_2O_2(aq) \rightarrow 2H_2O(aq) + O_2(g)$$

(Total for Question 3 = 9 marks)

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Examiner Comments

This was a common error.

(e) Complete the balanced equation for the reaction and fill in the two missing state symbols.
(2)

.... $H_2O_2(aq) \rightarrow 2H_2O($...L...$) + O_2($...g...$)$

(Total for Question 3 = 9 marks)

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Examiner Comments

Where dotted lines are given, it is very likely that a repsonse will be required.

Question 4 (a) (iii)

Candidates gave a good response to this calculation with many scoring two marks with well set out working. Many others gained one mark, usually by getting the ratiothe wrong way round and ending up with 1: 0.75.(Candidates who gave 3:4 as an equivalent of their ratio of 1: 1.33 scored both marks). It was quite common, if inefficient, for candidates to find the ratio just by cancelling down.

Some thought that nm^2 and nm^3 meant that the values had to be squared/ cubed before calculating the answer.

Some students didn't turn their answer into a ratio.

(iii) A nanoparticle has a surface area of 38 400 nm^2 and a volume of 51 200 nm^3.

Calculate the surface area to volume ratio.

(2)

$\frac{SA}{V}$ $\frac{38400}{51200}$ = 0.75 = $\frac{3}{4}$

3:4

surface area to volume ratio = 1.00 : 1.33

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Examiner Comments

A clearly set out answer with working shown.

(iii) A nanoparticle has a surface area of 38 400 nm^2 and a volume of 51 200 nm^3.

Calculate the surface area to volume ratio.

(2)

surface area to volume ratio = 1.00 : 1.33

ResultsPlus
Examiner Comments

It is very advisable to show working. In this case, the answer is correct and scores 2. Had there been a slip (e.g some candidates wrote 1.30 as final answer), no marks can be scored if no working is shown.

(iii) A nanoparticle has a surface area of 38 400 nm^2 and a volume of 51 200 nm^3.

Calculate the surface area to volume ratio.

(2)

~~147456000~~

$51200^3 \div 38400^2 = 91022.22222$

$51200 \div 38400 = 1.333333333$

surface area to volume ratio = 1.00 : [illegible]

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Examiner Comments

This answer shows correct and incorrect working. Candidates must be clear which working they wish to be marked. The examiner cannot tell as no final answer is given, so no marks can be awarded.

Question 4 (b) (i)

Many candidates selected the correct data about the three molecules and a variety of descriptions (alkene, unsaturated, double bonds present....for A and B) were accepted. Candidates generally understood the naming convention –ane / -ene and used it fairly well.

Unfortunately, several candidates only discussed one or two of the substances, or were unclear or ambiguous by not referring to each compound separately. A few candidates tripped themselves up by writing that alkenes were saturated and alkanes were unsaturated.

(b) The molecules of three organic substances **A**, **B** and **C** are shown in Figure 6.

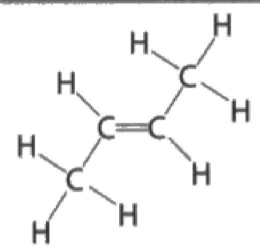
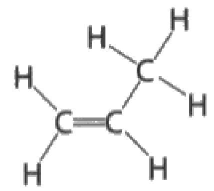
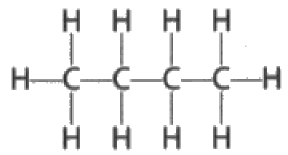
substance A	substance B	substance C
		

Figure 6

(i) A small volume of bromine water is added to each of the substances **A**, **B** and **C** and the mixtures shaken.
Explain why **A** and **B** decolourise bromine water but **C** does not.

(3)

Because A and B are alkenes which have double bond, where as substance C is alkane.

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Examiner Comments

A well explained answer.

(b) The molecules of three organic substances **A**, **B** and **C** are shown in Figure 6.

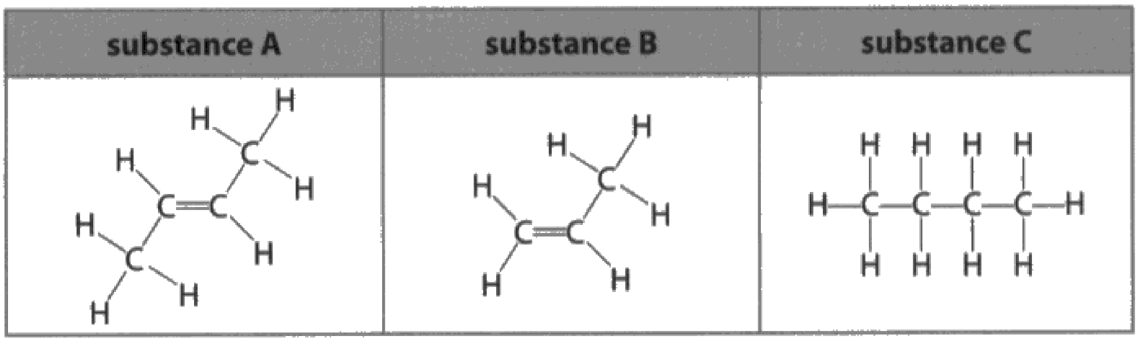

Figure 6

(i) A small volume of bromine water is added to each of the substances **A**, **B** and **C** and the mixtures shaken.
Explain why **A** and **B** decolourise bromine water but **C** does not.

