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Examiners' Report
June 2013

GCSE Chemistry 5CH3F 01

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Introduction

This is the first examination of the Unit C3 paper in the GCSE Science 2011 course.

The Foundation Tier paper assesses grades C to G and consists of a mixture of question styles, including objective questions, short answer questions, data analysis questions and extended writing style questions.

There was clear evidence of candidates having been well prepared for the examination, with a good understanding of many of the key concepts, across the topic areas.

There were, however, some general areas for concern, as highlighted by examiners, namely:

- extremely few candidates were able to recall the procedure for the preparation of a soluble salt, namely magnesium oxide, by reacting a metal oxide and sulfuric acid, as required in Q6 (a);
- a poor understanding of the correct procedure and results for carrying out simple 'flame tests' for metal ions, as required in Q2 (a) and (b);
- a poor knowledge of the equation and conditions necessary for 'fermentation', as required in Q3 (a) (i) and (ii);
- a poor knowledge of 'electrolysis', namely very few candidates were able to define 'reduction', or correctly describe and explain processes occurring at the electrodes in the purification of copper, and/or the electrolysis of molten lead bromide, as required in Q 5.

Successful candidates:

- read the questions carefully and answered the questions as they were set;
- could use the correct scientific terminology;
- could recall the procedures and results for testing gases and metal ions;
- could carry out simple calculations;
- could give well communicated descriptions with explanation for the electrolysis and methods of softening types of hard water.

Less successful candidates:

- failed to accurately copy the names or chemical formulae of species given in the stem of a question when writing equations;
- confused the processes occurring at the electrode surfaces in electrolysis;
- could not recall the correct procedures or results for flame tests or testing gases;
- gave answers which were too vague when referring to fermentation processes or method of softening hard water.

The report provides exemplification of candidates' work, together with tips and/or comments for selection of questions. The exemplification is mainly confined to those questions requiring a more complex response from candidates.

Question 1 (b) (i)

Most candidates gained credit for their answers, scoring the 1 mark available for simply stating 'gas'.

Question 1 (b) (ii)

Most candidates gained credit for their answers.

(ii) State the meaning of the symbol $\rightleftharpoons$ in the equation.

(1)

Reversible reaction.

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Examiner Comments

This response was the most commonly seen correct answer for the 1 mark available.

(ii) State the meaning of the symbol $\rightleftharpoons$ in the equation.

(1)

equal to

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Examiner Comments

A typical incorrect answer, where the reversible sign was confused with simply an equal sign, so does not score.

Question 1 (c)

As expected, most candidates gained credit for showing both the correct reactants and products.

Occasionally, extra incorrect products, namely 'carbon dioxide' or 'water' were given, so only 1 mark was scored.

Unfortunately, spelling errors were all too common, especially when the compounds were given in the question.

(c) Some ammonia is reacted with sulfuric acid to make ammonium sulfate.

Write the word equation for this reaction.

(2)

ammonia + sulfuric acid → ammonium sulfate

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Examiner Comments

Both the correct reactants and products have been given, so this response was awarded the 2 marks available.

(c) Some ammonia is reacted with sulfuric acid to make ammonium sulfate.

Write the word equation for this reaction.

(2)

Ammonia + sulfuric acid -> ammonium sulfate + water

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Examiner Comments

A typical 1 mark response for showing the correct reactants only. The right hand side is incorrect since 'water' has also been added.

Question 1 (d)

This question was well answered, with the majority of candidates clearly understanding the role of a fertiliser, to score the 1 mark available.

The most common correct answers referred to increasing the rate of plant growth or the addition of nutrients / mineral salts to the soil.

Where some candidates failed to score, the main misconception was to confuse fertilisers with pesticides or herbicides.

A typically seen correct response for 1 mark.

(d) Ammonium sulfate is used as a fertiliser.

State why farmers use fertilisers on their fields.

(1)

Farmers use fertilisers on their fields to speed up the growing rate of there crops and plants.

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Examiner Comments

A typical correct response referring to 'speed up rate of growth', so this was awarded 1 mark.

(d) Ammonium sulfate is used as a fertiliser.

State why farmers use fertilisers on their fields.

(1)

To keep away insects so damage isn't caused to crops.

ResultsPlus
Examiner Comments

A common misconception, namely to confuse insecticides and fertilisers, so this response did not score.

