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Examiners' Report
June 2013

GCSE Chemistry 5CH2F 01

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Introduction

This was the fourth examination that had been set for paper 5CH2F 01 and it was expected that there would be a considerable increase in the number of candidates as the Additional Science Course finished in time for the GCSE examination period. In the future, this examination will only be available at the end of the course in June of the academic year.

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.

On this paper, candidates met a variety of question styles varying in the number of marks available. A range of questions with a variety of levels of demand will always be set to be accessible for the weakest and to be challenging for the most able candidates taking this paper. As is the case for all science papers, there were two 6-mark questions that were levels-based in the marking.

Successful candidates:

- read the questions carefully and answered the questions they were set
- could write a word equation and write a simple balanced equation
- had a good knowledge of atomic structure and bonding
- could describe how to carry out experiments
- could carry out simple calculations

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
- had difficulty wring a word equation and did not know where to start with a simple balanced equation
- did not understand the meaning of key scientific words and phrases
- did not understand atomic structure and bonding
- were unable to describe how to carry out experiments similar to ones they had seen or carried out themselves during the course
- could not carry out calculations

This report provides exemplification of candidates' work, together with tips and/or comments for a selection of questions most of which highlight the misconceptions detected by the examiners. The exemplification will come mainly from questions that required more complex responses from candidates.

Question 1 (c) (i) (1)

Although the majority of the candidates could offer suitable values for the density of argon, a blank space was the usual cause for the mark not being awarded.

Question 1 (c) (i) (2)

A large majority of the candidates scored the mark here, and invariably an incorrect answer was down to giving the symbol of krypton incorrectly as 'KR' or as 'kr'.

Question 1 (c) (i) (3)

Again a large majority of the candidates followed the pattern of reactivity correctly and gave a correct answer of 'no reaction'; of the remainder quite a few blank spaces were seen and several answers of 'reaction' were given.

Question 1 (c) (ii)

Many candidates scored at 1 mark, usually for mentioning something about lack of reactivity, but only a small percentage of candidates were able to explain this lack reactivity to score the second mark. Many answers included irrelevant properties such as density or electrical conductivity. It was clear that many candidates did not understand the role of argon in a light bulb. Several thought that the argon was reacting with the metal filament and giving out light as a result. Some thought that using argon made the lighter brighter than if air had been used. Overall, almost half of the candidates scored at least 1 mark.

Explain why argon, instead of air, is used inside these light bulbs.

(2)

Because Argon is unreactive so it will not react with anything ~~that~~ which makes the light bulb safer. It's density is greater than air's

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Examiner Comments

This answer indicated that argon was so unreactive that it did not react with anything - for this, 1 mark was awarded.

Explain why argon, instead of air, is used inside these light bulbs.

(2)

Because argon is a non-reactant metal and a good conductor of heat to prevent the light bulb from blowing up or catching fire, its a good light sauce which helps the light bulb look brighter and work

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Examiner Comments

The candidate thought that argon was a metal and did not understand the purpose of its presence in a light bulb. There was nothing here to credit.

Explain why argon, instead of air, is used inside these light bulbs.

(2)

Argon is used instead of air because it is thinner, making the light shine brighter from the bulb.

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Examiner Comments

Several answers of this type were seen where candidates thought that the argon made the light shine brighter. No marks were awarded here.

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Examiner Tip

Learn the simple properties of the group 0 elements and be able to explain the lack reactivity in terms of full shells of electrons.

Question 1 (d)

It was disappointing to see the number of candidates who could not match up the properties of the elements with the correct element, with only about half the candidates scoring at least one mark on this question. Often iodine was matched with the yellow solid and copper matched with the grey solid.

Question 2a

The descriptions produced by candidates when answering this question were quite varied. A few were straightforward to mark, but the majority needed unpicking in order to award marks.

A significant number had no idea and many confused this type of separation with filtration. Although less than half of the candidates scored two marks, they were obtained largely by either allowing the layers to separate and operating the tap, or operating the tap and running out one layer.

Inversion of densities of oil and water was common and was ignored in this question, since no information about the densities of oil and water was provided.

This question attracted many misconceptions. Several candidates made reference to putting the oil and water into the separating funnel SEPARATELY (and then mixing and allowing to separate). Some described the lower layer being removed with the other liquid being left in the top half of the separating funnel (as if it had not moved). There were numerous, varied and inaccurate descriptions of the tap and its operation.

As mentioned, a significant number confused this separation with filtration. Some candidates wrote about using filter paper to allow water through but not oil (presumably being trapped by the filter paper). Some described the holes at the bottom could allow water to pass through but not oil as its molecules were too big.

Overall, almost two thirds of the candidates scored at least one mark on this question.

Describe how you would use a separating funnel to separate two immiscible liquids.

(2)

You would use a seperating funnel for eg oil and water. You would pore the two immiscible liquids into the top of the filter and there will be some filter paper in the middle or hot water so that the water will condence and leave just the oil.

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Examiner Comments

This answer was typical of those where confusion with the use of filter funnels occurred. Unfortunately there was nothing to credit here.

Describe how you would use a separating funnel to separate two immiscible liquids.

(2)

You would allow one of the immisicible liquids to pour out of the funnel ~~out~~ by releasing the screw until you get to the seconed liquid and screw back in So one liquid is out and the other is still in the funnel.

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Examiner Comments

This was an answer that needed a little unpicking to find where credit could be awarded. For 'releasing the screw' we assumed that the candidate was referring to the tap and reading the whole answer showed that the candidate understood the use of the tap funnel. This answer was awarded two marks.

Describe how you would use a separating funnel to separate two immiscible liquids.

(2)

You would put one liquid in, then place another one on top. Once opened this would release one of the liquids, to separate it from the other.

ResultsPlus
Examiner Comments

This type of answer was seen quite often where the candidate had not fully understood the question. This answer had set up the two layers rather than the mixture separating out and it was not clear what was meant by 'Once opened', so this answer was given 0 marks.

Describe how you would use a separating funnel to separate two immiscible liquids.

(2)

Because water floats on water, the oil will sit on top of the water. You would open the funnel and wait till the water is completly out of the funnel and you would be left with the oil.

ResultsPlus
Examiner Comments

This was a good answer where the candidate had indicated the formation of the two layers and the separation to give the two liquids.

Describe how you would use a separating funnel to separate two immiscible liquids.

(2)

the water evaporates from the oil leaveing the oil by it's self, and the oil particles that do come of will be caught by the filter as the oil particls are to big. The fillter is Made So ~~only~~ only small vapors can get throo.

ResultsPlus
Examiner Comments

This was another variation of a misconception often seen. It is clear that the candidate does not understand the workings of a separating funnel. This answer could not be given any credit.

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Examiner Tip

Make sure the separation methods in the specification have been understood.

Question 2 (b)

Two marks were scored by just over a third of the candidates: but chromatography, it seems, is not well-understood by a significant number. Descriptions of the interpretation varied widely and often showed little perception of what the dots actually represented. Many responses stated that the brown food colouring was made from two colours, so gaining one mark but didn't specify the actual colours.

