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Examiners' Report
June 2014

GCSE Chemistry 5CH2H 01

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June 2014

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Introduction

This was the fifth C2 Higher Chemistry examination for the GCSE Science specification. As the examination is now only available in June there was the expected massive increase in the entry numbers. The paper included a good variety of questions, both in terms of content and difficulty, and this gave candidates of all abilities the chance to show their knowledge and understanding of the subject at this level. There were very few blank spaces and no indication of candidates being short of time. Overall the paper proved to be even more accessible than in June 2013 with a significant increase in the mean mark. Many excellent answers were seen and it was again pleasing to see good responses to the free-response six mark questions, particularly the first one concerning uses of diamond and graphite with many giving detailed answers fully worthy of Level 3. The second six mark question on the reactivity of the halogens proved much more challenging and only the best candidates achieved good marks.

As a general point it was noticeable to many examiners that the standard of handwriting was often poor with some answers hardly legible. It was again very disappointing to see the difficulty so many candidates have in understanding chemical formulae and balancing equations. As last year candidates often lost marks for using scientific terms such as "intermolecular" inappropriately. The use of extra pieces of paper was quite common, in most cases fully justifiably, but there were also too many instances where only one or two extra lines were written which candidates could have fitted into the main body of the script. When candidates do wish to continue an answer on a separate sheet it would be very helpful to examiners if they indicated this at the end of the original space allocated for the question by inserting something like "continued on extra page" or "continued on page…"

Question 1 (a)

As anticipated this opening question on protons, neutrons and electrons provided a good start for most candidates with over 90% gaining 2 or more marks. The most common error was in the mass of the electron whilst some others included charges on the relative mass.

1 (a) Atoms contain protons, neutrons and electrons.

Complete the table to show the relative mass and relative charge of each particle and its position in an atom.

(3)

	relative mass	relative charge	position in atom
proton	1	+1	shells
neutron	1	0	in nucleus
electron	2	-1	shells

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Examiner Comments

The relative mass of the electron was the most common incorrect aspect but this was a surprising incorrect answer. Also the position of the proton was incorrect but four correct responses earned 2 marks.

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Examiner Tip

This is obviously just a matter of factual recall and should always be a good source of marks.

Question 1 (c) (i)

Most candidates gave the correct answer of Ca but a few did not follow the instructions and gave the name rather than the symbol.

Question 1 (c) (ii)

Over a third of candidates gave incorrect answers showing a lack of knowledge of the connection between groups and the charge on ions. Instead of the correct answer of O it was common to see K and Cl, with Ne also sometimes being given.

Question 1 (d) (i)

Many candidates seemed generally confused about different types of atoms and the total number of atoms. There were a wide range of incorrect answers – 3, 9, 10 and 12 all seemed popular. Some even went into the hundreds, perhaps multiplying rather than adding, whilst others were obviously working out a value of the relative formula mass.

(d) The formula of aluminium nitrate is $Al(NO_3)_3$

(i) State the total number of atoms in the formula $Al(NO_3)_3$

27

(1)

27 [(14+48)]3
22 + 186 = 213

213

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Examiner Comments

This candidate was one of quite a few who tried to work out a relative formula mass.

(d) The formula of aluminium nitrate is $Al(NO_3)_3$

(i) State the total number of atoms in the formula $Al(NO_3)_3$

(1)

3

ResultsPlus
Examiner Comments

Many, as this candidate did, gave the number of different elements present.

Question 2 (b)

The majority of candidates gained a mark for stating that at a higher temperature the particles will have more energy or alternatively move faster. However, only about a third then gained a second mark by mentioning more *frequent* collisions or *more* successful collisions. Usually they did not gain the second mark because they simply mentioned more collisions without the key reference to a time factor. Another acceptable idea was a correct reference to activation energy but these types of answers were not often seen.

(b) Explain why increasing the temperature of a reaction increases the rate of the reaction.

(2)

This gives the particles more energy. As a result they move faster and collide more frequently, with higher energy collisions. The more collision between particles, the higher the rate of reaction.

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Examiner Comments

A good response which refers to both the idea of the particles having more energy and colliding more frequently, and so was awarded two marks.

(b) Explain why increasing the temperature of a reaction increases the rate of the reaction.

(2)

Increasing the temperature of a reaction increases the rate of the reaction because it makes the particles in the reaction move faster.

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Examiner Comments

The candidate was awarded one mark for stating that the particles would move faster but there is no reference to more frequent or more successful collisions.

(b) Explain why increasing the temperature of a reaction increases the rate of the reaction.

(2)

Increasing the temperature of a reaction increases the rate of reaction because it makes the particles move ~~quicker~~ faster, causing more collisions, speeding up the rate of reaction.

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Examiner Comments

One mark was awarded for the particles moving faster but "more collisions" was not sufficient for a second mark which required a reference to "more frequent" or "more successful" collisions.

Question 2 (c) (ii)

Almost half the candidates gave a fully correct answer and others gained a mark for giving three correct formulae. However it was disappointing to see oxygen gas often being shown as O, rather than O_2. Even more disappointingly, the formula for water was sometimes incorrect as was the formula of hydrogen peroxide despite it being given in the question.

(ii) The decomposition of hydrogen peroxide, H_2O_2, produces oxygen and water.

Give the balanced equation for this reaction.

(2)

$2H_2O_2 \longrightarrow 2O_2 + H_2O$

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Examiner Comments

This response gained one mark for all the correct formulae, but not the second mark, as it was not correctly balanced.