Question 1 (e) (i)

Many candidates were unable to recall 'burette', and simply confused a pipette with a burette.

Of those candidates who gained credit for this item, invariably the word was spelled phonetically, this was in most cases sufficient to gain the 1 mark available.

Question 1 (e) (ii)

Few candidates gained the mark for this question.

Where correct answers were seen, credit was invariably for 'indicator' alone, or 'methyl orange' or 'phenolphthalein' (or a phonetic spelling which was more or less correct).

The most common incorrect answers referred to 'Universal Indicator'. It needs to be stressed to centres that Universal Indicator solution is an inappropriate indicator for titrations.

(ii) State what is added to the sulfuric acid to show when it has been neutralised by the ammonia solution.

(1)

Methyl Orange.

(Total for Question 1 = 8 marks)

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Examiner Comments

A typical 1 mark response for a correctly named indicator, namely 'methyl orange'.

(ii) State what is added to the sulfuric acid to show when it has been neutralised by the ammonia solution.

(1)

universal indicator.

ResultsPlus
Examiner Comments

A very commonly seen incorrect response. 'Universal indicator' does not score.

Question 2 (a) (i)

Very few candidates were able to link the yellow flame to sodium.

Invariably, candidates simply copied either of the two salts given in the stem of the question, namely 'sodium sulfate' or 'potassium chloride'.

Question 2 (a) (ii)

Very few candidates answered this question correctly.

It was clear that many candidates did not know the barium chloride test or correct result for sulfates. The most commonly seen incorrect responses simply mentioned 'chloride' or 'barium', perhaps confusing this with the result for the silver nitrate test for chlorides.

Question 2 (b)

This was poorly answered on the whole.

Few candidates were able to recall a correct procedure for flame testing, either by the use of the wire loop or dampened splint. Invariably 1 mark was scored, due to the use of the incorrect apparatus, typically 'tongs', but correctly mentioning **'in** the flame'. Many candidates attempted to use safety / yellow flames or incorrectly mentioned holding samples 'over or under the flame'.

(b) Describe how the technician should carry out a flame test on a solid.

(2)

He should Put the bunsen burner on a blue flame. Then hold the solid with some tongs with the rubber handgrips. hold the solid in the flame and see what colour the flame changes
Also dip the solid in hydrochlork acid to clean it.

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Examiner Comments

This is a typical 1 mark maximum answer where the 'test' mark was scored only, since the wrong apparatus, namely 'tongs', has been used.

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Examiner Tip

This is commonly asked question on the examination, make sure that you are able to recall the flame test accurately and the correct colours of the flames for specific metal ions.

(b) Describe how the technician should carry out a flame test on a solid.

(2)

clean a peace of wire with acid, heat the wire till it glows, then get some of the solid on the wire an put it in the flame

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Examiner Comments

A good example of a correct answer. All the three possible marking points have been mentioned, so this scored 2 marks.

Question 2 (c)

Most responses failed to gain credit, since they were unable to recall either the correct colour, 'brown', and/or that a 'precipitate' was formed. Of those responses which scored, many gained 1 mark only for mentioning the correct colour, but invariably mentioning 'solution', or alternatively, correctly mentioned 'precipitate', but gave the wrong colour or a wrong combination of colours.

(c) Describe what you would **see** when sodium hydroxide solution is added to a solution containing iron(III) ions, Fe^{3+}.

(2)

you would see a brown coloured precipitate form in the solution

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Examiner Comments

This is a typical fully correct response, where both marking points were clearly scored, namely 'brown' and 'precipitate', so this was awarded 2 marks.

(c) Describe what you would **see** when sodium hydroxide solution is added to a solution containing iron(III) ions, Fe^{3+}.

(2)

a green/brown/rust precipitate would form.

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Examiner Comments

Unfortunately, this response mentioned precipitate, but also gave an incorrect combination of colours, since it also mentions 'green' in combination with the correct colour, brown. This was awarded 1 mark only.

Question 2 (d)

Approximately half the responses failed to score, since invariably an incorrect test and test result were given, or simply an incorrect reagent was used, as opposed to 'limewater'. Of the responses which scored, most gained the maximum 2 marks available for 'limewater' and 'milky/cloudy.

The most common misconception was that carbon dioxide would extinguish a lighted splint. This might well be the case, but it is not a unique test for carbon dioxide. Many simply confused the carbon dioxide test with those tests for either oxygen or hydrogen.

