Pearson Edexcel

Examiners' Report
June 2018

GCSE Science 1SC0 1CH

ResultsPlus

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk.

Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

ResultsPlus

Giving you insight to inform next steps

ResultsPlus is Pearson's free online service giving instant and detailed analysis of your students' exam results.

- See students' scores for every exam question.
- Understand how your students' performance compares with class and national averages.
- Identify potential topics, skills and types of question where students may need to develop their learning further.

For more information on ResultsPlus, or to log in, visit www.edexcel.com/resultsplus.
Your exams officer will be able to set up your ResultsPlus account in minutes via Edexcel Online.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk.

June 2018
Publications Code 1SC0_1CH_1806_ER

Introduction

This paper was the first of this series for the new Combined Science Chemistry Higher tier, graded 9-1. It consisted of six questions, giving a total of 60 marks. These questions also appear in the separate Chemistry Higher tier paper.

This paper also has questions in common with the Foundation papers, totalling 16 marks. These overlap items are the whole of question 1 and the first four items of question 2.

The paper made use of a variety of question types suitable for candidates at this level; multiple choice, calculations and short answer questions being the frequent types. The paper contained only one extended open response question (6-marks), but 4-mark questions will feature more prominently in future papers. As with the other Chemistry papers, a minimum of 20% of the marks were for maths, a minimum of 15% for testing practical skills and a maximum of 15% on knowledge in isolation (recall) questions.

Candidates that did well were able to apply their scientific knowledge, to understand the core practicals, to use scientific terminology and correctly balance equations.

Those candidates who performed less well often did so as they had not read the question carefully which let them down. The level of knowledge in some areas of this specification was low. Whilst some candidates could explain some areas of the chemistry required, their response was not always directed to the question being asked or simply repeated the stem of the question.

Question 1 (a) (i)

Generally well answered with many candidates scoring both marks for the test and result of that test.

Those candidates who did not score well, consistently made the same errors including simply stating 'squeaky pop test' with no description offered of the test or expected result.

There were some candidates who started their answer by describing how hydrogen is made and some candidates suggested using a matchstick rather than a splint but, on those occasions, they failed to say that the match should be lit.

The occasional few responses described incorrect tests, often involving litmus paper and lime water.

Candidates should be taught that for every test, two components are required: what you do and what you observe for a positive result. Some responses failed to mention the use of a lit splint or mentioned glowing splint confusing the test with that for oxygen and so gained no credit.

1 (a) Salts of metals can be prepared by reacting the metal with an acid to produce the salt and hydrogen.

(i) Describe the test to show the gas is hydrogen.

(2)

The Sqeky pop test, on by putting water in a test tube and heating it and wating for a result to occur

ResultsPlus
Examiner Comments

The mention of the use of the 'squeaky pop test' is not creditworthy. There is no mention of the use of a lighted splint, so this does not score the first mark. The second mark is dependent on the first so also cannot be scored.

ResultsPlus
Examiner Tip

Learn the test and the result of the test for the common gases in the specification.

1 (a) Salts of metals can be prepared by reacting the metal with an acid to produce the salt and hydrogen.

(i) Describe the test to show the gas is hydrogen.

(2)

This is the squeaky pop test. Place a lit splint over a solution, and if it makes a 'pop' - like sound then it contains hydrogen.

ResultsPlus
Examiner Comments

A typical correct response worth 2 marks. Placing the lit splint 'over the solution' is just good enough for the first mark. The 'pop-like sound' scores the second mark.

Question 1 (a) (ii)

Generally well answered with most candidates gaining both marks available.

A few candidates mentioned that electrons had been lost but did not specify the number of electrons lost. Consequently, just 1 mark was scored.

Most candidates understood the link between the charge on an ion and the number of electrons lost and so most achieved 2 marks on this. Less successful learners suggested that positive charges are added to the atom**.** Often very full answers were given: explaining the number of protons now two greater than the number of electrons and also that the metal has been oxidised, needing to lose 2 electrons to become a stable ion.

Of those candidates who did not score 2 marks, they tended to incorrectly state that nickel gained two electrons. They were then able to access mark for the reference to 'two electrons'.

It was pleasing to note that only a very small number of candidates incorrectly referred to a loss or gain of protons or neutrons. Other misconceptions highlighted by examiners included: 'two positive protons added'; 'gained two positive electrons'; $Ni^{2+} + 2e^{-}$ Ni (in effect, so near, and yet so far, to scoring); 'two neutrons added forming two extra covalent bonds'.

Advice to students: remember to say, not just 'loses electrons' but to specify how many electrons are lost.

(ii) Nickel is a metal.

Explain how the structure of a nickel atom, Ni, changes when it forms a nickel ion, Ni^{2+}.

(2)

It has 2 electrons on it's outer most shell, so that when it ionises it has to lose these electrons in order for it to react making it 2+

ResultsPlus
Examiner Comments

A typical fully correct response. The correct reference to the loss of two electrons, scored both marking points in this response.

(ii) Nickel is a metal.

Explain how the structure of a nickel atom, Ni, changes when it forms a nickel ion, Ni^{2+}.

(2)

the outer shell will loose one electron due to it being an ion, and form together.

ResultsPlus
Examiner Comments

The answer correctly states that electrons are lost (1 mark) but the wrong number of electrons loses the second marking point. The reference to 'due to it being an ion' can be ignored.

ResultsPlus
Examiner Tip

When describing the formation of specific ions, remember to specify the number electons lost or gained.

Question 1 (b)

Although many candidates were able to gain the 2 marks available for correctly calculating the concentration, the majority of responses only scored 1 mark, since they had not converted the volume from cm^3 into dm^3, frequently obtaining 0.094, rather than the correct 94, as an answer.

Another common error was to invert the fraction - this scored no credit.

(b) A nickel sulfate solution is made by dissolving 23.5 g of nickel sulfate to make 250 cm^3 of solution.

Calculate the concentration of the solution in g dm^{-3}.

(2)

concentration = $\frac{\text{mass (g)}}{\text{volume (dm}^3\text{)}}$ 1000 cm^3 = 1 dm^3

250 cm^3 = 0.25 dm^3

$= \frac{23.5}{0.25} = 94 \text{ g dm}^{-3}$

concentration = 94 g dm^{-3}

ResultsPlus
Examiner Comments

A very good example of a fully correct response. The candidate has clearly shown all the steps required to obtain the correct response: converting the volume from cm^3 into dm^3, followed by the correct calculation for the concentration.

(b) A nickel sulfate solution is made by dissolving 23.5 g of nickel sulfate to make $250\ cm^3$ of solution.

Calculate the concentration of the solution in $g\ dm^{-3}$.

(2)

$\frac{23.5}{250} = 0.094\ g\ dm^{-3}$

concentration = 0.094 $g\ dm^{-3}$

ResultsPlus
Examiner Comments

A typical response which scored only 1 of the 2 available marks. The candidate has not converted the volume into the correct units. However, 1 mark was scored for 0.094, for dividing the mass by volume.

ResultsPlus
Examiner Tip

The calculation of concentrations is commonly asked for in chemistry - remember to convert volumes to the correct units, by checking the units required in the question.

Question 1 (c)

Many candidates were able to score only 1 or 2 of the 3 marks available for a description of this basic practical.

In some cases, candidates started by describing an alternative method of making the nickel sulfate solution and therefore scored a maximum of 1 mark.

Many responses simply did not mention ‘filtration’ as the first stage, restricting the score to 2 marks.

Other responses referred to filtering, but incorrectly thought that this would filter out nickel sulfate crystals, perhaps confusing this procedure with that for making insoluble salts.

Very few candidates referred to a means of drying the crystals. It would appear that in practical lessons, that after the reduction of the volume of the solution, the solution is left on the side to evaporate until next lesson and so the students may not have seen or had the drying part emphasised.

(c) Excess solid nickel carbonate is added to dilute sulfuric acid in a beaker.

nickel carbonate + sulfuric acid → nickel sulfate + carbon dioxide + water

Nickel sulfate is formed in solution.

Describe how a sample of pure, dry nickel sulfate crystals can be obtained from the mixture of nickel sulfate solution and excess solid nickel carbonate in the beaker.

salt soluble

(3)

The excess solid nickel carbonate is added to the ~~added~~ acid with nickel sulfate solution so all of the acid reacts once all of the acid reacts it is filltered to remove leftover solid. Then evaporated slowly to remove liquid, then left to dry out and crystalise.

ResultsPlus

Examiner Comments

This response scored 3 marks. The first three lines are a repeat of the stem of the question. There are correct references made to 'filtered' (1 mark), 'evaporated... to remove liquid' (1 mark) and 'left to dry... and crystallise' is the equivalent to the 4th marking point (1 mark).

(c) Excess solid nickel carbonate is added to dilute sulfuric acid in a beaker.

nickel carbonate + sulfuric acid → nickel sulfate + carbon dioxide + water

Nickel sulfate is formed in solution.

solid

Describe how a sample of pure, dry nickel sulfate crystals can be obtained from the mixture of nickel sulfate solution and excess solid nickel carbonate in the beaker.

liquid

(3)

By using crystalisation, you heat up the nickel sulfate solution, then wait for the ~~liquid~~ water to evaporate. After water is evaporated, there's only nickel sulfate. Then, you wait for it to dry and cool down, ~~[illegible]~~ the solution becomes crystals

(Total for Question 1 = 9 marks)

obtain solid from liquid

ResultsPlus
Examiner Comments

This is a typical response, which only scored 2 of the 3 marks available.

There are correct references to 'crystallisation' (1 mark); 'heat up... the solution' (1 mark), noting also that 'wait for the water to evaporate' is the same marking point. 'Cool down' is creditworthy, but 2 marks have already been scored. The omission of the filtering step, restricted this answer to 2 marks.

ResultsPlus
Examiner Tip

Read the question carefully when describing the steps required for the formation of soluble salts.

