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Examiners' Report
June 2014

GCSE Chemistry 5CH3F 01

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Introduction

This is the second examination of Unit C3 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 questions.

There was clear evidence of some very good candidates with some detailed responses to some areas, for example hard and soft water and eutrophication.

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

- the knowledge of simple tests for ions was less than expected, as required in Q3 (a) to (d).
- the recall of any indicator useful in a titration was poor, as required in Q5 (b) (ii).
- there was again a muddled response from many candidates to the question asking for details of preparing a soluble salt, namely copper sulfate, even when useful information was given in the question, as required in Q5 (c).
- the ability to describe simple acid reactions was poor, as required in Q6 (d).

Successful candidates:

- read the questions carefully and answered the questions that were set.
- could use the correct scientific terminology and write word equations.
- could recall the procedures and results for testing simple ions.
- could carry out a simple calculation.
- could analyse clearly data regarding samples of hard and soft water.

Less successful candidates:

- failed to copy accurately the names of species given in the stem of a question when writing equations.
- could not recall the methods of or results for simple tests for ions.
- were unable to name an indicator used in titrations.
- could not describe salt preparation or acid reactions.

The report provides exemplification of candidates' work, together with tips and/or comments for a selection of the questions.

Question 1 (a)

This part allowed many candidates to get off to a good start. There was, however, some confusion between fertilisers and pesticides or herbicides. There were a few references to fertilisers being catalysts (not credited) because they speed up the rate of growth (credited). Others suggested that the main function of fertilisers was to neutralise acidic soils.

Some good, detailed descriptions were given.

Fertilisers and ammonia

1 (a) State why farmers spread fertilisers on their fields.

(1)

To increase the crop yield, Fertilisers are made from nitrates which makes the crops grow bigger and faster

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Examiner Comments

This answer includes plenty of relevant detail.

Fertilisers and ammonia

1 (a) State why farmers spread fertilisers on their fields.

(1)

Farmers spread fertilisers to help there crops grow quicker and to keep animals away

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Examiner Comments

Fertilisers are not used to keep animals away.

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Examiner Tip

Learn the difference between fertilisers, pesticides and herbicides.

Question 1 (b)

This question had a good response with many candidates giving well-explained answers. Most candidates recognised that run-off of fertilisers into water was an issue, and a good number of candidates gained a further mark with answers related to eutrophication, named by some and described by others. However, some candidates thought that fertilisers may kill plants and animals on land, or were unclear what the effect was on water life. Candidates are advised not to be vague, for example "affecting fish" does not tell us whether fish are helped or harmed.

(b) Using too much fertiliser can harm the environment.

Describe how the spreading of too much fertiliser on fields can harm the environment.

(2)

If there is too much, it could be washed into rivers and lakes. It will increase algae and plants to grow on the surface of the lake. This will block sunlight getting in the river so plants can't photosynthesis so die. Fish and animals also die as there is little oxygen. This is eutrophication.

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Examiner Comments

This answer is explained very clearly using good, scientific terminology.

(b) Using too much fertiliser can harm the environment.

Describe how the spreading of too much fertiliser on fields can harm the environment.

(2)

The Fertiliser can damage living things that currently live in the area

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Examiner Comments

This answer contrasts with the first example, giving little detail.

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Examiner Tip

Be clear about what you mean. Fertilisers that are washed into lakes, for example, can lead to the death of fish, but this answer is much too vague.

Question 1 (c) (i)

Despite being given so much information in the question, i.e. all of the reactants and products, there were a surprising number of blanks or the misuse of ammonia for ammonium and vice versa (which of course had to be penalised in this example). A few candidates unwisely attempted to use formulae; all of those that did were incorrect.

(c) Ammonium nitrate is a fertiliser.

Ammonium nitrate is formed when nitric acid reacts with ammonia.

(i) Write the word equation for this reaction.

(2)

Nitric acid + Ammonia → Ammonia nitrate

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Examiner Comments

Be careful - the product 'ammonium nitrate' was written in the question, and information like this should be carefully transferred.

(c) Ammonium nitrate is a fertiliser.

Ammonium nitrate is formed when nitric acid reacts with ammonia.