(d) When dilute hydrochloric acid is added to copper carbonate, a gas is produced.

Describe a test to show that this gas is carbon dioxide.

(2)

The test would be a lit splint test. You would have a lit splint and a test tube containing the carbon dioxide. Put the lit splint into the test tube. If the lit splint goes out, there would be carbon dioxide in there as the splint needs oxygen.

(Total for Question 2 = 8 marks)

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Examiner Comments

This response was commonly seen by examiners. This test would work for carbon dioxide, but is not specific to carbon dioxide. Only the limewater test is acceptable, so this response did not score.

(d) When dilute hydrochloric acid is added to copper carbonate, a gas is produced.

Describe a test to show that this gas is carbon dioxide.

(2)

put some hydrochloric acid into a beaker with a delivery tube going into the acid, trans-porting the carbon dioxide into the hydrochloric acid and if the acid turns cloudy the gas is C2O

ResultsPlus

Examiner Comments

Although the observation, 'cloudy' is mentioned in this response, the wrong reagent, 'hydrochloric acid', has been given. The result is dependent upon using the correct test, so this response did not score.

(d) When dilute hydrochloric acid is added to copper carbonate, a gas is produced.

Describe a test to show that this gas is carbon dioxide.

(2)

Using a Collecting duct that would collect the gas during the experiment. The gas would ~~be~~ then travel through the collecting duct and onto a Container of limewater. If the gas is Carbon*

(Total for Question 2 = 8 marks)

* dioxide the limewater will go milky.

ResultsPlus

Examiner Comments

Both the correct reagent, 'limewater' and result, 'milky' are given, so this scored the maximum 2 marks.

Question 3 (a) (i)

This was poorly answered, with few candidates scoring either 1 or 2 marks. Many incorrect answers simply mentioned either 'fractional distillation', 'put in a fermenter' or 'boiling'. Of those answers which scored a mark it was invariably for mentioning the use of 'yeast'. Many candidates were not explicit, since they vaguely referred to using 'optimum / optimum conditions', using 'enzymes' or just 'heating', so could not score.

Organic chemistry

3 (a) Ethanol is produced by the fermentation of glucose solution.

(i) Describe how this fermentation is carried out.

(2)

Sugars(glucose) are heated with yeast which make the ethanol and ~~[scribbled]~~ Carbon dioxide.

ResultsPlus

Examiner Comments

This candidate simply mentioned 'heated', which alone was too vague to score. However, the mention of '(with) yeast', was sufficient to score 1 mark.

Organic chemistry

3 (a) Ethanol is produced by the fermentation of glucose solution.

(i) Describe how this fermentation is carried out.

(2)

Yeast is mixed with carbohydrate. The temperature then has to be kept between 30°-40° and no oxygen must enter. When 10-20% of ethanol is produced the yeast dies and falls to the bottom of the fermenter leaving the ethanol solution at the top.

ResultsPlus

Examiner Comments

This is a good example of a fully correct response, worth 2 marks. All the marking points have been adequately covered. On a minor point, the extra slightly incorrect mentioning of '20% ethanol is produced' could be ignored.

Question 3 (a) (ii)

The majority of responses simply scored 1 of the 2 marks available for 'ethanol' by failing to mention 'carbon dioxide'. The main misconception from most responses was that 'water' was formed as one of the products, besides ethanol.

(ii) Complete the word equation for the fermentation of glucose.

(2)

glucose → Ethanol acid + water.

ResultsPlus
Examiner Comments

Both products mentioned 'ethanol acid' and 'water' are incorrect, so this response scored 0 marks.

(ii) Complete the word equation for the fermentation of glucose.

(2)

glucose → ethanol + Carbon dioxide.

ResultsPlus
Examiner Comments

Both the correct products have been mentioned, so this response scored the full 2 marks available.

(ii) Complete the word equation for the fermentation of glucose.

(2)

glucose → Ethanol + water.

ResultsPlus
Examiner Comments

By far the most commonly seen answer for 1 mark only, correctly referring to 'ethanol' but putting 'water' instead of the correct 'carbon dioxide'.

Question 3 (a) (iv)

This was very well answered, with the most commonly seen responses referring simply to 'liver damage', or various spellings of 'cirrhosis', for the 1 mark available. In a few cases, slightly vague responses referring simply to 'affects reaction time' without qualifying this with 'increases', failed to score.