(3)

Because A and B react with it but substance C doesn't it just stays the same.

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Examiner Comments

This answer has not referred to the structure of the molecules.

(b) The molecules of three organic substances **A**, **B** and **C** are shown in Figure 6.

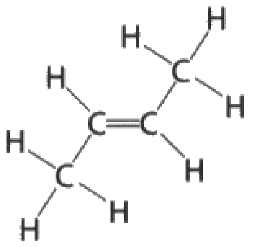
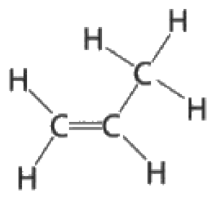
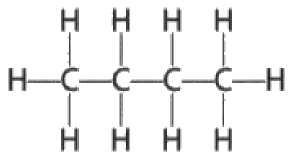
substance A	substance B	substance C
		

Figure 6

(i) A small volume of bromine water is added to each of the substances **A**, **B** and **C** and the mixtures shaken.
Explain why **A** and **B** decolourise bromine water but **C** does not.

(3)

A and Be Both have a double bond and substance B doesnt

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Read through your answers, this answer contradicts itself.

Question 4 (b) (ii)

There was a very pleasing response to this question.The most common error was for a double bond to be included (sometimes in a fully correct diagram of ethene).

A few candidates offered a diagram of ethene opened up as a repeating unit in polymerisation. It was unusual to see h instead of H which is encouraging.

Question 4 (b) (iii)

Most candidates knew that ethane contained carbon and hydrogen. Many, however, failed to state that these were the only elements.

It was surprisingly common to see ethane contained 'hydrogen and carbon molecules'. A crisp, concise definition is recommended here to avoid candidates tripping themselves up with contradictory information.

(iii) State why ethane is described as a **hydrocarbon**.

(2)

This is because it is made up of hydrogen and carbon atoms only

(Total for Question 4 = 11 marks)

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This is all that is needed for the 2 marks.

Question 5 (c) (i)

The majority of candidates were able to select the correct words from the box to complete the sentences and gain both marks.

Question 5 (c) (ii)

Many knew that the fraction from the bottom of the column has more carbon atoms per molecule than the fraction from the top of the column to score the mark.

Question 5 (d)

Most candidates were able to analyse the data in the table and recognise that fuel oil was the fraction for which the relative amount obtained exceeds the relative demand.

Question 5 (e)

In general, this question was answered well with candidates using variety of methods to calculate the number of barrels of fuel oil present in the 850 000 barrels of crude oil.

Most students used the 'chunking' method to find the percentage. In this case this was reasonably straightforward, if not very efficient.

A good proportion of candidates were able to calculate the 382 500. Of these, fewer were able to write this correctly to 2 significant figures. In most cases they did not attempt to round the number; a few rounded to 38 rather than 380 000.

A few gave answers based on 55% rather than 45%.

(e) In January 2015 the United Kingdom produced 850 000 barrels of crude oil per day.
45% of this crude oil was fuel oil.

Calculate the number of barrels of fuel oil present in the 850 000 barrels of crude oil.

Give your answer to two significant figures.

(3)

850 000 ÷ 10 = 10% = 85000   85000 x 4 = 40% = 340000

85000 ÷ 2 = 5% = 42500   340000 = 40% + 5% + 42500 = 382500

382500 = 45%

382500 barrels

(Total for Question 5 = 9 marks)

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This method works...but is very long-winded. No attempt has been made to round to two significant figures.

(e) In January 2015 the United Kingdom produced 850 000 barrels of crude oil per day. 45% of this crude oil was fuel oil.

Calculate the number of barrels of fuel oil present in the 850 000 barrels of crude oil.

Give your answer to two significant figures.

(3)

850 000 x 0.45 = 382500

400000 barrels

(Total for Question 5 = 9 marks)

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A more succinct calculation of percentage (with working shown). Unfortunately, not rounded correctly.

Question 6 (a)

This question showed that some candidates could not interpret a molecular formula correctly. In some cases, candidates did not read the question carefully and gave name of substance B rather than the formula.

Question 6 (b) (i)

Candidates found this question difficult with quite a low number able to write the correct word equation.

Some did not read the question carefully and tried to give a symbol equation. If symbol equations were given they were expected to be fully correct, which was rarely achieved.

Hydrogen oxide was not accepted as an alternative for water and in some cases candidates also had the word equation the wrong way around with the reactants and products mixed.

(b) (i) Substance **C** can be formed by burning an element in oxygen.

Write the word equation for this reaction.

(1)

Hydrogen + oxygen → hydroxide

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The oxide of hydrogen is water.