Question 2 (a) (ii)

Many candidates were only able to score 1 or 2 of the 3 marks available.

Many candidates simply calculated the formula mass of iron oxide for 1 mark only.

Other candidates calculated the number of moles, 1.5, leaving this as their final answer and were unable to calculate the mass.

Other common errors highlighted by examiners included: 160 x 240, 240/112, 240 – 160 and oddly 'Fe_2 = 56^2' and 'O_3 = 16^3'.

(ii) The formula of the iron oxide is Fe_2O_3.

Calculate the maximum mass of iron that can be obtained from 240 tonnes of iron oxide, Fe_2O_3.

(relative atomic masses: O = 16, Fe = 56)

(3)

~~16 x 2 = 32~~ 56 x 2 = 112

16 x 3 = 48

160

240 ÷ 160 = 1.5

112 x 1.5 = 168

mass of iron = 168 tonnes

ResultsPlus
Examiner Comments

This response is a good example of a fully correct response which scored 3 marks. There are several correct ways of obtaining the correct answer. In this case, the relative formula mass for Fe_2O_3 has been calculated, followed by the correct ratio of Fe_2O_3 as 1.5, in turn the mass of Fe formed has been correct calculated, recognising that 1 mole of Fe_2O_3 will form 2 moles of Fe.

(ii) The formula of the iron oxide is Fe_2O_3.

Calculate the maximum mass of iron that can be obtained from 240 tonnes of iron oxide, Fe_2O_3.

(relative atomic masses: O = 16, Fe = 56)

(3)

~~Fe₂ Fe₂O₃~~ Fe = 56 × 2 + O = 16 × 3 =

112 + 48

Fe = 56 × 1.5 = 84 160

$\frac{240}{160}$ = 1.5

mass of iron = ~~...~~ 84 tonnes

ResultsPlus
Examiner Comments

This response was typical of those seen that only scored 2 of the 3 marks available.

The relative formula mass of Fe_2O_3 has been calculated, followed by the correct ratio of Fe_2O_3. However, a final answer of 84 tonnes has been given, not the correct 168 tonnes, since the candidate has not recognised that 1 mole of Fe_2O_3 has twice the number of moles of Fe.

Question 2 (b)

This question was not well answered on the whole with few responses scoring the 2 marks available.

Most responses which scored 1 mark only, referred to 'aluminium being more reactive than carbon'. A significant majority of responses referred to aluminium being 'higher up the reactivity series' and oddly very few stated that carbon was less reactive than aluminium.

Very few candidates mentioned that aluminium cannot be reduced by carbon, *i.e.* they did not use the key word, reduced (or reduction). Some did comment about displacement which was sufficient, coupled with stating the position of aluminium on the reactivity series.

In commonly seen incorrect answers, a small minority had the reactivity the wrong way round or made irrelevant references to other properties such as melting points.

(b) Aluminium cannot be extracted by heating its oxide with carbon.
Aluminium has to be extracted from its oxide by electrolysis.

Explain why.

(2)

This is because Aluminion is highe in the reactivity series then carbon, so this means it's more reactive, so carbon is strong enough to displace Aluminium which means in the reaction nothing will happen.

ResultsPlus
Examiner Comments

This response only scored 1 of a possible 2 marks. The first marking point was scored only for 'aluminium is higher up the reactivity series than carbon'. However, the response mentions 'carbon is strong enough to displace aluminium' which is contradictory, so gained no further credit.

(b) Aluminium cannot be extracted by heating its oxide with carbon.
Aluminium has to be extracted from its oxide by electrolysis.

Explain why.

(2)

Aluminium is more reactive then carbon, and carbon ~~easy~~ can only carry out reduction on a metal if the metal is less reactive than the carbon - it's just like a displacement reaction.

ResultsPlus
Examiner Comments

A typically good response. Correct references to 'aluminium is more reactive than carbon' and 'carbon cannot reduce aluminium' scored both the marking points.

ResultsPlus
Examiner Tip

Learn the methods of extraction of the metals specified in the specification and be able to explain them in terms of there relative reactivities.

Question 2 (c)

This question was very well answered well on the whole with the majority of candidates being able to predict 'electrolysis' as the correct method of extraction of calcium from its ore. In some responses, candidates incorrectly referred to 'heating the ore with carbon' or 'neutralisation'.

Question 2 (d)

This question was not answered well on the whole, with a poor understanding of this section of the specification, namely phytoextraction as an alternative biological method of metal extraction.

Many candidates knew that the copper was absorbed but not what happened next or vice versa. Candidates often failed to score on the first marking point since they missed stating that the plants absorb the copper from the soil.

In responses which scored 1 mark only, the second marking point for stating ‘burning the plants’ was more commonly awarded.

In commonly seen incorrect answers: references to 'copper not being used in photosynthesis' were seen frequently; 'the roots of the plant dig up the copper'; 'the plant removes the nutrients from the soil leaving the copper behind'; 'the copper is collected by the plant'.

(d) In recent years, researchers have been investigating alternative methods of extracting metals from soils.

Researchers have found that growing certain plants in appropriate areas can result in the phytoextraction of copper.

Describe how growing plants can result in the phytoextraction of copper.

(2)

The plants are planted in soil that can contain copper compounds. The plants absorbs this from the soil. The plants are then removed from the soil and burned. The ashes then contain copper which is heated to remove from the ashes.

ResultsPlus
Examiner Comments

This response scored 1 mark only. There is an incorrect reference to copper compounds, rather than the correct copper ions, so the first marking point was not awarded. The correct reference to the 'plants... burned' scored on on the second marking point.

ResultsPlus
Examiner Tip

Make sure you can recall and evaluate the alternative biological methods of metal extraction, namely bacterial and phytoextraction.

(d) In recent years, researchers have been investigating alternative methods of extracting metals from soils.

Researchers have found that growing certain plants in appropriate areas can result in the phytoextraction of copper.

Describe how growing plants can result in the phytoextraction of copper.

(2)

The plants would take in all the copper from the soil when they grow after which you burn the plant and it leaves you with the copper

ResultsPlus
Examiner Comments

This response scored 2 marks, for correct references to ''take in ...copper from the soil' and 'burn the plant'.

Question 3 (b) (i)

Generally well answered with most students gaining both marks available.

The majority of responses correctly referred to the key processes, evaporating and condensing to score the 2 marks.

A number of candidates failed to differentiate between water and sea water, incorrectly stating that ‘sea water evaporates and condenses’ and often gained 1 mark only. Quite a large number of responses identified the process of evaporating but then did not go on to identify condensing.

Commonly seen incorrect responses referred to: the 'heat removes impurities'; the 'sea water travels along the tube and turns into pure water'; quite a few answers confused distillation and sterilisation, and referred to the heat being used 'to kill bacteria'.

(b) A student set up the apparatus shown in Figure 2 to obtain pure water from sea water by distillation.

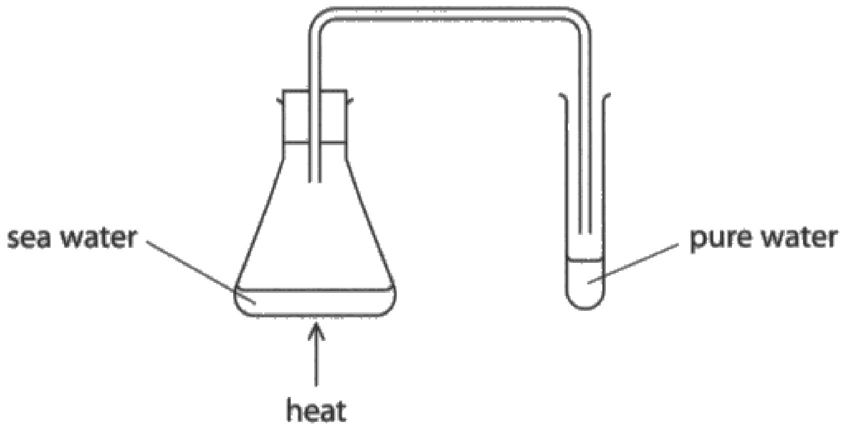


Figure 2

(i) Explain how the water in sea water separates to produce the pure water in this apparatus.

(2)

The water in the sea water evaporates first when heated as it has the lowest boiling point. The water vapour then travels through the tube and condenses to form pure water in the test tube.

ResultsPlus
Examiner Comments

A very good example of a fully correct response. There are correct references to 'water in the sea water evaporates when heated' and 'water vapour...condenses'.

(b) A student set up the apparatus shown in Figure 2 to obtain pure water from sea water by distillation.

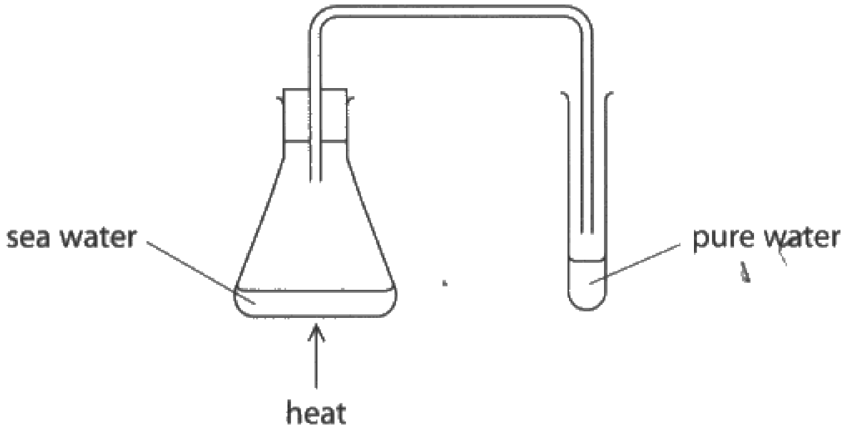


Figure 2

(i) Explain how the water in sea water separates to produce the pure water in this apparatus.