Question 2 (d)

This question proved very challenging with only just over a third of candidates gaining any credit for their answers. Most either simply did not appreciate that bond breaking requires energy and bond formation releases energy or, as was often the case, they made contradictory statements such as "the energy needed to break the bonds is less than the energy needed to make the bonds".

Some students failed to make the link between bond making and bond breaking in their answers, and just gave simple statements such as "in exothermic reactions heat is given out".

(d) Explain, in terms of the energy involved in the breaking of bonds and in the making of bonds, why some reactions are exothermic.

(2)

When bonds are being made in a reaction and heat is given off then this is an exothermic reaction.

(Total for Question 2 = 8 marks)

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Examiner Comments

This response gained one mark for a correct reference to bond making involving heat being given off.

(d) Explain, in terms of the energy involved in the breaking of bonds and in the making of bonds, why some reactions are exothermic.

(2)

Some reactions are exothermic (they give off heat). As there is more energy released when new bonds are formed than the energy taken in to break the old bond so more energy is given out overall making it exothermic.

(Total for Question 2 = 8 marks)

ResultsPlus
Examiner Comments

This answer was worth both marks.

(d) Explain, in terms of the energy involved in the breaking of bonds and in the making of bonds, why some reactions are exothermic.

(2)

Making bonds are endothermic This is because alot of heat energy is needed in making bonds where as breaking bond is exothermic and requires less energy and energy is released when breaking bonds

(Total for Question 2 = 8 marks)

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Examiner Comments

Unfortunately incorrect responses similar to this, in which the ideas were completely mixed up, were quite common.

Question 3 (b) (i)

The concept of delocalised electrons was quite common but a considerable numbers of candidates failed to mention cations or positive ions when answering this question. Some candidates thought metals contained positive and negative ions. Others mentioned protons instead of positive ions. Many candidates described the arrangement of particles in a metal and went on to describe how the arrangement explained the physical properties of a metal, but without mentioning that the particles are positive ions.

(b) (i) Describe the structure of metals in terms of the particles present in their structures.

(2)

within metals there are protons which are sourrounded by a sea of delocalised electrons

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Examiner Comments

This candidate gained one mark for a correct reference to delocalised electrons but, like many others, wrote protons rather than cations/positive ions.

(b) (i) Describe the structure of metals in terms of the particles present in their structures.

(2)

metals are made up of positive ions surrounded by a 'sea' of delocalised electrons

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Examiner Comments

This is the type of answer which earned two marks.

Question 3 (b) (ii)

Most students were able to identify electrons as being involved in metals conducting electricity. Many were also able to explain that this was because the electrons were free to move and so gained both marks. However a proportion of candidates referred to "charged particles" instead of electrons.

Others confused the conductivity of metals with that of ionic substances with references made to ions or that the metal had to be molten to conduct.

(ii) Explain how metals conduct electricity.

(2)

Metals conduct electricity through the delocalised electrons which create a "sea" around the metal, meaning a current can be carried.

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Examiner Comments

This gained one mark for correctly identifying the involvement of electrons, but unfortunately did not mention the idea of them moving so did not gain the second mark.

(ii) Explain how metals conduct electricity.

(2)

There is space between the positively charged ions for the electrons to move about, and due to the fact they are free to move, they conduct electricity.

ResultsPlus
Examiner Comments

An example of a response indicating that electrons are free to move and so worth both marks.

Question 3 (c) (i)

The reaction between sodium and water was very well described by most candidates indicating the value of teacher demonstrations, however some candidates did not appreciate that the question was asking for things that can be *seen* during the reaction. Comments on the reactivity of sodium or explaining its reactivity in terms of electron arrangement are not required. Candidates should realise that "fizzing" and "bubbling" are really the same observation and that "hydrogen is given off" is not an observation. A few candidates included observations made after adding universal indicator, which were not credited.

Question 3 (c) (ii)

About 30% of candidates produced a fully correct balanced equation. Most commonly candidates scored just one mark for the formulae on the left hand side of the equation, which was meant to be a straightforward mark. Given that the products were also named in the question, it was very disappointing that so few candidates were able to score the second mark. H for hydrogen was common as was sodium hydroxide being given as $Na(OH)_2$

It was also very surprising to see the introduction of substances not mentioned in the question.

(ii) Write the balanced equation for the reaction of sodium with water to form sodium hydroxide and hydrogen.

(3)

$Na + H_2O \rightarrow NaOH + H_2$

(Total for Question 3 = 10 marks)

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Examiner Comments

This candidate was awarded two marks as the symbols and formulae are correct on both sides of the equation but the equation has not been balanced.

(ii) Write the balanced equation for the reaction of sodium with water to form sodium hydroxide and hydrogen.

(3)

$2Na + 2H_2O \longrightarrow 2Na(OH)_{(s)} + H_2$

(Total for Question 3 = 10 marks)

ResultsPlus
Examiner Comments

Although it should obviously not be encouraged the use of brackets around OH was not penalised. Candidates who wrote NaHO were treated in a similar way.

Question 4 (b)

The question told the candidates that the compound was ionic so if they mentioned molecular, intermolecular or covalent in their explanations they did not score any marks. Many identified "strong bonds" which gained a mark, but then followed this by referring to high temperature being needed to melt the compound or that the bonds would be hard to break, instead of the required reference to a lot of energy being required.

(b) Barium chloride is an ionic compound and has a high melting point.

Explain why barium chloride has a high melting point.

(2)

Barium chloride has a high melting point because it's particles are held together by strong bonds in a lattice structure.

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Examiner Comments

This was awarded one mark for the mention of strong bonds.

(b) Barium chloride is an ionic compound and has a high melting point.

