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Examiners' Report
June 2016

GCSE Chemistry 5CH3F 01

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June 2016

Publications Code 5CH3F_01_1606_ER

Introduction

The paper contained a range of questions with a mixture of question styles and varying levels of demand, ranging from some designed to be accessible for the weaker students, to others meant to be challenging for the stronger ones. There were opportunities for candidates to show their knowledge and experience of a wide range of the course including practical work they have carried out as part of their study.

In general, in relevant questions on the paper, the stronger candidates could:

- assimilate and use information given in the question
- show knowledge of hard and soft water
- construct a word equation
- write a simple balanced equation from given information
- show understanding of salt preparation techniques
- show knowledge and understanding of tests for ions
- show knowledge of industrial processes and the uses and applications of the products
- demonstrate knowledge of alkanes and alkenes.

In comparison, other candidates were less effective in these aspects, and they also sometimes gave answers that either did not use the information which had been given in the question to assist them, or gave answers which were not directly relevant to the question. However, it was pleasing to see some very good responses to the free-response six mark questions, with some good knowledge of organic chemistry evident in the second one.

This report gives examples of typical responses to the questions and some comments on them.

Question 1 (a)

1 Water from reservoirs is treated and tested before it is supplied to our homes.

(a) Give a reason why water is tested before it is supplied to our homes.

(1)

to make sure it is clean and safe for people to drink and also it isn't had water

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Examiner Comments

Reference to ensuring the water is clean was not sufficient on its own but here the candidate also refers to it being safe to drink which was an acceptable answer. Any references to hardness of water were ignored.

Question 1 (b) (i)

(b) Water taken from reservoirs can be hard or soft.

You are given samples of hard water and soft water.

(i) Explain how you could show which sample was hard water and which sample was soft water.

Use the words from the box in your answer.

lather	scum	soap

(3)

Hard water is & harder to create a lather and produces sum. Where as Soft water produce a large lather with a small amount of soap and does not produce any scum.

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Examiner Comments

This candidate shows a good knowledge in stating that hard water forms a scum with soap but soft water does not. The candidate also gives information about the relative difficulty of forming a lather with soap. This was a very good answer and scored 3 marks.

(b) Water taken from reservoirs can be hard or soft.

You are given samples of hard water and soft water.

(i) Explain how you could show which sample was hard water and which sample was soft water.

Use the words from the box in your answer.

lather	scum	soap

(3)

Hard water does not easily form a lather with soap and will form a nasty precipitate called scum on the surface of the water.

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Examiner Comments

Good information for hard water is given but unfortunately no information about soft water so only worth 2 marks.

Question 1 (b) (iii)

(iii) Hardness in water can be either temporary or permanent.

Describe a test to show whether the hardness in a sample of water is temporary or permanent.

(2)

You could boil the water and then if it lathered after boiling it would be temporary hard water, if it doesn't form a lather and forms scum it will be permenant hard water.

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Examiner Comments

There were alternative ways of scoring 2 marks and this is a good example referring to the effect of soap on the boiled water.

(iii) Hardness in water can be either temporary or permanent.

Describe a test to show whether the hardness in a sample of water is temporary or permanent.

(2)

If it is temporary then it should become soft water once boiled & if it doesn't then it's permanent.

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Examiner Comments

This was a common answer worth only 1 mark as it does not give any suitable observation which could be made after boiling.

Question 2 (a) (i)

This proved to be more difficult than had been expected. It was common for candidates to heat or even melt the crystals before adding them to water and many, sometimes having made a solution, or just starting with a solution, then proceeded to explain how to get crystals from the solution.

Solutions and tests for ions

2 (a) (i) Describe how you would make a solution of sodium chloride from sodium chloride crystals and distilled water.

(2)

heat the crystals up and mix them in with the water.

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Examiner Comments

There is no need to heat the crystals but 1 mark was awarded for mixing them in with the water.

Question 2 (a) (ii)

(ii) A test for chloride ions is carried out on the sodium chloride solution.

P, **Q**, **R** and **S** are involved in tests for ions.

P add silver nitrate solution to the solution

Q a white precipitate forms

R add sodium hydroxide solution to the solution

S add dilute nitric acid to the solution

Only three of these form part of the test for chloride ions.