Some responses stated there was more than one colour present which did not attract a mark, having made no reference to any specific colours. Some responses had brown as a component e.g. green, red and brown colouring present or brown colour in the brown colouring or two shades of brown.

A small number of candidates were a little side-tracked and started writing about solvents and solvent fronts, strength of colours and solubility of colours without following through on their argument.

Use the results of the chromatography experiment to describe the colours present in the brown food colouring.

(2)

In brown food colouring it is obvious that their is more than one colour as is shown in the chromatography experiment

ResultsPlus
Examiner Comments

Had this candidate given the actual number of colours or identified the colours, then marks could have been given. Stating '... more than one colour ...' without clarification attracted no marks.

Use the results of the chromatography experiment to describe the colours present in the brown food colouring.

(2)

The results show that the brown food colouring contain 2 colours. One is brown and the other maybe, yellow.

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Examiner Comments

Although having correctly stated that two colours were present, this candidate gave the wrong colours, so no marks could be given.

Question 2 (c)

The answers given to this question were quite varied. The more successful candidates started their answer by stating what would happen to the light bulb when each solution was tested and then went on to explain the observations. The examiners reported seeing very answers of this type. Quite a few candidates stated what happened to the light bulb in each case, but did not go on to account for the observations. A similar number gave the explanation correctly that the sodium chloride solution does conduct and the sucrose solution does not conduct but did not include how they knew this (i.e. whether the light bulb was glowing or not).

Common misconceptions included that the sucrose solution conducted, the correct observation about the bulb with the explanation that sodium chloride was covalent and the sucrose was ionic as well as the bulb not lighting because the sodium chloride was ionic. A significant number talked of delocalised electrons here when trying to explain conductivity; very few mentioned the presence of mobile ions. Some responses didn't refer to the specific solutions and gave a generic answer e.g. if it conducts the bulb will light, if it doesn't conduct it won't. Occasionally examiners saw answers of the type 'the sodium chloride lit the bulb brighter than sucrose' - a comparison of brightness so both were conducting. Some cited sodium chloride conducting electricity as it has a metal in it.

Explain what happens when each solution is tested in the circuit shown.

(3)

The sodium chloride will be found to not conduct electricity, This is due to it being an ionic compound. The sucrose will be found to conduct electricity, this is because Covalent compounds conduct electricity when molten or dissolved.

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Examiner Comments

This candidate had confused the properties of ionic compounds with those of covalent, molecular compounds. Nothing was given in terms of observations and so this answer was given 0 marks.

Explain what happens when each solution is tested in the circuit shown.

(3)

~~when the mixture is~~ when the two solutions are mixed and poured into the beaker if ~~the~~ they conduct electricity the circuit will be complete and the bulb will light up. ~~this~~

ResultsPlus
Examiner Comments

The question had asked for what happened when each solution was tested; so mixing the solutions does not score. Although the answer indicates that the bulb lights, it is not clear which component would cause the bulb to light up. So this answer could not be awarded any marks.

Explain what happens when each solution is tested in the circuit shown.

(3)

As sodium chloride is tested, the bulb would illuminate yet as sucrose is tested the bulb would not.

ResultsPlus
Examiner Comments

Here the candidate had just given the observation and had not given an explanation of what happened. Only one mark could be given here.

ResultsPlus
Examiner Tip

Learn the characteristic properties of ionic and molecular, covalent compounds.

Question 2 (d)

Surprisingly, fewer than half the candidates could calculate correctly the relative formula mass of water. Common errors seen here were answers 1+16 = 17 and 1 + 2x16 = 33. There were many who did not appear to know what to do with this question.

Question 3 (b)

Many candidates answered this question very well giving the expected answer of 8 protons and 9 neutrons in the nucleus. Candidates sometimes just stated 8 protons, 9 neutrons and 8 electrons, implying, probably without intending to do so as they did not make a clear enough distinction between the nucleus and the rest of the atom, that the nucleus contained all three sub-atomic particles. Poor maths was evident in the processing of the numbers of particles: candidates also confused atomic number and mass number and therefore obtained incorrect values for the numbers of protons and of neutrons.

Unfortunately in this question, many candidates had not comprehended the significance of the information about the oxygen atom given in the question. This question was about the oxygen-17 isotope and was deliberately chosen so it was clear how the numbers of protons and neutrons had been obtained. Some candidates thought they should point out what they perceived as an error and gave the answer of 8 protons and 8 neutrons – they achieved one mark for this. Doing this they showed that they did not understand the difference between the terms 'relative atomic mass' (as given on the periodic table) and 'mass number' (as referred to in the question), since only the mass number could give the total number of protons and neutrons.

(b) The atomic number of oxygen is 8.

The mass number of an atom of oxygen is 17.

Describe the number and type of particles in the nucleus of this atom.

(2)

The number of particles in this nucleus is 17

8 protons and 7 neutrons

ResultsPlus
Examiner Comments

Evidence of poor maths skills. One mark scored for the correct number of protons.

(b) The atomic number of oxygen is 8.

The mass number of an atom of oxygen is 17.

Describe the number and type of particles in the nucleus of this atom.

(2)

there are 8 protons and 8 electrons in it and there are also 9 neutrons

ResultsPlus
Examiner Comments

Several answers were seen like this. It was not clear if they understood where the electrons were located in an atom. Answers like this scored one mark, as the presence of the electrons stopped the awarding of the second mark.

(b) The atomic number of oxygen is 8.

The mass number of an atom of oxygen is 17.

Describe the number and type of particles in the nucleus of this atom.

(2)

In the first shell there will be two  and in the second shell there is 6. 2:6 equals 8 and then you times the 8 by the 2 to get the mass.

ResultsPlus
Examiner Comments

Here is an example of an answer where the candidate had wrongly corrected the mass number of the oxygen atom. In this case the answer then went on to describe the electron arrangement and showed they did not understand the arrangement of particles in an atom. This answer scored 0 marks.

(b) The atomic number of oxygen is 8.

The mass number of an atom of oxygen is 17. ← Thats 16

Describe the number and type of particles in the nucleus of this atom.

(2)

There will be 8 protons and 9 neutrons

ResultsPlus
Examiner Comments

Although here the candidate pointed out a perceived error, they then chose to ignore it and obtained two marks for the correct answer.

ResultsPlus
Examiner Tip

Learn the difference between relative atomic mass and mass number. Learn the basic properties of the sub-atomic particles - mass, relative charge and location.

Question 3 (c)

This question was answered generally well, with many scoring 2 marks. Of the correct answer the majority were of the type stating that both oxygen and sulfur were in group 6 because their atoms had 6 electrons in the outer shell and the minority were of the type where their atoms both needed two more electrons to fill the outer shell.