(i) Write the word equation for this reaction.

(2)

N_2 + NH_3 → N_3H_3

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Examiner Comments

Some candidates give symbol equations when asked for word equations. They have to be completely correct - and rarely are - to score.

Question 1 (d) (i)

Most responses were given as some spelling of "reversible". Some incorrect responses included "the Haber Process" (an understanding of 'type' is important), "reverse**/** reverse reaction", "interchangeable", "vice versa" and "static equilibrium".

(d) In the Haber process, nitrogen and hydrogen react to form ammonia.

nitrogen + hydrogen ⇌ ammonia

(i) The ⇌ symbol in the word equation shows that the reaction goes forwards and backwards at the same time.

Give the name of this type of reaction.

(1)

Two - way reaction.

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Examiner Comments

Reversible reaction / equilibrium was required.

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Examiner Tip

You must learn correct scientific terms - why not produce a list of all the key words you learn in each topic?

Question 2 (a) (ii)

Some candidates wrote very detailed correct answers, describing well that enzymes become denatured. However, not all of these fully answered the question, describing why rather than how the contents were different. Some completely missed the point with references to rates of reaction and the effect of heat with increased collision frequency at a higher temperature, causing there to be more product in the hotter flask.

Examples of incorrect responses included "the contents would be higher/lower/less" without saying what the contents were, "the contents of the flask at 75°C would be hotter", "water evaporates at 75°C", "yeast/enzymes are killed", "40°C is the optimum temperature" with no explanation in terms of enzymes.

(ii) A teacher demonstrated the effect of temperature on fermentation.

She made a mixture of water, sugar and yeast.
Half of the mixture was kept in a flask at 40 °C and the other half was kept in a flask at 75 °C.

Ethanol was formed by fermentation at 40 °C.

Explain how the contents of the flask at 75 °C would be different from the contents of the flask at 40 °C.

(2)

The contents of the flask at 75° would be less than the contents of the flask at 40° because at 75° the heat will begin to kill the enzymes in the yeast. There would be more ethanol in the flask heated to 40° because this is the optimum temperature for the enzymes in yeast to thrive.

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Examiner Comments

This answer has some very good detail, but unfortunately contains a misconception.

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Examiner Tip

Enzymes are denatured, not killed, at high temperatures.

(ii) A teacher demonstrated the effect of temperature on fermentation.

She made a mixture of water, sugar and yeast.
Half of the mixture was kept in a flask at 40°C and the other half was kept in a flask at 75°C.

Ethanol was formed by fermentation at 40°C.

Explain how the contents of the flask at 75°C would be different from the contents of the flask at 40°C.

(2)

the contents of the flask at 75°C would be different because it is at a higher temperature, the mixture would be too hot to create ethanol.

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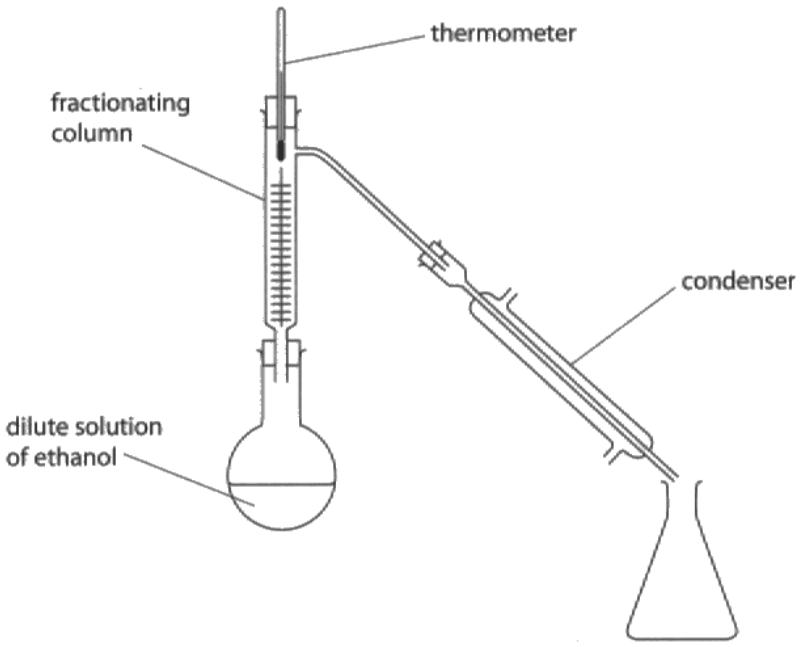
Examiner Comments

This answer does not explain why there would be less ethanol at a higher temperature.