Question 3 (b) (i)

Most answers correctly gave a value from the interpreting the graph in the acceptable range to score the 1 mark available. Incorrect responses were either wildly out of range or just outside the range.

Question 3 (b) (ii)

This question was very well answered on the whole and most responses scored the 1 mark available. A few candidates were able to gain credit for giving the reverse argument. Incorrect answers often gave the opposite trend or referred to arguments based on bond breaking.

(ii) State how the boiling points of these alkanes change as the number of carbon atoms in one molecule of each alkane increases.

(1)

the boiling point increases.

ResultsPlus
Examiner Comments

A commonly seen correct response, so this scored 1 mark.

(ii) State how the boiling points of these alkanes change as the number of carbon atoms in one molecule of each alkane increases.

(1)

because more carbon atoms need to be broken

ResultsPlus
Examiner Comments

A commonly seen incorrect response, in this case referring to 'carbon atoms need to be broken', so this did not score.

Question 4 (c)

This was very well answered on the whole, with the majority of responses giving a colour for Universal indicator within the correct 'yellow / orange / red' range. In the few incorrect responses seen either 'blue/purple' or 'green' were commonly seen, confusing the colour with that for alkalis or neutral solutions.

Question 4 (d)

Most candidates scored at least 1 mark of the 2 marks available, either for showing the correct reactant or product formula. A few candidates thought that the formula for the reactant was NaH_2, or carelessly, showed the second letter in the symbol for sodium using an upper case 'A', namely NAOH.

(d) The word equation for the reaction of dilute ethanoic acid with sodium hydroxide solution is

ethanoic acid + sodium hydroxide → sodium ethanoate + water

Complete the balanced equation for this reaction.

(2)

CH_3COOH + NaOH → CH_3COONa + H_2O

ResultsPlus
Examiner Comments

The most commonly seen fully correct response, with both the correct reactant and product formulae shown, so this scored 2 marks.

(d) The word equation for the reaction of dilute ethanoic acid with sodium hydroxide solution is

ethanoic acid + sodium hydroxide → sodium ethanoate + water

Complete the balanced equation for this reaction.

(2)

CH_3COOH + NaH_2 → CH_3COONa + H_2O

ResultsPlus
Examiner Comments

A commonly seen error, showing the reactant formula, NaH_2, but giving the correct formula for water, so this response clearly scored 1 mark only.

Question 4 (e)

Most candidates could recall 'hydrogen', as being the correct gas from the 'pop' test, to score the 1 mark available.

Question 4 (f) (i)

Few candidates gained the full 2 marks available, that is for correctly writing both the correct reactants and products. The majority simply gained credit for writing the reactants, which were clearly given in the stem of the question. The most common mistake was to omit 'water' as the other product besides ethyl ethanoate. In a few cases, 'carbon dioxide' was incorrectly given as one of the products, instead of water, or careless, misspelled names meant a mark could not be awarded.

(f) Ethanoic acid reacts with ethanol to form ethyl ethanoate.

(i) Write the word equation for this reaction.

(2)

Ethanoic acid + Ethanol → Ethyl ethanoate

ResultsPlus

Examiner Comments

The correct reactants have been shown, but there is the omission of 'water' from the products, so this response was awarded just 1 of the 2 marks available.

(f) Ethanoic acid reacts with ethanol to form ethyl ethanoate.

(i) Write the word equation for this reaction.

(2)

ethanoic acid + ethanol → ethyl ethanoate + water

ResultsPlus

Examiner Comments

A typical correct answer. Both the reactants and products have been shown correctly, so this was awarded the full 2 marks available.

(f) Ethanoic acid reacts with ethanol to form ethyl ethanoate.

(i) Write the word equation for this reaction.

(2)

ethanoic acid + ethanol → ethyl ethanoate + carbondioxide

ResultsPlus

Examiner Comments

A commonly seen response. The reactants are correct, but 'carbon dioxide' has been given as one of the products in addition to ethyl ethanoate, instead of the correct product 'water'. This response scored 1 mark only.

Question 4 (f) (ii)

Most candidates scored at least 1 of the 2 marks available. By far the most commonly seen correct 2 mark responses linked 'perfumes' (use) to 'pleasant smelling' (property) or less commonly 'flavourings/sweets' to 'tastes nice' or words to that effect. Occasionally, candidates scored just 1 mark by reference to 'in clothing' (polyesters), but rarely linked this to 'can be made into fibres'.