(2)

Sea water is salty and salt can't evaporate so when sea water is boild it evaporates and will travel up the tube where it cools and will condence into water and dip into the test tube leaving salt behind in the beaker

ResultsPlus
Examiner Comments

Although the processes referred to in this response are correct, namely 'evaporate' and 'condense', 'sea water...evaporates' is not correct. It is the water in the solution that evaporates. The stem of the question also clearly specifies what is required, namely 'how the water in sea water separates'.

ResultsPlus
Examiner Tip

Read the question carefully. When discussing distillation of aqueous solutions, such as sea water, remember to refer to 'water evaporating'.

Question 3 (b) (ii)

This question was poorly answered on the whole with few responses scoring any of the 2 marks available.

Some candidates understood the idea behind using a condenser or something to cool down the water vapour. Those who scored that point usually suggested that all the water vapour could be condensed or that none escaped.

Commonly seen incorrect responses referred to: 'higher heat'; 'use of a longer/wider/larger/diagonal tube'; 'bung on the tube'; 'add more sea water' or 'use a higher concentration of sea water'.

back into water.

(ii) **Explain how the apparatus could be improved to increase the amount of pure water collected from the same volume of sea water.**

(2)

By adding a condenser so that more steam can get turned back into pure water efficiently.

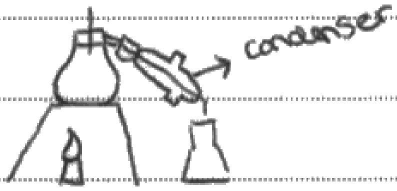
ResultsPlus
Examiner Comments

This response scored 2 marks. There are correct references to 'adding a condenser' and an explanation, 'more steam can get turned back into pure water efficiently' which implies an increase in the amount of condensation (from steam to water).

(ii) Explain how the apparatus could be improved to increase the amount of pure water collected from the same volume of sea water.

(2)

instead of a delivery tube you could use a condencer



ResultsPlus
Examiner Comments

This response only scored 1 mark. A correct improvement to the apparatus has been described and shown in a simple diagram. However, this improvement has not been explained.

ResultsPlus
Examiner Tip

Suggesting or explaining improvements to experiments are a common feature on the new specification. Read the question carefully, to make sure that you not only state an improvement but also that you explain how this improves the experiment.

Question 3 (c)

This question showed a wide variation in responses from the candidates, with very few scoring the maximum of 4 marks available.

Many candidates recognised that A-B was referring to a solid – but the wording for the structures of a solid was often poorly expressed. Many candidates referred to a regular arrangement or closely packed structure.

Most candidates scored 1 mark only, by reference to B-C, namely a solid turned to a liquid, or for the same marking point that the forces between the particles in a solid had to be broken down to become a liquid.

A lot of candidates incorrectly commented that C-D was the gas phase (one change of state). Some were able to score the mark for saying the particles moved more or had a more random arrangement. A common response here was that the particles had more energy, which is correct, but then did not suggest the results of this.

The overall common misconception here was that there were two changes of state occurring, namely from solid to liquid to gas. This was usually backed up with a clear understanding of the particle arrangement at each stage of the change. Candidates were clear in the arrangement of solid particles *i.e.* fixed positions, however not that they vibrated more when more energy was applied.

The higher achieving candidates could link energy use to bond breaking. However, this was only seen in about 5% of responses. A large proportion of responses simply described particle behaviour without referring to the graph.

(c) A substance is heated at a constant rate and its temperature is taken every minute. During the heating, the substance undergoes one change of state.

The results are shown on the graph in Figure 3.

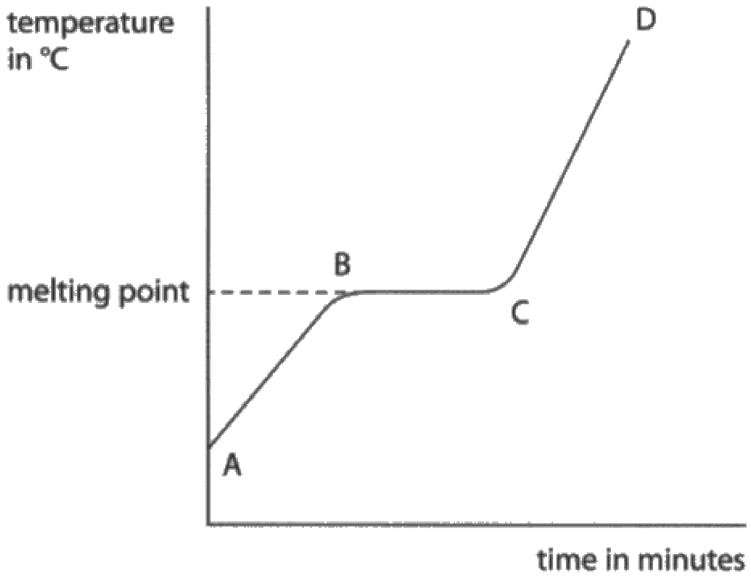


Figure 3

Explain the shape of the graph in terms of the changes in the movement and arrangement of the particles as the substance is heated.

(4)

from A-B the particles are gaining more Kenetic energy from heat so they are vibrating more. from B-C it is the changing of the state from a solid to a liquid, meaning the particle bonds are being broken. In a liquid they arent arranged as evenly as in a solid as some bonds are broken. from D-C the particals are gaining even more energy & are vibrating more.

ResultsPlus
Examiner Comments

This response scored only 2 of the 4 marks available. There are correct references to: 'particles...vibrating more' which scored 1 mark (related to A-B on the graph); 'changing...from solid to a liquid' scored 1 mark (related to B-C on the graph). It is worth noting that 'particle bonds being broken' is correct, but is the same marking point.

ResultsPlus
Examiner Tip

Describing changes of state is new to this specification. Make sure that not only can you describe the arrangement and movement of particles in the states of matter, but also that you are able to explain changes of state in terms of particles.

(c) A substance is heated at a constant rate and its temperature is taken every minute. During the heating, the substance undergoes one change of state.

The results are shown on the graph in Figure 3.

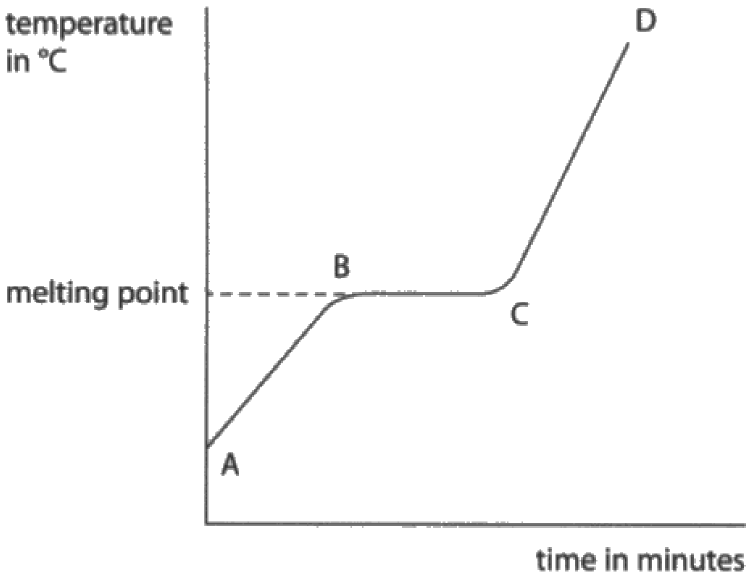


Figure 3

Explain the shape of the graph in terms of the changes in the movement and arrangement of the particles as the substance is heated.

(4)

The Substance was being heated ~~up~~ and the temperature was increasing until it reached the ~~boiling point~~ melting point. Then the temperature remained the same for a number of minutes, before finally increasing again.

As the Substance was heated, the particles began to slowly vibrate more and begin moving slowly. This then lead to the change of state.

ResultsPlus
Examiner Comments

This response scored 1 mark only. There is only one creditworthy point, namely 'particles... vibrate more when the solid is heated' (related to A-B on the graph).

(c) A substance is heated at a constant rate and its temperature is taken every minute. During the heating, the substance undergoes one change of state.

The results are shown on the graph in Figure 3.

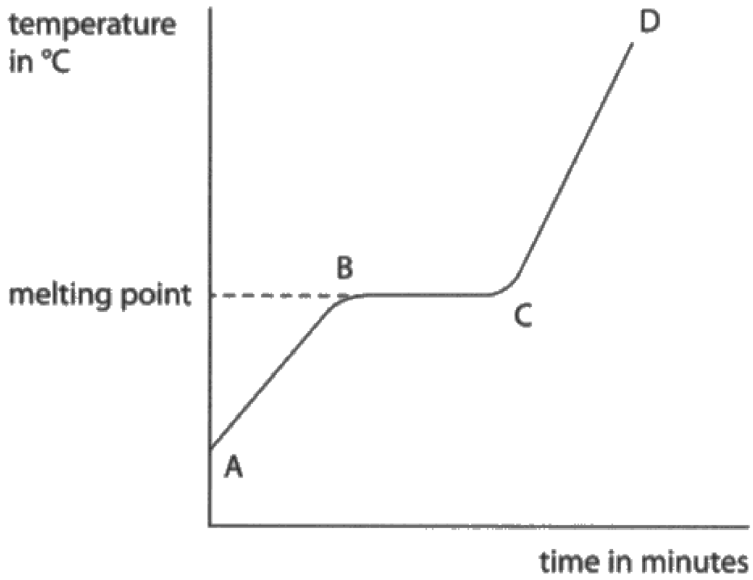


Figure 3

Explain the shape of the graph in terms of the changes in the movement and arrangement of the particles as the substance is heated.