Question 2 (b)

Candidates quite often failed to heat the ethanol solution and hence nothing would happen. Others did not grasp the idea of distillation – the "ethanol solution" evaporating, or were unclear as to what was evaporating. Others, a minority, had an understanding but got it the wrong way round, with the water evaporating first and the pure ethanol left behind in the round bottomed flask.

(b) A dilute solution of ethanol is concentrated by fractional distillation.



Describe how this apparatus is used to obtain a more concentrated solution of ethanol.

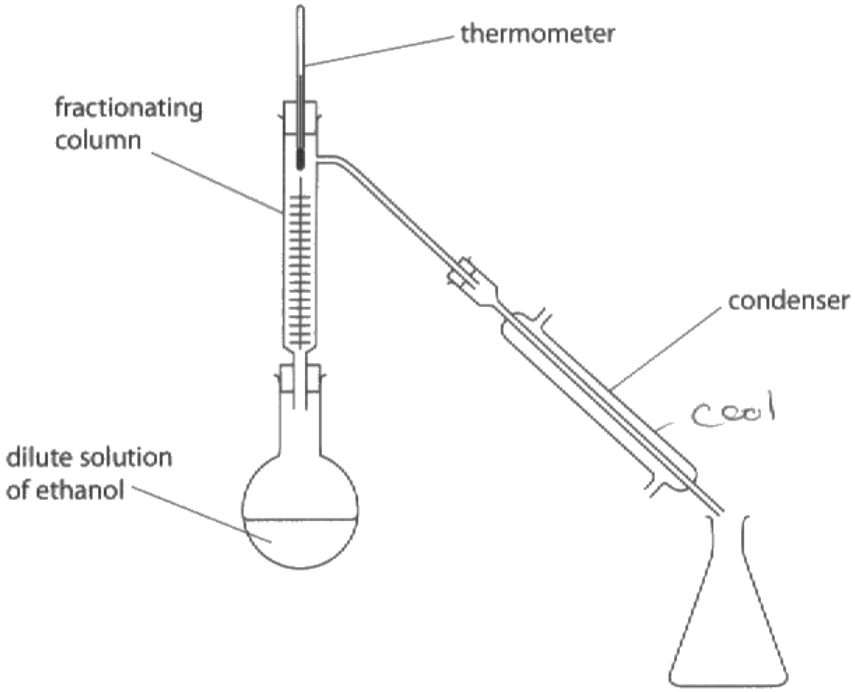
(2)

A flame is used to heat the dilute solution of ethanol, the ethanol evaporates and condenses at the condenser thus will then produce pure ethanol at the flask.

ResultsPlus
Examiner Comments

This answer neatly describes the process of distillation.

(b) A dilute solution of ethanol is concentrated by fractional distillation.



Describe how this apparatus is used to obtain a more concentrated solution of ethanol.

(2)

ethanol has a lower boiling ~~point~~ point than water, so it evaporates up the fractioning column and leaves the water behind. The condenser condenses the ethanol by cooling it. So the solution is more concentrated.

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Examiner Comments

This answer has plenty of detail but unfortunately has not used any heat, so nothing would happen.

Question 2 (c)

This question was well answered, with good reasons given, and with an 'open' mark scheme many scored two marks. The candidates do have to be careful with 'reaction time'. This is longer after alcohol, and on this occasion 'reaction time is slower' was allowed although it is not well expressed.

Some did say "reduced reaction time" which is, of course, wrong. In rates of reaction questions there is often a similar confusion between rate and time, and this is worth discussing in class.

(c) Alcoholic drinks contain ethanol.

Explain why people should not drink alcoholic drinks before driving.