Explain why barium chloride has a high melting point.

(2)

Barium chloride has a high melting point because it is an ionic substance, meaning that it has strong bonds which need a lot of energy to break, and a strong lattice structure.

ResultsPlus
Examiner Comments

This was worth two marks for referring to strong bonds and a lot of energy needed to break them.

(b) Barium chloride is an ionic compound and has a high melting point.

Explain why barium chloride has a high melting point.

(2)

barium chloride has high melting point because its an ionic compound and it has a strong electrostatic force of attraction between the oppositely charged ions in the lattice, this requires high energy to break the bonds

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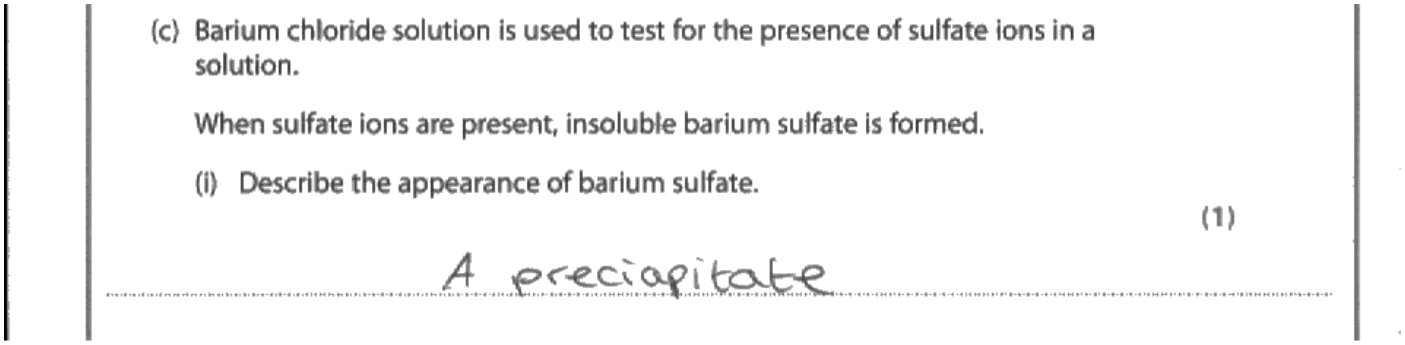
Examiner Comments

This is an example of a very good answer giving a full explanation of the high melting point of an ionic compound.

Question 4 (c) (i)

It was disappointing to find that there was an almost exactly even split between correct and incorrect answers.

Some candidates, unfortunately, simply answered "white" and so did not gain the mark because they did not add precipitate or solid. It appeared that others simply guessed or got confused with other tests and so there were wide ranging suggestions including yellow precipitate, orange solid, brown liquid/precipitate.



(c) Barium chloride solution is used to test for the presence of sulfate ions in a solution.

When sulfate ions are present, insoluble barium sulfate is formed.

(i) Describe the appearance of barium sulfate.

(1)

A preciapitate

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Examiner Comments

No mention of white so no mark awarded.

Question 4 (c) (ii)

It is very disappointing to report that only about a quarter of candidates gained any credit here, especially given that they already had the left hand side of the equation. Most incorrect answers seemed to include K_2Cl_2.

(ii) Complete the balanced equation for the reaction between barium chloride and potassium sulfate.

(2)

$BaCl_2 + K_2SO_4 \rightarrow$ $BaSO_4 + KCl$

ResultsPlus
Examiner Comments

This was worth one mark for correct formulae but it had not been balanced.

(ii) Complete the balanced equation for the reaction between barium chloride and potassium sulfate.

(2)

$BaCl_2 + K_2SO_4 \rightarrow$ $BaSO_4 + K_2Cl_2$

ResultsPlus
Examiner Comments

Answers like this were the most common of all.

Question 4 (d) (ii)

There were some very good answers describing how to prepare a sample of lead carbonate with many scoring full marks.

However others failed to say that the two salt solutions should be mixed/reacted and others gave an incorrect sequence of steps.

It was quite common for candidates to suggest the use of heat or the addition of another reagent, usually an acid.

The use of a separating funnel was sometimes given as a method of separation with fractional distillation also being suggested.

(ii) Lead carbonate is an insoluble salt.

Describe how a pure, dry sample of solid lead carbonate can be obtained from sodium carbonate solution and lead nitrate solution.

(3)

Sodium carbonate solution and lead nitrate solution are mixed together. Then, the insoluble salt formed is filtered to take out ~~remove~~ the lead carbonate. The lead carbonate is the washed with distilled water (to make sure that no other ions are involved) and then it's dried.

(Total for Question 4 = 10 marks)

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Examiner Comments

A response worth all three marks.

Question 5 (a) (i)

The majority of candidates scored both marks. Those who gained only one mark had usually incorrectly calculated the number of neutrons for both isotopes.

5 (a) Chlorine has an atomic number of 17.
Chlorine-35 and chlorine-37 are two isotopes of chlorine.

(i) Complete the table to show the numbers of protons, neutrons and electrons in each of the isotopes.

(2)

	chlorine-35	chlorine-37
number of protons	17	17
number of neutrons	18	19
number of electrons	17	17

ResultsPlus
Examiner Comments

One mark for correctly giving the numbers of protons and electrons but the neutrons were incorrect.

Chlorine-35 and chlorine-37 are two isotopes of chlorine.

(i) Complete the table to show the numbers of protons, neutrons and electrons in each of the isotopes.

(2)

	chlorine-35	chlorine-37
number of protons	8.84	8.87
number of neutrons	8.86	8.83
number of electrons	17	17

ResultsPlus
Examiner Comments

One of the more unusual incorrect responses seen.