(4)

At point A the substance is a solid it has regularly arranged particles which are in fixed positions and can vibrate but not move out of place. This solid is carried on heating and the particles gain more energy so they have the ability to move into a less regularly pattern and can move more fast. This is the liquid at point B because solid has now melted so the liquid particle remain in motion and still touch. This is the same at point C but the increase in temperature now means particles have more heat energy and are starting to move more rapidly in a much more random order. The heating continues and eventually at point D the particles may start to separate and start collide and moving extremely quickly.

(Total for Question 3 = 9 marks)

ResultsPlus
Examiner Comments

This response scored all 4 marks available. The changes occurring in all three sections of the graph (heating of the solid, melting of the solid and heating of the liquid) have been described in detail by reference to the arrangement and movement of particles.

Question 4 (b) (i)

Generally well answered with most candidates gaining at least 1 of the 2 marks available.

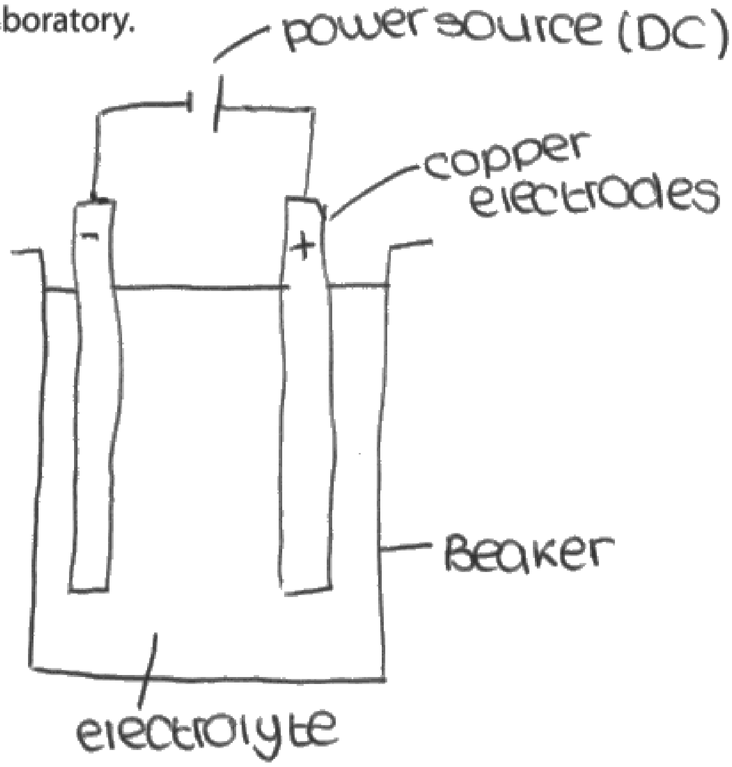
It was also noted by examiners that there were some very detailed responses, often with a lot of unnecessary details about how electrolysis happens, labelling the movement of ions *etc* and effectively candidates not having understood the command word of the question.

Examiners also noted that the quality of diagrams was poor and commonly seen errors included: candidates not putting any solution in the beaker; unconnected electrodes / not connecting up the circuit correctly. A noticeable number of candidates labelled the solution in the beaker as 'zinc chloride', despite the stem of the question mentioning 'copper sulfate solution using copper electrodes'.

(b) Copper sulfate solution was electrolysed using copper electrodes.

(i) Draw a labelled diagram to show the apparatus that is used to carry out this electrolysis in the laboratory.

(2)



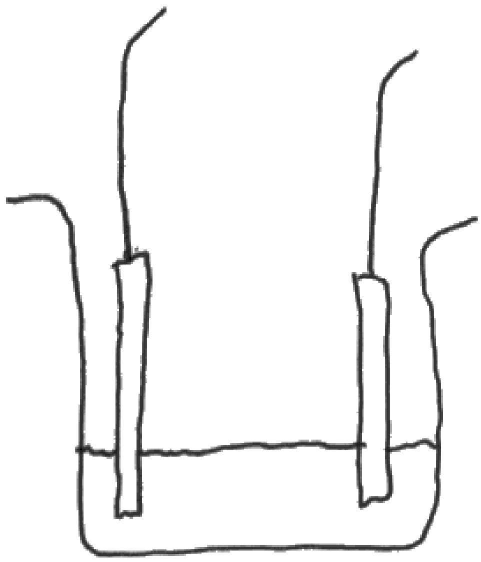
ResultsPlus
Examiner Comments

A good example of a correct, fully-labelled diagram, namely where the electrodes are labelled and shown in an electrolyte with the power source correctly connected.

(b) Copper sulfate solution was electrolysed using copper electrodes.

(i) Draw a labelled diagram to show the apparatus that is used to carry out this electrolysis in the laboratory.

(2)



ResultsPlus
Examiner Comments

This response did not score. Despite the electrodes drawn in an electrolyte in a beaker, they have not been labelled, neither have they been connected to an appropriate power supply.

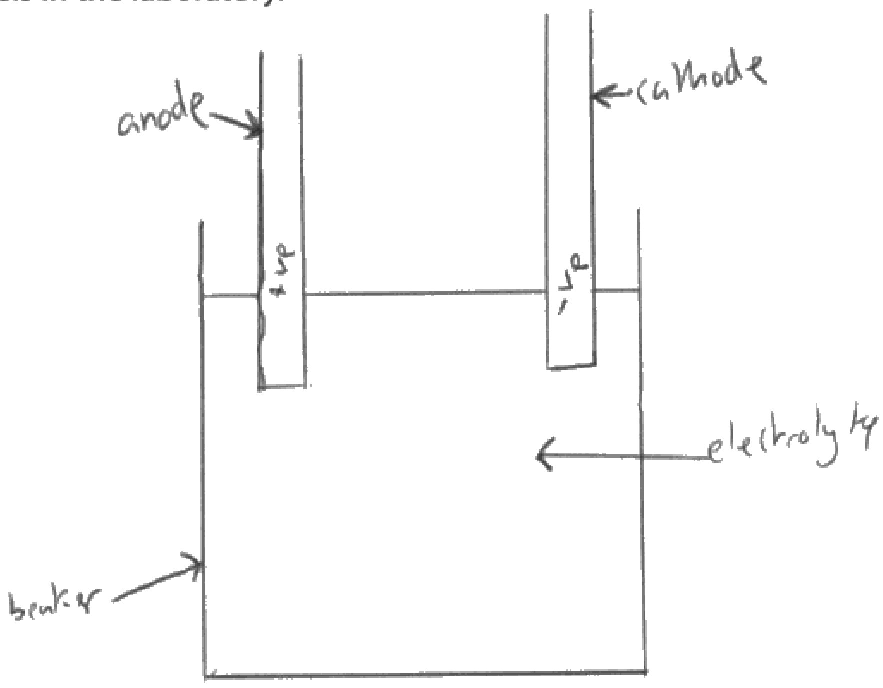
ResultsPlus
Examiner Tip

Read the question carefully. When drawing electrolysis apparatus, make sure you label the diagram and show the electrodes connected to direct current power supply.

(b) Copper sulfate solution was electrolysed using copper electrodes.

(i) Draw a labelled diagram to show the apparatus that is used to carry out this electrolysis in the laboratory.

(2)



ResultsPlus
Examiner Comments

This response scored 1 mark only. The diagram is neatly drawn. The electrodes are correctly labelled and shown in the electrolyte in a beaker. However, the electrodes have not been connected to a power supply.

ResultsPlus
Examiner Tip

When drawing apparatus for electrolysis, not only show labelled electrodes in an electrolyte but also make sure they are connected properly in a circuit to a direct current power supply.

Question 4 (b) (ii)

This question was very poorly answered on the whole with few responses scoring any of the 4 marks available.

This is now a Core practical and questions very similar to this have appeared on many papers in the previous specification where they performed well. Most candidates did not grasp the idea of the question at all. Candidates wasted time describing the data in the table rather than explaining the results.

Most candidates had not realised that the electrodes were made of copper. Consequently, when they talked about a loss or gain of electrons (correct), the mark could not be awarded since they did not refer to 'two electrons'.

Examiners noted that it was apparent that many candidates understood what happens in electrolysis (the movement of anions and cations to the anode and the cathode respectively) but applying this correct knowledge did not answer the question. Quite a few responses incorrectly mentioned that electrons were gained by the cathode. Hence, incorrectly attempting to explain why the cathode increased in mass. A small proportion used ionic equations to help to support their answers (whether there was actual understanding here, or they simply just so happened to understand reduction and oxidation in general).

A lot of candidates could suggest that oxidation was taking place at the anode and reduction at the cathode – but not many could grasp where the extra mass was coming from (for the cathode/or why anode was losing mass).

Some responses discussed zinc/chlorine/hydrogen being given off in the electrolysis experiment. Some responses made references to the reactivity series (in connection with the particular product being formed) which was also irrelevant.

(ii) Before the electrolysis, the masses of the electrodes were determined.
After the electrolysis, the electrodes were washed and dried and their masses re-determined.

Figure 4 shows these masses and the resulting changes in masses of the electrodes.

	mass of electrode before electrolysis in g	mass of electrode after electrolysis in g	change in mass of electrode in g
anode	11.27	10.42	−0.85
cathode	11.32	12.17	+0.85

Figure 4

Explain these results.

(4)

The anode lost mass because it ~~gained~~ lost electrons because the negative electrons are attracted to the positive cathode. Therefore, cathode gained 0.85 g because ~~than~~ it gained more electrons.

ResultsPlus
Examiner Comments

This response did not score. The loss and gaining of electrons must be specific to the copper atoms and copper ions respectively and not linked to the anode losing electrons and the cathode gaining electrons, both of which are incorrect.

ResultsPlus
Examiner Tip

Make sure you learn the steps required for this core practical and can explain the formation of the products in the electrolysis of copper sulfate solution using copper electrodes.

(ii) Before the electrolysis, the masses of the electrodes were determined. After the electrolysis, the electrodes were washed and dried and their masses re-determined.

Figure 4 shows these masses and the resulting changes in masses of the electrodes.