Question 6 (b) (ii)

This question was attempted reasonably well. Some candidates did not read the question carefully. Some gave only one letter, or included C in their answer, when they had been told to consider only A, B and D.

Question 6 (c)

A large number of candidates were able to score at least 1 mark on this question, often for showing an understanding that plants/ trees were responsible for causing the change in the amount of oxygen in the atmosphere since the Earth's early atmosphere.

Fewer were able to take this further and explain that it was the photosynthesis of these plants that caused the change. In some cases, candidates thought that respiration was the process.

Some candidates did not read the question carefully and stated facts they knew about the atmosphere such as global warming, pollution, volcanoes, burning fossil fuels or greenhouse gases, that did not relate to the amount of oxygen increasing.

Question 6 (d)

Candidates found it reasonably straightforward to identify at least one of the two processes that caused the change in the amount of carbon dioxide in the atmosphere.

In some cases, candidates drew more than one line from each change and therefore scored no marks.

Question 6 (e) (iii)

This question was answered well with the majority of candidates gaining both marks for being able to read the values from the graph and using them to calculate the change in the amount of carbon dioxide from 1990 to the beginning of 2000.

In some cases, candidates were able to read the values from the graph correctly but then divided rather than subtracted the numbers and therefore scored just the first marking point.The most common error was an inaccurate/ careless reading from the graph.

(iii) Calculate the change in the amount of carbon dioxide in the Earth's atmosphere from the beginning of 1990 to the beginning of 2000.

(2)

'90; 350ppm   365 - 350 = 15

'00; 365ppm

change in amount = 15 ppm

(Total for Question 6 = 11 marks)

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It is good to give very clear working.

Question 6 (e) (i) - (ii)

Some candidates didn't seem to read the question carefully – muddling the answers between 6e(i) and 6e(ii) or repeating the same information.

Giving a description of how the amount of carbon dioxide in the Earth's atmosphere varied within in a year proved more challenging for some candidates. Usually this was because they did not read the scale carefully and thought that the amount increased in one year and decreased the next.

Part 6(e)(ii) was answered well. A few candidates offered explanations for the variation although this had not been requested. Some candidatesused numbers, which is fine if these are used to illustrate the point and the overall trend is stated.

(e) Figure 9 shows a graph of the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

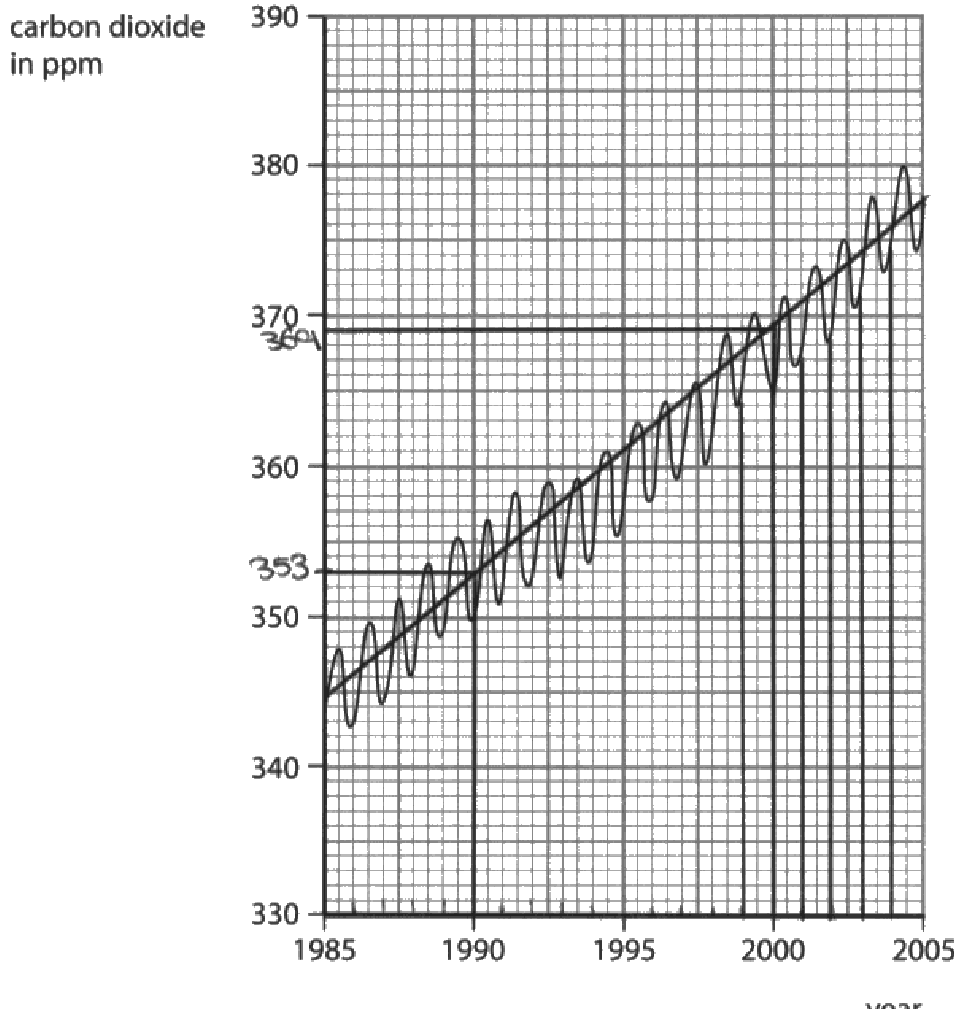

Figure 9

(i) Describe how the amount of carbon dioxide in the Earth's atmosphere varies within each year.