(2)

Alcohol lowers inhibitions, it affects the central nervous system, leaving you with poor judgement and balance, blurred vision and bad co-ordination. Accidents could be caused.

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Examiner Comments

This answer is good because it states the effect of alcohol on the brain and then goes on to explain why this is a problem.

Question 2 (d)

This part was quite low scoring, surprisingly.

Question 3 (b)

Candidates' knowledge of tests for ions was poor - only about a third of candidates getting 2 marks.

Question 3 (d)

This question was not particularly well answered.

Many candidates were awarded one mark for "limewater turning milky" or "gas given off" but relatively few gave a fully correct answer. Some 'bubbled the solution' through limewater or said that limewater turns cloudy in the presence of carbonate ions but said nothing about passing gas into limewater.

Other completely incorrect answers included:

- a flame test for carbonate ions.
- using litmus/ Universal Indicator solution.
- using silver nitrate.
- the squeaky pop test.

Question 3 (e)

There were some good responses here but a lack of careful explanation sometimes prevented the scoring of full marks. Good answers commented on some of the many aspects allowed in the mark scheme with excellent use of specific examples of contaminants.

Weaker answers were very vague. They talked about water looking or tasting nice, or being clean, but did not consider safety. They may have used unclear terminology such as

"bad chemicals" and did not explain that this meant the water was unsafe or may cause illness.

Question 3 (f)

This question proved straightforward with many good, two mark answers. Even those candidates not scoring full marks often gained a mark for defining 'quantitative'.

Others, perhaps guessing, mentioned 'quality' in a definition for qualitative which was not credited.

Question 4 (a) (i)

Mainly correct, but capital and small letters must be clear.

Question 4 (a) (ii)

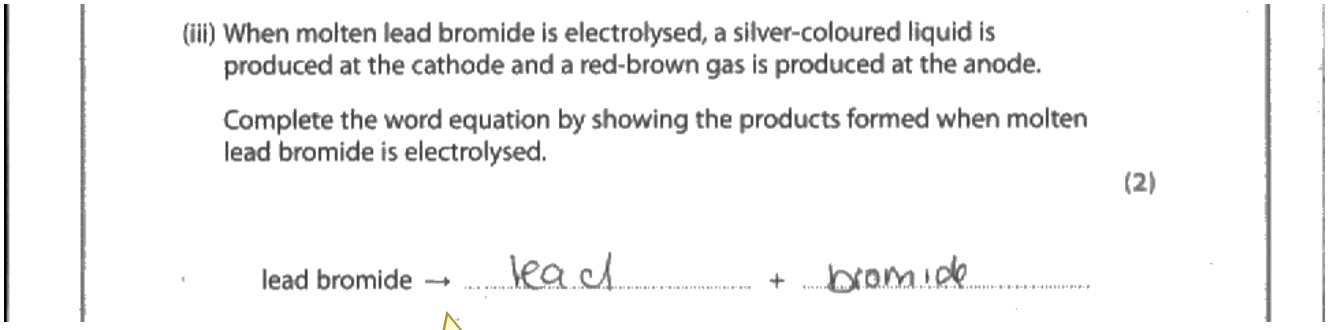
This part was not well answered with a high proportion of blanks or incorrect answers. Many said it was a good conductor, but omitted 'heat' or said "a good conductor of electricity". Others latched on to the word 'molten' and made comments about free moving electrons/ ions being present in a molten substance allowing electrolysis to take place (or that solid sodium could not be used). Others latched on to 'sodium' and described that it was suitable due to its high reactivity.

Question 4 (b) (i)

Reasonably well know, with 'OIL RIG' regularly seen jotted down beside correct answers. A useful mnemonic!

Question 4 (b) (iii)

Whilst there were many correct answers here, a surprising number of other elements (or even compounds) were generated out of lead bromide (including iron, copper, silver, chlorine and nitrogen). Bromide was an obvious error as a product, and candidates are advised that rather than superimposing 'n' over 'd' to correct an error, it would be better to cross out the incorrect answer and write in the correct answer above. The question clearly required the completion of the word equation, so symbols were not credited.