Ox Is Loss Redu Is Gain

	mass of electrode before electrolysis in g	mass of electrode after electrolysis in g	change in mass of electrode in g
anode	11.27	10.42	−0.85
cathode	11.32	12.17	+0.85

Figure 4

Explain these results.

(4)

The copper electrodes are not inert. The anode loses mass, because positively charged copper cations (Cu^{2+}) are drawn off of it and towards the negatively charged cathode due to their opposing charges causing electrostatic forces.* The negatively charged copper cathode gains these ~~[illegible]~~ copper cations, and so mass, because they are reduced and gain electrons from it, forming a solid copper layer.

*so it loses mass

ResultsPlus
Examiner Comments

This response scored 1 mark only. This candidate has not identified copper ions moving into the solution at the anode and out of solution at the cathode, so did not score on the first marking point. However, the candidate then correctly explains how the copper ions become copper atoms at the cathode, scoring 1 mark. They also correctly identify that copper ions are reduced at the cathode, but this is the same marking point.

(ii) Before the electrolysis, the masses of the electrodes were determined.
After the electrolysis, the electrodes were washed and dried and their masses re-determined.

Figure 4 shows these masses and the resulting changes in masses of the electrodes.

	mass of electrode before electrolysis in g	mass of electrode after electrolysis in g	change in mass of electrode in g
anode	11.27	10.42	−0.85
cathode	11.32	12.17	+0.85

Figure 4

Explain these results.

(4)

At the anode copper atoms ~~have~~ are ripped from the electrode forming a copper 2+ ion that dissolves into the copper sulphate solution. $(Cu \rightarrow Cu^{2+} + 2e^-)$. ~~Copper ions at the same time~~ This causes the mass to decrease at the ~~electrode~~ ~~cathode~~ anode as it is loosing copper. Copper ions in the solution, at the same time, recieve 2 electons from the cathode causing them to form copper atoms that surround the cathode increasing it's mass. The loss in mass at the anode is the same as the gain in mass at the cathode ~~because~~ as copper is pulled from the anode it is formed at the cathode at the same rate also keeping the concentration in the solution constant.

ResultsPlus
Examiner Comments

An excellent example of a rarely seen fully correct response for 4 marks.

The candidate has correctly identified copper ions entering the solution at the anode and leaving the solution at the cathode, and that this is the reason for the changes in mass, for 1 mark.
They correctly identify that copper atoms become copper ions at the anode, which is worth 1 mark, but they superseded this with a correct half equation, which scores both of the anode explanation marking points, for 2 marks.
They explain that the copper ions become atoms at the cathode, for 1 mark, by gaining 2 electrons, for 1 mark.
Although, the candidate's response continues on out of clip, they have written more than enough to justify all 4 marks being awarded.

Question 4 (c)

This question was very poorly answered on the whole with few responses scoring any of the 2 marks available.

Many candidates did not score any marks as they could not recall the correct species or had an incorrect sign for the number of electrons on the left hand side of the equation. Very few responses demonstrated any knowledge of half equations.

Commonly seen incorrect responses and misconceptions included: including extra species tosuch as sodium and copper sulphate; a common near miss was $2H^+ \rightarrow H_2 + 2e$ (rather than '-2e' on the right hand side); $H^+ + H^+ \rightarrow H_2$; many learners incorrectly started with H_2 on the left despite the question clearly stating this was the product and so this should have been on the right hand side of the equation, such as $H_2 \rightarrow 2H^+ + 2e^-$ or $H_2 - 2e^- \rightarrow 2H^+$.

(c) When sodium sulfate solution is electrolysed, using inert electrodes, hydrogen is formed at the cathode.

Write the half equation for the formation of hydrogen gas, H_2, from hydrogen ions, H^+.

(2)

$2H^+ \rightarrow H_2$

ResultsPlus
Examiner Comments

This response was commonly seen and did not score.

Although the hydrogen ions, H^+, and hydrogen molecule, H_2, have been written in the correct places in the equation, no electrons are shown on the left hand side, so the first marking point was not scored. As with many questions of this type, the second marking point is dependent on the first being scored.

ResultsPlus
Examiner Tip

When writing half equations, they must always contain electrons.

(c) When sodium sulfate solution is electrolysed, using inert electrodes, hydrogen is formed at the cathode.

Write the half equation for the formation of hydrogen gas, H_2, from hydrogen ions, H^+.

(2)

$H^+ + e^- \rightarrow H_2$

ResultsPlus
Examiner Comments

This response only scored 1 mark.

The species shown are correct and have been shown on the correct sides of the equation respectively. However, the half equation has not been balanced.

ResultsPlus
Examiner Tip

Once you have written the correct species on the correct sides of the half equation, you need to balance these to score the final marking point.

(c) When sodium sulfate solution is electrolysed, using inert electrodes, hydrogen is formed at the cathode.

Write the half equation for the formation of hydrogen gas, H_2, from hydrogen ions, H^+.

(2)

$2H^+ + 2e^- \rightarrow H_2$

ResultsPlus
Examiner Comments

A rarely seen fully correct half equation. The species are all shown in the correct places and these are correctly balanced.

Question 5 (a) (ii)

This question was very poorly answered on the whole with few responses scoring any of the 2 marks available.

Many students failed to score as they did not recognise that the formulae of nitrogen and hydrogen are N_2 and H_2 respectively, with a lot of students writing 2N or H_3 as the reactant species.

(ii) Ammonia, NH_3, is made by reacting nitrogen with hydrogen.

Write the balanced equation for this reaction.

(2)

$N + 3H \rightarrow NH_3$

ResultsPlus

Examiner Comments

This is a typical example of an incorrect response frequently seen by examiners.

The incorrect formulae of both nitrogen and hydrogen have been shown on the left hand side, so the first marking point cannot be scored. Since the second marking point is dependent on the correct formulae being shown, no further mark can be awarded.

ResultsPlus

Examiner Tip

Learn the correct formulae for hydrogen, H_2 and nitrogen, N_2. Along with the formulae of carbon dioxide, water, oxygen. methane and hydrogen chloride, they are commonly asked for molecules in the specification, particularly in questions relating to the formation of ammonia and reversible reactions.

(ii) Ammonia, NH_3, is made by reacting nitrogen with hydrogen.

Write the balanced equation for this reaction.

(2)

$H_2 + 3N_2 \rightleftharpoons 2NH_3$

ResultsPlus
Examiner Comments

This response scored 1 mark only.

The formulae for hydrogen and nitrogen have been correctly written on the left hand side of the equation, for 1 mark. Unfortunately, the balancing of the number of molecules of nitrogen and hydrogen molecules has been reversed, so the balancing mark was not scored.

ResultsPlus
Examiner Tip

Make sure you check your balancing in equations - simply check to make sure that there are same number of atoms of each element on both sides of the equation.

18 24 32

2 . 8 . 8 . 8

(ii) Ammonia, NH_3, is made by reacting nitrogen with hydrogen.

Write the balanced equation for this reaction.

(2)

$3H_2 + N_2 \rightarrow 2NH_3$

ResultsPlus
Examiner Comments

An example of a rarely seen fully correct response, which scored 2 marks. The correct formulae for hydrogen and nitrogen have been given and the equation correctly balanced.

Question 5 (b)

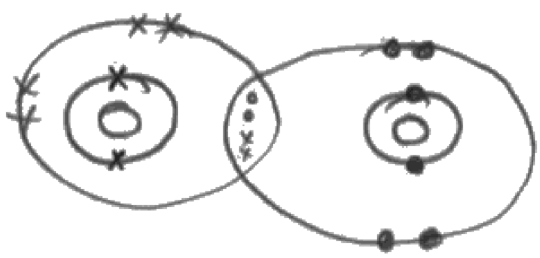
About half the candidates managed to score at least 1 or both marks for a correct dot and cross diagram for a molecule of oxygen.

In commonly seen incorrect responses, candidates only drew a single bond; some scored the 1 mark for showing two pairs of shared electrons, but often with too many electrons unshared shown; a few formed ions, showing confusion with ionic bonding.

(b) Oxygen, O_2, is also a simple molecular, covalent substance.

Draw a dot and cross diagram for the molecule of oxygen.

(2)



ResultsPlus
Examiner Comments

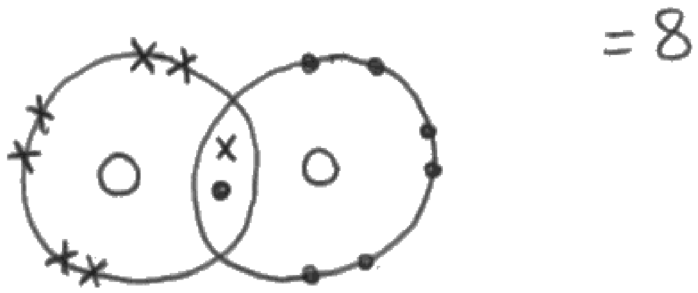
This response scored both marks.

Although the inner shells are correctly shown this is not required in the answer and ignored.

(b) Oxygen, O_2, is also a simple molecular, covalent substance.

Draw a dot and cross diagram for the molecule of oxygen.

(2)



ResultsPlus
Examiner Comments

This response did not score. Unfortunately, a single covalent bond has been shown between the oxygen atoms, rather than a double bond.

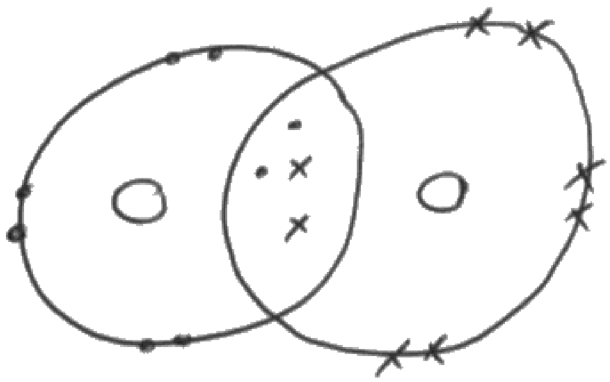
ResultsPlus
Examiner Tip

Practise drawing dot and cross diagrams to show the covalent bonding in oxygen and also for the six covalent substances mentioned in the specification.