(1)

Each year, the amount of carbon dioxide ~~is~~ starts low, rises significantly in the middle of the year then falls again at the end.

(ii) Describe the overall trend in the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

(1)

Over, the amount of carbon dioxide in the Earth's atmosphere since 1985 to 2005 has be rising, with rises and falls each year.

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A clearly explained answer.

(e) Figure 9 shows a graph of the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

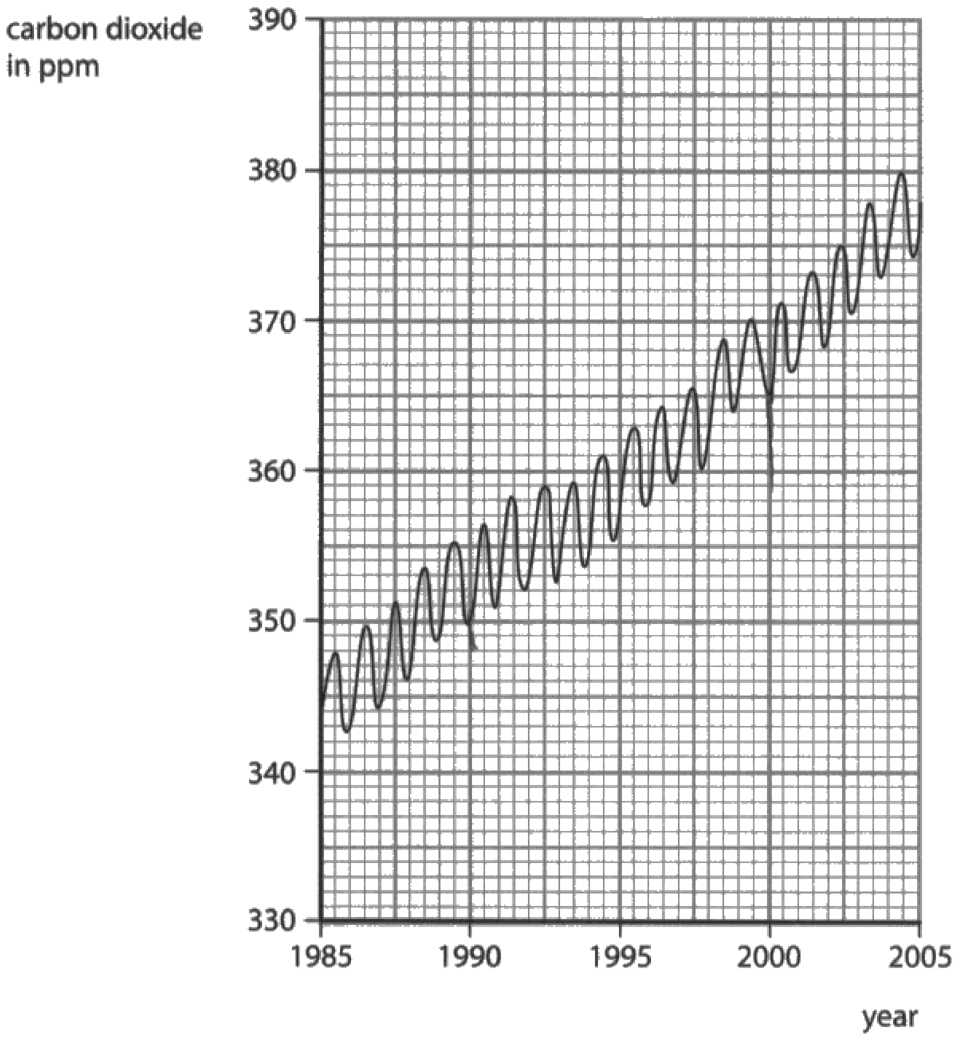

Figure 9

(i) Describe how the amount of carbon dioxide in the Earth's atmosphere varies within each year.

(1)

In each year, there tends to be a clear rise or fall in the amount of carbon dioxide in the atmosphere.

(ii) Describe the overall trend in the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

(1)

The amount is increasing.

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This candidate has misread the scale. The amount rises and falls within one year.

