PEARSON EDEXCEL GCSE CHEMISTRY · 1CH0

CHEMISTRY



MARK SCHEME

TOPIC 9: SEPARATE CHEMISTRY 2 (PACK 2)

SCORE	PERCENTAGE
/135	%

STEMUP

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Q1.

(ii)

Most candidates realised that a flame test was required, although it should be noted that holding the solid over/ around/ above/ under the flame, or 'burning' the solid are not acceptable descriptions. The flame colour for potassium is almost universally known, that for sodium, yellow, not quite as well known. Some candidates tried to give a precipitation test.

(ii) The technician wanted to find out which bottle contained the sodium salt and which bottle contained the potassium salt.

Explain how the technician should do this.

(2)

- FLAME TESTS
- PUT SUBSTANCE ON A WIRE LOOP AND OVER A BUNSEN BURNER
- POTASSIUM WILL GIVE A LILAC FLAME, SODIUM WILL GIVE A YELLOW FLAME

Results Plus: Examiner Comments

Flame test is correct, but description is not.

Results Plus: Examiner Tip

Candidates should note that if in a flame test the solid is held over the flame, no result will be seen. The solid must be held **in** the flame.

Q2.

(a) (ii)

Although many candidates did know how to test for ammonia, there were many poor descriptions. A significant number omitted to heat the mixture. A surprising number thought that ammonia would turn blue litmus red or even bleach it. A common error was to place red litmus in the solution with sodium hydroxide rather than in the gas.

(ii) Describe how sodium hydroxide solution can be used to show that ammonium ions are present in substance **X**.

(2)

sodium hydroxide solution could be added to substance X. If a white precipitate is formed then ammonium ions are present.

Results Plus: Examiner Comments

This candidate has not learnt the test for ammonium ions so has not scored a mark.

Results Plus: Examiner Tip

Learn all the tests for the ions that are listed in the specification.

(ii) Describe how sodium hydroxide solution can be used to show that ammonium ions are present in substance **X**.

(2)

Add a few drops of sodium hydroxide solution to substance X and, if aluminium ions are present, a white precipitate should form. To make sure they are aluminium ions and not calcium ions, add more sodium hydroxide solution. The precipitate should redissolve leaving a colourless solution.

Results Plus: Examiner Comments

This candidate has described the test for aluminium ions and has not scored any marks as the question asks for ammonium ions.

Results Plus: Examiner Tip

Read the questions carefully.

(ii) Describe how sodium hydroxide solution can be used to show that ammonium ions are present in substance **X**.

(2)

Sodium hydroxide solution can be added to substance X, no precipitate will form but it heated, will give off ammonia, this can be tested by the smell and ~~red litm~~ blue litmus paper as it will turn red.

Results Plus: Examiner Comments

This candidate knows that the mixture should be heated and has remembered that litmus is used to test for ammonia. However, ammonia is an alkaline gas so the colour change in this description is wrong and the answer scored 1 mark.

Results Plus: Examiner Tip

Learn the colour changes for litmus in acidic and alkaline substances.

(ii) Describe how sodium hydroxide solution can be used to show that ammonium ions are present in substance **X**.

(2)

Add sodium hydroxide solution to the substance and boil. A smell of ammonia would be produced and damp red litmus paper ~~to~~ would turn blue.

Results Plus: Examiner Comments

This is a very good answer, scoring both marks.

Results Plus: Examiner Tip

When you are asked to describe a test, always describe how you would carry out the test and the observation that would be made.

(b)

A surprising number of candidates were unable to give the correct formula for the hydroxide ion and an even smaller number were able to work out the formula for aluminium hydroxide.

However, a significant number of candidates did score 3 marks for this question.

(ii) Describe how sodium hydroxide solution can be used to show that ammonium ions are present in substance **X**.

(b) Aluminium ions, Al^{3+}, react with hydroxide ions in solution to give a white precipitate of aluminium hydroxide.

Write the ionic equation for this reaction.

(3)

$Al^{3+} + 3OH^- \rightarrow AlOH_3$

Results Plus: Examiner Comments

This candidate has written the correct formula for hydroxide ions so has scored 1 mark. If this candidate had drawn brackets around the OH in the formula for aluminium hydroxide, they would have scored 3 marks.

Results Plus: Examiner Tip

Learn how to write formulae for ionic compounds.

(b) Aluminium ions, Al^{3+}, react with hydroxide ions in solution to give a white precipitate of aluminium hydroxide.

Write the ionic equation for this reaction.

(3)

$Al^{3+}_{(aq)} + 3OH^-_{(aq)} \rightarrow Al(OH)_{3(s)}$

Results Plus: Examiner Comments

This is an excellent answer, scoring 3 marks. The state symbols were not necessary in this question.

(b) Aluminium ions, Al^{3+}, react with hydroxide ions in solution to give a white precipitate of aluminium hydroxide.

Write the ionic equation for this reaction.

(3)

$Al^{3+} + OH^- \rightarrow Al(OH)_3$

$Al^{3+} + OH^- \rightarrow Al(OH)_3$

Results Plus: Examiner Comments

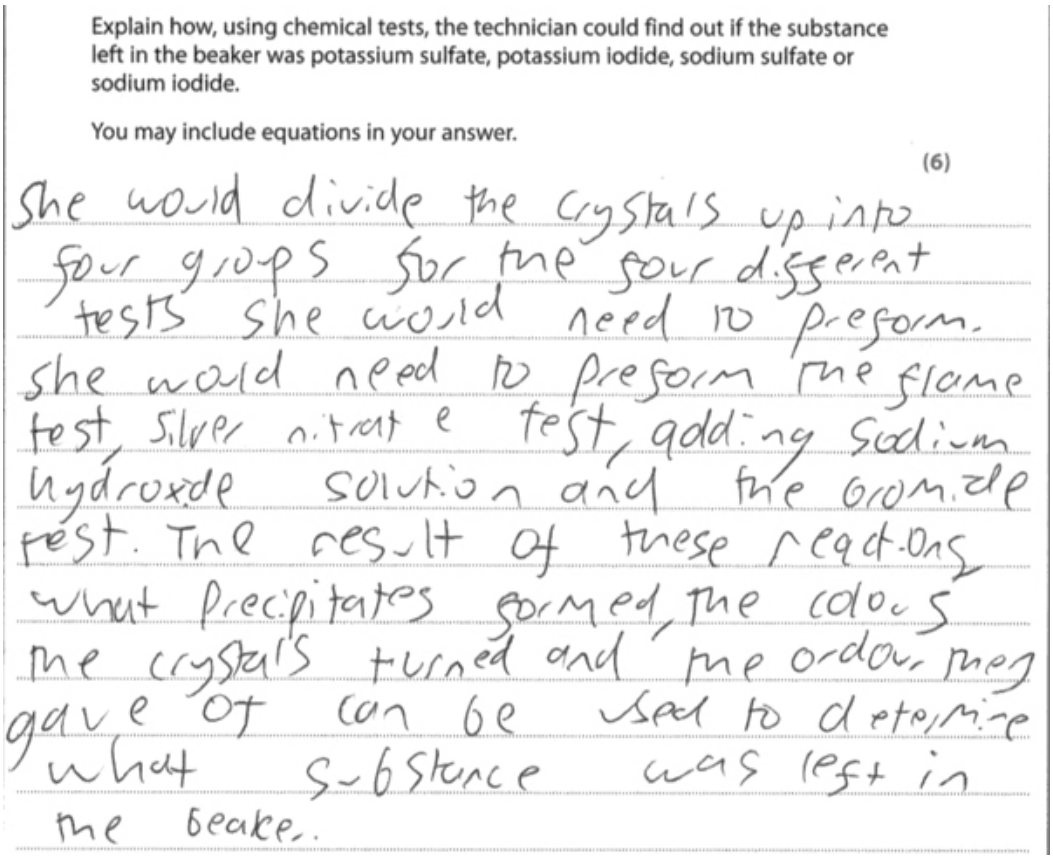
This candidate has written all the correct formulae so has scored 2 marks. If they had balanced the equation, they would have scored an extra mark.

Results Plus: Examiner Tip

Remember to balance all equations.

(c)

Candidates who had learnt the tests for sodium, potassium, iodide and sulfate ions carefully were able to score full marks for this question. Only a few candidates did not know the correct flame test colours for the cations. More candidates did not know the tests for the anions and made errors such as using dilute hydrochloric acid to acidify the silver nitrate solution to test for iodide ions or stated that a yellow solution would be formed rather than a yellow precipitate.



Explain how, using chemical tests, the technician could find out if the substance left in the beaker was potassium sulfate, potassium iodide, sodium sulfate or sodium iodide.

You may include equations in your answer.

(6)

She would divide the crystals up into four groups for the four different tests she would need to preform. she would need to preform the flame test, silver nitrate test, adding sodium hydroxide solution and the bromide test. The result of these reactions, what precipitates formed, the colours the crystals turned and the ordour they gave off can be used to determine what substance was left in the beake.

Results Plus: Examiner Comments

This candidate has given a number of tests that could be carried out, but has not given the results that would be observed from these four salts. This answer was given 1 mark for carrying out a flame test.

Results Plus: Examiner Tip

When you are asked for tests to identify substances, describe how you would carry out the test and what you would expect to see.

Explain how, using chemical tests, the technician could find out if the substance left in the beaker was potassium sulfate, potassium iodide, sodium sulfate or sodium iodide.