(b) Oxygen, O_2, is also a simple molecular, covalent substance.

Draw a dot and cross diagram for the molecule of oxygen.

(2)



ResultsPlus
Examiner Comments

This response only scored 1 mark. Two bonding pairs of electrons have been shown between the oxygen atoms to correctly represent the double covalent bond. However, too many electrons (six on each shell) have been drawn, so the second marking point was not scored.

ResultsPlus
Examiner Tip

When drawing dot and cross diagrams for covalent substances, check that there are no more than eight (or two for hydrogen) in total, including the bonding electrons, on the outer shell in each atom in the molecule.

Question 5 (c)

This extended open response question showed a wide variation in responses from candidates, with most candidates scoring at least Level 1, namely 2 of the 6 marks available.

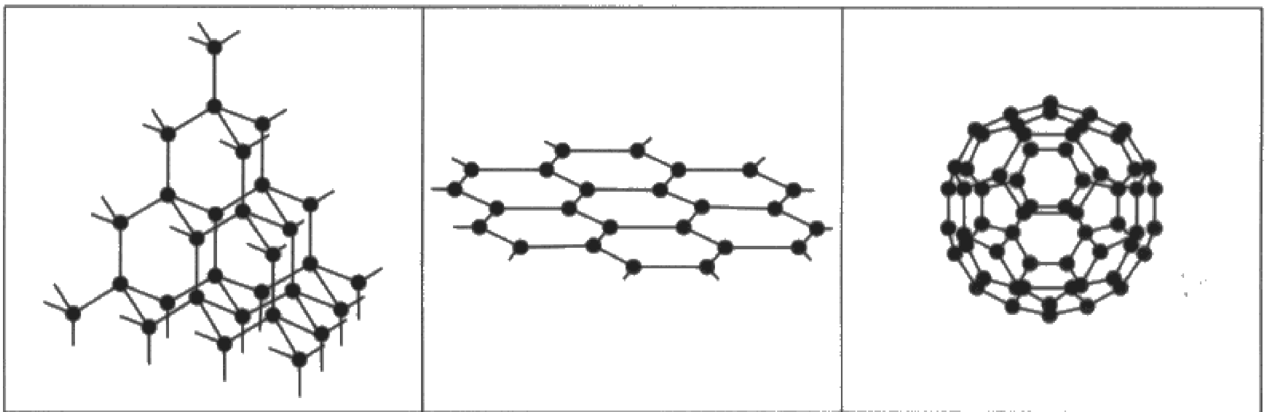
Most candidates scored by reference to the ability to conduct electricity and linked explanations, namely that diamond does not have delocalised electrons and graphene does. Not many candidates knew that fullerenes have delocalised electrons or that they can conduct.

With regard to other properties, melting point was less well explained, with some candidates mentioning the strong covalent bonds for diamond, but invariably there were lots of incorrect explanations, most commonly referring to ‘strong intermolecular forces’ being the reason that diamond had a high melting point. Consequently, this meant that even though responses correctly referred to ‘a lot of energy would need to be used to overcome these forces’, they could not score the mark due to the incorrect statement beforehand.

Where Level 3 responses were seen, it was usually by reference to conduction of electricity. Frequently 5 marks, rather than the full 6 marks, were awarded for explanations for diamond and graphene with a poor explanation for fullerene.

The structure of graphene was commonly confused with graphite. Only a few candidates suggested that the melting point was still high, rivalling diamond. A lot of candidates incorrectly thought that graphene had a low melting point and the fullerene had a high melting point due to its spherical structure.

*(c) Figure 5 shows the arrangement of carbon atoms in diamond, graphene and a fullerene (C_{60}).



diamond	graphene	a fullerene, C_{60}

Figure 5

Consider these three substances.

Explain, in terms of their structures and bonding, their relative melting points, strengths and abilities to conduct electricity.

(6)

Diamond is known to have ~~a~~ 4 covalent bonds so ~~the~~ its complex structure would make it very hard ~~[illegible]~~ due to the strong covalent bonds ~~that are strongly attracted~~ in which the particles are strongly attracted to each other.

Graphene also has a fairly complex structure so it would also be very strong due to the intermolecular forces that it's made up of.

The ~~f~~ fullerene has ~~[illegible]~~ a giant covalent spherical structure that allows it to conduct electricity.

The strong covalent bonds it's made up of would make it have a very high melting point, due to all of the heat it would take to break down the ~~bond~~ electrostatic forces.

Graphene would have the lowest melting point because of its simpler structure. It would also be unable to conduct electricity because the ~~bon~~ covalent bonds are not strong enough.

The more complex the structure and stronger the bonds, the better the isotope would act as a conductor of electricity.

ResultsPlus

Examiner Comments

This response was typical of a Level 1 response which scored 2 marks only.

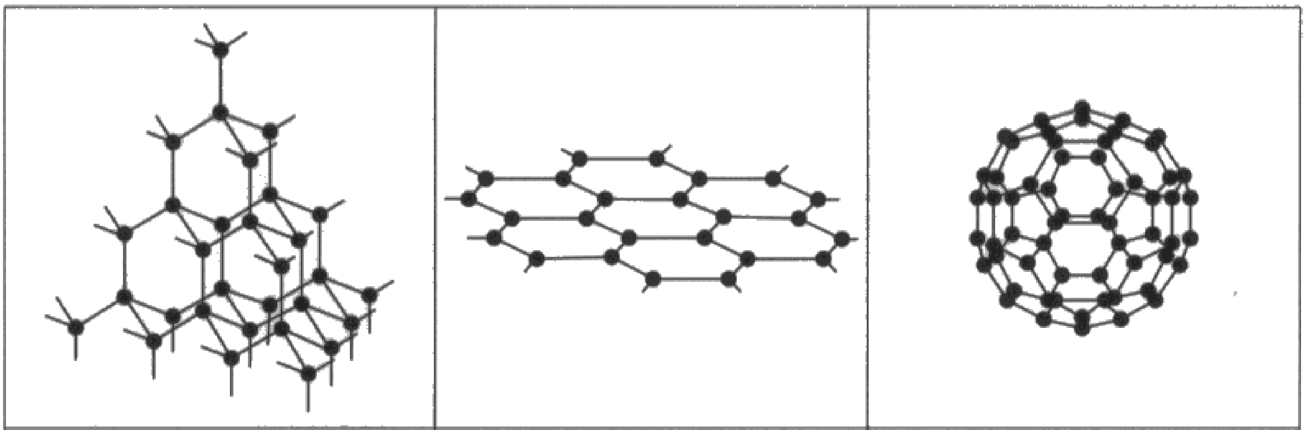
This answer contains some relevant facts, none of which are linked, which limited this to Level 1.

ResultsPlus

Examiner Tip

When comparing the properties of substances in extended open response tasks, rather than simply stating the properties, you need to give linked explanations of these properties in terms of their structures and bonding.

*(c) Figure 5 shows the arrangement of carbon atoms in diamond, graphene and a fullerene (C_{60}).



diamond	graphene	a fullerene, C_{60}

Figure 5

Consider these three substances.

Explain, in terms of their structures and bonding, their relative melting points, strengths and abilities to conduct electricity.

(6)

Diamond is in a rigid structure where each carbon atom has ~~three~~ ~~3~~ four covalent bonds and is therefore strong has a high melting and boiling point and does not conduct electricity because there is no 'sea' of delocalised electrons. It is used for tips of drills due to its strength. Graphene is weak as each carbon only has three covalent bonds and weak hydrogen bonds between each layer, so can easily slide over each other and break. However it can conduct electricity as there is room for the electrons to flow through. It is commonly used for pencils. A fullerene (C_{60}) has only three bonds ~~betw~~ per carbon atom however is stronger than graphene due to its spherical shape.

Diamond has a giant ~~ke ke~~ lattice structure.
~~Graphene is hexagonal shapes~~

ResultsPlus
Examiner Comments

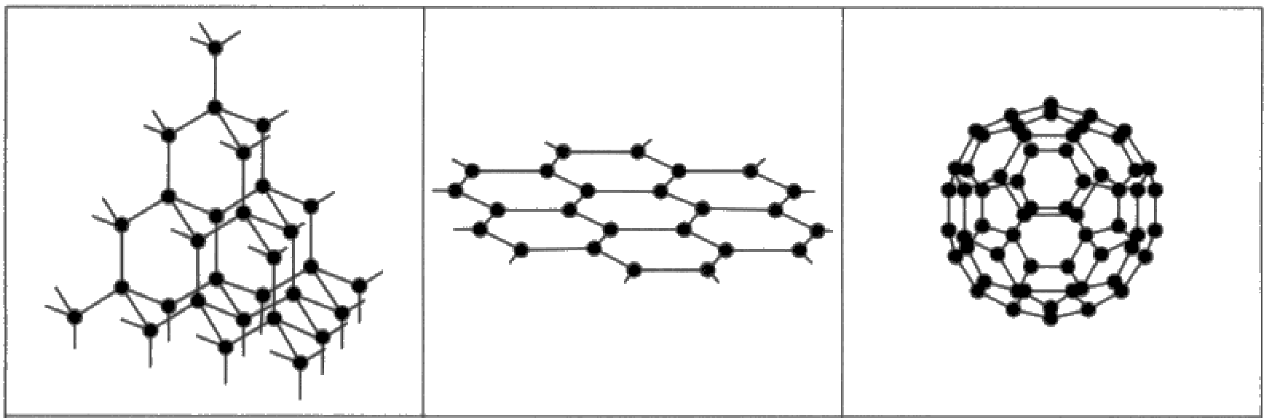
This response was typical of a Level 2 response which scored 4 marks.