Identify the three and place them in the order they occur in the test.

(2)

1 P

2 S & R

3 .....

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Examiner Comments

As here, it was common for the use of sodium hydroxide to be suggested. However 1 mark was gained for P and S.

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Examiner Tip

Learn the tests for the ions.

Question 2 (c)

This was poorly answered in the main with incorrect answers such as carbon and limestone often seen.

(c) Two tests are carried out on a solid.

- In a flame test, a yellow flame is seen.
- When some dilute hydrochloric acid is added to the solid, a gas is evolved. The gas turns limewater milky.

Give the name of the solid.

(2)

Sodium.

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Examiner Comments

This was a common way of being awarded 1 mark.

Question 3 (a) (i)1

3 (a) Some metals are extracted by the electrolysis of a molten compound.

(i) Complete the sentences about the electrolysis of a molten compound using words from the box.

decomposed	electricity	electrons	ions	molecules	purified

Each word may be used once, more than once or not at all.

(2)

The compound has to be molten so that the electrons can move.

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Examiner Comments

This was a very common misunderstanding.

Question 3 (a) (i)2

When a molten compound is electrolysed its elements are formed. During electrolysis the compound is purified .

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Examiner Comments

A common incorrect answer.

Question 3 (b) (i)

(b) (i) When molten zinc chloride is electrolysed, a solid forms at one electrode and a pale green gas forms at the other electrode.

Use this information to complete the word equation for the reaction that takes place when molten zinc chloride is electrolysed.

(2)

zinc chloride → Zinc + Chloride

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Examiner Comments

This was worth 1 mark for zinc but the incorrect answer of chloride instead of chlorine, was given by many.

Question 3 (b) (ii)

(ii) In this electrolysis, chloride ions lose electrons to form the pale green gas.

State the type of reaction that occurs when electrons are lost.

(1)

reduction

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Examiner Comments

There were many examples of reduction which was understandable, but also answers such as neutralisation and exothermic were not uncommon.

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Examiner Tip

Try to remember OIL - Oxidation is Loss RIG - Reduction is Gain (of electrons).

Question 3 (c)

This was only answered well by a minority of students with references to bubbling frequently seen and various colours being suggested.

(c) Copper chloride dissolves in water.

Describe what you **see** when sodium hydroxide solution is added to a solution containing copper ions, Cu^{2+}.

(2)

A precipitate being formed, fizzing.

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Examiner Comments

This gained 1 mark for the mention of a precipitate without a colour. The reference to fizzing was ignored.

Question 3 (d)

This was very poorly answered despite it being directly from the specification. Most suggestions involved uses for sodium chloride/salt.

(d) Sodium is manufactured by the electrolysis of molten sodium chloride.

Explain a large-scale use of sodium.

(2)

sodium is used in street lamps and is also used in a coolant for nuclear reactors.

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Examiner Comments

It was pleasing to see some very good answers such as this but they were very rare.

Question 4 (a) (i)

Spellings for Haber which could be recognised, including phonetically were accepted.

Question 4 (a) (ii)

Many thought that hydrogen was either found in the air or obtained from water (presumably by electrolysis).

(ii) State the main source of the nitrogen and of the hydrogen used in this process.

(2)

source of nitrogen Air

source of hydrogen Water

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Examiner Comments

This was a common suggestion as a source of hydrogen instead of methane/natural gas.

Question 4 (a) (iii)

(iii) Write the balanced equation for the reaction between nitrogen and hydrogen to produce ammonia.

(2)

$N_2 + H_2 \rightarrow NH_3$

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Examiner Comments

The required formulae were given in the question and this candidate used them but did not balance the equation so was limited to 1 mark.

Question 4 (a) (iv)

(iv) State why the following hazard symbol is seen on a bottle of concentrated ammonia solution.

(1)

ammonia can burn the skin.

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Examiner Comments

The preferred answer was corrosive but answers such as this were accepted.

Question 4 (b)

(b) The formula of a molecule of ammonia is NH_3.

Use the formula to describe the atoms combined in one molecule of ammonia.

(2)

There are one nitrogen and four Hydrogens in the molecule of ammonia.