You may include equations in your answer.

(6)

Firstly, the technician could do a flame test. A flame test would involve ~~testing~~ a ~~sp~~ a testing up the substance. A flame test would be able to show if the substance ~~was~~ had potassium or sodium in it. The substance would glow lilac if potassium was present.

Add dilute hydrochloric acid followed by some silver nitrate. ~~Then~~ This test should show the difference between the sulfate and the iodide.

Results Plus: Examiner Comments

This is an example of a level 1 answer, scoring 2 marks. The flame test for potassium is correct. However, if you use dilute hydrochloric acid with silver nitrate solution, you will obtaing a precipitate of silver chloride.

Results Plus: Examiner Tip

Use dilute nitric acid with silver nitrate solution to test for halides.

Use dilute hydrochloric acid with barium chloride solution to test for sulfates.

Explain how, using chemical tests, the technician could find out if the substance left in the beaker was potassium sulfate, potassium iodide, sodium sulfate or sodium iodide.

You may include equations in your answer.

(6)

- Add dilute nitric acid to potassium iodide and then a few drops of silver nitrate. Iodide produces a yellow precipitate. In a flame test the potassium will turn the flame lilac.

In a flame test sodium will produce a red flame.

Add dilute nitric acid to sodium sulphate or sodium iodide then add a few drops of nitric acid. A white precipitate will be formed.

Results Plus: Examiner Comments

This is an example of a level 2 answer, scoring 4 marks. The flame test for potassium and the test for iodide are correct. However, sodium does not give a red flame and the test for sulfate is incorrect.

Results Plus: Examiner Tip

Learn the tests for all of the ions in the specification.

Explain how, using chemical tests, the technician could find out if the substance left in the beaker was potassium sulfate, potassium iodide, sodium sulfate or sodium iodide.

You may include equations in your answer.

(6)

To identify potassium ions, you can use a flame test. Add the solution to a lit bunsen burner, and if the flame turns ~~purple~~ lilac, potassium ions are present. You can also test for sodium ions by a flame test. Again add the solution to a flame and if the flame is yellow/~~orange~~ orange then sodium ions are present. To test for iodide ions, add dilute nitric acid (to get rid of any carbonate ions) and add silver ~~chloride~~ nitrate. If iodine ions are present, a yellow precipitate will form. The equation for this is $Ag^+ + I^- = AgI_{(s)}$. Lastly, to test for sulfate ions, add hydrochloric ~~te~~ acid to the solution followed by barium chloride. If sulfate ions are present, the a precipitate of barium sulfate will form.

Results Plus: Examiner Comments

This is a very good level 3 answer, scoring 6 marks. The candidate has written correct identification test for the ions and has even added a correct ionic equation.

Q3.

(i)

It was very surpising that, even though the limewater test was given, only about half of candidates could name carbon dioxide.

(ii)

This part of the question was very poorly answered with almost no correct answers.

Q4. No Examiner's Report available for this question

Q5. No Examiner's Report available for this question

Q6. No Examiner's Report available for this question

Q7. No Examiner's Report available for this question

Q8. No Examiner's Report available for this question

Q9. No Examiner's Report available for this question

Q10. No Examiner's Report available for this question

Q11. No Examiner's Report available for this question

Q12.

(i) Many candidates identified the > C=C < as the functional group, a few other went for C-Cl. However some just circled the Cl atom and so did not score.

(ii) This proved quite tricky for many candidates with only a few scoring full marks. Errors included only having 5 carbon atoms in a line, double bonds remaining between the carbon atoms and not having the correct ratio of hydrogen to chlorine atoms.

(iv) This should be a straightforward calculation at this level. However, several had problems working out the formula mass of the chloroethene molecule. The next step would be to multiply that formula mass by the number of monomer molecules in the polymer molecule, but many candidates took one number and divided by the other. Giving an answer to a required number of significant figures still remains a mystery to some candidates although it is a required maths skill for chemistry.

Q13. No Examiner's Report available for this question

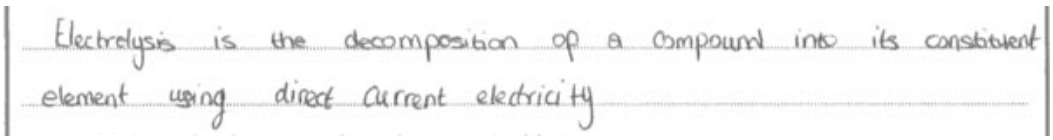
Q14. No Examiner's Report available for this question

Q15.

ai

Candidates seem to have a good understanding of what is meant by electrolysis. The majority of candidates knew that it is a process that requires electricity and some knew that a d.c. supply

was used. However many candidates are still stating that it is the process of separating compounds, which is not sufficient as a response and does not score the second marking point.



Results Plus: Examiner Comments

A perfect answer including the decomposition of a compound and using direct current.



Results Plus: Examiner Comments

Many candidates are still stating that it is the process of separating compounds, which is not sufficient as a response and does not score the first marking point.

Results Plus: Examiner Tip

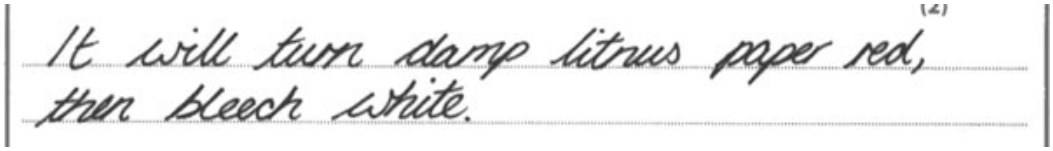
When thinking about electrolysis remember

electro– electricity

lysis– splitting.

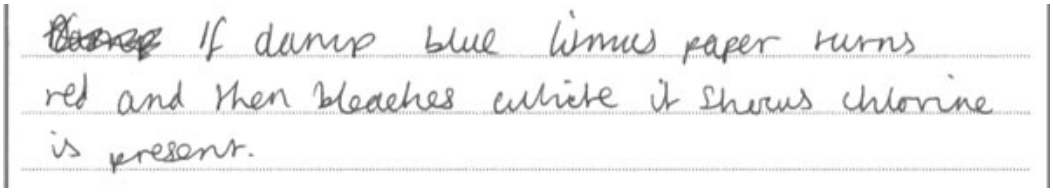
aii

This question was answered well by the majority of candidates with most being able to state that litmus paper bleaches. Although many candidates are not stating that the litmus is blue and that it is best when damp, marks were not lost for omitting these details.



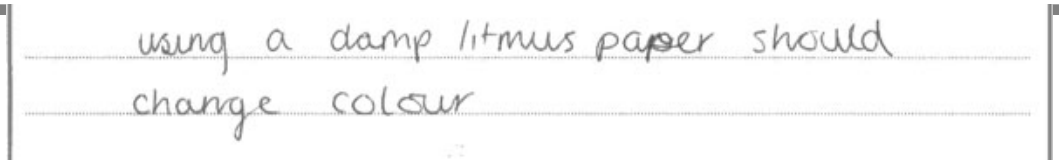
Results Plus: Examiner Comments

Whilst this candidate has not stated to use blue litmus the first marking point is still scored for litmus, they then state that the litmus turns red and is then bleached, so is awarded full marks overall.



Results Plus: Examiner Comments

A perfect answer, fully describing how damp blue litmus paper turns red then is bleached white.



Results Plus: Examiner Comments

This candidate knows that damp litmus should be used so gains the first marking point. However, they have then not given sufficient detail of the colour change to be able to gain the second marking point.

Results Plus: Examiner Tip

If a colour change is occurring that you need to describe, always give the starting colour and the end colour of whatever substance is used.

aiii

Candidates found this question very difficult and only the best candidates scored the mark here.



Results Plus: Examiner Comments

This candidate has not given the complete name of the compound, just the name of one of the atoms that is present.



Results Plus: Examiner Comments

This candidate has recognised that a polymer is present but has not given the correct name of the compound.

Results Plus: Examiner Tip

When naming a compound ensure that all parts of the structure are accounted for

poly– to show that it is a polymer

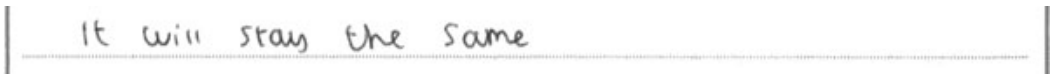
chloro– it contains chlorine

eth– from ethane

ene– as it formed a polymer from its double bond.

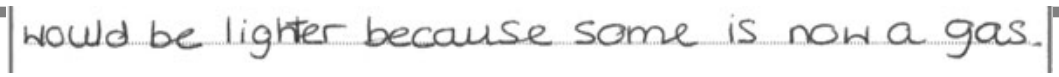
bii

Many candidates did not score here. Candidates that did not get the mark, did so as they thought that a gas was produced and so the mass decreased. They did not read the question fully and did not take on board that no gases were produced in the reaction and that a bung was in the top of the apparatus. There was also evidence of some fundamental misunderstandings such as the magnesium oxide condensing or water vapour being produced, condensed and therefore increasing the water level.



Results Plus: Examiner Comments

Fine, scores one mark.