(iii) When molten lead bromide is electrolysed, a silver-coloured liquid is produced at the cathode and a red-brown gas is produced at the anode.

Complete the word equation by showing the products formed when molten lead bromide is electrolysed.

(2)

lead bromide → lead + bromide

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Examiner Comments

This answer scored 1.

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Examiner Tip

Remember that the halogens are called fluorine, chlorine, bromine and iodine, but the ions are fluoride, bromide, chloride and iodide.

Question 4 (c) (i)

It is important in a question like this that **all** of the correct answers are given.

Question 4 (c) (ii)

Many excellent 3 mark answers were seen here, where the type of hardness in the three liquids was clearly stated with evidence from the data, some candidates using the conductivity data effectively. Some candidates just stated the types of hardness but gave no explanations, and only scored one mark. In some cases, there was a lack of clarity over liquid B; not showing that scum formed before and lather after.

There were some apparent 'slips of the pen' where one liquid was repeated with a different explanation and one liquid was omitted. Candidates are strongly advised to read through such answers before moving on.

(ii) Use the results of the tests to explain whether each of the liquids **A**, **B** and **C** is soft, shows permanent hardness, or shows temporary hardness.

(3)

Hard water conducts electricity, therefore liquid A ~~and~~ and B are both hard water, liquid B is tempory hard water because ~~so~~ after it is boiled, it forms a latter, liquid A is permanent Hard water becase it still dosent form a latter after its boiled, and liquid C is soft water because it dosent conduct electricity and forms a latter without Boiling.

(Total for Question 4 = 10 marks)

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Examiner Comments

This is an excellent answer that uses the data given to explain whether the liquids are soft or show permanent or temporary hardness.

(ii) Use the results of the tests to explain whether each of the liquids **A**, **B** and **C** is soft, shows permanent hardness, or shows temporary hardness.

(3)

-A is a permanant hard water
-B is temporary hardness but boiled.
-C is ~~temporary hard~~, is distilled water.

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Examiner Comments

This candidate has some knowledge but has not applied it to answer the question as required.

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Examiner Tip

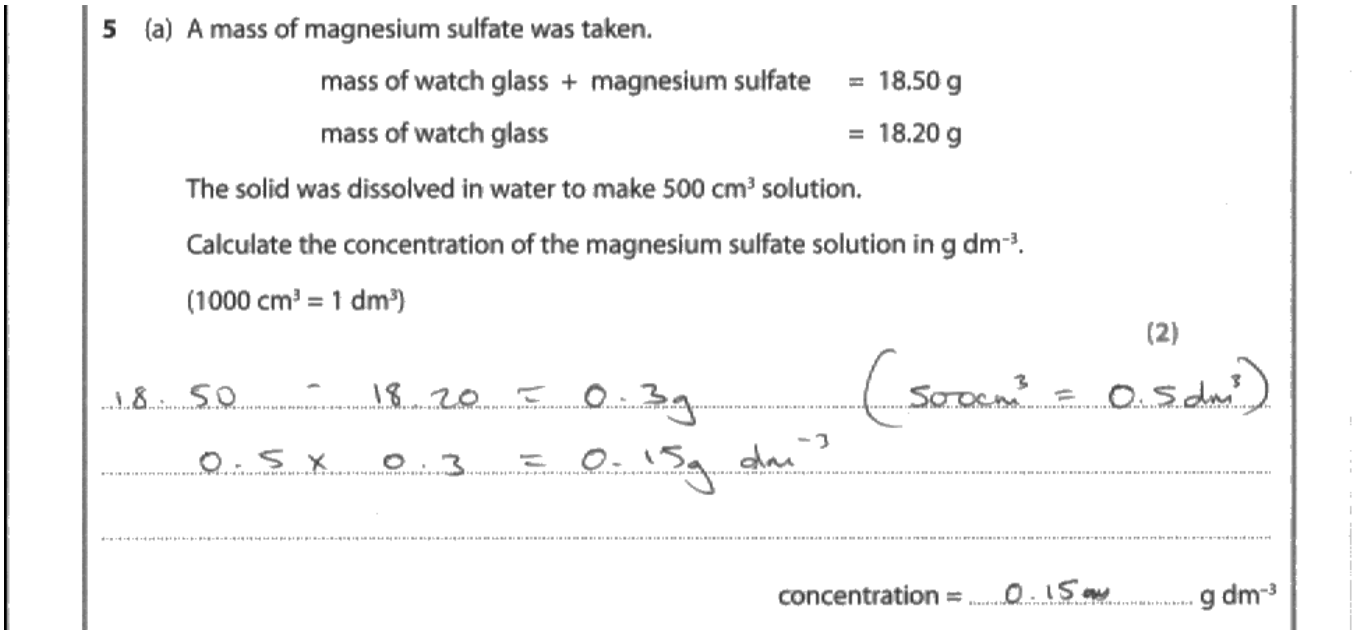
Read through your answers and check that they do what is asked. If the question says 'use the results...' then you must refer to the data given.