Question 5 (a) (ii)

This proved to be a challenging question. Many scored one mark but only the strongest candidates scored both marks. The idea of RAM as an average mass was appreciated by many candidates, but there was a substantial minority who tried to explain the non-integer value with half a neutron. Many candidates made non-specific comments about abundances of isotopes but failed to say that Cl-35 was the most abundant. Others incorrectly stated that 35.5 was half way between 35 and 37 or that it should be 36, but 36 doesn't exist and so it's given as 35.5!

Some of the best candidates were able to use a calculation method to work out how to get 35.5 as the mean value.

(ii) A normal sample of chlorine contains only chlorine-35 and chlorine-37 atoms.

Explain why the relative atomic mass of chlorine is 35.5

(2)

Because there is a higher amount of chlorine which is 35 which means the relative atomic mass would be closer to 35 than 37.

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Examiner Comments

This was worth one mark for indicating there is more Cl-35 but there is no mention of average.

(ii) A normal sample of chlorine contains only chlorine-35 and chlorine-37 atoms.

Explain why the relative atomic mass of chlorine is 35.5

(2)

because it contains some every 3 chlorine-35 it contains 1 chlorine-37 atoms so by doing 3x 35 = 105 +37 = 142 142 ÷ 4 = 35.5 So the Relative atomic mass of chlorine is 35.5

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Examiner Comments

This answer is worth both marks by correctly using a calculation type approach.

(ii) A normal sample of chlorine contains only chlorine-35 and chlorine-37 atoms.

Explain why the relative atomic mass of chlorine is 35.5

(2)

~~The~~ 75% of Chlorine atoms are -35 while only 25% are -37 so when you calculate the relative atomic mass by (35x75)+(37x25)=3,550 3,550 ÷ 100 = 35.5 which is the relative atomic mass

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Another calculation method worth both marks.

Question 5 (b)

The majority of candidates gave fully correct electron structures. Those who did not often gave the incorrect number of atoms (despite having been given the chemical formula), had the atoms linked in a row, or drew ionic structures. A few candidates made careless errors such as missing out an electron in one of the shared pairs and subsequently forfeited both marks.

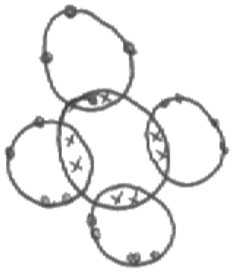
(b) Tetrachloromethane is a simple molecular, covalent compound.
The formula of its molecule is CCl_4.

There are four electrons in the outer shell of a carbon atom.
There are seven electrons in the outer shell of a chlorine atom.

Draw a dot and cross diagram to show the bonding in a molecule of tetrachloromethane, CCl_4.

Show outer shell electrons only.

(2)



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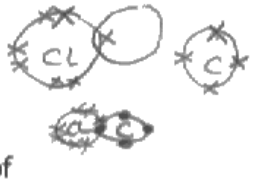
Examiner Comments

This answer was worth one mark for correctly showing four pairs of electrons being shared despite there being no symbols given.

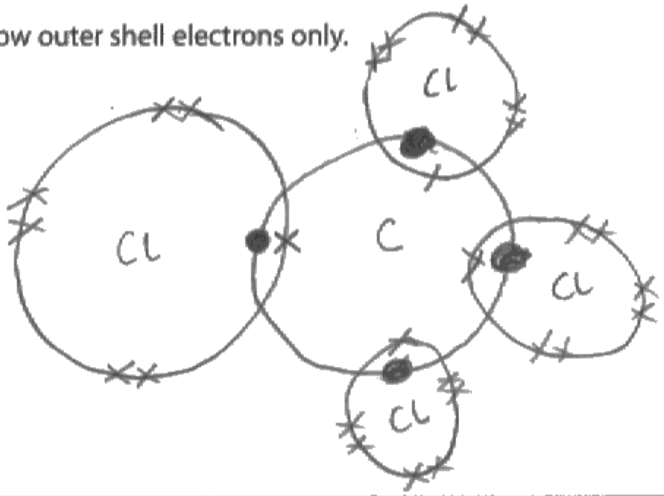
(b) Tetrachloromethane is a simple molecular, covalent compound.
The formula of its molecule is CCl_4.

There are four electrons in the outer shell of a carbon atom.
There are seven electrons in the outer shell of a chlorine atom.



Draw a dot and cross diagram to show the bonding in a molecule of tetrachloromethane, CCl_4.

Show outer shell electrons only.



1 carbon
4 chlorines
= CCl_4

(2)

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Examiner Comments

A fully correct answer worth both marks.

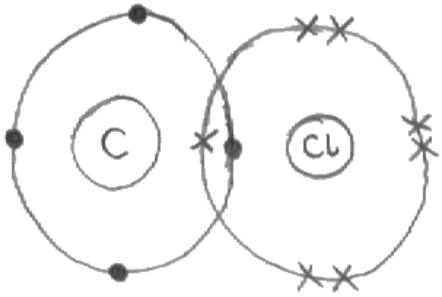
(b) Tetrachloromethane is a simple molecular, covalent compound.
The formula of its molecule is CCl_4.

There are four electrons in the outer shell of a carbon atom.
There are seven electrons in the outer shell of a chlorine atom.

Draw a dot and cross diagram to show the bonding in a molecule of tetrachloromethane, CCl_4.

Show outer shell electrons only.

(2)



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Examiner Comments

Answers like this were quite common despite the correct formula having been given in the question. It obviously gained no marks.