(ii) Ethyl ethanoate is an ester.

Explain **one** use of esters.

(2)

Esters are used in perfumes. This is because they have a sweet smell.

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Examiner Comments

The mentioning of 'perfume' is a suitable use. However, although commonly seen in responses 'sweet' is not a correct description of a smell, so the mark for the linked property was not awarded. Overall this was awarded just 1 mark.

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Examiner Tip

When answering typical 2 marked responses linking the use and property of esters, be careful to avoid 'sweet' when referring to (pleasant) smells.

(ii) Ethyl ethanoate is an ester.

Explain **one** use of esters.

(2)

a holiday which you collect chocolate eggs.

ResultsPlus

Examiner Comments

A response seen in quite a few cases 'esters' confused with 'Easter'! This was awarded 0 marks.

Question 5 (a)

This was well answered on the whole, with most candidates able to correctly identify the two cations, Mg^{2+} and Na^{+}, for the 1 mark available. Occasionally, candidates simply listed all the ions and consequently did not score.

Question 5 (b)

The majority of responses did not score any of the 2 marks available, since few candidates were able to recall the definition for reduction, namely 'gain of electrons'. Occasionally, a few responses gained just 1 mark for 'the cathode gains electrons'.

(b) During electrolysis, reduction takes place at the cathode.

Explain, in terms of electrons, what is meant by reduction.

(2)

Reduction is the gain of electrons during a reaction.

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Examiner Comments

A good example of a correct, albeit rarely seen, response. This was awarded the 2 marks available.

(2)

A reduction is when it loses an electron. So for example sodium has () an extra one on its last shell. So it loses it to make itself stable.

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Examiner Comments

Oxidation has been confused with reduction - a typical error. This was awarded 0 marks.

(2)

Reduction is loss of oxygen and the gain of electrons.

ResultsPlus
Examiner Comments

A good 2 marks answer. The first statement alone, referring to 'loss of oxygen', would have secured 1 mark.

Question 5 (c)

This question was badly answered. Very few correct responses gaining 3 marks were seen. Most responses were able to score just 1 mark, by reference to the third marking point, namely by reference to the idea that bromide ions are attracted to the anode. Occasionally, responses referred to the second marking point, namely to movement of ions in molten liquid. It was evident that few candidates could recall, let alone explain, the electrolysis of molten lead bromide, or recognise that molten ionic substances can conduct electricity.

(c) Solid lead bromide cannot be electrolysed.
Molten lead bromide can be electrolysed.

Explain how, when solid lead bromide is melted and electrolysed, bromine is formed at the anode.

(3)

As it is melted its particles are more free to move. Therefore the negative ions go to the anode. This then allows bromine to form at the anode.

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Examiner Comments

A typical 2 marks response when seen, awarded 2 out of the 3 marks available. Marking points 2 and 3 have been awarded.

(c) Solid lead bromide cannot be electrolysed.
Molten lead bromide can be electrolysed.

Explain how, when solid lead bromide is melted and electrolysed, bromine is formed at the anode.

(3)

bromine is ~~a~~ negitively charged therefore it would migrate towards the positively charged anode, and looses all other properties towards the ~~positive~~ negatively charged cathode

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Examiner Comments

A typical 1 mark response awarded for marking point 3 only. There is no specific mention of particles moving in the molten liquid, so marking point 2 was not scored.

(c) Solid lead bromide cannot be electrolysed.
Molten lead bromide can be electrolysed.

Explain how, when solid lead bromide is melted and electrolysed, bromine is formed at the anode.

(3)

~~In~~ when solid lead bromide is melted, the ions are free to move so it can be electrolysed. The lead is attracted to positive cathode and bromine is attracted to the opposite electrode which is anode.

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Examiner Comments

A typical 1 mark answer awarded for marking point 2 only, namely for the recognition that ions are free to move in the molten lead bromide. The final incorrect sentence can be ignored.

(c) Solid lead bromide cannot be electrolysed.
Molten lead bromide can be electrolysed.

Explain how, when solid lead bromide is melted and electrolysed, bromine is formed at the anode.

(3)

When the molten lead bromide is electrolised, the negatively charged bromine particles move towards the anode as it is positively charged whereas the positively charged lead particles move towards the cathode. Therefore bromine is colected at the anode. This is not possible with ~~sto~~ solid lead bromide as the particles are not free to move.