Question 5 (a)

As usual, the sight of a calculation threw some candidates into panic mode, and they either made no attempt or wrote figures all over the place with no indication as to what they were.

Most candidates who made an attempt got 1 mark for showing 18.50 - 18.20 = 0.30 (even though some came out with wrong answer, due to the fact that they omitted the decimal point).

After that, very few correctly divided by 0.5, with most candidates multiplying the two figures.



5 (a) A mass of magnesium sulfate was taken.

mass of watch glass + magnesium sulfate = 18.50 g

mass of watch glass = 18.20 g

The solid was dissolved in water to make 500 cm^3 solution.

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

(1000 cm^3 = 1 dm^3)

(2)

18.50 - 18.20 = 0.3g (500cm^3 = 0.5dm^3)

0.5 x 0.3 = 0.15g dm^{-3}

concentration = 0.15 g dm^{-3}

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Examiner Comments

This answer scored 1 and does have the merit of being clearly set out. It was the most common error where full marks were not scored.

Question 5 (b) (i)

Some nice answers were given with pipette and pipette/safety filler (filler was not required).

Question 5 (b) (ii)

This question was very poorly answered. It was expected that most candidates could describe the Universal Indicator (or even Litmus) results effectively, but this was not so, and the examiners were surprised by this. A large proportion gave no indicator or an irrelevant substance that was not an indicator. Some did give Universal Indicator or Litmus but could not give correct colours. A fair minority did (try to) give phenolphthalein or methyl orange (and some leeway was given here with spelling). It is perhaps notable that those using phenolphthalein were much more likely to get the correct colours.

Question 5 (c)

There was a lot of confusion in this question, either because the candidates did not grasp at all the idea of salt preparation, or because they apparently did not read the information provided. Hence, although candidates were told a soluble salt is formed, they proceeded to describe precipitate collection, filtering the mixture to collect the residue which was washed and dried. Others mixed up the correct answer with a titration method. The most common answer was to react the substances and then evaporate water with no filtration stage. Having said this, there were some excellent answers scoring 6 marks.

*(c) Copper sulfate is a soluble salt.
Copper sulfate can be prepared by reacting copper oxide with dilute sulfuric acid.
Copper oxide is an insoluble solid.

Describe how you would prepare some pure, dry crystals of copper sulfate by reacting excess copper oxide with dilute sulfuric acid.

(6)

The copper oxide and the dilute sulfuric acid will be mixed until a product begins to form at the bottom of the flask, once this occures then the solution will be filtered so there is only the solution containing the salt and water. This solution should the be boilded leaving behind a pure sample of the salt. The water level should be continusly checked to make sure it is all evaporated before re weighing the salt crystals left behind.

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Examiner Comments

This answer is not fully correct but is clearly set out and the basic principles are understood.

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Examiner Tip

-Try to remember how you did these experiments in class (usually, the reaction mixture is heated)

-Use the information given (copper oxide is insoluble so the excess would be filtered out - this should be explained in the answer)

-Remember how crystallization occurs - not all of the water is evaporated

*(c) Copper sulfate is a soluble salt.
Copper sulfate can be prepared by reacting copper oxide with dilute sulfuric acid.
Copper oxide is an insoluble solid.

Describe how you would prepare some pure, dry crystals of copper sulfate by reacting excess copper oxide with dilute sulfuric acid.