Question 5 (c)

It was very pleasing to see so many good answers to this question with about three quarters of candidates gaining a Level 2 or 3. However some had not read the question carefully which asked for a comparison of a use for diamond and *a* use for graphite with relevant explanations in terms of the bonding and structure, and so credit was only given for one use or property of each.

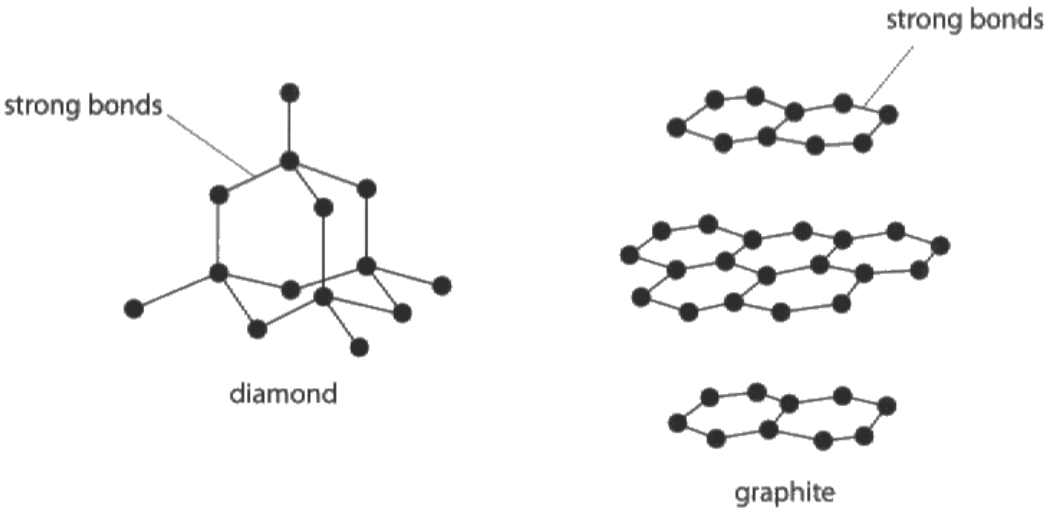
Candidates had a very good idea of the uses and properties of graphite and the linked explanations. They were less strong on those of diamond, with many just restating that diamond has strong bonds, which they had been told in the question and so did not attract credit. Others did not link their good explanations to a property or use, so limiting the mark they gained.

Some suggested a use of graphite as kitchen work surfaces or as a building material, suggesting they were thinking of granite.

Significant numbers incorrectly used the term intermolecular forces/bonds in their descriptions of diamond and graphite.

*(c) The diagrams show the arrangements of carbon atoms in diamond and in graphite.

● = carbon atom



Compare a use of diamond with a use of graphite, explaining each use in terms of the bonding and structure. In your answer you should use information from the diagrams.

(6)

A use of graphite is pencils. As it has weak attractive forces the sheets slide over each other so the graphite fragments rub off easily. Whereas a Diamond is used for cutting stones, metals and other gems. Diamonds can do this as they have strong bonds making it dense.

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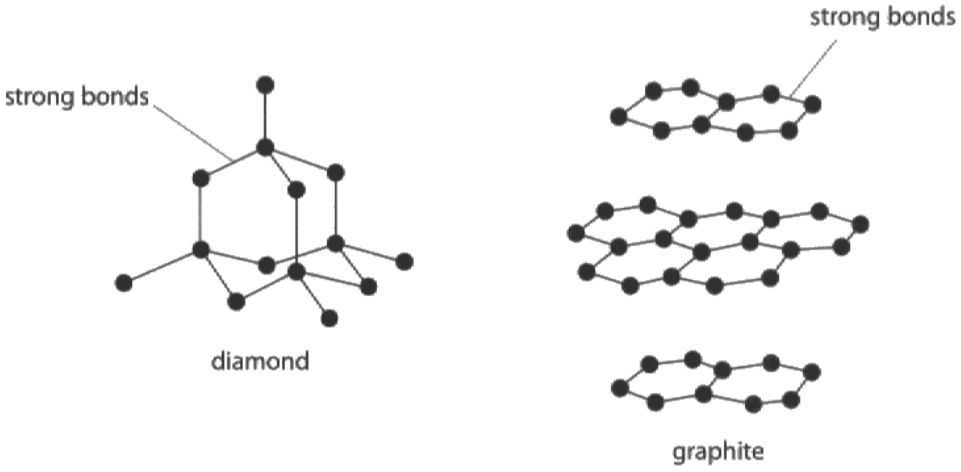
Examiner Comments

The candidate has given a use of both graphite and diamond with some relevant explanation. However it is not worth Level 3 as there are not three relevant explanation points (no credit was given for the mention of strong bonds as this information was given in the question). Level 2 and 4 marks.

*(c) The diagrams show the arrangements of carbon atoms in diamond and in graphite.

● = carbon atom



Compare a use of diamond with a use of graphite, explaining each use in terms of the bonding and structure. In your answer you should use information from the diagrams.

(6)

Both diamond and graphite are giant molecular covalent structures. Diamond is made of thousands of carbon atoms and has very strong covalent bonds between the atoms. It is very hard and does not conduct electricity. Diamond is therefore used for cutting tools as it does not break easily and it is therefore ideal for this purpose. Graphite is made of layers of carbon atoms also held together by covalent bonds. Graphite is softer than diamond and can conduct electricity as there is one delocalised electron from each carbon atom which is able to move between layers, and thus conduct electricity. Graphite is therefore used as a lubricant as the layers of carbon atoms can slide over each other easily, and it is also used to make electrodes as it can conduct electricity.