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Examiner Comments

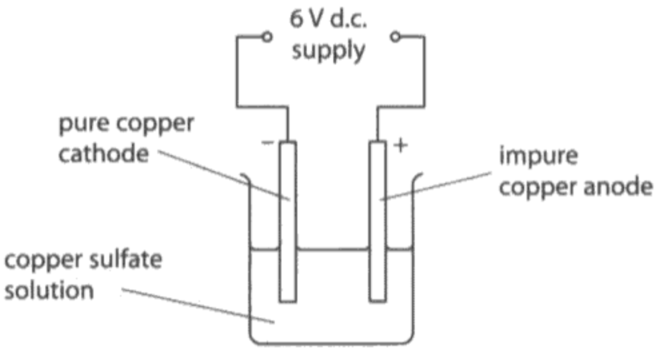
A very rarely seen fully correct response. Marking points 1, 2 and 3 have been mentioned, so 3 marks have been awarded.

Question 5 (d)

This was a poorly answered question overall. Most candidates failed to give any creditworthy points. Of the correct responses seen, most gained just 2 marks, Level 1, often by a simple description of the deposition of copper at the cathode and a decrease in size of the anode. Few candidates could add further description for Level 2, let alone explain the redox processes, necessary for Level 3.

*(d) Impure copper can be purified using electrolysis.

The impure copper is used as the anode.
A pure copper cathode is used.
The electrodes are placed in copper sulfate solution.
A direct electric current is passed through the solution.



Describe and explain what is seen when this apparatus is used to purify a piece of impure copper.

(6)

The copper ions from the impure copper anode are released into the copper sulfate solution The impurities deposit and form sludge at the bottom of the beaker. The pure copper ions attract to the cathode as the pure copper ions are positively charged. The impure copper anode will decrease in mass as oxidation (loss of electrons) occurs and the cathode of pure copper will increase in mass as reduction occurs (gain of electrons). This will leave a pure copper cathode.

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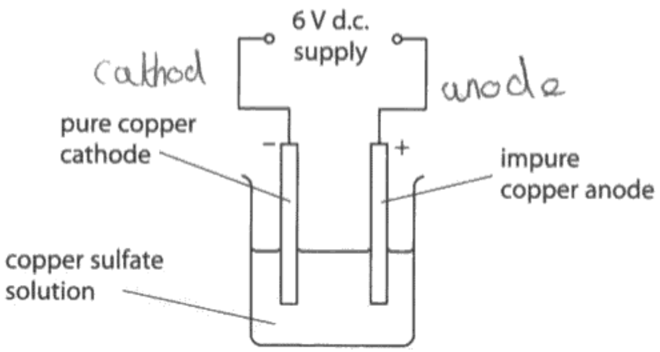
Examiner Comments

A typical good quality Level 3 answer. There is a detailed description (3 clear points) and an explanation (3 clear points). This was awarded 6 marks.

*(d) Impure copper can be purified using electrolysis.

The impure copper is used as the anode.
A pure copper cathode is used.
The electrodes are placed in copper sulfate solution.
A direct electric current is passed through the solution.



Describe and explain what is seen when this apparatus is used to purify a piece of impure copper.

(6)

Copper is ~~negatively~~ positively charged so its attracted to the negatively charged cathode. At the cathode a copper coating begings to form, the size of the cathode increases through out the purification. At the anode, since copper atoms are being lost, the size of the anode decreases and impurties form below the anode. ~~Sulfric~~ Sulfur gas is given off also at the anode since ~~it has~~ sulfur is negatively charged. ~~The~~ At the beging of the electrolysis the solution was blue but at the end the blue fades

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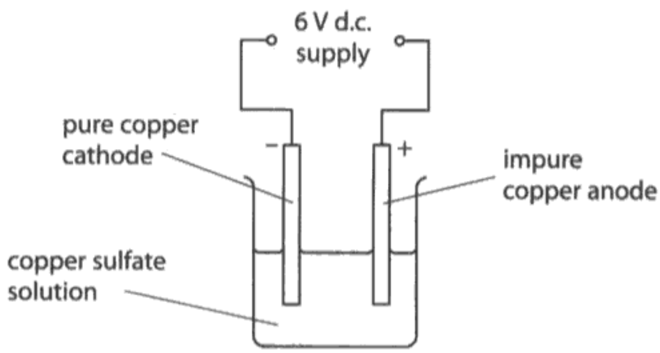
Examiner Comments

A typical Level 2 response. There is sufficient description of processes occurring at the cathode and anode and of the impurities, so this was awarded 4 marks. There is insufficient explanation to award Level 3.