Results Plus: Examiner Comments

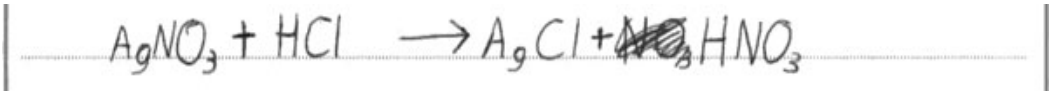
The candidate has not read the question and realised that no gas has been made or seen that there was a bung on top of the conical flask.

Results Plus: Examiner Tip

Check that you read the question fully. When practicals are being discussed ensure that you are clear as to what the reactants and the products are.

biii

Candidates showed that they could write equations and many scored here. However candidates that had not learnt the formulae of the common laboratory acids did not score here.



Results Plus: Examiner Comments

Fine, 2 marks awarded.



Results Plus: Examiner Comments

Whilst the reactants side of the equation was correct for one mark, this candidate could not recall the formulae of nitric acid, the only other product in the reaction.

Results Plus: Examiner Tip

It is important that candidates can recall the formulae of common laboratory compounds used in the specification such as hydrochloric acid and nitric acid.

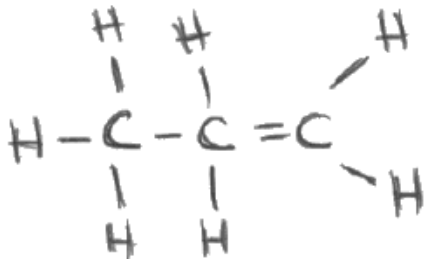
Q16.

Most candidates managed to draw a three carbon molecule with one double bond. It was disappointing that so many of these had 3- or commonly 5-valent carbons. Worse errors were propane or even including oxygen atoms.

4 (a) Propene is a gaseous hydrocarbon.

Draw the structure of a molecule of propene, showing all bonds.

(2)



Results Plus: Examiner Comments

This scored 1 mark only.

Results Plus: Examiner Tip

When you have drawn a molecular structure for an organic compound take time to count the bonds around each atom. In this example one carbon has 5 bonds so there must be an error.

Q17. No Examiner's Report available for this question

Q18.

Many candidates did not attempt this question. Of those that did, few scored the full 3 marks available. Some candidates knew that when bromine water was added to an alkane there would be no change and that when added to an alkene the bromine water would become colourless. However many did not refer to the colour of the bromine water before the reaction by stating that it stays orange, or that it turns from orange to colourless. Some candidates are still referring to the bromine water turning clear when reacted with the alkene which is not acceptable for the mark. In some cases the candidates were not reading the question carefully and gave a difference between an alkane and an alkene e.g. alkanes have all single bonds and alkenes have a double bond. Whilst this is correct, it does not answer the question posed and therefore gained no credit.

(b) Bromine water is used to distinguish between alkenes and alkanes.

Describe what would be **seen** when an alkene and an alkane are shaken with separate samples of bromine water.

(3)

alkene goes from orange to colourless

Results Plus: Examiner Comments

A short but succinct answer that scored all three marking points.

(b) Bromine water is used to distinguish between alkenes and alkanes.

Describe what would be **seen** when an alkene and an alkane are shaken with separate samples of bromine water.

(3)

alkene the bromine water turns colourless

Results Plus: Examiner Comments

This response scored two marks. The bromine water will turn colourless when shaken with the alkene and there will be no change in colour when shaken with alkane. If the candidate has given the extra detail and stated that there was no change in colour so it would remain orange then the last mark could have been awarded.

(b) Bromine water is used to distinguish between alkenes and alkanes.

Describe what would be **seen** when an alkene and an alkane are shaken with separate samples of bromine water.

(3)

alkene it will stay orange.

Results Plus: Examiner Comments

In this response, the candidate has confused the results of the test for the alkane and alkene. However even though 'stays orange' is the incorrect response for the alkene, it does show an understanding that the bromine water was originally orange and so therefore scored 1 mark.

(b) Bromine water is used to distinguish between alkenes and alkanes.

Describe what would be **seen** when an alkene and an alkane are shaken with separate samples of bromine water.

(3)

alkene Has a double bond

Results Plus: Examiner Comments

Whilst the information given in the reponse is correct, it does not address the question posed and therefore gains no credit.

Results Plus: Examiner Tip

When you have written your answer you should re-read the question along with your answer to check that you have answered the question that has been posed and that you have not repeated the stem of the question.

Q19. No Examiner's Report available for this question

Q20. No Examiner's Report available for this question

Q21. No Examiner's Report available for this question

Q22. No Examiner's Report available for this question

Q23.

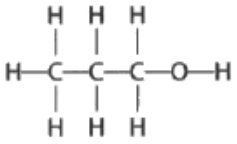
This was badly answered. Identification of '-OH' was the most frequent correct answer, but often not stated correctly as a 'group' or functional group.

Many responses had 'all have C', 'all have H', (which would apply to any organic molecule) and 'all have O'.Some thought that it was because they all ended in "anol". A surprising number referred to the compounds as 'hydrocarbons'.

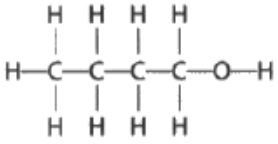
Trends in physical properties were rarely mentioned and similar chemical properties even less so.Others mixed these up – identical physical properties/ same boiling point.

In general there was little understanding of an homologous series.

Propanol and butanol are both members of the same homologous series as ethanol.



propanol



butanol

Propanol and butanol can also be burned in the apparatus shown in Figure 15.

Give **three** reasons why ethanol, propanol and butanol are members of the same homologous series.

(3)

reason 1 They all contain hydrogen & carbon

reason 2 None of them contain double bonds

reason 3 They all have 1 oxygen

Results Plus: Examiner Comments

This was typical of an answer and scored 0 because it did not relate specifically to alcohols.

Q24.

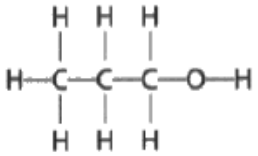
This was poorly answered overall, with most candidates scoring just 1, sometimes 2, of the 3 marks available.

This should have been a straightforward question since all that was required is to state the standard features of a homologous series.The 'same functional group/identification of the '-OH'' and 'same general formula' were the most common correct answers seen by the examining team.

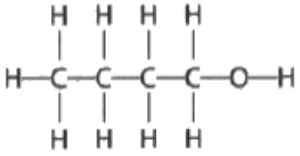
Common errors, omissions, misconceptions:

There were many references to the compounds being hydrocarbons in one sentence and then saying that all the molecules contained just carbon, hydrogen and oxygen. A number of candidates talked about the 'same general formula' and then spoilt this by giving an incorrect general formula. Many talked vaguely about the same or similar properties or incorrectly about same physical properties.

Propanol and butanol are both members of the same homologous series as ethanol.



propanol alcohol



butanol

Propanol and butanol can also be burned in the apparatus shown in Figure 3.

Give **three** reasons why ethanol, propanol and butanol are members of the same homologous series.

(3)

reason 1 They are alcohols. ~~-OH~~

reason 2 ~~Repeating~~ always have -OH unit.

reason 3 Alkanes, saturated, only single bonds.

Results Plus: Examiner Comments

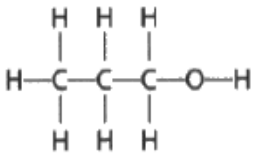
This response scored only 1 of the 3 available marks.

Although correctly identified as alcohols this is not a marking point and cannot score. They are not alkanes, so only reason two, namely that they all have -OH, scores a mark.

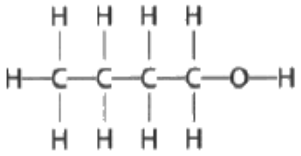
Results Plus: Examiner Tip

Learn the definition of a homologous series. This has been frequently asked for in the previous examination series and also a requirement on this new specification.

Propanol and butanol are both members of the same homologous series as **ethanol.**



propanol



butanol

Propanol and butanol can also be burned in the apparatus shown in Figure 3.

Give **three** reasons why ethanol, propanol and butanol are members of the same homologous series.

(3)

reason 1 they are all alcohols - used for medical drugs, cosmetics, varnishes, etc

reason 2 have the functional group -OH which means they react similarly

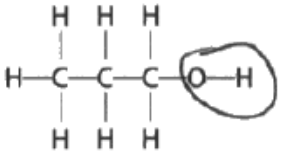
reason 3 the alkanes - follow the general formula of C_nH_{2n+2}

Results Plus: Examiner Comments

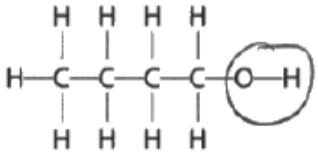
This response scored 2 of the 3 marks available.

The first reason given in the response is ignored on the mark scheme. The second reason line has two correct points, namely same 'functional group , -OH', and 'react similarly'. The third reason line is incorrect. Hence the response scores 2 marks for two correct reasons (on the same line).

Propanol and butanol are both members of the same homologous series as ethanol.



propanol



butanol

Propanol and butanol can also be burned in the apparatus shown in Figure 3.

Give **three** reasons why ethanol, propanol and butanol are members of the same homologous series.

(3)

reason 1 They all have an OH functional Group

reason 2 They all follow the general formula $C_nH_{2n+1}OH$

reason 3 They all react with carboxylic acids to form esters

Results Plus: Examiner Comments

A good example of a rarely seen fully correct response.

All three reasons given are creditworthy.

Q25.