(e) Figure 9 shows a graph of the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

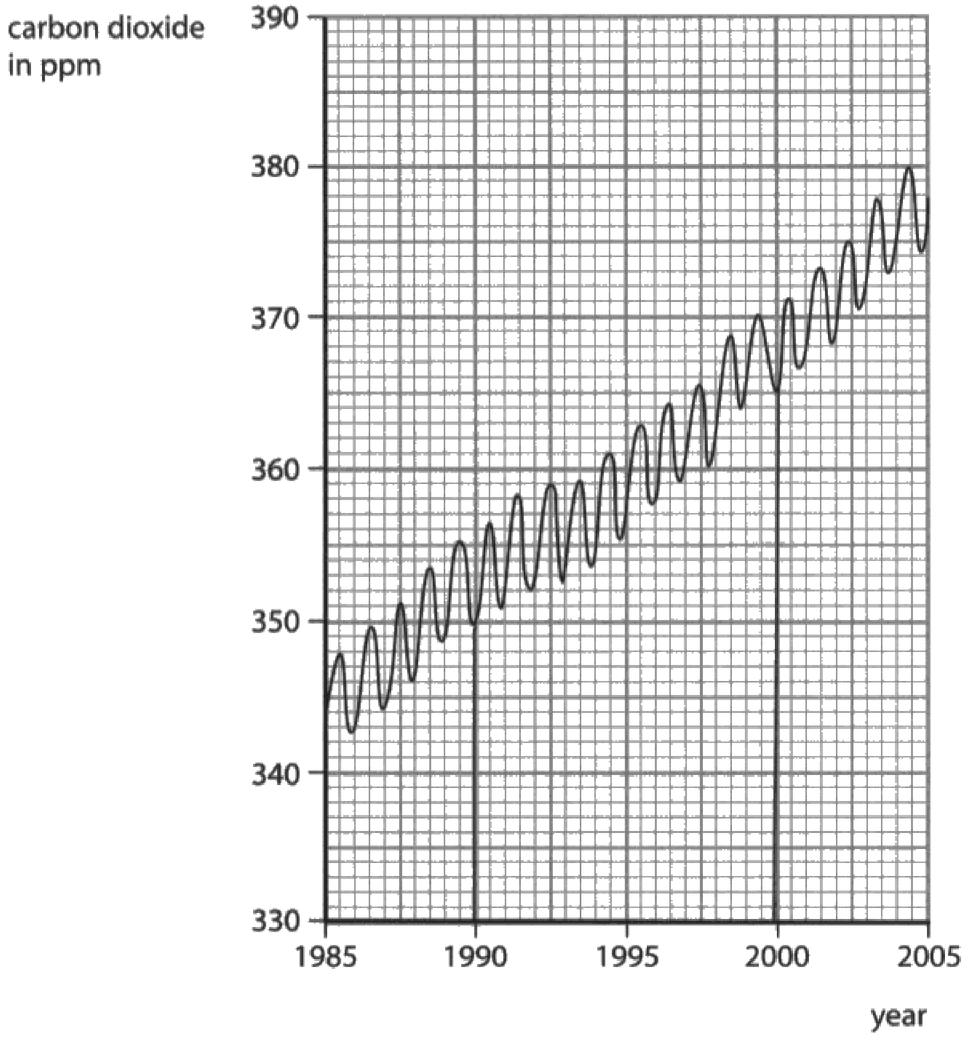

Figure 9

(i) Describe how the amount of carbon dioxide in the Earth's atmosphere varies within each year.

(1)

As the years have gone by, the amount of Carbon ~~di~~ dioxide has increased year by year.

(ii) Describe the overall trend in the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

(1)

From 1985, the amount of CO_2 was around 340 - 350, but in 2005 it was around 370 - 380 ppm.

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In part (i) the overall trend has been given. In part (ii), values have been quoted but the trend has not been stated.

Question 7 (b)

The vast majority of candidates scored 1 mark for identifying a suitable property. Candidates are advised that a scatter gun approach, citing every property (including conductivity) whether relevant or not, is very inadvisable. Other candidates picked properties not in the table at all. Some candidates did not understand the need to explain, and therefore did not score the second mark.Those that tried to explain usually made a reasonable attempt.The most common correct answer was that the hot drink would not melt the cup due to the ceramic's high melting point.

(b) Explain, using information from Figure 10, why the ceramic is a suitable material to make a cup that will contain a hot drink of tea or coffee.

(2)

The reason ceramic is sutable is because it has a high melting point and it does not react with water.

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Properties given - but no explanation as to why these are important.

Question 7 (c) (i)

Most candidates answered this correctly. Some failed to add a double bond between the carbons (usually adding a single bond), a few had that double bond but also another double bond between the C and H. Other candidates added extra bonds and atoms to the molecule.

(c) (i) The structure of a molecule of a polymer is shown in Figure 12.

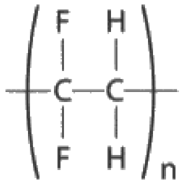
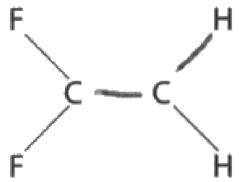


Figure 12

Complete the structure of a molecule of the monomer used to make this polymer by adding the missing covalent bonds.

(2)



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A typical error missing the double bond.

Question 7 (c) (ii)

There were a few good responses to this question but many were simply a list of vague eco-generalisations with little, if any, scientific content.

Most commonly marks were scored for considering the disposal of polymers.