Common errors included references to them being in group 6 as they were both gases or noble/Nobel [sic] gases. There was frequent reference to the atomic number and mass number e.g. those of sulfur being double that of oxygen: 8 → 16 or 16 → 32. Often a reference was made to oxygen and sulfur having same properties, qualities or reactivity or to them both being non-metals, gases or non-conductors. In these instances, the candidates were not answering the question as given.

(c) Sulfur and oxygen are both in group 6 of the periodic table.

Explain, in terms of their electronic configurations, why they are both in group 6.

(2)

They are both in group 6, because they are both in the air, they are both gases.

ResultsPlus
Examiner Comments

This did not answer the question and scored 0 marks.

(c) Sulfur and oxygen are both in group 6 of the periodic table.

Explain, in terms of their electronic configurations, why they are both in group 6.

(2)

they are both in group 6 because they only have 6 electrons in their outer shell. they both need 2 more electrons to complete their outer shell

ResultsPlus
Examiner Comments

This was a very good answer scoring 2 marks.

(c) Sulfur and oxygen are both in group 6 of the periodic table.

Explain, in terms of their electronic configurations, why they are both in group 6.

(2)

They are both in group 6, because they are both in the air, they are both gases.

ResultsPlus
Examiner Comments

One of a number of common errors seen in the marking of this question. 0 marks given.

ResultsPlus
Examiner Tip

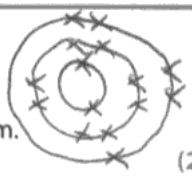
Understand how the electronic configuration of an atom of an element is related to the position of that element in the periodic table.

Question 3 (d)

Generally, this question was answered well; most candidates scored both marks sometimes by the inclusion of a correct electronic configuration diagram. Occasionally seen was references to shells of atoms e.g. 2 atoms on first shell. There were some vague responses such as the electrons were 'around the nucleus' or 'in circles dotted around the nucleus'. Some candidates gave incorrect shells such as 2, 10, 5 with incorrect numbers of electrons that the shells could hold.

(d) An atom of phosphorus contains 15 electrons.

Describe how these 15 electrons are arranged in a phosphorus atom.



(2)

it will be arranged with 3 spare places on its outer shell. it may take electrons from other elements atoms, or it may join with three hydrogen atoms

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Examiner Comments

The answer was helped with the inclusion of the electronic configuration diagram. This was given 2 marks.

(d) An atom of phosphorus contains 15 electrons.

Describe how these 15 electrons are arranged in a phosphorus atom.

(2)

These 15 electrons are arranged in a phosphorus atom with two electrons in the nucleus, eight in the first shell and five in the outer shell.

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Examiner Comments

Although there was a clear electronic configuration diagram to aid this answer, there was some confusion as to where the electrons were located. Unfortunately the candidate had thought the inner circle of the diagram was part of the nucleus, and so only the mark for the correct number of electrons in the outer shell could be given.

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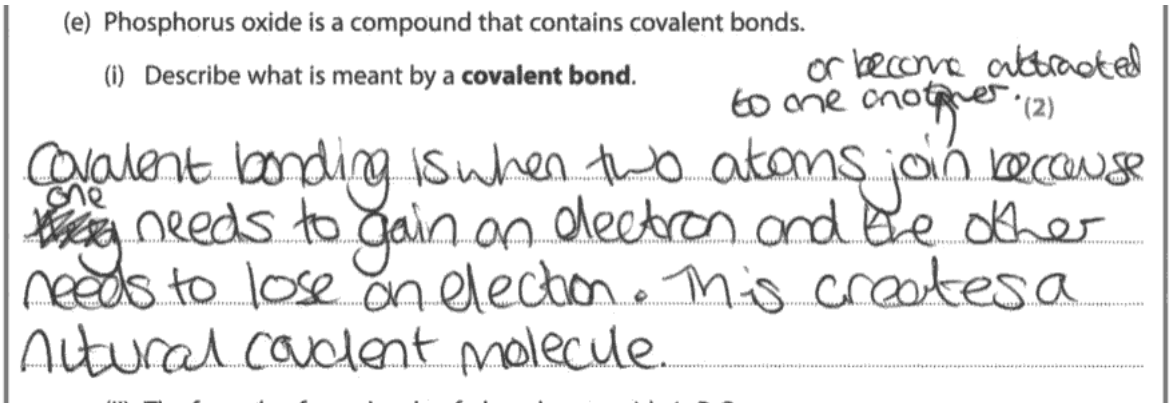
Examiner Tip

Learn the maximum number of electrons that can be held in an electron shell and how the electronic configuration can be worked out.

Question 3 (e) (i)

Of the candidates who scored at least one mark for this question, the greater majority obtained 1 mark for the idea of sharing electrons between two atoms. Only a few indicated that a pair of / two electrons were shared. Many others had indicated a sharing of electrons, but between elements rather than between atoms and so could not be given that mark. A number of candidates had confused ionic with covalent bonding and wrote about electrons being transferred.



(e) Phosphorus oxide is a compound that contains covalent bonds.

(i) Describe what is meant by a **covalent bond**. (2)

or become attracted to one another.

Covalent bonding is when two atoms join because one needs to gain an electron and the other needs to lose an electon. This creates a natural covalent molecule.

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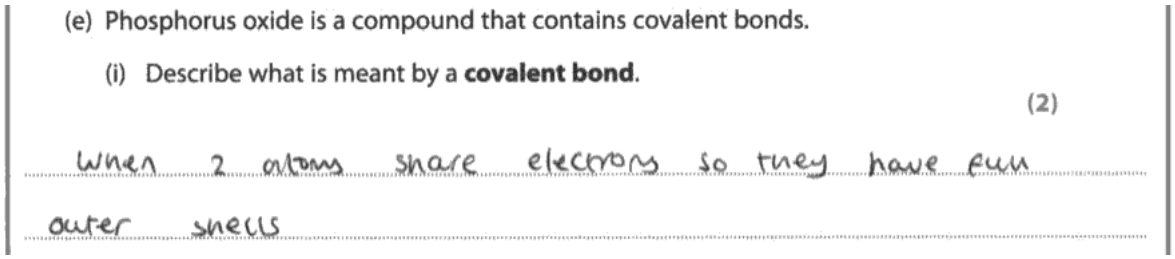
Examiner Comments

There is confusion here between ionic and covalent bonding. This answer was given 0 marks.



(e) Phosphorus oxide is a compound that contains covalent bonds.

(i) Describe what is meant by a **covalent bond**. (2)

When 2 atoms share electrons so they have full outer shells

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Examiner Comments

One mark was given for the sharing of electrons. No mention was made of the number of electrons in the covalent bond.