Some candidates missed the point here, and tried to propose completely different (and incorrect) tests. (Note the wording in the question: "...changes ...to be made to this test for it to work). The word 'dry' was mentioned on four occasions and many picked up the fact that the litmus must be damp. Perhaps surprisingly, slightly fewer identified that the litmus paper was the wrong colour.

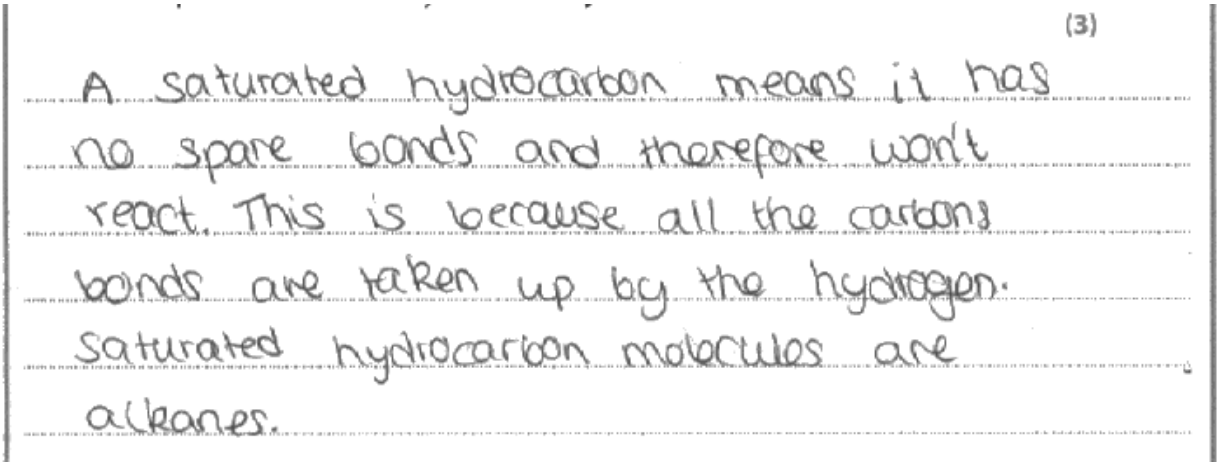
Q26. No Examiner's Report available for this question

Q27. No Examiner's Report available for this question

Q28.

(a)(i)

Many candidates were able to explain that octane contained only hydrogen and carbon atoms. Fewer candidates were able to explain what is meant by unsaturated with many losing marks as they used vague terms such as 'spare bonds'. Another weak answer was to say that octane has a single bond. This is unacceptable as unsaturated hydrocarbons also contain single bonds and it is the fact that the saturated hydrocarbon contains ALL single bonds or NO double bonds that is important. Another unacceptable response seen often was that the unsaturated hydrocarbon would not react or could not have anything else added to it. Many candidates included references to the bromine water test and its results, which whilst correct it was not asked for in the question and so therefore was not given credit.



(3)

A saturated hydrocarbon means it has no spare bonds and therefore won't react. This is because all the carbons bonds are taken up by the hydrogen. saturated hydrocarbon molecules are alkanes.

Results Plus: Examiner Comments

There is no credit for using the term spare bond.

Results Plus: Examiner Tip

You must be careful not to use non-scientific terms when explaining ideas in your exam. No 'spare bonds' is not an acceptable alternative to 'no double bonds' and will not gain credit.

Saturated hydrocarbons only have singu bonds between atoms meaning that you can't add any more atoms to the molecule because each atom has already bonded to gain a full outer shell.

Results Plus: Examiner Comments

This response has given a good explanation of unsaturated for one mark. Sadly the candidate has not gone on to describe what is meant by hydrocarbon so gained no credit for this part.

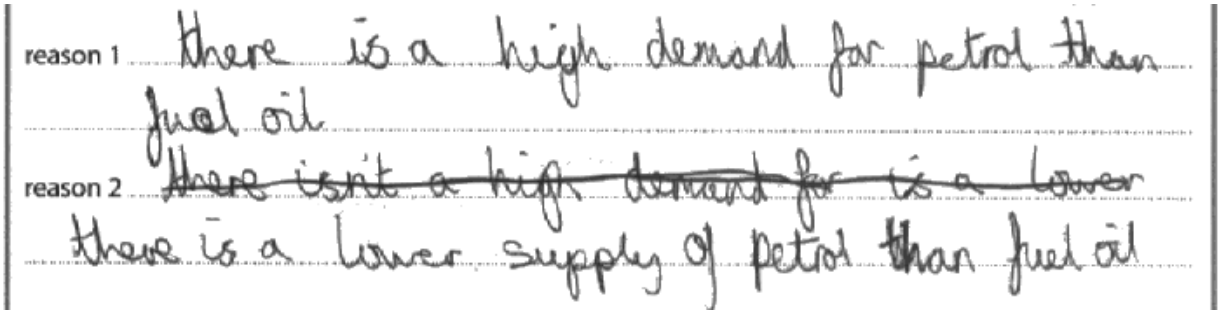
Results Plus: Examiner Tip

This question was generally well answered, although too many candidates thought that the process was thermal decomposition rather than cracking.

(b)(ii)

Students overall demonstrated their knowledge of the high demand there is for petrol and often understood that cracking fuel oil helps to meet the supply need or overcome the shortage of petrol. Others stated that petrol or shorter chains/molecules are more useful than fuel oil or that there was a surplus of fuel oil, some of which could be put to good use through cracking into petrol.

Some candidates lost marks as they wrote about oil being 'useless' rather than less useful.



Results Plus: Examiner Comments

Both marks were scored here for high demand of petrol and low supply.

(c)

As with the previous equation, it was pleasing to see that candidates seemed to have a much better understanding of how to balance the equations than in previous sessions. A large majority of students were able to give the correct formulae of the products of combustion of methane, but fewer were able to give the correct formula of methane with 'Me' often appearing on the left hand side of the equation in place of CH_4. Some students did not show oxygen as diatomic. As a result of these errors, some candidates were unable to provide the balanced equation necessary to score maximum marks. Other common errors seen, were the appearance of lower case letters e.g. h_2O or H_{20} for H_2O.



Results Plus: Examiner Comments

This candidate scored one mark for the correct products of the complete combustion. However, even though the formula for methane is correct, no mark was scored for reactants due to the incorrect formula for oxygen.

Results Plus: Examiner Tip

It is important to practice the key formula of the elements and compounds in the specification. You must remember than you cannot change the formula of a molecule in an attempt to balance the equation.



Results Plus: Examiner Comments

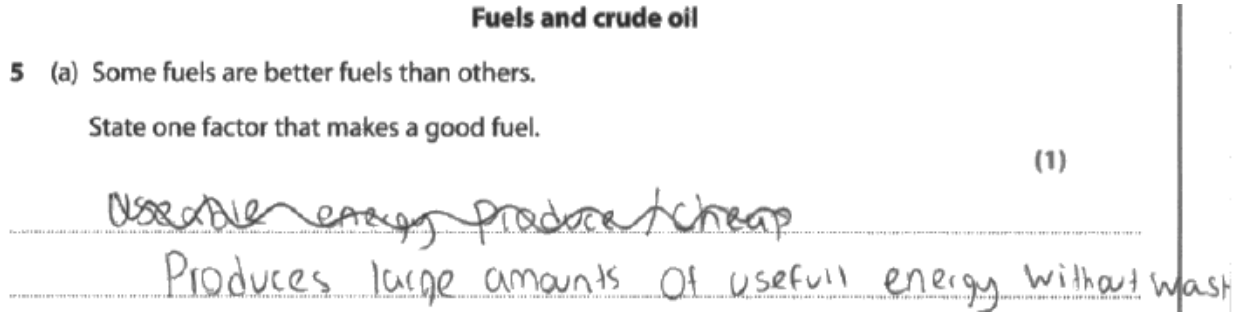
The formula on both the left hand side and right hand side are correct, although not in its lowest form, the balancing is correct and the equation scores full marks.

Q29.

(a)

There were many responses that were worthy of credit but some common incorrect answers included: 'burns for longer', 'cheaper to buy'. Some knew the factors to consider but did not state how that factor makes a good fuel eg 'ease of ignition' instead of 'easy to ignite'. Some

candidates referred to the fuel lasting a long time but without a use this is not necessarily a feature of a good fuel.



Fuels and crude oil

5 (a) Some fuels are better fuels than others.

State one factor that makes a good fuel.

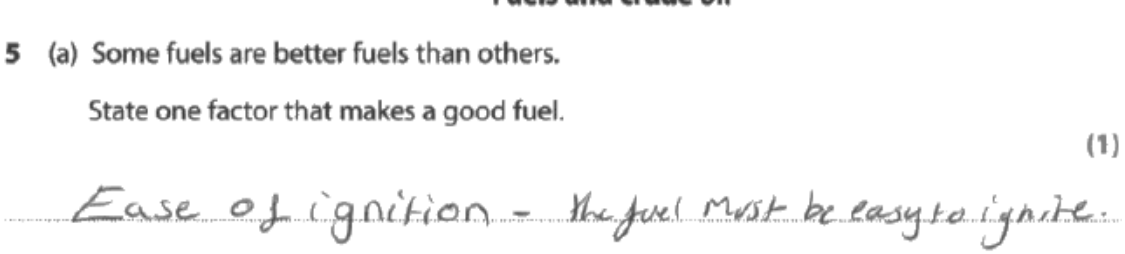
(1)

Useable energy produce cheap

Produces large amounts of useful energy without wast

Results Plus: Examiner Comments

A good choice of factor for a good fuel. Note : 'cheap' was crossed out. Any reference to cost is ignored unless it is backed up in a suitable way.