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Examiner Comments

Nitrogen and hydrogen are correctly identified but the number of hydrogen atoms is incorrect so this was worth 1 mark.

Question 4 (c)

(c) Explain why ammonium compounds are important in agriculture.

(2)

It helps kill off bugs and kills any pests that try to eat vegetables and fruit from farmlands.

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Examiner Comments

Many candidates such as this one thought ammonium compounds are used as pesticides instead of fertilisers.

Question 5 (b) (i)

Candidates had been told that ethanoic acid reacts with the alkali sodium hydroxide so it was disappointing that more did not give neutralisation as the type of reaction occurring.

(b) Sodium ethanoate can be made by reacting ethanoic acid solution with a solution of the alkali sodium hydroxide.
Water is also formed.

(i) Give the name of the type of reaction that occurs when ethanoic acid reacts with sodium hydroxide.

(1)

Exothermic.

ResultsPlus
Examiner Comments

This was the alternative acceptable answer. Common incorrect answers included reduction, oxidation and combustion.

Question 5 (b) (ii)

(ii) Write the word equation for this reaction.

(2)

ethanoic acid + sodium hydroxide → sodium ethanoate

ResultsPlus
Examiner Comments

Many candidates like this one, scored 1 mark and not 2 as they omitted water, even though it had been given in the information in the question.

Question 5 (c) (i)–(ii)

(c) Ethanoic acid is present in vinegar.

(i) State why vinegar is sprinkled on some foods.

(1)

To add taste

(ii) State why other foods are stored in vinegar.

(1)

To kill bacteria and keep them preserved, also known as pickling

ResultsPlus
Examiner Comments

Many candidates were able to make good suggestions about the reasons for using vinegar - any sensible reference to taste was allowed in part (i).

Question 5 (d)

There was a wide variety of quality of answers given. Unfortunately many of those who made a decent start and gained credit by adding the acid and carbonate together, then thought the magnesium ethanoate was formed as a precipitate (despite being told it was soluble in water) and did not gain any further marks. Others tried to describe titration reactions and surprisingly electrolysis was not uncommon.

*(d) Magnesium ethanoate is a salt which is soluble in water.
It can be made by reacting magnesium carbonate powder with dilute ethanoic acid.
Magnesium carbonate is insoluble in water.

The equation for the reaction is

$$\text{ethanoic acid}\ (aq) + \text{magnesium carbonate}\ (s) \rightarrow \text{magnesium ethanoate}\ (aq) + \text{carbon dioxide}\ (g) + \text{water}\ (l)$$

You are given some dilute ethanoic acid and magnesium carbonate powder.

Describe how you would prepare a pure solution of magnesium ethanoate and how you would obtain pure, dry magnesium ethanoate crystals from that solution.

(6)

Firstly mix ~~mag~~ excess magnesium carbonate powder with dilute ethanoic acid and stir. then using filter paper and a funnel filter the solution into a beaker. After then heat it using a bunson burner to evaporate some water, however do not evaporate all water as that is what gives the crystals the blue appearance. Finally, dry the solution in a bowl by leaving it in the exposiour of the sun for a few days. When this is complete you will have pure dry magnesium ethanoate crystals. from the magnesium ethanoate solution.

* you will then have a pure solution of magnesium ethanoate.

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Examiner Comments

This answer contains a sufficient description of mixing the acid and carbonate including stirring, and also describes filtering. Despite the "blue" and poorly expressed "dry the solution" it also gives a good description of making crystals. As it contains acceptable descriptions of 3 of the stages it was awarded level 3 and 6 marks

*(d) Magnesium ethanoate is a salt which is soluble in water.
It can be made by reacting magnesium carbonate powder with dilute ethanoic acid.
Magnesium carbonate is insoluble in water.

The equation for the reaction is

$$\text{ethanoic acid}_{(aq)} + \text{magnesium carbonate}_{(s)} \rightarrow \text{magnesium ethanoate}_{(aq)} + \text{carbon dioxide}_{(g)} + \text{water}_{(l)}$$

You are given some dilute ethanoic acid and magnesium carbonate powder.

Describe how you would prepare a pure solution of magnesium ethanoate and how you would obtain pure, dry magnesium ethanoate crystals from that solution.