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Examiner Tip

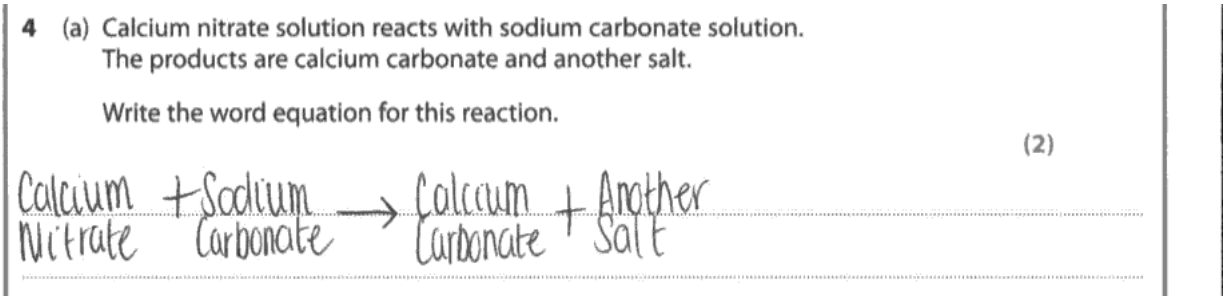
Know the difference between covalent and ionic bonding and how the two types of bonding are formed.

Question 3 (e) (ii)

Only a small number of candidates knew that the empirical formula meant the simplest ratio of the atoms in the formula of a substance. Many calculated the formula mass or contrived some other form of response, but most left this question unanswered.

Question 4 (a)

Nearly half of the candidates could write the correct balanced equation given the information in the question; a further one third scored one mark for a partly correct word equation. It was disappointing to see that so many could not copy the reactants correctly; 'calcium solution' and 'sodium solution' were commonly seen as reactants. Many candidates used just the information and formed the products 'calcium carbonate + salt' or more frequently 'calcium carbonate + another salt'. A small number thought they had to write a balanced equation and invariably failed as they were making up formulae for the substances, e.g. SC for sodium carbonate. Candidates should be advised that where a word equation is asked for, they are not expected to write a balanced equation using chemical formulae.



4 (a) Calcium nitrate solution reacts with sodium carbonate solution.
The products are calcium carbonate and another salt.

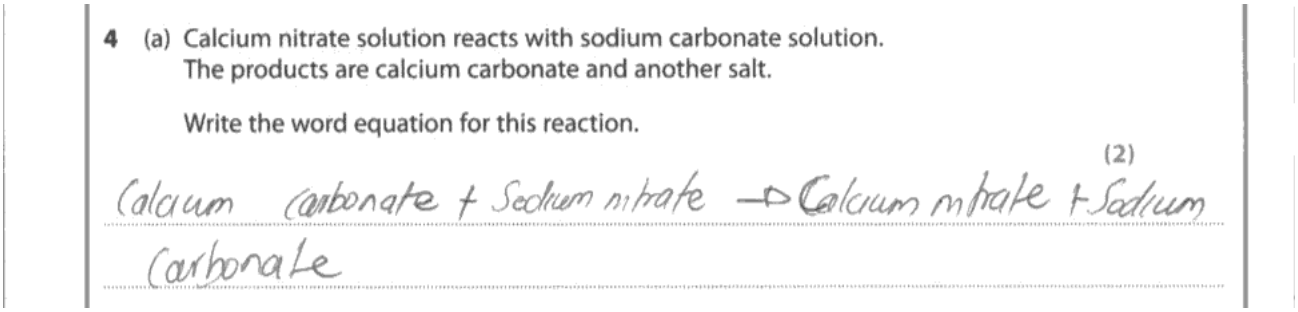
Write the word equation for this reaction.

(2)

Calcium Nitrate + Sodium Carbonate → Calcium Carbonate + Another Salt

ResultsPlus
Examiner Comments

Quite a common answer. However, 1 mark was score for the correct reactants.



4 (a) Calcium nitrate solution reacts with sodium carbonate solution.
The products are calcium carbonate and another salt.

Write the word equation for this reaction.

(2)

Calcium carbonate + Sodium nitrate → Calcium nitrate + Sodium Carbonate

ResultsPlus
Examiner Comments

All the correct substances, but in the wrong places. This scored 0 marks.

4 (a) Calcium nitrate solution reacts with sodium carbonate solution.
The products are calcium carbonate and another salt.

Write the word equation for this reaction.

(2)

$CaN_3 + NaC_3 \longrightarrow CaC_3 + Salt.$

ResultsPlus
Examiner Comments

Here is an attempt to write a balanced equation using invented chemical formulae. Answers like this can only be awarded 0 marks.

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Examiner Tip

When word equations are asked for, do not attempt to write a balanced equation using chemical formulae. Use the information in the question to help in the construction of the word equation.

Question 4 (b) (ii)

Only a few candidates scored both marks for describing how to correctly carry out a flame test on a solid. Generally the candidates that scored 1 mark did so for 'putting 'it' into flame' or putting a solid on a rod/loop/splint. Many held the solid OVER or under (?) a flame or just stated 'over a Bunsen'. There were few real attempts to describe the test accurately; the majority described using inappropriate equipment e.g. tongs, spatulas, tweezers, spoons, clamps. Very few mentioned the need to clean the wire loop before carrying the flame test.

(ii) Describe how a flame test is carried out on a solid.

(2)

a bunson burner is used/lit. Then with gloves and tongs you would pickup the solid and hover it over the flame and the colour should appear

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Examiner Comments

Incorrect equipment (tongs) as well as 'hover it over the flame' do not attract marks for carrying out the flame test. 0 marks awarded here.

(ii) Describe how a flame test is carried out on a solid.

(2)

you put a chosen solid in the blue flame and see what colour the flame goes above the solid

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Examiner Comments

1 mark was given for putting the solid into a blue (Bunsen) flame.

(ii) Describe how a flame test is carried out on a solid.

(2)

you dip a piece of water into your solid, then place the wire in the hottest part of the Bunsen Burner and watch the colour

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Examiner Comments

If only the candidate could re-read their answer! Unfortunately similar errors were often seen in answers to this question.

(ii) Describe how a flame test is carried out on a solid.

(2)

by using a metal flame [redacted] loop. you dip it in acid. You then pick up the solid on the flame loop. You then put the flame loop into the bunsen burner flame and record the colour seen.

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Examiner Comments

An answer like this was rarely seen. This was very pleasing to see and 2 marks were given for this answer.