Fuels and crude oil

5 (a) Some fuels are better fuels than others.

State one factor that makes a good fuel.

(1)

Ease of ignition - the fuel must be easy to ignite.

Results Plus: Examiner Comments

Ease of ignition alone did not score. This candidates had qualified their answer by indicating that the fuel must be easy to ignite.

(b) (i)

Good answers had to include an advantage with a linked explanation. Many candidates just listed several advantages and did not explain them so only scored 1 mark. Bioethanol is renewable because 'more sugar beet can be grown' was the most common 2 mark answer. Many candidates made the observation that bioethanol is (nearly) 'carbon neutral', but several thought that petrol produced carbon dioxide on burning, but bioethanol did not. Some candidates referred to fuels being able to be used again rather than they can be renewed.

(b) Bioethanol is a fuel that can be obtained from the plant, sugar beet.

(i) Bioethanol and petrol can both be used as fuels.

Explain one advantage of using bioethanol produced from sugar beet, rather than petrol produced from crude oil.

(2)

Bioethanol is carbon neutral, as the CO_2 released from burning is counteracted by the CO_2 absorbed by photosynthesis when the plant was growing. Petrol releases lots of CO_2, in comparison.

Results Plus: Examiner Comments

A good answer explaining the advantage of using bioethanol in terms of it being 'carbon neutral' and comparing that aspect with petrol. Two marks awarded.

(b) Bioethanol is a fuel that can be obtained from the plant, sugar beet.

(i) Bioethanol and petrol can both be used as fuels.

Explain one advantage of using bioethanol produced from sugar beet, rather than petrol produced from crude oil.

(2)

a ~~biofue~~ Bioethanol is ecofriendly which Petrol from crude oil is not.

Results Plus: Examiner Comments

Vague terms such as 'eco-friendly', 'environmentally friendly' are ignored.

Results Plus: Examiner Tip

Terms such as 'ecofriendly' need to be explained to gain credit.

(b) (ii)

Many correct answers were seen but some candidates wrote just O for oxygen in the balanced equation. Many candidates had the correct formulae for the reactants and products and either did not attempt to balance the equation or just balanced the products side and could not work

out how to balance for oxygen, O_2, on the reactants side.

(ii) The main component of bioethanol is ethanol.

When burnt completely, ethanol, C_2H_5OH, reacts with oxygen to produce carbon dioxide and water.

Write the balanced equation for this reaction.

(3)

$2C_2H_5OH + 6O_2 \longrightarrow 4CO_2 + 6H_2O$

$2C_2H_5OH + O_2 \rightarrow 2CO_2 + 3H_2O$

$2C_2H_5OH + 6O_2 \longrightarrow 4CO_2 + 6H_2O$

Results Plus: Examiner Comments

Three marks awarded for correct reactants (1), correct products (1) and correct balancing(1). Multiples are always acceptable. Out of the three possible equations, the one on the answer line is the one that is marked.

(ii) The main component of bioethanol is ethanol.

When burnt completely, ethanol, C_2H_5OH, reacts with oxygen to produce carbon dioxide and water.

Write the balanced equation for this reaction.

(3)

$C_2H_5OH \rightarrow Co^2 + H_2O$

Results Plus: Examiner Comments

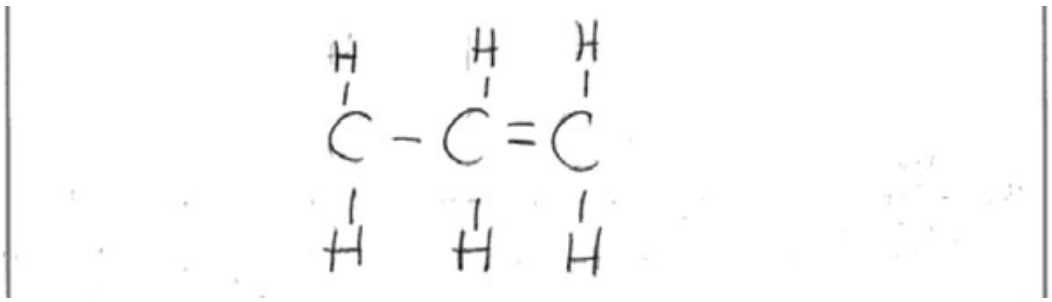
The mark for products was not given here owing to the incorrect formula for carbon dioxide - Co^2, and for water, H_2^O. Candidates do need to use correct formulae with subscripted numbers and correct upper case / lower case letters.

Results Plus: Examiner Tip

Practice writing formulae and balanced eqautions for the reactions met in the course.

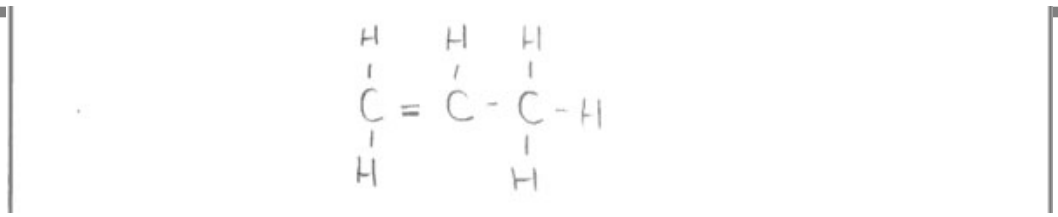
Q30.

Many candidates could correctly draw the carbon backbone of propene, including the correct number of carbons and the double bond for 1 mark but then lost the second mark as they did not add the correct number hydrogens to each carbon.



Results Plus: Examiner Comments

This response gained one mark for the correct carbon backbone, but did not score the second marking point as the number of hydrogens on the second carbon is incorrect.



Results Plus: Examiner Comments

Fine for 2 marks.

Q31.

A surprising number of candidates were unable to give the correct formula for the hydroxide ion and an even smaller number were able to work out the formula for aluminium hydroxide. However, a significant number of candidates did score 3 marks for this question.

(ii) Describe how sodium hydroxide solution can be used to show that ammonium ions are present in substance **X**.

(b) Aluminium ions, Al^{3+}, react with hydroxide ions in solution to give a white precipitate of aluminium hydroxide.

Write the ionic equation for this reaction.

(3)

$Al^{3+} + 3OH^- \rightarrow AlOH_3$

Results Plus: Examiner Comments

This candidate has written the correct formula for hydroxide ions so has scored 1 mark. If this candidate had drawn brackets around the OH in the formula for aluminium hydroxide, they would have scored 3 marks.

Results Plus: Examiner Tip

Learn how to write formulae for ionic compounds.

(b) Aluminium ions, Al^{3+}, react with hydroxide ions in solution to give a white precipitate of aluminium hydroxide.

Write the ionic equation for this reaction.

(3)

$Al^{3+}_{(aq)} + 3OH^-_{(aq)} \rightarrow Al(OH)_{3(s)}$

Results Plus: Examiner Comments

This is an excellent answer, scoring 3 marks. The state symbols were not necessary in this question.

(b) Aluminium ions, Al^{3+}, react with hydroxide ions in solution to give a white precipitate of aluminium hydroxide.

Write the ionic equation for this reaction.

(3)

$Al^{3+} + OH^- \rightarrow Al(OH)_3$

$Al^{3+} + OH^- \rightarrow AL(OH)_3$

Results Plus: Examiner Comments

This candidate has written all the correct formulae so has scored 2 marks. If they had balanced the equation, they would have scored an extra mark.

Results Plus: Examiner Tip

Remember to balance all equations.

Q32.

A number of candidates did not know how to produce ethanol by fermentation, but generally this question was well-answered with the majority of candidates scoring marks for adding yeast, using anaerobic conditions and a correct temperature. Very few candidates mentioned that sugar solution is used, although this was not necessary to score full marks.

(b) Ethanol can also be produced by fermentation.

Describe how ethanol can be produced from sugar by fermentation.

(2)

Ethanol is put in a fermenter and the temperature, pressure and pH levels would be set for optimum yield of ethanol and as ethanol is made, it is removed and the sugar is added at the same rate to keep the pressure and volume uncharged in the fermenter.

Results Plus: Examiner Comments

This is a vague answer that mentions temperature but does not suggest a suitable value. This answer did not score any marks.

Results Plus: Examiner Tip

When you describe an experiment, give specific details.

(b) Ethanol can also be produced by fermentation.

Describe how ethanol can be produced from sugar by fermentation.

(2)

In warm, anaerobic conditions, yeast can break down glucose (sugar) into ethanol, carbon dioxide and energy.

$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

Yeast has enzymes which do this.

Results Plus: Examiner Comments

This is a very good answer, scoring both marks.

Q33.

(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 Carbon dioxide.

Results Plus: 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.

Results Plus: 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.

(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

Results Plus: 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.

Results Plus: 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.

Results Plus: 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'.

(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.

Q34. No Examiner's Report available for this question

Q35.