(6)

-add the dilute sulfuric acid with the copper oxide.
-wait till the solution is ~~a~~equal and filter and dy undissolved copper oxide.
-~~B~~evaporate all the solution on a bunsen berner in a beaker until the solution has crystalised.
-Then you have pure, dry crystals of copper oxide.

ResultsPlus
Examiner Comments

A reasonable answer, with the use of a bullet point style being helpful. This might be a useful answer to ask a class to rewrite to make it even better.

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Examiner Tip

The use of bullet points can be helpful in extended writing.

Question 6 (a) (i)

Ester formation was well known.

Question 6 (a) (ii)

Interestingly, many candidates said in this question that esters were harmless/good for you/ natural – perhaps due to the use of the word 'organic' in the question. Many candidates scored the mark with "smells nice", (though one discerning candidate put nice in quotation marks and another said "some of them smell nice").

Incorrect answers included:

- "strong/distinctive smell or scent" without describing it.
- talking about flavourings and not scent.
- just writing the word 'esters'.
- talking about how appealing esters were to the opposite sex (or writing about pheromones).

Question 6 (b)

Some candidates did not read the question carefully enough and answered the question but replacing 'recycled' with 'used', giving properties of polyesters, and not reasons for recycling. In such questions, candidates should be wary of advertising-type slogans ("environmentally friendly", "saves the environment", "doesn't destroy the planet/ harm the earth" and so on). Not many candidates recognised that recycling leads to less use of landfill, and saves resources and energy.

(b) Fleece jackets can be made from recycled polyesters.

Explain why polyesters are recycled to make fleece jackets.

(2)

After polyesters are used on packaging, they cannot be used again to form packaging. And if you bury it under the earth soil, it takes thousands of years to ~~it~~ ~~biodegrade~~ biodegrade. Creating a fleece jacket is the most sensible way of protecting the environment and not wasting the polyesters.

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Examiner Comments

This answer explains why polyester should be recycled.

(b) Fleece jackets can be made from recycled polyesters.

Explain why polyesters are recycled to make fleece jackets.

(2)

It greatly helps the environment to recycle things like plastic bottles and make clothing out of them. It is also much cheaper than the conventional way of making clothing.

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Examiner Comments

The first part of the answer refers to the environment but has no scientific detail worthy of a mark.

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Examiner Tip

When explaining environmental reasons, scientific detail must be given.