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Examiner Tip

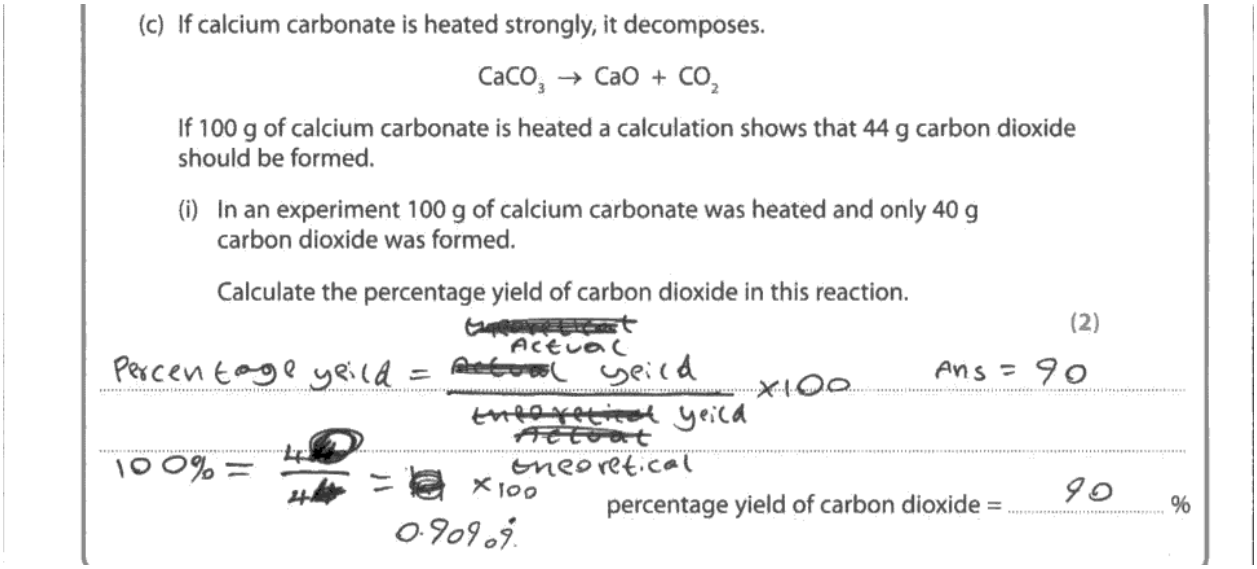
The three steps involved in a flame test are:

1. Clean the flame testing rod with hydrochloric acid.
2. Dip the rod into the acid and then into the solid being tested.
3. Put the end of the testing rod into a Bunsen flame with the air hole half open.

Learn the steps involved to carry out a flame test and the colours that are obtained for the ions Na^+, K^+, Ca^{2+} and Cu^{2+}.

Question 4 (c) (i)

It was clear that most candidates did not know how to calculate the percentage yield as very few candidates obtained the correct answer, however some achieved only one mark because their answer was approximated to 90% from 90.91%. Some had the ratio of mass inverted and obtained an answer of 110% without thinking about the implication. Other incorrect answers were seen using various mathematical processes involving the numbers 40, 44 and 100. The answer of 100 – 40 = 60% was commonly seen.



(c) If calcium carbonate is heated strongly, it decomposes.

$$CaCO_3 \rightarrow CaO + CO_2$$

If 100 g of calcium carbonate is heated a calculation shows that 44 g carbon dioxide should be formed.

(i) In an experiment 100 g of calcium carbonate was heated and only 40 g carbon dioxide was formed.

Calculate the percentage yield of carbon dioxide in this reaction.

(2)

Percentage yield = Actual yield / theoretical yield × 100 Ans = 90

100% = 40/44 = 0.909 × 100

0.909 09.

percentage yield of carbon dioxide = 90 %

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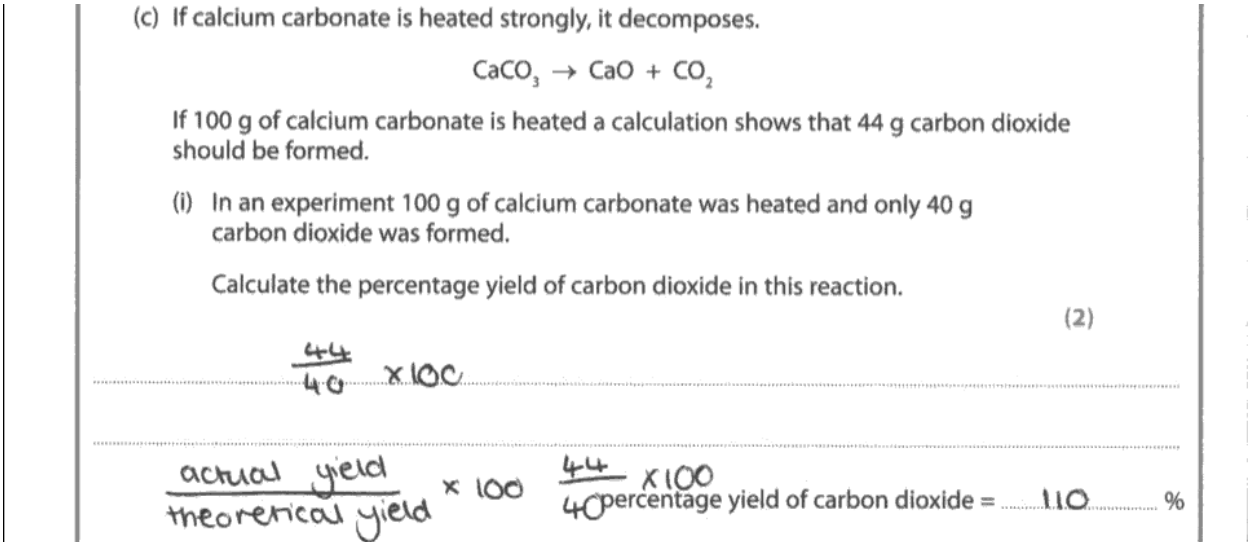
Examiner Comments

A correctly calculated percentage yield. Sadly the candidate then approximated the answer to 90 rather than 91% and so only 1 mark could be given for this.



(c) If calcium carbonate is heated strongly, it decomposes.

$$CaCO_3 \rightarrow CaO + CO_2$$

If 100 g of calcium carbonate is heated a calculation shows that 44 g carbon dioxide should be formed.

(i) In an experiment 100 g of calcium carbonate was heated and only 40 g carbon dioxide was formed.

Calculate the percentage yield of carbon dioxide in this reaction.

(2)

44/40 × 100

actual yield / theoretical yield × 100 44/40 × 100

percentage yield of carbon dioxide = 110 %

ResultsPlus
Examiner Comments

Candidates who had the ratio inverted didn't stop to think about the consequence of their answer. Here, 1 error had been made - the inverted ratio - so 1 mark was awarded in these instances.

(c) If calcium carbonate is heated strongly, it decomposes.

$$CaCO_3 \rightarrow CaO + CO_2$$

If 100 g of calcium carbonate is heated a calculation shows that 44 g carbon dioxide should be formed.

(i) In an experiment 100 g of calcium carbonate was heated and only 40 g carbon dioxide was formed.

Calculate the percentage yield of carbon dioxide in this reaction.

(2)

100g − 40g = 60g

percentage yield of carbon dioxide = 60 %

ResultsPlus
Examiner Comments

This answer (or that which showed 100 - 44 = 56) was often seen, showing that the candidate did not understand how to calculated the percentage yield of a product. 0 marks were awarded.

ResultsPlus
Examiner Tip

Know that percentage yield = (actual yield) x 100 / (theoretical yield), and that this value will always be less than 100%. If you have obtained an answer greater than 100, check your calculation to see where you have made an error.