*(d) Impure copper can be purified using electrolysis.

The impure copper is used as the anode.
A pure copper cathode is used.
The electrodes are placed in copper sulfate solution.
A direct electric current is passed through the solution.



Describe and explain what is seen when this apparatus is used to purify a piece of impure copper.

(6)

The copper sulfate solution will start to fizz as the electrons move to the anode and cathode through the solution. The pure copper will start to build up around the cathode and a sludge will start to form ~~at~~ in the solution.

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Examiner Comments

A typical Level 1 response. Only two valid descriptions have been made, namely the build up of copper on the cathode and the formation of sludge, ignoring the first few lines in the response. This was awarded 2 marks only.

Question 6 (a)

This was very poorly answered on the whole. Most candidates failed to score or had no idea what was required for the 2 marks available. Many simply repeated the stem of the question or confused the reaction for a precipitation reaction and incorrectly suggested filtering the product. The reaction of acids and bases is clearly covered in the specification. However, from the vast majority of responses seen, it was clear that candidates from most centres may neither have carried out this particular practical nor that of the preparation of a similar soluble salt.

Aqueous Solutions

6 (a) Magnesium sulfate solution can be made by reacting magnesium oxide with dilute sulfuric acid.

The word equation for the reaction is

magnesium oxide + sulfuric acid → magnesium sulfate + water

Describe how solid magnesium oxide and dilute sulfuric acid are used to prepare a sample of pure magnesium sulfate solution.

(2)

Magnessium sulfate solution can be made by reacting magnessium oxide with dilute sulfric acid

ResultsPlus
Examiner Comments

A typical incorrect response, where the stem of the question has simply been repeated, so this did not score.

Aqueous Solutions

6 (a) Magnesium sulfate solution can be made by reacting magnesium oxide with dilute sulfuric acid.

The word equation for the reaction is

magnesium oxide + sulfuric acid → magnesium sulfate + water

Describe how solid magnesium oxide and dilute sulfuric acid are used to prepare a sample of pure magnesium sulfate solution.

(2)

The magnesian Oxide is mixed with the Sulfuric acid once mixed you filter out the excess water and are left with Pure magnesian Sulfate

ResultsPlus
Examiner Comments

Although filtering is suggested, this did not score since it is clearly implied that the solid, namely magnesium sulfate, is a precipitate and that this is being filtered, as opposed to excess solid reactant, magnesium oxide.

Aqueous Solutions

6 (a) Magnesium sulfate solution can be made by reacting magnesium oxide with dilute sulfuric acid.

The word equation for the reaction is

magnesium oxide + sulfuric acid → magnesium sulfate + water

Describe how solid magnesium oxide and dilute sulfuric acid are used to prepare a sample of pure magnesium sulfate solution.

(2)

They are mixed together and then heated and filtered.

ResultsPlus
Examiner Comments

A rarely seen response, in which the 'filtered' could be credited, so this scored 1 mark.

Question 6 (b)

Most candidates were able to score at least 1 of the 2 available marks, typically for stating the correct formulae of the reactants in this balanced equation as given in the stem of the question.

(b) Magnesium carbonate, $MgCO_3$, can be reacted with dilute sulfuric acid, H_2SO_4, to form magnesium sulfate, water and carbon dioxide.

Write the balanced equation for this reaction.

(2)

$MgCO_3 + H_2SO_4 \rightarrow MgSO_4 + H_2O + CO_2$

1 Mg 1
1 C 1
7 O 3 . 4
2 H 2
1 S 1

ResultsPlus
Examiner Comments

A typical example of a fully correct answer for 2 marks. Although, not necessary, this candidate has clearly checked the balancing beneath.

(b) Magnesium carbonate, $MgCO_3$, can be reacted with dilute sulfuric acid, H_2SO_4, to form magnesium sulfate, water and carbon dioxide.

Write the balanced equation for this reaction.

(2)

$2MgCO_3 + 2H_2SO_4 \rightarrow$ ~~Magnesium sulfate~~ $2MgSO_4 + H_2O + CO_2$

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Although the correct formulae of the reactants reactants and products have been shown, the incorrect attempt at balancing, limited the score to 1 mark only.