(6)

you mix the ethanoic acid and magnesium carbonate ~~and~~ ~~st~~ and wait for it to dissolve. It will disolve because the acid will break it down, even if its insoluble in water. This will be done in a test tube. Then you are left with magnesium ethanoate mixed with water. The carbon dioxide will not be mixed in with the solution because it is a gas. It will still be present. To prove this, bubble the gas through lime water and it will turn cloudy. To get pure magnesium ethanoate, pour the solution into a container. You can leave it in the sun to evaporate, but this will take time. To quicken the process, pour the solution into a non-melting container and heat over a bunsen burner. This will make the water evaporate and leave you with pure magnesium ethanoate.

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Examiner Comments

This contained adequate descriptions of the mixing and making crystals stages and was awarded level 2 and 4 marks.

*(d) Magnesium ethanoate is a salt which is soluble in water.
It can be made by reacting magnesium carbonate powder with dilute ethanoic acid.
Magnesium carbonate is insoluble in water.

The equation for the reaction is

$$\text{ethanoic acid (aq)} + \text{magnesium carbonate (s)} \rightarrow \text{magnesium ethanoate (aq)} + \text{carbon dioxide (g)} + \text{water (l)}$$

You are given some dilute ethanoic acid and magnesium carbonate powder.

Describe how you would prepare a pure solution of magnesium ethanoate and how you would obtain pure, dry magnesium ethanoate crystals from that solution.

(6)

By mixing ethanoic acid and magnesium carbonate you form a solution. This can then be heated to evaporate the liquids. Once they have gone you should be left with dry magnesium ethanoate crystals that have formed from the solution. You should use a bunsen burner, a heating basin and protective clothing such as goggles.

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Examiner Comments

This is a level 1 type answer.

Question 6 (a) (i)

6 (a) The formula of a molecule of ethanol is C_2H_5OH.

(i) State how you know, from its formula, that ethanol is **not** a hydrocarbon.

(1)

hydrocarbons don't have oxygen in them.

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Examiner Comments

Many candidates gave answers similar to this although references to double bonds were quite common.

Question 6 (a) (ii)

Many candidates repeated information from the question by referring to fermentation and then gained a mark by referring to the use of yeast. However, most neglected to involve water with the sugar but some did highlight the need for anaerobic conditions.

(ii) A dilute solution of ethanol can be produced by the fermentation of a carbohydrate.

Starting from sugar (a carbohydrate), describe how a dilute solution of ethanol can be produced.

(3)

~~Store~~ Add yeast to the carbohydrate solution and store in a warm place between 30°-40° as the enzymes work best in these temperatures. Once at the right concentration, the ethanol can be extracted from the top of the solution.

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Examiner Comments

This is an example of a very good answer with carbohydrate solution being mentioned as well as yeast and using a warm place - this was the alternative to anaerobic conditions for the third mark.

Question 6 (a) (iv)

This proved an accessible mark with many correctly giving the missing formula as H_2O