Question 4 (c) (ii)

This question was fairly open in terms of the possible responses as shown by the command word 'suggest' in the question. However, to account for a difference between theoretical and actual yields, self-deprecating possibilities such as 'human error', 'spillage', 'anomalies', 'not weighed out accurately', 'wrong equipment' and 'gas escaping' were often cited but would not gain credit and candidates should be advised of this. Some referred to calculation only being a prediction and actual yields were always wrong. Some offered the vague term 'not heated properly'. There was also some confusion with incomplete combustion, as some stated 'there was not enough oxygen being present for a reaction'.

However, almost a quarter of candidates cited a correct reason here and referred to 'not heating it for long enough', 'the reaction not being complete', 'the flame not being hot enough' or 'the calcium carbonate contained impurities'.

(ii) Suggest a reason why only 40 g of carbon dioxide was formed in the experiment.

(1)

Some of the carbon dioxide could have been lost during the experiment.

ResultsPlus
Examiner Comments

The candidate had not thought about what was happening during the reaction. All the carbon dioxide was being lost during the reaction. This answer scored 0.

(ii) Suggest a reason why only 40 g of carbon dioxide was formed in the experiment.

(1)

Some of the reactants or product may have been lost during the experiment trough spillages or when transfering liquids to different beakers

ResultsPlus
Examiner Comments

The candidate had not thought through the process. A solid was being heated to form another solid with the loss of a gas, so loss of transferring liquids could not possibly happen in this situation. 0 marks given.

(ii) Suggest a reason why only 40 g of carbon dioxide was formed in the experiment.

(1)

The experiment might not have been done properly it might have been left long enough ~~too~~ long which meant some didnt decompose

ResultsPlus
Examiner Comments

Although not phrased very well to start with, 'might not have been done properly' was ignored and the second part of the answer was very good and scored the 1 mark.

ResultsPlus
Examiner Tip

To account for yield being less than 100%, there are three main reasons:

a) Incomplete reaction - not all reactants used up.

b) Product lost during the reaction - usually when transferring liquids from one container to another.

c) Other unwanted reactions - usually to make a different product.

Think about the reaction when applying these ideas.

Question 5 (a) (i)

It was clear where candidates had been given practice in working out the formula of ionic compounds from the ions present. About half of the candidates achieved the correct formula; many of those who did not score left it blank presumably because they did not know what to do. Errors seen included multiplying the symbols of the elements by the magnitude of the charge in some way, for example Ba_2SO_4 and $Ba_2S_2O_8$. Also penalised was not giving the 4 as a subscript as in BaSO4.

Question 5 (a) (ii)

There were some good and valiant attempts at this, but many poor attempts were seen. The majority of candidates missed the point about atoms having lost or gained electrons. There was much confusion with metals and alloy-type descriptions. In addition, many described loss / gain of electrons but lost the mark by putting the answer in terms of 'an element that loses/gains electrons'.

(ii) Give the meaning of the term **ion**.

(1)

Where an atom either loses or gains an atom in the outer shell

ResultsPlus
Examiner Comments

A careless mistake has cost this candidate the mark. This answer was given 0 marks.

(ii) Give the meaning of the term **ion**.

(1)

a compound which has a high boiling and melting point and conducts electricity

ResultsPlus
Examiner Comments

It looks like this candidate was trying to describe an ionic compound rather than an ion. 0 marks given.

(ii) Give the meaning of the term **ion**.

(1)

A Ion is when ~~he loses~~ an elements loses or gains ~~atte~~ electrons to become charged.

ResultsPlus
Examiner Comments

Another careless mistake has cost this candidate the mark. The answer had to be in terms of an atom losing or gaining electrons. 0 marks given.

ResultsPlus
Examiner Tip

Know how ions are formed and know how to use the formulae of ions to be able to work out the formula of an ionic compound.

Question 5 (b)

There was a pleasing number of 2-mark responses for this stage of the examination paper; the biggest fault lay with the candidates not explaining 'insoluble' and just repeating that part of the question in their answer, for which there was no mark. This question was a good discriminator as it allowed the more able candidates an opportunity to compile a set of linked points. The majority of those that did score a mark here was for indicating that the barium sulfate could not be absorbed into the blood system.

Some candidates tried the argument concerning the percentage of water in our bodies: "about 70-80% water in our bodies and as there's so much it won't be harmful". There was occasional reference made to it reacting with stomach acid and/or being neutralised therefore not harmful or barium sulfate dissolving into water and becoming safe.

Explain why it is safe for the patient to have barium sulfate in his body.

(2)

Because barium sulfate is insoluble in water the body cannot absorb it so it passes straight through causing no harm.

ResultsPlus
Examiner Comments

This was a good answer and scored two marks: for the body not able to absorb the barium sulfate and that it passed straight through causing no harm. The first line would not have attracted a mark by itself as this was a repeat of the question.

Explain why it is safe for the patient to have barium sulfate in his body.

(2)

The body does not digest the barium - it passes straight through the body.

ResultsPlus
Examiner Comments

1 mark for stating that the barium sulfate passes straight through the body.

Explain why it is safe for the patient to have barium sulfate in his body.

(2)

It is ~~not~~ ~~so~~ insoluble in water, so it will not be taken into the bloodstream where its toxins could take effect.

ResultsPlus
Examiner Comments

No marks for the first line, but the second line scored a mark indicating that the barium sulfate would not be taken into the blood stream. The majority of the answers that scored on this question were similar to this.

ResultsPlus
Examiner Tip

Explanations usually carry two marks, but sometimes three. So 2 linked points need to be made when answering questions of this type.

Rewriting part of the question does not gain credit. Take care to use scientific terminology in a correct context.

Question 5 (c)

The response to this 6-mark was very disappointing. Over half the candidates could not score a single mark, with the majority of the weaker candidates leaving a blank space. Only a quarter of the candidates produced a level 1 response. Confined to the more able candidates on this paper, very few produced a level 2 answer and a similar number giving a level 3 answer.

A level 1 answer involved making solutions of the reactants and mixing the solutions. Of those that recognised the starting materials were solids, many wanted to dissolve them in hydrochloric acid. For this step we were not sure why this was needed. Many candidates also thought the reactants needed to be heated and melted, rather than simply dissolved in water, before mixing.

A level 2 answer developed this a little further by filtering off the precipitate. Candidates' explanations of filtration and drying were generally good if unsupported by a wider grasp of practical chemistry. A level 3 answer required the idea of drying the precipitate, hopefully having washed it with water before drying.

*(c) Barium sulfate is prepared by reacting barium chloride with sodium sulfate. The barium sulfate is formed as a precipitate.

Describe an experiment to prepare a pure, dry sample of barium sulfate, starting with barium chloride crystals and sodium sulfate crystals.

(6)

Barium chloride and sodium sulfate are both soluble. When two soluble compounds join a precipitate is formed. To prepare a pure, dry sample of barium sulfate you can put the barium chloride crystals and the sodium sulfate crystals in dilute water and they will dissolve because they are soluble. You can then put some filter paper over a funnel and pour the mixture on to the filter paper. The liquid will sink through the filter paper. However, some will sit on the filter paper and a pure dry sample of barium sulfate will have formed.