This question was pleasingly tackled with better candidates giving excellent responses. Most candidates were able to identify some or all of the significance of the formulae of the acids and their reaction with alcohol and sodium hydroxide solution. Most able candidates mentioned the formation of esters and the production of sodium salts. Weaker ones stated that they 'started with CH_3' (not creditworthy) but a good number recognised the significance of some or all of -COOH, carboxylic acid and formula mass increasing by 14 (although not connecting this with the difference of CH_2). Weaker candidates thought that their densities were 'similar' or that only that of ethanoic acid was an outlier; again, whilst rather more recognised the trend in respect of boiling points, many still stated that they were 'similar'. The best candidates identified the common functional group and hence similar chemical reactions, and then identified the patterns in the boiling point and in the density.

Q36.

Most candidates were able to link the idea of enzymes and yeast and then followed this up with the ideas of the enzymes denaturing.

Ethanol is made by fermentation of a carbohydrate dissolved in water, in the presence of yeast.

The reaction is carried out at 30 °C.

Explain why the reaction is carried out at a temperature of 30 °C rather than at a temperature of 80 °C.

(2)

As fermentation uses enzymes, this means that the enzymes will denature at 80°c and not 30°c.

Results Plus: Examiner Comments

Candidates that scored 1 mark often did so as they knew that enzymes were denatured but did not link the enzymes to the yeast thus losing the first mark point, as in this example.

Explain why the reaction is carried out at a temperature of 30 °C rather than at a temperature of 80 °C.

(2)

30°C is the optimum temperature for yeast as a catalyst and too high temperatures will denature the enzyme (yeast)

Results Plus: Examiner Comments

A good answer that scored both marking points.

Explain why the reaction is carried out at a temperature of 30 °C rather than at a temperature of 80 °C.

(2)

Because the enzymes inside the reaction would denature at a temperature too high. Also alcohol burns easily therefore if the temperate is too high it could begin evaporating

Results Plus: Examiner Comments

The misconception that the alcohol would evaporate was ignored, this answer scored 1 mark.

Q37.

This question was poorly answered on the whole with only about a quarter of responses scoring any of the 2 marks available.

Few candidates were able to correctly link the idea of enzymes and yeast and to discuss enzymes denaturing. Most responses identified that enzymes are denatured at 80 °C, but not that yeast provided these enzymes.

In responses that did not score many marks, candidates simply stated vaguely 'too hot' or confused the 'carbohydrates with the yeast'.

Ethanol is made by fermentation of a carbohydrate dissolved in water, in the presence of yeast.

The reaction is carried out at 30 °C.

Explain why the reaction is carried out at a temperature of 30 °C rather than at a temperature of 80 °C.

(2)

The enzymes would be denatured at 80°C so wouldn't react properly.

Results Plus: Examiner Comments

This response scored 1 mark only.

There is a correct reference made in the response to the enzymes being denatured. However, the source of the enzymes, namely yeast, has not been identified.

Because the enzyme in the yeast can denature if the temperature is too high and the active site changes shape.

Results Plus: Examiner Comments

This first part of the response scores both marks, coupled with the fact that the second part actually gives a good description (although not required in this particular question) of what is

meant by denaturing.

Q38.

Candidates found explaining why ethene is unsaturated relatively straightforward with many gaining a mark for this. However, a large proportion of these failed to continue to explain what was meant by hydrocarbon to gain the second of the two marking points.

Ethene, C_2H_4, is an unsaturated hydrocarbon.

Explain why ethene is an **unsaturated hydrocarbon**.

(2)

It has a double bond between the carbons.

Results Plus: Examiner Comments

The most common answer that addresses the unsaturated nature of the ethene gains just 1 mark only.

Explain why ethene is an **unsaturated hydrocarbon**.

(2)

Ethene is an unsaturated hydrocarbon because it contains a double C=C bond, and contains only of hydrogen and carbon atoms.

Results Plus: Examiner Comments

A good answer that explains both parts of the definition.

Q39. No Examiner's Report available for this question

Q40.

The second of the two extended answer level based questions was again well attempted with marks awarded equally across the mark range. Candidates appeared to interact well with the question and understood what was required of them to gain the marks. Again, it was clear that many candidates were familiar with the practical and those that had were able answer well.

Knowledge of the tests was good. Candidates found discussing the additional test required to justify the presence of the ammonium ion and the sulfate ions the most difficult.

The more successful candidates structured their answers in a systematic, organised manner discussing each substance in turn. The test for chloride and iron (II) were well known. However, a noticeable proportion of candidates appeared to be confused between ammonium and aluminium ions.

A student tests solutions of three ionic substances, **K**, **L** and **M**.

The student carries out the same two tests on each of the three solutions.

Test 1 add dilute nitric acid and then silver nitrate solution.

Test 2 add a few drops of sodium hydroxide solution and warm the mixture.

Figure 7 shows the results of the tests and the student's conclusions about the identity of each substance.

ionic substance	test 1	test 2	student's conclusion
K	white precipitate	colourless solution	ammonium chloride ✓
L	white precipitate	white precipitate	aluminium chloride ✓
M	no precipitate	green precipitate	iron(II) ✓ sulfate

Figure 7

None of the student's conclusions are fully justified.

Explain which part of each conclusion is justified and what further work can be carried out to fully justify each conclusion.

(6)

Test 1 - This is a test for Halide ions (anions)

(K) - This produces a white precipitate so yes the 'CHLORIDE' is justifiable ~~work~~ but NOT 'AMMONIUM' as we have not tested for that yet.

(L) - This also produces a white precipitate so again, 'CHLORIDE' is justifiable but not yet 'ALUMINIUM' as chloride is meant to produce white precipitate

(M) - Since there is no precipitate we know there are no HALIDE ions present but it is impossible yet to justify "IRON (II) SULPHATE".

Test 2 - This is a test for Cations.

(K) Since it is colourless, it is possible that the result is 'AMMONIUM' but further tests are required to completely justify this.

(L) - Again, 'ALUMINIUM' is potentially correct but needs further tests to confirm.

(M) - A green precipitate is defineitely "Iron (II)" so yes this is justifiable

FURTHER TESTS:

(K) To check it is ammonium, hold up damp red litmus paper to test tube. If it turns blue, 'AMMONIUM CHLORIDE" is correct as AMMONIUM turns red litmus paper blue

(L) To confirm 'ALUMINIUM' is correct, add excess Sodium Hydroxide. If it goes colourless, "ALUMINIUM CHLORIDE" is correct - Else it is "CALCIUM CHLORIDE".

(M) To verify that "SULPHATE" is correct, add dilute hydrochloric acid and then barium chloride. If white precipitate forms, "SULPHATE" ion is present so "IRON(II) SULPHATE" is correct.

else:

-if sulphates test negative, add dilute HCL and if a gas is given off test gas with limewater. If limewater goes cloudy, CO_2 is given off and carbonates are present. This proves (M) is Iron(II)carbonate.

Results Plus: Examiner Comments

In this example, the candidate has gone through the results in the table in a logical way, discussing the results of each test for each substance, this very clear answer gained full credit at level 3.

For substance M the Iron(II) is identified by the green precipitate formed by test two but they havn't identified the sulfate, a different test for sulfer ions would need to be carried out using dilute hydrochloric acid and barium chloride, if a white precipitate forms there are sulfer ions present. In substance K and L the chloride is justified by the first test where a white precipitate forms showing the presense of a halide ion, Chlorine.

Results Plus: Examiner Comments

In this example, the candidate has fully discussed both ions in substance M and the anions in substances K and L, they have not explained the further work required to justify the ammonium and aluminum in K and L. The answer was sufficient to gain full credit at level 2.

Test 1 ions substance K and L had white precipitate and the student concluded that if was chloride this is justified has they both have the same answer.

Results Plus: Examiner Comments

In this example, the candidate has explained why two of the ions present are justified by the results shown. These partial explanations are sufficient for full credit in level 1.

Q41. No Examiner's Report available for this question

Q42. No Examiner's Report available for this question

Q43.

This question was poorly answered with approximately a third of the responses scoring 1 or 2 of the 2 marks available.

It was clear that many candidates were unfamiliar with the bromine test for unsaturation, with many simply repeating the colour changes as stated in the question, offering no explanation.

The terms saturation and unsaturation were rarely used by candidates. Likewise explanations in terms of reactivity were rarely seen.

The most commonly seen correct responses often scored 1 mark for stating that A is alkene or B is an alkane. However, many responses got the identification of the alkenes and alkanes the wrong way round.

A common misconception seen by examiners was that alkanes are more reactive than alkenes so the alkane must be the one that goes colourless.

Two liquid hydrocarbons, **A** and **B**, were tested with bromine water.
One hydrocarbon was known to be an alkane.
The other hydrocarbon was known to be an alkene.

Each hydrocarbon was shaken with a few drops of bromine water.

The results of the tests were
hydrocarbon A + bromine water: the mixture turned from orange to colourless.
hydrocarbon B + bromine water: the orange colour remained.

Explain these results.

hydrocarbon A is unsaturated but B is saturated (2)

Results Plus: Examiner Comments

A good example of a fully correct, response which scored 2 marks.

Both the hydrocarbons have been correctly identified.

The Hydrocarbon B shows that it is an alkane as it stayed the same, A was an alkene as the colour changed.

Results Plus: Examiner Comments

This is typical example of a response which scored 1 mark.

The hydrocarbon A has been identified as an alkene and hydrocarbon B has been identified as an alkane.

Q44.

There were several good answers that scored both marks with the idea of the increased surface area and a greater rate of reaction, but there were those who limited their answers to the nanoparticles being very small without further development and again these did not score.

Q45.