There are linked explanations for the strength and conductivity of diamond. There is a correct reference to the conductivity of graphene, but there is some confusion with graphite, therefore no credit is awarded, so the response is not at Level 3.

ResultsPlus
Examiner Tip

When discussing the properties and structure of graphene, make sure that you avoid confusing these with graphite.

*(c) Figure 5 shows the arrangement of carbon atoms in diamond, graphene and a fullerene (C_{60}).



diamond	graphene	a fullerene, C_{60}

Figure 5

Consider these three substances.

Explain, in terms of their structures and bonding, their relative melting points, strengths and abilities to conduct electricity.

(6)

~~x~~ ~~B~~ Diamond has 4 covelant ~~bond~~ bond, has ridgid lattice ~~spa~~ structure, Diamond has a high melting point ~~x~~ because ~~they~~ diamond ~~does~~ have a strong attraction between ~~them~~ the bonds, means it has a high boiling ~~point~~ point and melting point. Diamonds do not a ~~conduct~~ conduct elecricity because, they have a four (4) ~~covel~~ covelant bond, which means diamond ~~doesnt~~ does not have any free electrons ~~me~~ to conduct elecricity. Graphene ~~has~~ is a one ~~a~~ layer ~~one~~ of ~~graphite~~ graphite, ~~m~~ this means ~~graph~~ graphene

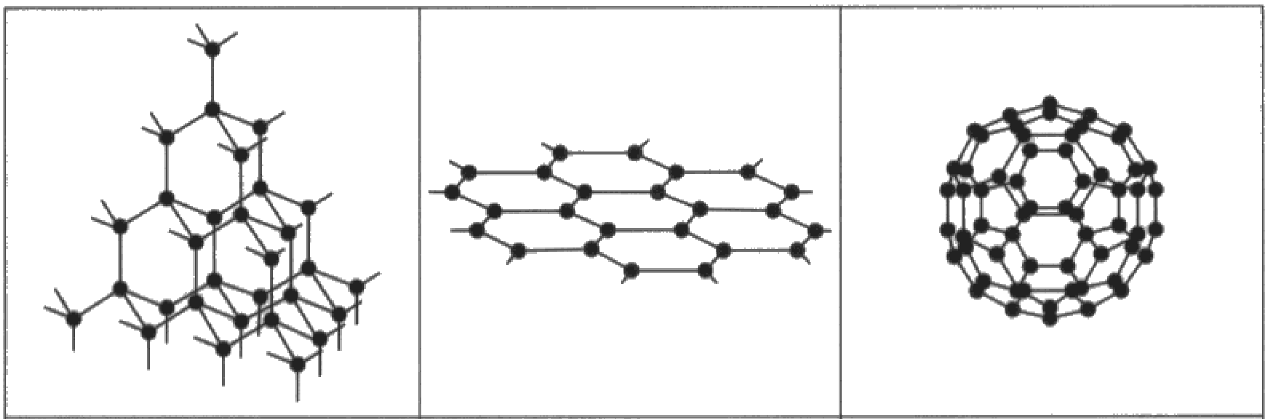
Is ~~[illegible]~~ a lubricating material ~~that~~ that ~~a~~ ~~[illegible]~~ mens it can slide of the page. Graphene has a high boiling point ~~be~~ because ~~they~~ the bonds between the molecules are very strongyly attracted together. ~~Graphene~~ ~~gra~~ graphe can conduct ~~e~~ elecricity because it has 3 covelant bond ~~a~~ which means they have a free electron or delocilised electron to conduct electricity. Fullerene is similar to graphene ~~be~~ because fullerene ~~ha~~ have similair hexagon shapes, Fullerene ~~is a~~ ~~an~~ has a high melting point due to the strong ~~for~~ attractions between ~~the~~ the molecules. Fullerene ~~can co~~ can conduct electricity because it has only 3 covelant ~~bonds~~ covelant bonds it has a free electron, means it can conduct electricity.

ResultsPlus
Examiner Comments

This response scored a Level 3 for 6 marks.

The electrical conductivity has been explained for all three substances in terms of structure and bonding.

*(c) Figure 5 shows the arrangement of carbon atoms in diamond, graphene and a fullerene (C_{60}).



diamond	graphene	a fullerene, C_{60}

Figure 5

Consider these three substances.

Explain, in terms of their structures and bonding, their relative melting points, strengths and abilities to conduct electricity.

(6)

Diamond is made out of carbon each with 4 bonds therefore does not conduct electricity as it has no delocalised electrons. The 4 bonds also mean that diamond is very hard and has high electrostatic ~~forces~~ bonds between it so has a very high melting and boiling point as it would take a lot of energy to break these forces apart. Graphene is a single sheeat of graphite, its carbon atoms only make 3 bonds therefore graphene can conduct electricity as each ~~one~~ carbon atom has one delocalised electron that can move around. The bonds between graphene are very strong therefore it has a high melting ~~points~~ and boiling point. Fullerene also has carbon atoms that make 3 bonds with one delocalised electron on every atom so it can conduct electricity. The bonds between these atoms are very strong and the atoms are arranged in hexagonal shapes. It would take a lot of energy to break down these bonds so fullerene also has a high boiling and melting point.

ResultsPlus
Examiner Comments

This response scored a Level 3 for 6 marks.

Both the electrical conductivity and relative melting points have been explained for all three substances in terms of their structures and bonding.

Question 6 (a) (i)

This was a very straightforward question.

The vast majority of candidates were able to score the 2 marks available, by using the information from the observations table to correctly put the four metals in their correct order of reactivity, from least reactive to most reactive.

Very occasionally candidates failed to score since they put the reverse order, *i.e.* from most to least reactive or scored 1 mark only for listing only two observations in the correct order.

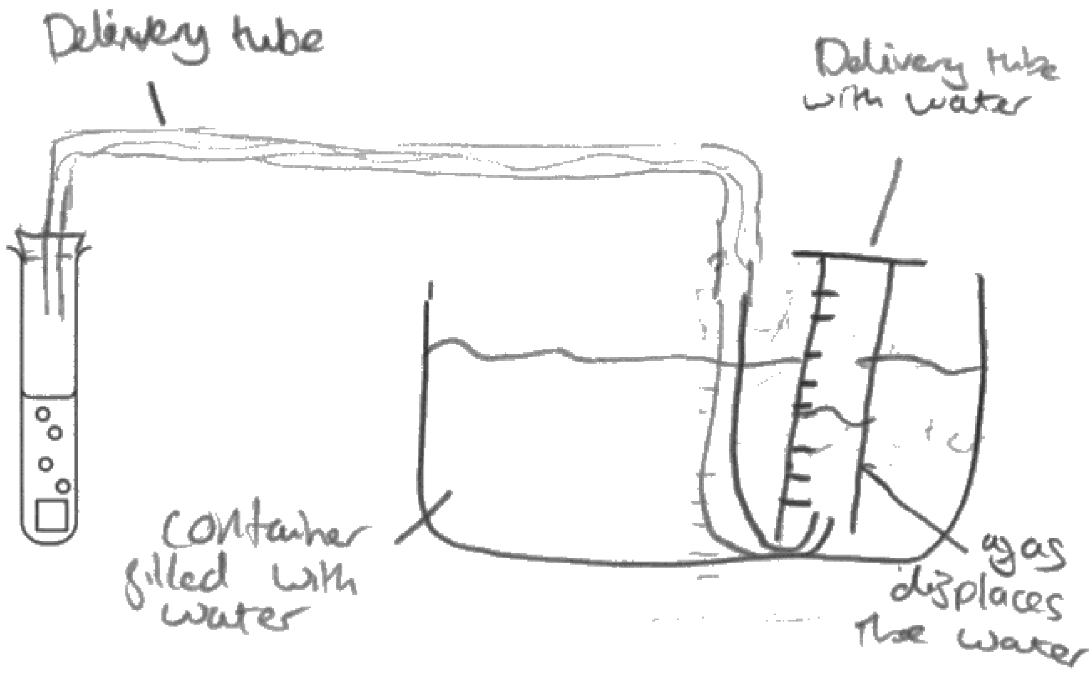
Question 6 (a) (ii)

About half the candidates managed to score at least 1 or both marks for a correct workable diagram showing a method to measure the volume of the gas.

Many candidates identified a delivery tube of some kind but often failed to draw a bung at the top of the test tube. The most common gas collection vessel was a gas syringe. If a diagram for collection of gas over water was drawn candidates often failed to show graduations on the collection vessel or labelled it as a test tube.

(ii) Complete the diagram below to show how the student could add to the apparatus to measure the volume of gas produced in the two minutes.

(2)



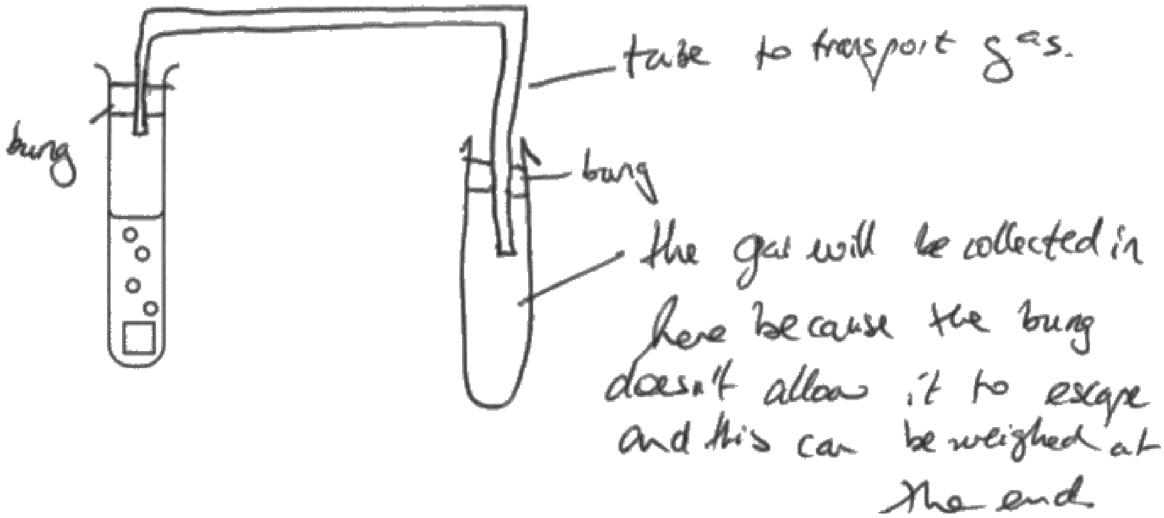
ResultsPlus
Examiner Comments

This response was awarded 2 marks.