ResultsPlus
Examiner Comments

This was judged to be a level 2 answer. The candidate had indicated how the precipitate of barium sulfate could be made, but lacked detail. The precipitate was then filtered to obtain a 'pure dry sample', but the washing and drying parts of the process were not detailed. Overall a good answer at this level and 4 marks were given to this answer.

*(c) Barium sulfate is prepared by reacting barium chloride with sodium sulfate. The barium sulfate is formed as a precipitate.

Describe an experiment to prepare a pure, dry sample of barium sulfate, starting with barium chloride crystals and sodium sulfate crystals.

(6)

put barium chloride into a test tube, and fill it with distilled water. Make sure it's dissolved by giving the test tube a shake. Do the same again, this time with sodium sulfate, and give it a shake again. Pour the contents of the two test tubes into a beaker and mix. Put the ~~funnel~~ filter paper into the funnel, and pour the contents of the beaker into the centre of the filter paper. Mix round the filter paper, so all the liquid's gone through. Then scrap the crystals onto a fresh piece of filter paper, and leave to dry.

ResultsPlus

Examiner Comments

A level 3 answer. This was considered to be a very good answer at this level. It contained the principles of making the solutions, mixing to form the precipitate, filtering and drying the product. Not a perfect answer as the washing process was not present, but a level 3 answer does not have to be perfectly correct answer. There was sufficient for 6 marks to be given.

*(c) Barium sulfate is prepared by reacting barium chloride with sodium sulfate. The barium sulfate is formed as a precipitate.

Describe an experiment to prepare a pure, dry sample of barium sulfate, starting with barium chloride crystals and sodium sulfate crystals.

(6)

Dilute the crystals and mix together the barium chloride and sodium in to either an acidic solution or water, mix well. Then filter the substance formed through a filter paper by using a funnel. Once left with the barium sulphate dry the substance with a paper towel taking out the water creating a dry sample of barium sulphate.

ResultsPlus
Examiner Comments

Again another level 3 answer. This is not a perfect answer but still has sufficient detail of the steps involved to create a sample of the product. 6 marks were awarded here.

*(c) Barium sulfate is prepared by reacting barium chloride with sodium sulfate. The barium sulfate is formed as a precipitate.

Describe an experiment to prepare a pure, dry sample of barium sulfate, starting with barium chloride crystals and sodium sulfate crystals.

(6)

put the barium sulfate in a test tube, add some hydrochloric acid and mix them together, then drain off the acid.

ResultsPlus
Examiner Comments

Many answer to this question included the idea of mixing either or both of the reactants with hydrochloric acid, but this step was not explained by the candidates. There was nothing in this answer to credit and so it scored 0 marks.

ResultsPlus
Examiner Tip

Practice answering the 6-mark questions. To achieve good marks on these questions there has to be a reasonably detailed description or explanation that the question is requiring. Avoid rewriting the question; there is no credit for this.

Question 5 (d)

Several candidates were able to interpret the information correctly and produce a correctly balanced equation. The commonest error was found to be that chlorine was not recognised as a diatomic molecule so giving 2Cl on left hand side; the resultant equation scored one mark. Balanced equations of this type will be tested on the F-tier paper where a simple ratio exists between the reactants and or products. The weaker candidates attempted a word equation, which did not score. Other errors included incorrect symbols such as 'BA', 'ba' and 'CL', but they were not present in significant numbers.

Other errors found included incorrect balancing which limited them to 1 mark. Other ways in which a mark could be scored and were seen included '$2Ba + 2Cl \rightarrow 2BaCl_2$ ',

'$Ba^{2+} + Cl^- \rightarrow BaCl_2$'. Some correctly gave $BaCl_2$ or $Ba + Cl_2$ but didn't draw an arrow to show where in the equation these appeared and so could not be credited.

(d) Barium reacts with chlorine to produce barium chloride, $BaCl_2$.

Write the balanced equation for this reaction.

(2)

$Ba_2 + Cl_2 \rightarrow BaCl_2$

ResultsPlus
Examiner Comments

The Ba_2 did not score, so 1 mark was given for the correct right hand side of the equation.

(d) Barium reacts with chlorine to produce barium chloride, $BaCl_2$.

Write the balanced equation for this reaction.

(2)

~~Barium~~ $2Ba + Cl_2 \rightarrow BaCl_2$

ResultsPlus
Examiner Comments

Correct formulae on both sides of the equation was spoilt by incorrect balancing of the equation. Only 1 mark was given.

(d) Barium reacts with chlorine to produce barium chloride, $BaCl_2$.

Write the balanced equation for this reaction.

(2)

Barium + Chlorine$_2$ → Barium Chloride$_2$

ResultsPlus
Examiner Comments

Word equations do not score when asked for balanced equations.

(d) Barium reacts with chlorine to produce barium chloride, $BaCl_2$.

Write the balanced equation for this reaction.

(2)

Ba + 2Cl → Ø: $BaCl_2$

ResultsPlus
Examiner Comments

This was probably the most frequent of the errors seen. These candidates had not realised that the formula of chlorine gas is Cl_2. 1 mark was awarded.

ResultsPlus
Examiner Tip

Use the information given when constructing balanced equations. You will be expected to know the formulae of simple compounds you have met in the course, for example, sodium hydroxide, water etc., and you should also know the formulae of the gaseous elements such as hydrogen (H_2), oxygen (O_2) and that they all have 2 atoms in one molecule.

Spend time making sure you can balance simple equations.

Question 6 (a) (i)

This question was generally answered well and scoring the mark. Unfortunately, several candidates were giving two or sometimes three HAZCHEM descriptors or contradictions that meant the mark could not be awarded. More worrying were answers of the type 'Sodium hydroxide is an acid….'.

Reactions

6 (a) A technician made some dilute sodium hydroxide solution by carefully adding some solid sodium hydroxide to pure water.

This is the hazard symbol on a bottle of solid sodium hydroxide.

(i) State what this symbol shows about sodium hydroxide.

(1)

toxic - it can burn through anything (~~arrove~~ arroding)

ResultsPlus
Examiner Comments

Many candidates were mixing the descriptions for the hazard symbols. 0 mark was given for the answer 'toxic'.

(i) State what this symbol shows about sodium hydroxide.

(1)

it is harmful / corrosive highly acidic

ResultsPlus
Examiner Comments

Several candidates were hedging their bets by giving alternative answers. Candidates should be deterred from this as an incorrect alternative will negate the mark as in this case. 0 mark given.

ResultsPlus
Examiner Tip

Know the meanings of the hazard symbols.

Avoid giving alternative answers as in this example as an incorrect answer will negate the mark.

Question 6 (b)

Of the candidates who scored a mark on this question, the overwhelming majority was for stating that a catalyst speeds up a reaction. However the second point about it not being used up or changed during the reaction was only scored by a minority of the candidates. Many candidates made at an attempt at the second point but stated something similar to 'not involved/does not take part' in the reaction, despite saying it speeded up the reaction. A few of the most able on this paper did write about lowering activation energy, which gained credit, but is not a requirement of this specification.