(Total for Question 5 = 12 marks)

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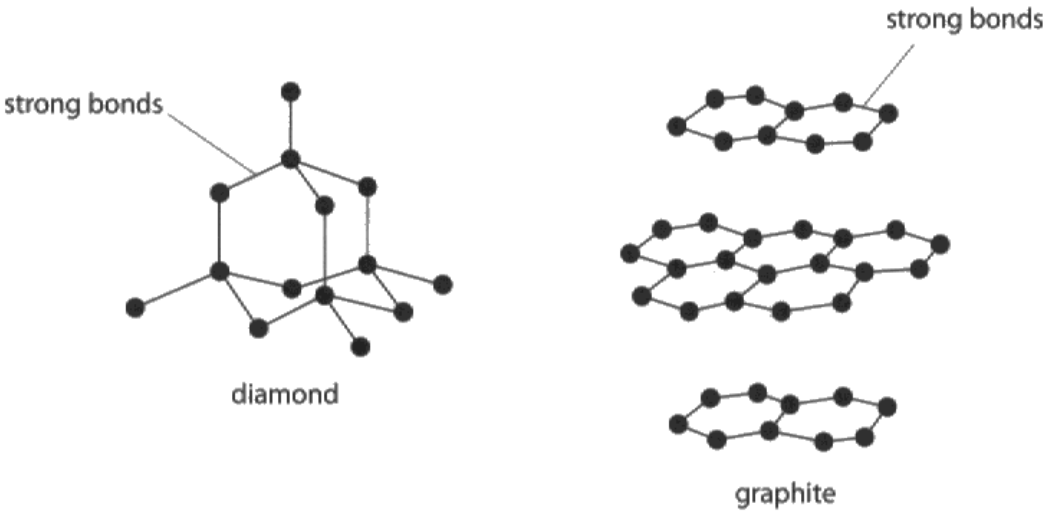
Examiner Comments

This response was one of the many which were worthy of Level 3 and 6 marks.

*(c) The diagrams show the arrangements of carbon atoms in diamond and in graphite.

● = carbon atom



Compare a use of diamond with a use of graphite, explaining each use in terms of the bonding and structure. In your answer you should use information from the diagrams.

(6)

Both graphite and diamond have strong bonds. Graphite can conduct electricity unlike diamond. But diamonds are examples of strong covalent substances. They ~~are~~ have strong bonds, insoluble, do not conduct electricity unlike graphite.

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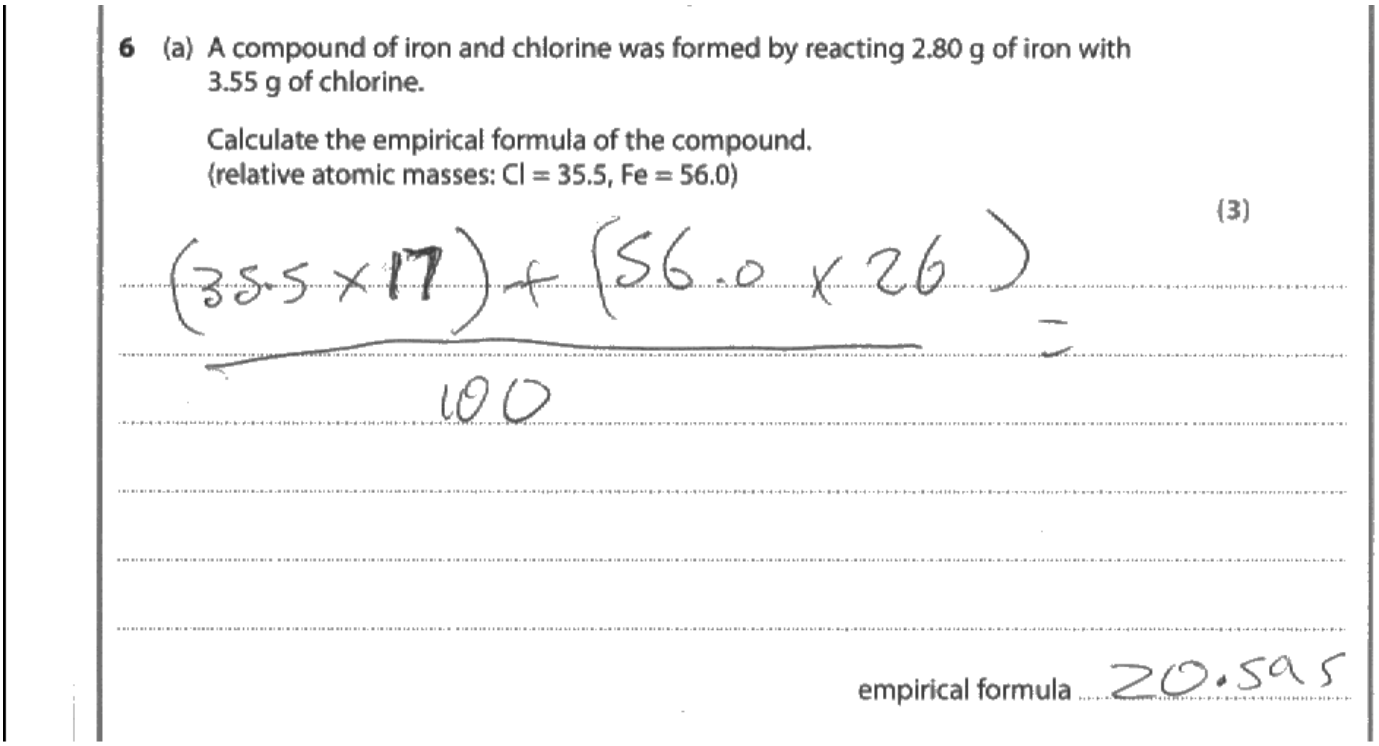
Examiner Comments

This response contains a correct property of graphite (and diamond) but there are no relevant explanation points so it was awarded Level 1 and 2 marks.