The delivery tube is acceptable (the tube must have some type of stopper). The method shown for the collection of gas is correct, namely the use of an inverted measuring cylinder over water (the measuring cylinder or container must have graduations shown or be labelled to score).

(ii) Complete the diagram below to show how the student could add to the apparatus to measure the volume of gas produced in the two minutes.

(2)



ResultsPlus
Examiner Comments

This response scored 1 mark only for the delivery tube only.

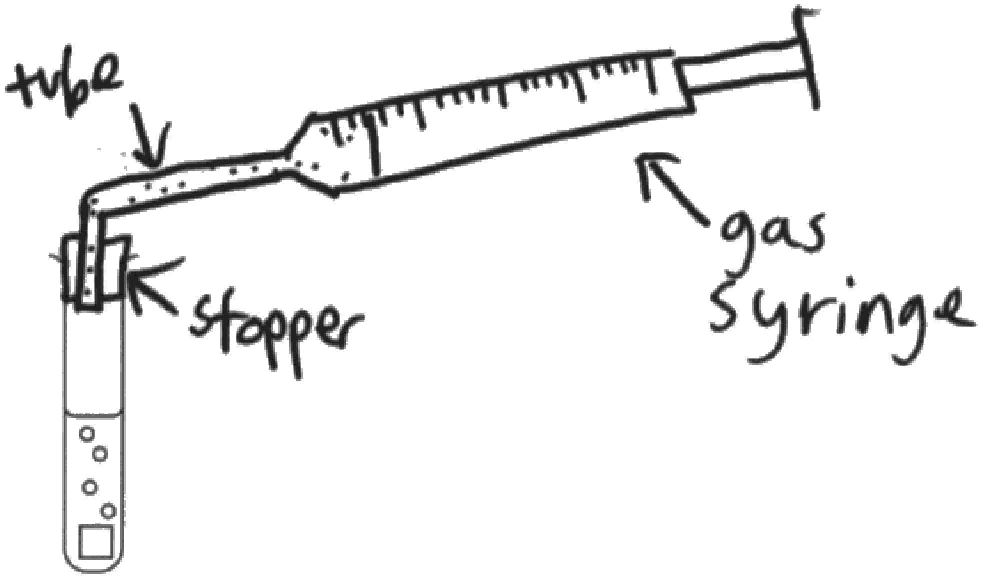
The diagram is not workable, since the volume of gas cannot be measured using the sealed test tube shown (the collection vessel not shown over water nor is a gas syringe being used) and there are no graduations shown on the collection tube.

ResultsPlus
Examiner Tip

Learn the main ways of collection of gases and measurement of volume of gases - by the use of a delivery tube with either a labelled, inverted and graduated collection vessel over water or a gas syringe.

(ii) Complete the diagram below to show how the student could add to the apparatus to measure the volume of gas produced in the two minutes.

(2)



ResultsPlus
Examiner Comments

This response scored both marks. This is a workable diagram - both the delivery tube with a stopper in the neck of the test tube, coupled with the labelled gas syringe are creditworthy.

Question 6 (b)

This was poorly answered on the whole with a wide range of different responses seen here.

In most incorrect responses, candidates simply calculated the relative formula masses of the reactants and products and then tried to justify a response. Many responses did correctly show the necessary ratios of 10/56 and 11.34/63.5. However, they did not round their answers to the correct number of significant figures required and consequently lost marks here.

Examiners reported seeing many and varied random responses which had nothing creditworthy, as candidates basically wrote every possible calculation they knew that might possibly relate to this question and then simply stated 'A' for a letter.

(b) When iron reacts with copper sulfate solution, solid copper is formed.

Two possible equations for this reaction are

A $CuSO_4 + Fe \rightarrow Cu + FeSO_4$
B $3CuSO_4 + 2Fe \rightarrow 3Cu + Fe_2(SO_4)_3$

It was found that 10.00 g of iron powder reacted with excess copper sulfate solution to produce 11.34 g of copper.

Carry out a calculation to decide which equation, **A** or **B**, represents the reaction taking place.
(relative atomic masses: Fe = 56.0, Cu = 63.5)

(2)

$CuSO_4 = 63.5 + 32 + (16 \times 4) = 159.5$
Fe = 56.

$FeSO_4 = 56 + 32 + (16 \times 4) = 152$
Cu = 63.5

∴ A.

ResultsPlus
Examiner Comments

This was typical of responses which did not score.

The response makes no use of the masses of iron and copper which are pertinent to answering the question. The candidate simply worked out the relative formula masses of copper sulfate and iron(II) sulfate, with a guess as to which reaction is occurring.

(b) When iron reacts with copper sulfate solution, solid copper is formed.

Two possible equations for this reaction are

A $CuSO_4 + Fe \rightarrow Cu + FeSO_4$
B $3CuSO_4 + 2Fe \rightarrow 3Cu + Fe_2(SO_4)_3$

It was found that 10.00 g of iron powder reacted with excess copper sulfate solution to produce 11.34 g of copper.

Carry out a calculation to decide which equation, **A** or **B**, represents the reaction taking place.
(relative atomic masses: Fe = 56.0, Cu = 63.5)

(2)

$\frac{10.00}{56.0} = 0.17\dot{8}$ $\frac{11.34}{63.5} = 0.17\dot{8}$

$\frac{0.17\dot{8}}{0.17\dot{8}} = 1$ $\frac{0.178}{0.17\dot{8}} = 1$

equation A
as both copper
and iron are
only made up
of one lot.

ResultsPlus
Examiner Comments

This response scored 1 mark only.

There is a rounding error in the ratios - this is a maths skill in chemistry.
Here there is a rounding error to 0.178, and the ratio related to equation A, but 1 mark overall was allowed for carrying out the correct chemistry.

ResultsPlus
Examiner Tip

Take care with rounding answers correctly.

Question 6 (c)

This was poorly answered on the whole with a wide range of different responses here and few responses scoring the 2 marks available.

Many candidates struggled to balance the correct species in this equation. A few responses scored on the first marking point for Al and H_2, with many adding other incorrect species (especially Cl) in the balancing spaces or had Al^{3+} on both sides of the equation.

(c) Acid solutions contain hydrogen ions.

Aluminium reacts with dilute hydrochloric acid to form a solution containing aluminium ions, Al^{3+}.

Complete the balanced ionic equation for this reaction.

(2)

Al + Cl H^+ → .... Al^{3+} + H_2

ResultsPlus
Examiner Comments

The candidate has successfully identified Al and H_2 on the left hand side and right hand side of the equation respectively, but then incorrectly balanced it.

ResultsPlus
Examiner Tip

Practise balancing ionic equations - checking that the total charges of ions on both sides of the equation are equal.

(c) Acid solutions contain hydrogen ions. $2Al + 6HCl \rightarrow 2AlCl_3 + 3H_2$

Aluminium reacts with dilute hydrochloric acid to form a solution containing aluminium ions, Al^{3+}. Al^{3+} H^+ Cl^-

Complete the balanced ionic equation for this reaction.

(2)

$2Al + 6H^+ \rightarrow 2Al^{3+} + 3H_2$

ResultsPlus
Examiner Comments

This is a fully correct response, rarely seen by examiners.

The correct species, namely Al and H_2, have been written on the left hand side and right hand side of the equtaion respectively. These have been correctly balanced.

Question 6 (d)

The vast majority of candidates did not score the 1 mark available.

It was clear from responses that few candidates were able to recall the effect of changing the hydrogen ion concentration of a solution on pH, namely that decreasing the concentration of hydrogen ions by a factor of ten, increases the pH by 1, or vice versa.

Question 6 (e)

This question was very poorly answered on the whole with few responses scoring any of the 3 marks available.

Many candidates incorrectly wrote 1 x 6.022 x 10^{23} as an answer. In was clear to examiners that candidates did not understand what the Avogadro constant actually is and therefore could not apply it to this question.

Most candidates either provided 1g as an answer, or left it blank. Unusually, there were quite a few students who provided the correct working, but wrote the final answer incorrectly. This could perhaps be due to a weakness with writing standard form from a calculator.

(e) Calculate the mass, in g, of a hydrogen atom, using the data below.
(relative atomic mass: H = 1.00;
Avogadro constant = 6.02 × 10^{23})

(3)

6.02×10^{23}

$1.00 \div 6.02 \times 10^{23} = 1.66 \times 10^{22}$

mass of hydrogen atom = 1.66×10^{22} g

ResultsPlus
Examiner Comments

This response scored 1 mark only.

The correct method, namely $1.00 / 6.02 \times 10^{23}$ is worth 1 mark. The evaluation is incorrect.

ResultsPlus
Examiner Tip

Take care when writing values in standard form from your calculator.

Paper Summary

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

- practise a variety of calculations as described in the specification.
- learning the formulae of gases and simple compounds as used in the specification.
- practise writing and balancing equations.
- practise writing and balancing ionic equations.
- explaining the electrolytic processes described in the specification and in the Core practical.
- practise answering extended open-response questions.
- To help with the above, there are plenty of examples in examination papers of the previous specification has similar coverage.

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

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London WC2R 0RL.