A majority of responses focused on flexibility, with very few alluding to unreactivity, non-toxicity or impermeability (to air or water). Explanations were, unsurprisingly, weaker than the statement of a property, and sometimes here insufficiently scientific or rigorous language prevented the awarding of a mark.

Q46. No Examiner's Report available for this question

Q47.

This question was not well answered, with approximately half of the responses scoring 1 of the 2 marks available.

This part of the specification is frequently tested. However, few candidates were able to recall the term hydrocarbon correctly.

The vast majority of responses focused on why the molecule was unsaturated by correctly stating the presence of the double bond, scoring 1 mark only.

A common error was to confuse atoms and molecules, i.e. hydrocarbon containing hydrogen molecules and carbon molecules.

Substance X is an unsaturated hydrocarbon.
The structure of a molecule of substance X is shown in Figure 10.

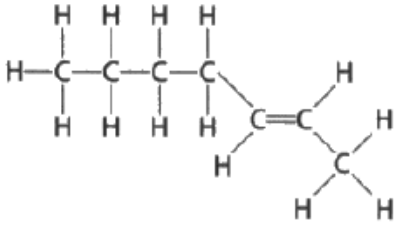


Figure 10

Explain how the structure of substance X shows that it is an **unsaturated hydrocarbon**.

(2)

Has a carbon carbon double bond and only contains hydrogen and carbon atoms.

Results Plus: Examiner Comments

An example of a fully correct response.

The candidate clearly states that an unsaturated hydrocarbon contains a carbon carbon double bond and only contains hydrogen and carbon atoms.

Results Plus: Examiner Tip

Note that when defining the term hydrocarbon the word 'only' is essential in relation to hydrogen and carbon atoms.

Explain how the structure of substance X shows that it is an **unsaturated hydrocarbon**.

(2)

The structure of substance X is an unsaturated hydrocarbon because of its double carbon bond which shows its an alkene.

Results Plus: Examiner Comments

This response is typical of one that scored only 1 mark.

The term unsaturation has been correctly defined. However, the term hydrocarbon has not been defined.

Q48.

There were several good answers seen that answered the question 'Explain ....'. However, many candidates just made a simple point about a risk associated with nanoparticles such as 'they can penetrate through the skin' without further consequence and so could score 1 mark. Some answers such as 'they are very small' didn't warrant a mark.

Q49.

(i)

This part was not well answered.

Incorrect responses included : experimental error, too much water, other reactions might occur, didn't burn for long enough, the theoretical value is just a guess. Other candidates said that ethanol didn't burn fully which was excluded by the question.

(ii)

Use of a lid was mentioned more often than a generic 'draught shield' but surprisingly this wasn't particularly well answered. Mention of types of insulating material were unusual. Lots of ideas about using Bunsen burners, different fuels, different volumes of water or using a glass beaker (or a polystyrene cup) instead of a metal can. Other candidates did know that heat loss was to be minimised, but gave no way of doing this. Perhaps the most innovative suggestion was to carry the experiment out in a room at 85oC to minimize heat loss.

(iii)

There were many correct answers here.

Some obtained 1 mark by using the wrong temperature change but correctly showing their working and with correct evaluation. The candidates that did not score typically divided instead of multiplying.

Q50.

(i)

Generally well answered with most candidates able to score the 1 mark available for mentioning that 'energy is lost'. The word 'dissipate' was frequently seen by examiners.

Incorrect responses included: experimental error, too much water, other side-reactions might occur, did not burn for long enough, the value is theoretical is therefore never achieved (possibly thinking of yields). Others said that ethanol did not burn fully which was excluded by the question.

Ethanol can be used as a liquid fuel.

A student investigates how much heat energy is released when a known mass of ethanol is burned.

The apparatus is set up as shown in Figure 3.

A known volume of water is placed in a metal can.
The temperature of the water is measured.
The ethanol is ignited and placed under the beaker so that the flame is touching the beaker.
The water is heated by the flame.
The flame is extinguished.
The final temperature of the water is measured.

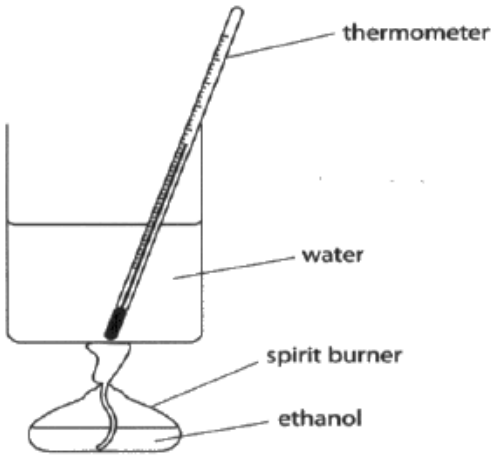


Figure 3

The theoretical temperature rise for burning a given mass of ethanol is 82.4 °C.

In the experiment the actual temperature rise for burning this mass of ethanol was only 34.8 °C.
One reason why the temperature rise is less than expected is that the ethanol does not burn completely.

(i) Give a reason why, even if the ethanol burns completely, the actual temperature rise is much less than the theoretical value.

(1)

Because some of the ~~ethanol~~ heat energy is released into the surrounding.

Results Plus: Examiner Comments

A typical correct response scoring 1 mark.

'Heat energy' is fine and 'released into the surrounding' describes it being lost.

Ethanol can be used as a liquid fuel.

A student investigates how much heat energy is released when a known mass of ethanol is burned.

The apparatus is set up as shown in Figure 3.

A known volume of water is placed in a metal can.
The temperature of the water is measured.
The ethanol is ignited and placed under the beaker so that the flame is touching the beaker.
The water is heated by the flame.
The flame is extinguished.
The final temperature of the water is measured.

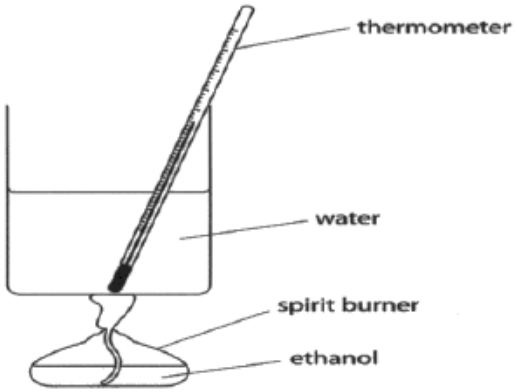


Figure 3

The theoretical temperature rise for burning a given mass of ethanol is 82.4 °C.

In the experiment the actual temperature rise for burning this mass of ethanol was only 34.8 °C.
One reason why the temperature rise is less than expected is that the ethanol does not burn completely.

(i) Give a reason why, even if the ethanol burns completely, the actual temperature rise is much less than the theoretical value.

(1)

Some of the ethanol gas might've escaped into the air.

Results Plus: Examiner Comments

A typical incorrect response.

The response incorrectly refers to 'ethanol gas' escaping. This is the wrong thing that has 'escaped' - it is heat/energy that escapes.

(ii)

Generally well answered with about half the responses able to score the 2 marks available, with most candidates recognising the need for a lid or another form of insulation and the effect that would have in reducing heat loss.

Incorrect responses included:

Proposing the use of a 'closed system' without indicating how this may be accomplished practically. Some wanted to move the burner closer although the diagram showed it very close already. Some missed the point completely and were proposing purer ethanol or better weighing of the fuel or a whole range of other spurious changes.

(ii) Explain how the method described above could be improved to give a temperature rise closer to the theoretical value.

(2)

The person should put a lid on the beaker and insulate the sides to prevent energy being lost to the surroundings giving a closer temperture increase to the theoretical.

Results Plus: Examiner Comments

A typical example of the responses which scored 2 marks.

This gains both the first and second marking points for adding a 'lid' and for the idea of the prevention of energy loss.

(ii) Explain how the method described above could be improved to give a temperature rise closer to the theoretical value.

(2)

~~Using a bunsen~~ Use a smaller amount of water and increase the spirit burner size - this would give more heat to a smaller volume - it would be hotter.

Results Plus: Examiner Comments

This response was not creditworthy.

The changes suggested will change the theoretical value as there is less water being heated, so does not answer the question.

(iii)

Generally extremely well answered with most responses scoring the 2 marks available.

Incorrect responses included:

The use of an incorrect temperature change, particularly 82.4, 82.4 minus 34.8, and 34.8 minus an assumed room temperature often 20. This limited the score to 1 mark for an error carried forward.

(iii) The amount of heat energy used to raise the temperature of the water by 34.8 °C can be calculated using

heat energy = 210 × temperature rise

Calculate the amount of heat energy used.

(2)

$210 \times 34.8 = 7308$

heat energy = 7308 (energy units)

Results Plus: Examiner Comments

A typical example of a correct response, scoring 2 marks.

The correct numerical answer, namely 7308 (energy units), is credited with full marks.

(iii) The amount of heat energy used to raise the temperature of the water by 34.8 °C can be calculated using

heat energy = 210 × temperature rise

Calculate the amount of heat energy used.