Question 6 (a)

Candidates found this empirical formula calculation challenging and so it proved to be a good discriminator with about a third gaining full marks.

A significant number of students confused the empirical formula calculation with relative atomic mass type calculations. Some students were able to correctly calculate the simplest whole number ratio but then mixed up the numbers with the elements so gave the incorrect formula Fe_2Cl. Another common error was to divide the mass by the wrong relative atomic mass e.g. 2.8/35.5



6 (a) A compound of iron and chlorine was formed by reacting 2.80 g of iron with 3.55 g of chlorine.

Calculate the empirical formula of the compound.
(relative atomic masses: Cl = 35.5, Fe = 56.0)

(3)

$\frac{(35.5 \times 17) + (56.0 \times 26)}{100} =$

empirical formula 20.595

ResultsPlus
Examiner Comments

Quite a number of candidates seemed to confuse empirical formula with a relative atomic mass type calculation.

6 (a) A compound of iron and chlorine was formed by reacting 2.80 g of iron with 3.55 g of chlorine.

Calculate the empirical formula of the compound.
(relative atomic masses: Cl = 35.5, Fe = 56.0)

(3)

35.5 → 3.55 56 → 2.80

2.80 / 56 = 0.05 3.55 / 35.5 = 0.1

× 1000.05 : 0.1 × 100

5 : 1 = Fe_5Cl

empirical formula Fe_5Cl

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Examiner Comments

Significant numbers started the question well but then could not give a correct empirical formula. This was awarded 2 marks.

6 (a) A compound of iron and chlorine was formed by reacting 2.80 g of iron with 3.55 g of chlorine.

Calculate the empirical formula of the compound.
(relative atomic masses: Cl = 35.5, Fe = 56.0)

(3)

Iron

$\frac{56.0}{2.80}$

$= 20$

$\frac{20}{10}$

$= 2$

chloride

$\frac{35.5}{3.55}$

$= 10$

$\frac{10}{10}$

$= 1$

Fe_2Cl

empirical formula Fe_2Cl

ResultsPlus
Examiner Comments

Some used the numbers "upside down" as in this example but were still credited with two marks.

6 (a) A compound of iron and chlorine was formed by reacting 2.80 g of iron with 3.55 g of chlorine.

Calculate the empirical formula of the compound.
(relative atomic masses: Cl = 35.5, Fe = 56.0)

(3)

Fe = 2.8 / 56 = 0.05 / 0.05 = 1

Cl = 3.55 / 35.5 = 0.1 / 0.05 = 2

1 : 2 Fe : Cl

empirical formula 1 : 2

ResultsPlus
Examiner Comments

In this example the candidate performs the first two steps correctly but does not give a final empirical formula.

(b) Sodium reacts with chlorine to form sodium chloride.

$$2Na + Cl_2 \rightarrow 2NaCl$$

Calculate the maximum mass of sodium chloride that could be formed by reacting 9.20 g of sodium with excess chlorine.
(relative atomic masses: Na = 23.0, Cl = 35.5)

(3)

$2Na + Cl \longrightarrow 2NaCl$

$(23 \times 2) + (35.5) \rightarrow 2(23 + 35.5)$

$46 + 35.5 \rightarrow 81.5$

Na	NaCl
46	81.5
9.2	x

$81.5 \times 9.2 = \frac{749.8}{46}$

$= 16.3$

mass of sodium chloride 16.3 g

ResultsPlus
Examiner Comments

This candidate has made just one error when they incorrectly calculated 2(23+35.5) to give 81.5 instead of 117. It was awarded two marks.

Question 6 (c)

This question caused a great deal of confusion and many examiners wondered whether candidates had actually seen, or better still carried out the relevant practical work. Some did include descriptions of the halogens but in their pure elemental form - this is not what is seen when this is carried out using halogen and halide solutions.

Some candidates were correctly able to state the order of reactivity of the halogens, but then went on to try to describe experiments in which reaction rates were to be measured.

Good numbers were able to suggest a suitable method of reacting correct combinations of the given solutions, and also a correct explanation or order of reactivity to achieve Level 2. However it was disappointing to see the number who did not know the correct order of reactivity.

Word equations were often helpful in answers as were tables of showing results of experiments. There was the usual confusion about the use of –ide and –ine e.g. "potassium bromine is formed". Those who attempted formulae equations very often gave incorrect formulae such as KCl2 and monatomic halogens. A reversal of the order of reactivity was also fairly often given.

*(c) Chlorine, bromine and iodine are in group 7 of the periodic table.

The order of reactivity of these three elements can be shown by carrying out displacement experiments.

You are provided with

potassium bromide solution
potassium chloride solution
potassium iodide solution
bromine solution
chlorine solution
iodine solution

Describe how these solutions could be used to carry out experiments to show the order of reactivity of bromine, chlorine and iodine, explaining how the results would show the order of reactivity.
You may use equations if you wish.

(6)

well once you are all set up with Saftey gear and the solutions to show the order of reactivity, you would make it a fair test by doing it in the same place Same time same temp etc. then by timing the reactions of bromine, chlorine and iodine, one right after the other.