Points that were made included:

-polymers are non-biodegradable so landfills fill up

-finite nature of crude oil

-effect of plastic waste on animals (especially sea animals)

There was less emphasis on the production of plastic, but when it was mentioned it was associated with the use of energy and the Greenhouse Effect. There was obvious confusion in many about how cracking, fractional distillation and crude oil link together.

There seemed to have been a definite *Blue Planet* effect with answers referring to plastics entering the sea and damaging the marine habitat.There was much irrelevant material concerning the use of plastics, or economic arguments about the cost of production.

Good answers:

-considered the manufacture and the disposal of polymers separately

-organised their response clearly

-backed up their statements with scientific terms and sound reasoning.

*(ii) Poly(ethene) has many uses in everyday life.
Large amounts of poly(ethene) are manufactured from ethene produced by cracking fractions obtained from crude oil.

Poly(ethene) is used to make many objects.
After use it is necessary to dispose of the large amounts of poly(ethene) in these objects.

Explain some of the problems associated with the manufacture and disposal of poly(ethene).

(6)

Poly ethene is a polymer, so therefore polyethene is non-bio degradeble, So the large amounts of poly ethene that are disposed cannot be broken down and causes problem for the environment. The manufacturing of poly ethene can release dangerous gases and substances that can cause alot of harm to the environment and people if they breathe the gases and substance into their bodies.

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This answer does cover both production and disposal. It gives a relevant point about disposal (polyethene is non-biodegradable) but nothing relevant about manufacture. Vague statements such as 'causes problems for the environment' will never score. Level 1 answer.

*(ii) Poly(ethene) has many uses in everyday life.
Large amounts of poly(ethene) are manufactured from ethene produced by cracking fractions obtained from crude oil.

Poly(ethene) is used to make many objects.
After use it is necessary to dispose of the large amounts of poly(ethene) in these objects.

Explain some of the problems associated with the manufacture and disposal of poly(ethene).

(6)

Some issues with producing poly(ethene) is that it's often single use only and can't be reused in the home. This will mean large quantites of poly(ethene) must be produced for it then to be thrown away. Some of the issues with the disposal of poly(ethene) is that if it's put in landfill it will not break down completley for hundreds if not thousands of years. If it's

Sent to be ~~re~~ recycled, not only does it cost alot but the more it's recycled the weaker poly(ethene) will become. if it were to be burnt it would release green house gases (like carbon dioxide) into the ~~air~~ atmosphere. This makes the disposal of poly(ethene) extremley difficult.

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Examiner Comments

This answer has given enough relevant points about disposal to be a Level 2 answer. Unfortunately, it does not cover manufacturing at all, so cannot get to Level 3.

Question 8 (a) (i)

Candidates found it quite hard to state the mass number of this chlorine atom.

A common error was to give the atomic number instead or to use the periodic table at the back rather than the information given in the stem of the question and give an answer of 35.5.

Question 8 (a) (ii)

More candidates scored in (ii) compared to (i), and were able to correctly give the electronic configuration at the atom.

In some cases, the question was not read correctly, and the number of electrons were given rather than the electronic configuration.

Some candidates drew diagrams, which were accepted.

Question 8 (b)

The result of the test for chlorine was not well recalled. Many candidtes could state the paper went red or white, but few could fully describe what would be seen to gain both marks.

Some candidates lost marks as they were not specific with their answers, simply stating that the colour would change without describing to what colour it would change.

Question 8 (c) (i)

A small proportion of candidates were able to fully describe what is meant by a covalent bond to gain both marks.

More knew that a covalent bond involves the sharing of electrons, without stating that it was a shared pair of electrons.

In a few cases this question was answered using a diagram which was accepted if it showed a shared pair.

There were quite a few generalised answers such as ‘it is a strong bond holding atoms together’.

(c) Chlorine exists as diatomic molecules.

In a molecule, two chlorine atoms are joined by a covalent bond.

(i) Describe what is meant by a **covalent bond**.

(2)

Sharing electrons to complete their outer shell of electrons.

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To score both marks, the number of shared electrons must be stated.

(c) Chlorine exists as diatomic molecules.

In a molecule, two chlorine atoms are joined by a covalent bond.

(i) Describe what is meant by a **covalent bond**.

(2)

A single bond joing the 2 atoms together.

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Examiner Comments

A common error, not mentioning electrons at all.

Question 8 (c) (ii)

Explaining why chlorine is a gas rather than a liquid at room temperature was very hard for candidates and few could give an answer that related to the intermolecular forces involved.

Some knew that it had to do with forces between molecules but referred to these as bonds or covalent bonds and so did not gain credit.

Those that did score on this question often did so for showing an understanding that chlorine has a low boiling point, although some did confuse the melting point with the boiling point and so did not score.

When describing forces in between molecules, candidates should take care that they are using the correct scientific language at all times.

(ii) Explain why chlorine is a gas, rather than a liquid, at room temperature.

(2)

Chlorine has a low melting point, meaning even at a low temperature it has evaporated and turned into a gas.

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This candidate has mixed melting and boiling.