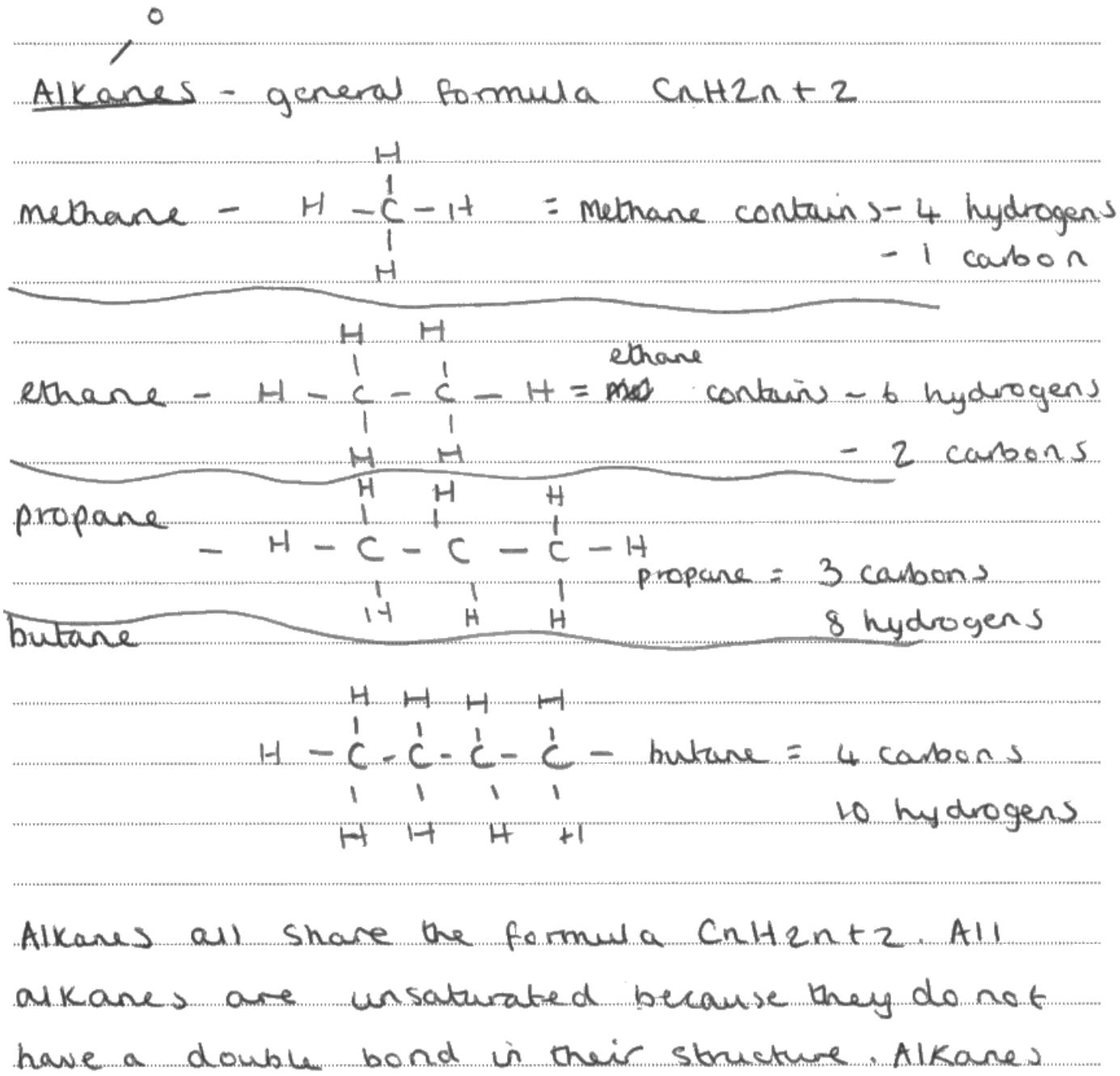
Question 6 (b)

This proved an excellent opportunity for those candidates who had a good knowledge of alkanes and alkenes to gain several marks. There were well-organised and detailed answers in some cases and those whose knowledge was not as complete were still able to gain some credit. Common errors were confused use of saturated/unsaturated and incorrect structures for named compounds. Methene occurred quite often as did the presence of carbon atoms with five bonds.

*(b) The alkanes and the alkenes are two examples of homologous series.

Name and draw the structures of some alkanes and of some alkenes and use them to show how members of a homologous series are similar in their general formula, names and structures of their molecules.

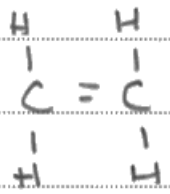
(6)



turn orange in bromine water when tested. In the homologous series all alkanes share the same structure and formula. All alkanes contain carbon and hydrogen molecules only.

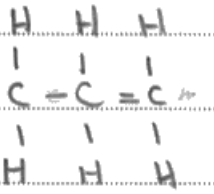
Alkenes - general formula C_nH_{2n}

ethene -



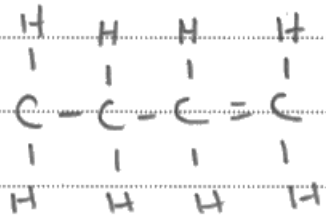
ethene - 2 carbons
contains 4 hydrogens

propene -



propene - 3 carbons
contains 6 hydrogens

butene -



butene - 4 carbons
8 hydrogen

Alkenes all share the same formula C_nH_{2n}. All alkenes are saturated because they contain 1 double bond in their structure. Alkenes stay colourless in bromine water so therefore show no change chemically in bromine water. Alkenes contain carbon and hydrogen molecules only.