The weaker candidates where they did attempt this question were making reference to catalytic convertors on vehicles.

(b) A catalyst is added to some reactions.

Explain the meaning of **catalyst**.

(2)

A catalyst is a substance that either slows down or speeds up the reaction.

ResultsPlus
Examiner Comments

At this level we consider catalysts as increasing the speed of a reaction. This answer contradicts itself, perhaps by the candidate not being completely sure, so does not score the mark.

(b) A catalyst is added to some reactions.

Explain the meaning of **catalyst**.

(2)

This speeds up a chemical reaction, so if you react two chemicals and the reaction is slow you add a catalyst to speed it up.

ResultsPlus
Examiner Comments

The same point is being made twice here, so only 1 mark was awarded.

(b) A catalyst is added to some reactions.

Explain the meaning of **catalyst**.

(2)

A catalyst is something thats added to a chemical reaction to speed it up. But it doesn't take place in the reaction.

ResultsPlus
Examiner Comments

This was given 1 mark for the first sentence in the answer; however, the second sentence was frequently seen and gained no credit.

ResultsPlus
Examiner Tip

Know the factors that can increase the rate of a chemical reaction and be able to explain how changing that factor causes the increase in the reaction rate.

Question 6 (c)

There was much confusion over size of calcium carbonate pieces and its surface area; many stated that large had a large surface area, small pieces a small surface area. The majority of the candidates repeated the data in the question and consequently narrowed down their possible score to one by stating that 'the smaller the pieces the faster the reaction'. There were some really elegant one sentence responses scoring both marks, but they were sadly, few and far between.

Describe what this shows about the effect of the surface area of calcium carbonate on the rate of this reaction.

(2)

The smaller the size of calcium carbonate pieces used, the bigger the volume of carbon dioxide released in five minutes.

ResultsPlus
Examiner Comments

This answer merely summarised the table of information in the question and scored 0 marks.

Describe what this shows about the effect of the surface area of calcium carbonate on the rate of this reaction.

(2)

the longer the surfuace are the less carbon dioxide releases the smaller the surface of calcium carbonate use the the higher the volume of carbon dioxide releasered.

ResultsPlus
Examiner Comments

This is where a candidate has confused particle size with its surface area. In addition, the second half of this answer is the reverse argument of the first half. Many candidates fell into this situation of incorrectly linking large particle size with large surface as well as repeated their answer with the reverse argument as demonstrated here.

ResultsPlus
Examiner Tip

If you take a large lump of solid and start to break it up into smaller pieces, the total surface of the smaller pieces is greater than that of the large lump. This means there is more surface over which reactions can occur and so the reaction is faster.

Remember: the smaller the pieces - the larger the surface area - the faster the reaction.

Question 6 (d)

As with the other 6-mark question, the response to this was equally disappointing. The weakest candidates largely left this unanswered. About a quarter of the candidates achieved a level 1 answer by a very simple description of adding pieces of magnesium to different concentrations of hydrochloric acid in a suitable container. Some candidates developed this idea to describe how to make or record observations or what conclusions could be drawn. However, few candidates secured level 3, due to the absence of a solid description of a workable method.

Often where no marks were scored the response was couched in general terms and collision theory, not addressing the point of 'tell me how you would do it'. Many candidates wasted lots of lines by repeating the question. Where candidates were more successful, many different methods used to collect the hydrogen gas were seen – some mentioned filling inverted test tubes in water, others mentioned collecting it in a balloon.

*(d) Hydrochloric acid reacts with magnesium metal to produce hydrogen gas.

magnesium + hydrochloric acid → magnesium chloride + hydrogen

Describe how you could use magnesium ribbon and a solution of hydrochloric acid to show that decreasing the concentration of the hydrochloric acid changes the rate of this reaction.

(6)

The higher the concentration of acid, the quicker the rate of the reaction will be. If you have 5 test tubes all with a piece of magnesium ribbon in and put the same amount of hydrochloric acid in each test tube, however each test tube has a different amount of concentration. For example ~~amount~~ 0m, 0.25m, 0.5m, 0.75m and 1m then you could witness the speed in which it takes, using a stopwatch, for the reaction between hydrochloric acid and magnesium metal to produce hydrogen gas. Also conecting the ~~gas~~ test tubes using a delivery tube to the gas cyclinder measuring how much hydrogen gas is produced in a set amount of time.

ResultsPlus

Examiner Comments

This was judged to be a level 3 answer. This answer could be read and understood as to how to go about finding out how decreasing the concentration of hydrochloric acid changes the rate of reaction. However, there were several spelling and grammar errors which meant that this answer scored 5 marks.

- As you change the concentration of acid the rate of reaction will change due to the collision theory.
- The higher the concentration the quicker the reaction as there will be more collisions meaning the magnesium and hydrochloric acid will react together quicker.
- The magnesium ribbon could be used as a way of identifying the rate this reaction has taken place.

ResultsPlus
Examiner Comments

Many candidates did not answer the question of how this reaction could be carried out to show that decreasing the concentration changed the rate of reaction. This candidate did give a valid conclusion which was judged to be a level 1 answer with a mark of 1.

By adding the magnesium ribbon into the solution of hydrochloric acid can show the reaction between the two by doing this repeatedly with different concentrations of hydrochloric acid will show the decomposing of the magnesium. Therefore showing the reaction between the two. Recording the time of reaction and stages of reaction will help determine whether different concentrations of hydrochloric acid changes

the rate of reaction with the magnesium ribbon.

ResultsPlus
Examiner Comments

This answer was judged to be level 2. However it lacked the detail needed for level 3 and was awarded 4 marks.

Magnesium ribbon is not as strong as normal magnesium this will cause the reaction to slow down. The reason for this is because the concentration of the acid wont be very high. The rate of reaction will rapidly change because of this! The reaction will still be the same as if you where using normal magnesium but just this reaction will be slower. you will be able to see the reaction more.

ResultsPlus
Examiner Comments

Several candidates were well off the mark when it came to answering this question. This was an example of where a candidate was probably unsure as to what magnesium ribbon was. Another candidate could only give the response 'I don't know what magnesium ribbon is so I can't answer the question.' This answer really did not answer the question at all and was given 0 marks.

ResultsPlus
Examiner Tip

Practice answering the 6-mark questions. Read the question carefully and use the information to help you put together your ideas and then write out your answer.

Paper Summary

As part of preparation for the June 2014 examination paper, there are four papers available. Candidates would benefit greatly by using the past papers as preparation for the GCSE examination. In particular, candidates should focus their attention on those questions that involve describing experiments as well as the 6-mark questions. Success here will be reflected in the grade achieved for the examination paper.

From this paper, candidates should aim to;

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

Grade Boundaries

Grade boundaries for this, and all other papers, can be found on the website on this link:

http://www.edexcel.com/iwantto/Pages/grade-boundaries.aspx

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