By putting the potassium bromide Solution with the bromine Solution chloride with chlorine etc. this would be the fastest way to sort out results but you could draw a table and use all the top three solutions with all the three bottom Solution @ Unfortunately to get an overall test.

ResultsPlus
Examiner Comments

This is an example where quite a lot has been written but unfortunately nothing of credit.

*(c) Chlorine, bromine and iodine are in group 7 of the periodic table.

The order of reactivity of these three elements can be shown by carrying out displacement experiments.

You are provided with

- potassium bromide solution
- potassium chloride solution
- potassium iodide solution
- bromine solution
- chlorine solution
- iodine solution

Describe how these solutions could be used to carry out experiments to show the order of reactivity of bromine, chlorine and iodine, explaining how the results would show the order of reactivity.
You may use equations if you wish.

(6)

In a displacement reaction, the more reactive substance displaces a less reactive substance from the compound. In group 7, there are the halogens which are ordered in increasing reactivity (the reactivity increases as you go down the group.) Therefore, iodine is the most reactive, followed by bromine and then chlorine as the least reactive from the three. A displacement reaction can be carried between Potassium bromide and the iodine solution to form potassium iodide and Bromine so iodine displaces the bromine as it is more reactive so it is clear that iodine is more reactive than bromine. Another displacement reaction can happen between Potassium chloride and the bromine solution to form potassium bromine and Chlorine. So the bromine displaces the Chlorine to show that bromine is more reactive than Chlorine. ~~Furthermore there can be another displacement reaction between~~

Potassium iodide and the chlorine solution to form potassium chloride and iodine. So the chlorine displaces the iodine As a result by using these reactions, these halogen can be put into order of reactivity.

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

ResultsPlus
Examiner Comments

The addition of a halogen solution to a halide solution has been made (even though with incorrect results) but there is a wrong order of reactivity. It was awarded Level 1.

*(c) Chlorine, bromine and iodine are in group 7 of the periodic table.

The order of reactivity of these three elements can be shown by carrying out displacement experiments.

You are provided with

potassium bromide solution
potassium chloride solution
potassium iodide solution
bromine solution
chlorine solution
iodine solution

Describe how these solutions could be used to carry out experiments to show the order of reactivity of bromine, chlorine and iodine, explaining how the results would show the order of reactivity.
You may use equations if you wish.

(6)

If potassium bromide solution was reacted with ~~potassium chloride~~ chlorine solution: $2KBr + Cl_2 \rightarrow 2KCl + Br_2$ this equation shows that Chlorine would replace Bromine (a displacement reaction). This is because Chlorine is more reactive than bromine, as Chlorine is higher than bromine in the reactivity series. However, if potassium bromide solution was reacted with iodine solution, than bromine would still remain with potassium as bromine is higher than iodine in the reactivity series. So no change would occur; $KBr + I_2 \rightarrow KBr + I_2$. If potassium iodide solution was reacted with chlorine solution; $2KI + Cl_2 \rightarrow 2KCl + I_2$. Chlorine would replace Iodine as it is ~~still higher~~ higher than iodine in the reactivity series. If potassium bromide solution reacts with bromine solution, no reaction will

happen, because it's the same, so no displacement reaction occurs. Displacement only happens if the halide is high in the reactivity series if it isn't nothing changes.

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

ResultsPlus
Examiner Comments

This is an excellent response with correct descriptions of suitable experiments with correct explanations and balanced equations. It was given Level 3 and 6 marks.

*(c) Chlorine, bromine and iodine are in group 7 of the periodic table.

The order of reactivity of these three elements can be shown by carrying out displacement experiments.

You are provided with

- potassium bromide solution
- potassium chloride solution
- potassium iodide solution
- bromine solution
- chlorine solution
- iodine solution

Cl
Br
I

Describe how these solutions could be used to carry out experiments to show the order of reactivity of bromine, chlorine and iodine, explaining how the results would show the order of reactivity.
You may use equations if you wish.

(6)

Firstly we could start with potassium chloride solution. If we add bromine solution to potassium chloride solution, no reaction will take place. Similarly if we add iodine solution, no reaction will take place. Next we could use potassium bromide solution. If we add chlorine solution to potassium bromide solution, a displacement reaction will take place and we would be left with potassium chloride and bromine. However if we add iodine solution to potassium bromide solution, no reaction will take place. Finally we would use potassium iodide solution. If we add chlorine solution to potassium iodide solution, a displacement reaction will take place and we will be left with potassium chloride and iodine. Similarly, if we add bromine solution to potassium iodide a displacement reaction will take place and we will be left with potassium ~~chloride~~ bromide and iodine. The fact chlorine displaces both bromine and iodine suggests that it is the most reactive of the three elements. Bromine displaces iodine, but not chlorine, which suggests it is the second most reactive of the three

elements. Iodine does not displace bromine or chlorine, and is in fact displaced by them both, which therefore suggests it is the least reactive of the three elements.

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

ResultsPlus
Examiner Comments

Suitable experiments have been suggested and correct explanations and order of reactivity given. However it was limited to Level 2 and 4 marks as there was no mention of correct observations or balanced equations.

Paper Summary

On the basis of their performance on the current examination candidates are offered the following advice to improve their performance:

- memorise or learn how to work out the formulae of compounds - this is a vital aspect of chemistry.
- practise writing balanced chemical equations.
- practise calculations - particularly those involving empirical formula and reacting masses. Presentation of calculations is important: a logical step by step approach is best and do not be afraid to use words as well as numbers to explain your work.
- carry out as much practical work as time allows in addition to what is required by the controlled assessment tasks.

Grade Boundaries

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