Question 8 (d)

It was surprising that relatively few candidates scored this mark.

Some did not read the question carefully or were not careful with their language and stated that chlorine is acidic which is incorrect and therefore not accepted.

Some stated that it turned red due to the presence of hydrogen rather than hydrogen ions which did not gain the mark.

Question 8 (e) (i)

The vast majority of candidates were able to estimate the melting point of iodine to gain the mark.

Question 8 (e) (ii)

Fewer candidates than in (i) were able to name a halogen that would react with the iron more vigorously with bromine.

A common error was where candidates again did not read the question carefully and gave the name of a reactive element such as sodium or potassium rather than a more reactive halogen.

Question 9 (a)

Some candidates produced exemplary answers, often using a table which clearly showed their working and helped them to organise their work correctly. However, in general the response was not encouraging.

Some candidates managed get the correct ratio but did not then covert this ratio to the formula to gain the last mark.

In some cases, candidates inverted the fraction and so lost the first mark. In these cases, the next two marks could be awarded for an error carried forward and scored for the correct ratio from the incorrect fraction and the correct formula from this ratio. This highlights the importance of showing working. Those candidates that just stated NaO_2 scored zero marks, those that showed their working and came to an answer of NaO_2 could score 2 marks.

Some candidates had clearly not attempted empirical formula calculations before and simply multiplied all the numbers together and produced a numerical answer.

9 Lithium, sodium and potassium are reactive metals in group 1 of the periodic table.

(a) Sodium metal tarnishes in air to form a layer of sodium oxide on its surface. 0.92 g of sodium combined with 0.32 g of oxygen in this oxide.

Calculate the empirical formula of this sodium oxide.
(relative atomic masses: O = 16, Na = 23)

You must show your working.

(3)

	Sodium	Oxygen
atomic mass=	23	16
	$\frac{0.92}{23} = 0.04$	$\frac{0.32}{16} = 0.02$
	$\frac{0.04}{0.02} = 2$	$\frac{0.02}{0.02} = 1$

Na_2O

empirical formula of sodium oxide = Na_2O

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Examiner Comments

A very clearly worked out response.

Question 9 (b)

The balancing here was refreshingly well done. As in question 3e, state symbols were poor, with water as aq a common mistake.

The 2 in front of the sodium was very often correct and more so than the 2 in front of the sodium hydroxide.

Again, it was clear that some candidates had not used state symbols before and tried to add further elements, compounds or numbers in the brackets.

(b) Sodium reacts with water to form sodium hydroxide in solution and hydrogen.

Complete the balancing of the equation for this reaction and add the state symbols for each substance.

(3)

$$2\,Na(s) + 2H_2O(l) \rightarrow 2\,NaOH(aq) + H_2(g)$$

Na	2		Na	2
H	4		H	4
O	2		O	2

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Examiner Comments

This candidate has carefully counted the atoms of each element on each side of the equation.

Question 9 (c) (ii)

It was pleasing to see that many candidates had obviously seen this practical demonstrated and gave a good response, with very few blank responses. Many were able to describe how the teacher could demonstrate the experiment.

In addition to describing the experiment, better candidates also described how the results of the experiment give the order of reactivity of the metals.

Common safety precautions credited were the used of safety goggles, gloves, use of a safety shield and ensuring that the students were stood well back. Some candidates gave generic lab rules such as wearing your hair up, tucking chairs under tables etc; these were not credited. Concerned, if not necessarily high-scoring, candidates suggested the teacher should “stay calm”, “have a fire extinguisher close”, “tell students to wear PPE” and “carry out the experiment whilst still thinking of maximum safety”.

Other points such as the need to cut the metal into small pieces, the fact that a large bowl would be needed, that tweezers should be used to transfer the metals were less common.

The biggest source of error in the description was to do the experiment in beakers or test tubes or simply not stress the size of the container of water. When it came to the analysis of the results, some candidates simply copied out the table, which gained no marks. As with the other 6 mark question lots of candidates finished their answer with one aspect (method of experiment) and did not talk about the reactivities at all; again they need to tackle the whole question.

It was encouraging (although not necessary) to see some candidates giving the science behind the observations, most of this seemed correct.

*(ii) A teacher demonstrated this experiment.

The results are shown in Figure 14.

	lithium	sodium	potassium
position of metal in water	floats	floats	floats
movement of metal	slow	fast	very fast
effervescence / bubbling	slow	fast	very fast

Figure 14

Describe, in detail, how the teacher would demonstrate this experiment safely, showing how the results give the order of reactivity of the metals.