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Examiner Comments

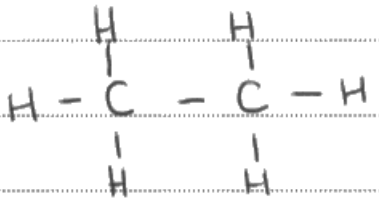
An answer well worth level 3 and 6 marks.

*(b) The alkanes and the alkenes are two examples of homologous series.

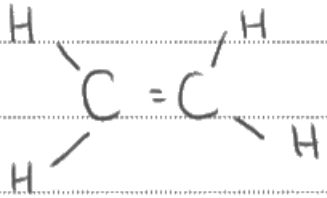
Name and draw the structures of some alkanes and of some alkenes and use them to show how members of a homologous series are similar in their general formula, names and structures of their molecules.

(6)

alkane



alkene



They have similar names just different endings. There structure is very similar, each carbon atom needs 4 covalent bonds coming of them.

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Examiner Comments

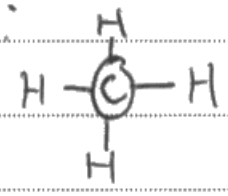
A very brief response with just two correct structures which were not named, and it was judged to be worth level 1 and 1 mark

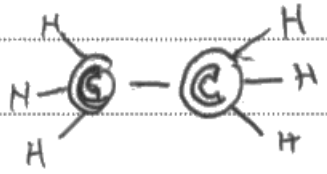
*(b) The alkanes and the alkenes are two examples of homologous series.

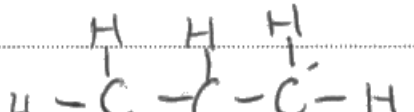
Name and draw the structures of some alkanes and of some alkenes and use them to show how members of a homologous series are similar in their general formula, names and structures of their molecules.

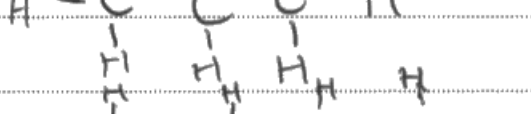
(6)

Alkanes:

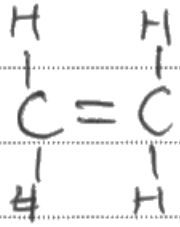
CH_4 

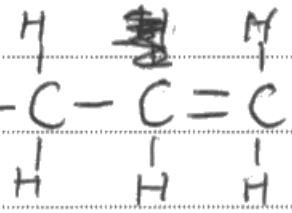
C_2H_6 

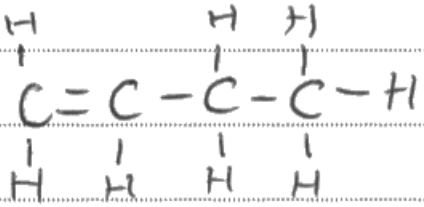
C_3H_8 

C_4H_{10} 

Alkenes:

C_2H_4 

C_3H_6 

C_4H_8 

As the number of carbon atoms go up by 1 the number of hydrogen atoms goes up by 2. The covalent bonds are single

As the number of carbon atoms go up by one the number of hydrogen atoms goes up by 2 but the alkenes contain double covelent bonds

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Examiner Comments

An answer containing many correct structures of alkanes and alkenes with also a reference to the connection between the numbers of carbon and hydrogen atoms in alkanes and alkenes. It was awarded level 2 and 4 marks.

Paper Summary

Based on their performance on this paper, candidates are offered the following advice in order to improve:

- read all the information in the question carefully more than once, and, where possible, use the information provided to help answer the question
- revise the methods and results for testing the ions in the specification
- learn to appreciate the methods used for preparation of soluble and insoluble salts
- try to gain a better grasp of what is occurring in electrolysis reactions including references to reduction and oxidation as gain and loss of electrons
- try to remember the key points concerning industrial processes including sources of raw materials and uses of the products.

Grade Boundaries

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