Question 6 (c)

This was particularly well answered by candidates, with many fully correct responses seen, gaining the 2 marks available. Most candidates correctly subtracted the correct masses or gained credit simply for the working and pleasingly were able to work out the concentration. Many candidates simply completed the table correctly, as opposed to using the space provided for the answer and working. This was also perfectly acceptable to score full marks.

Question 6 (d)

Although many candidates knew little about hard water softening, over half of the responses gained at least 2 marks (Level 1), mainly in recognition that temporary hardness can be removed by boiling. In several cases, flawless answers were seen, with excellent descriptions of the methods needed to remove hardness from temporary and/or permanent hardness given by candidates, coupled with detailed explanations, so these scored the full 6 marks (Level 3). Minor errors often seen included simply mentioning 'heating the water' rather than explicitly boiling. In many cases candidates simply misread the question and described methods of testing water hardness, rather than removal, so were unable to receive credit for their responses.

*(d) Some dissolved solids cause hardness in water.
Hard water can be softened.
Water hardness can be temporary hardness or permanent hardness.
Not all softening processes remove both types of hardness.

Describe and explain different methods of softening water, indicating the type of hardness each method removes.

(6)

Some areas of the country ~~conta~~ have dissolved calcium (Ca^{2+}) ions and/or (Mg^{2+}) magnesium ions in their tap water and it is the presence of these ions which determines the hardness of water. Hardness in water can be permanent or temporary; temporary hardness in water is caused by dissolved calcium hydrogencarbonate and/or magnesium hydrogencarbonate. Only temporary hardness in water can be removed or softened by the method of boiling; although this process leaves behind limescale. Permanent hardness in water cannot be softened by the process of boiling - but, it can be softened through the use of an ion exchange resin. Whilst using an ion exchange resin to soften water, the permenantly hardened water is passed through the ion exchange resin and in order to remove the hardness, the dissolved Ca^{2+} and Mg^{2+} ions are swapped or exchanged for sodium ions.

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An excellent example of a Level 3 response. Both the methods of removal of temporary hardness by boiling and for permanent hardness using an ion exchange resin have been described, but importantly explained to gain the higher Level 3 score.

*(d) Some dissolved solids cause hardness in water.
Hard water can be softened.
Water hardness can be temporary hardness or permanent hardness.
Not all softening processes remove both types of hardness.

Describe and explain different methods of softening water, indicating the type of hardness each method removes.

(6)

Hard water is scum, it can be removed by boiling or permenting. Permanent hardness is removed by permenting and temporary hardness is removed by boiling. An example of ~~temporary~~ permanent hardness is limescale. This is found on kettles, even though the kettle gets boiled the limescale stays put.

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Only lines 4 and 5 of this response are creditworthy for 'temporary hardness... removed by boiling'. This was sufficient for a typical Level 1 answer and was awarded 2 marks.

*(d) Some dissolved solids cause hardness in water.
Hard water can be softened.
Water hardness can be temporary hardness or permanent hardness.
Not all softening processes remove both types of hardness.

Describe and explain different methods of softening water, indicating the type of hardness each method removes.

(6)

If there is temporary hardness it can be removed by using the boiling method which is just where you boil the temporary hardness and it ~~will~~ will just simply dissolve. For permanent hardness you must use a otin resin to remove the permanent hardness because boiling will not be enough to get rid of it.

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This response makes a reference to the removal of temporary hardness by boiling and the use of ion exchange resin for the removal of permanent hardness, with boiling not being enough for permanent hardness removal. This description is detailed and is sufficient for Level 2, so was awarded 4 marks. There is no explanation given to support a higher Level 3 (5-6 marks) answer.

Paper Summary

Based on their performance in this paper, in order to improve their performance, candidates should:

- read all the information in the question carefully and use this to help them answer the question.
- learn and use correct scientific terminology.
- learn the correct procedure for flame testing of ions and flame colours as in the specification.
- learn the specific conditions needed for fermentation and the equations associated with this process.
- learn the procedure for the preparation of an insoluble salt.
- be able to describe the processes occurring in electrolysis reactions in the specification and explain these in terms of redox processes occurring.
- practise writing extended writing tasks, addressing the whole question, often giving a scientific explanation to access higher levels.

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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