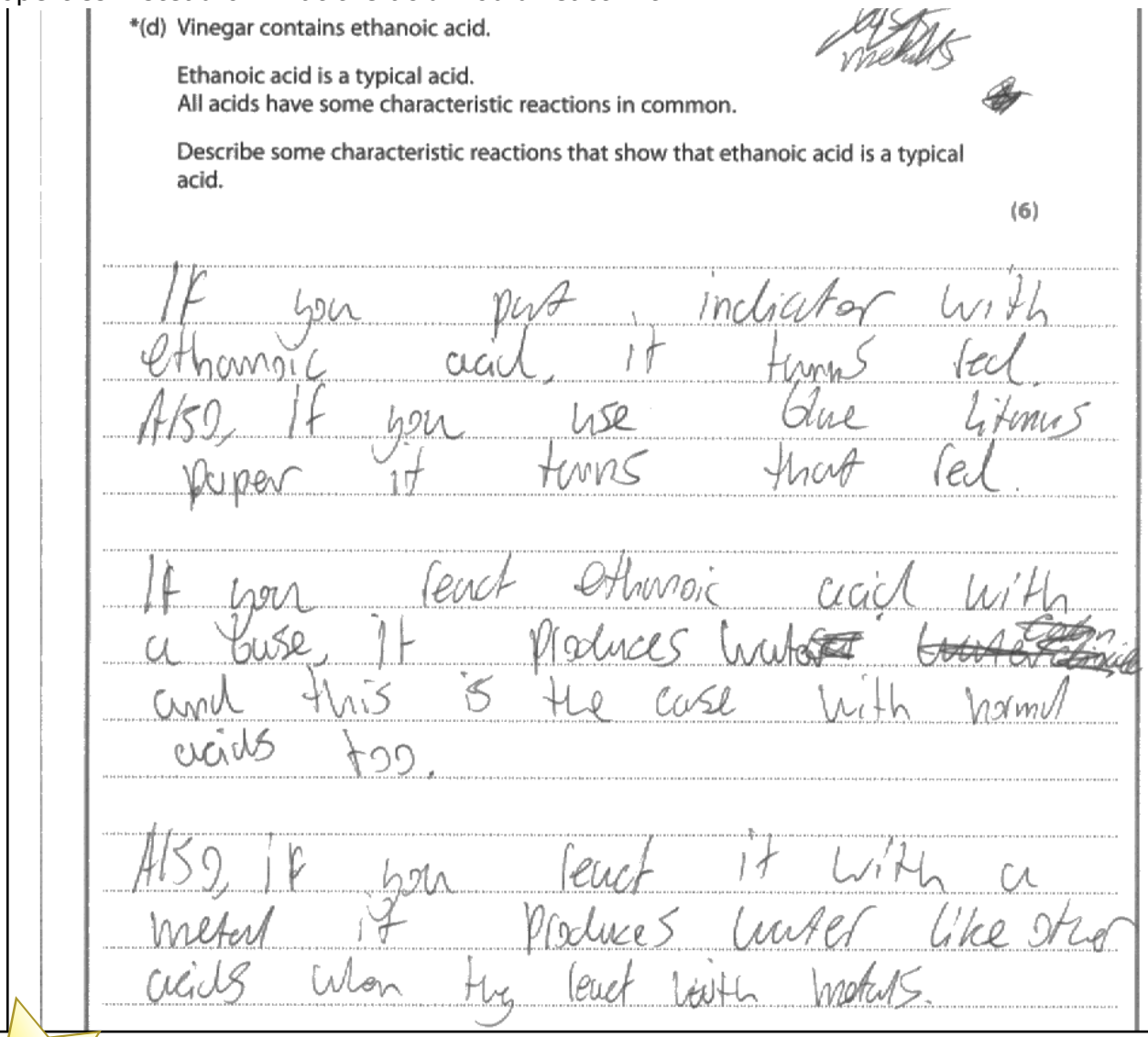
Question 6 (c)

Most candidates had no idea how to make soap, with most just repeating the information in the question. There were almost no examples seen of 'salting out', or perhaps more surprisingly of a relevant safety precaution. Where a mark was scored it was for heating the mixture.

Question 6 (d)

There were lots of blank answers, suggesting that the candidates had no idea. Others had mixed up and jumbled observations or products suggesting that the factual knowledge of reactions was not complete.

Some candidates gave answers relating to esterification, homologous series, oxidation of alcohols, a sour taste, a distinctive smell, corrosiveness and other physical and chemical properties instead of what the acid would react with.



*(d) Vinegar contains ethanoic acid.

Ethanoic acid is a typical acid.
All acids have some characteristic reactions in common.

Describe some characteristic reactions that show that ethanoic acid is a typical acid.

(6)

If you put indicator with ethanoic acid it turns red. Also if you use blue litmus paper it turns that red.

If you react ethanoic acid with a base it produces water and this is the case with normal acids too.

Also if you react it with a metal it produces water like other acids when they react with metals.

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Examiner Comments

This answer is clearly laid out. The reference to 'indicator' in the first sentence should refer to a specific indicator. (Many candidates seem to think that UI is "indicator"). The reaction with a base is correct and could have been improved by adding a salt as the other product. The candidate has identified that acids react with metals, but the product is incorrect. This answer was awarded 4.

Paper Summary

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

- Look at past papers to see the difference between 'describe' and 'explain' questions.
- Make a word list of scientific terms to use in your answers.
- Practise describing experiments that you have covered in the course, e.g. distillation, salt preparation.
- Distinguish carefully between rate and time: a faster reaction = shorter reaction time.
- When using given data, refer to it in your answer.
- Use past papers to practise calculations.
- Show your working clearly when setting out calculations.
- Learn some indicators and their colours in acid and alkali.
- Practise writing out different methods of salt preparation.

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