(6)

Half-fill a small tank with water. Weigh and record a sample of solid lithium, wearing safety goggles. ~~Continuing to wear safety goggles, add the piece of lithium to the water tank using a pair of tongs~~ Place a screen around the tank of water to avoid being hurt. Continuing to wear safety goggles, add the piece of lithium to the water tank using a pair of tongs. The lithium does not move very quickly and produces a small amount of bubbling. This is because lithuim is at the top of group 1 (alkali metals) and so the forces of attraction between the nucleus and electrons are strong as it only has 2 shells of electrons. This means it will be difficult for these forces of attraction to be overcome, hence the lithium is not very reactive. Repeat this experiment in the same way with clean water. Weigh a piece of sodium of the same size as the piece of lithium. Place the sodium in the water tank. Sodium moves faster and bubbles faster than lithium. It is below lithium in group 1 of the Periodic Table. This means it is less reactive than lithuim as the atom has an extra electron shell, so the outer electron is further from the nucleus and the forces of attraction between the nucleus and electron are easier to overcome, so sodium is more reactive. Potassium moves very fast and bubbles very fast. This is because it is more reactive than lithuim and sodium as it is below both in group 1 of the Periodic Table. The electrons are further from the nucleus, and so the electron is able to leave the atom more easily.

(Total for Question 9 = 13 marks)

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Examiner Comments

This is a Level 3 answer. The explanation of the reactivity in terms of electronic configuation was NOT expected. Even without this, the answer covers both the method in enough detail and the trend.

*(ii) A teacher demonstrated this experiment.

The results are shown in Figure 14.

	lithium	sodium	potassium
position of metal in water	floats	floats	floats
movement of metal	slow	fast	very fast
effervescence / bubbling	slow	fast	very fast

Figure 14

Describe, in detail, how the teacher would demonstrate this experiment safely, showing how the results give the order of reactivity of the metals.

(6)

The teacher would demonstrate this safely by Standing up rather than getting acid in her lap. She would wear gloves and goggles to protect acid ~~fro~~ irritating Skin and Splashing in eyes. Use Lithicm, then Sodium and potassium in order of their reactivity Series. Lithicm was least reactive as it was slow bubberling. However sodium was next and then pottassium as it gave the ~~&~~ very fast bubbling.

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Examiner Comments

This is a Level 2 answer.

There are some practical details and the trends is given. Unfortunately, in using data from the table the candidate just copies these out. It would have been better to say that potassium bubbbles the fastest, then sodium, and lithium bubbles the slowest. giving an interpretation to the words in the table.

Question 10 (a) (i)

This part was not well answered.

Incorrect responses included : experimental error, too much water, other reactions might occur, didn't burn for long enough, the theoretical value is just a guess. Other candidates said that ethanol didn't burn fully which was excluded by the question.

Question 10 (a) (ii)

Use of a lid was mentioned more often than a generic 'draught shield' but surprisingly this wasn't particularly well answered. Mention of types of insulating material were unusual. Lots of ideas about using Bunsen burners, different fuels, different volumes of water or using a glass beaker (or a polystyrene cup) instead of a metal can. Other candidates did know that heat loss was to be minimised, but gave no way of doing this. Perhaps the most innovative suggestion was to carry the experiment out in a room at 85^{o}C to minimize heat loss.

Question 10 (a) (iii)

There were many correct answers here.

Some obtained 1 mark by using the wrong temperature change but correctly showing their working and with correct evaluation. The candidates that did not score typically divided instead of multiplying.

Question 10 (b)

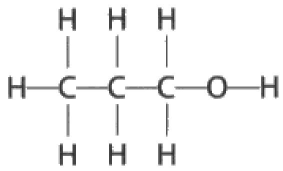
This was badly answered. Identification of '-OH' was the most frequent correct answer, but often not stated correctly as a 'group' or functional group.

Many responses had 'all have C', 'all have H', (which would apply to any organic molecule) and 'all have O'.Some thought that it was because they all ended in "anol". A surprising number referred to the compounds as 'hydrocarbons'.

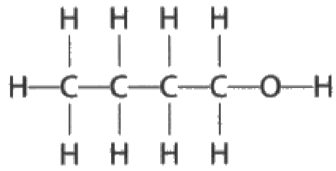
Trends in physical properties were rarely mentioned and similar chemical properties even less so.Others mixed these up – identical physical properties/ same boiling point.

In general there was little understanding of an homologous series.

(b) Propanol and butanol are both members of the same homologous series as ethanol.



propanol



butanol

Propanol and butanol can also be burned in the apparatus shown in Figure 15.

Give **three** reasons why ethanol, propanol and butanol are members of the same homologous series.

(3)

reason 1 They all contain hydrogen & carbon

reason 2 None of them contain double bonds

reason 3 They all have 1 oxygen

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This was typical of an answer and scored 0 because it did not relate specifically to alcohols.

Question 10 (c) (i)

It was pleasing to see a good number of correct interpretations here. Common errors were air instead of oxygen, missing water, and ethanoic acid/ propane oxide/ propanol oxide as a product. Some added extra products, such as carbon dioxide.

Paper Summary

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

- practise the typical calculations at foundation tier
- design experiments and analyse the designs of given experiments
- practice drawing data from graphs and using this data to explain trends etc.
- learn tests for gases
- practise simple maths skills such as percentages, simplifying ratios, significant figures
- learn definitions of basic concepts e.g covalent bond
- practice 6-mark questions, focused on succinct layout and logical presentation of relevant information.

Grade Boundaries

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