(2)

$34.8 - 82.4 = -47.6$ $hE = 210 \times -47.6$

$= -9996$

heat energy = -9996 (energy units)

Results Plus: Examiner Comments

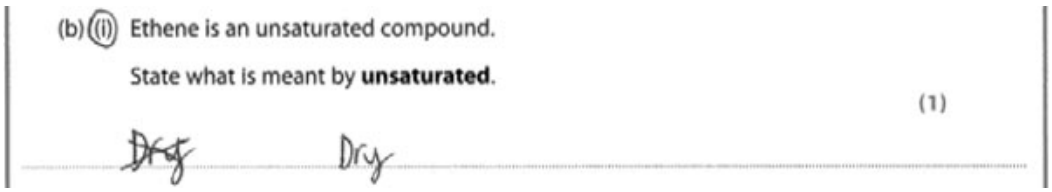
A typical example of a response only scoring 1 of the 2 marks available, with an error carried forward.

The final answer is not 7308. However, there is 210 multiplied by a number which has then been correctly evaluated. The sign on the answer can be ignored.

Q51.

(i)

This basic recall question was poorly answered, with a great many candidates having no notion at all of what 'unsaturated' means. Unfortunately, some wrote the answer the wrong way round ("has no double bond"). Others suggested that unsaturated meant "not saturated" - true, but this is never going to get a mark. Other errors included: not mixed with anything else, answers related to fats, still room for more atoms/bonds. There were a large number of answers related to water e.g. "no water", "unreactive to water", "no added water".


(b) (i) Ethene is an unsaturated compound.

State what is meant by **unsaturated**.

(1)

Drg Dry

Results Plus: Examiner Comments

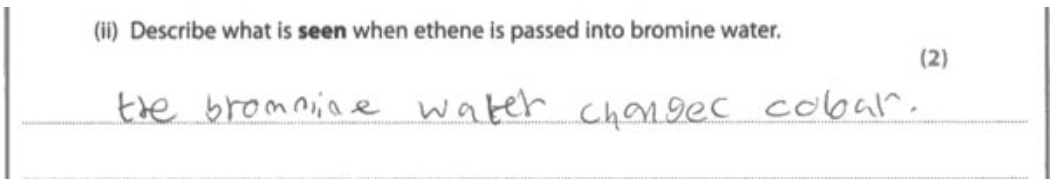
This was not acceptable as an answer to a question on a chemistry paper.

Results Plus: Examiner Tip

Learn the meaning of common chemical terms.

(ii)

In this question the starting colour of bromine was less commonly seen than the end colour. Many responses correctly stated that the bromine water went colourless, however there were other incorrect descriptions of what happened: bubbles, goes cloudy, milky, orange, brown or yellow. Some answers stated that a colour change occurs, but did not specify the colours. It is disappointing to still see many answers where "clear" or "transparent" are used rather than colourless.


(ii) Describe what is **seen** when ethene is passed into bromine water.

(2)

the bromine water changed colour.

Results Plus: Examiner Comments

Correct - but the colours must be given.

Results Plus: Examiner Tip

Tests occur often in exams and learning these carefully will be credited.

Q52. No Examiner's Report available for this question

Q53. No Examiner's Report available for this question

Q54.

(b)

Most candidates gained full credit for showing the correct formulae for both reactants for the hydration of ethene.

Despite the reactants being given in the question, a large number of candidates were unable to recall the formula for ethene. Often the formula of ethane, C_2H_6, was shown, or C_2H_5 was given. Occasionally, candidates got the reactants and products the wrong way round. Several even got the formula for water wrong. Many candidates attempted to add a hydrocarbon and water to arrive at the product, a method that might have worked, but unfortunately were unable to work out the number hydrogen atoms in ethanol, with the hydrogen atom in the hydroxyl group omitted.

(c)(i)

Many candidates were able to gain full credit.

The majority of candidates scored the 2 marks for references to 'same general formula' and 'similar chemical properties'. Often candidates could correctly recall the general formulae for various homologous series.

Often candidates failed to score due to being too vague, referring to 'same properties', 'similar structure', 'similar formula'. In a few cases, confused the definition for an homologous series with that of a hydrocarbon.

(i) Describe what is meant by an **homologous series**.

(2)

A homologous Series is a grop of compands that all have a similar formula. This moans they have a similar molecular Structure, and have Similar properties.

Results Plus: Examiner Comments

This was a commonly seen incorrect response seen by examiners. The three points made regarding 'similar chemical formula, structure and similar properties' are not specific enough, so this response did not score.

(i) Describe what is meant by an **homologous series**.

(2)

This means that they all share very similar properties and all follow the same general formula.

Results Plus: Examiner Comments

This candidate mentions 'similar properties', but this is too vague, since there is no reference to 'similar chemical properties'. However, the reference to 'same general formula' is correct, so this scored 1 mark only.

(i) Describe what is meant by an **homologous series**.

(2)

A group of compounds all with the same general formula and the same functional group so that makes them all have similar chemical properties and react in same way

Results Plus: Examiner Comments

This is a very good example of a fully correct response. There are three creditworthy points made. The response scored the maximum 2 marks.

(c)(ii)

This was very well answered on the whole. Most candidates could correctly draw the displayed formula for methanol.

Most incorrect responses showed an C–HO bond for an C–OH, or tried to make the oxygen double bonded, as in C=OH or C=O, as in an aldehyde.

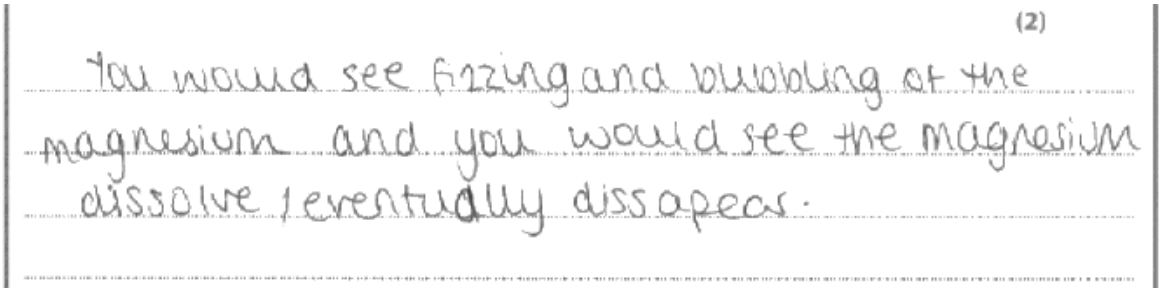
(d)(i)

Most candidates could correctly state that the type of reaction which occurs when ethanol changes into ethanoic acid is 'oxidation'. The most common incorrect responses often confused the oxidation process with 'fermentation' or 'reduction'.

(d)(ii)

Most candidates typically scored at least 1 of the 2 marks available for 'fizzing and/or 'disappear'. Although, not desirable, 'dissolve' was credited as an alternative to 'disappear'.

The most commonly seen error was for candidates not giving observations, but either mentioning 'gas given off' or simply naming the species formed, hydrogen and/or magnesium ethanoate, or explaining the chemical process. The question specifically asks for what you would **see**, as opposed to an explanation.


(2)

You would see fizzing and bubbling at the magnesium and you would see the magnesium dissolve / eventually dissapears.

Results Plus: Examiner Comments

A good example of a fully correct response. Marking points 1 and 2 are for the correct references to 'fizzing/bubbling' and 'disappear'.

Results Plus: Examiner Tip

Read the question carefully. This is a commonly asked question on the examination, so make sure you write down what is **seen**, rather than simply naming the chemical products or stating that a gas is given off. You cannot see a gas.

Q55.

(a)

A large number of candidates could write the correct equation. However, a significant number

did not know the formula for ethene.

3 (a) Ethanol can be produced by reacting ethene with steam.

Write the balanced equation for this reaction.

$C_2H_5OH + H_2O \rightarrow C_2H_4$ (2)

Results Plus: Examiner Comments

This candidate has mis-read the equation and written the equation in reverse, so did not score any marks.

Results Plus: Examiner Tip

Read the question carefully and write equations in the correct direction.

3 (a) Ethanol can be produced by reacting ethene with steam.

Write the balanced equation for this reaction.

$C_2H_4 + 2H_2O \rightarrow C_2H_3OH$ (2)

Results Plus: Examiner Comments

This candidate has scored 1 mark for the correct formula for ethene as a reactant. The formula for ethanol is incorrect, even though this was given in part (d) of this question.

Results Plus: Examiner Tip

Use the correct formulae given on the examination paper.

3 (a) Ethanol can be produced by reacting ethene with steam.

Write the balanced equation for this reaction.

$C_2H_4 + H_2O \rightarrow C_2H_5OH$ (2)

Results Plus: Examiner Comments

This is an example of a completely correct equation, scoring 2 marks.

(b)

A number of candidates did not know how to produce ethanol by fermentation, but generally this question was well-answered with the majority of candidates scoring marks for adding yeast, using anaerobic conditions and a correct temperature. Very few candidates mentioned that sugar solution is used, although this was not necessary to score full marks.

(b) Ethanol can also be produced by fermentation.

Describe how ethanol can be produced from sugar by fermentation.

(2)

Ethanol is put in a fermenter and the temperature, pressure and pH levels would be set for optimum yield of ethanol and as ethanol is made, it is removed and the sugar is added at the same rate to keep the pressure and volume unchanged in the fermenter.

Results Plus: Examiner Comments

This is a vague answer that mentions temperature but does not suggest a suitable value. This answer did not score any marks.

Results Plus: Examiner Tip

When you describe an experiment, give specific details.

(b) Ethanol can also be produced by fermentation.

Describe how ethanol can be produced from sugar by fermentation.

(2)

In warm, anaerobic conditions, yeast can break down glucose (sugar) into ethanol, carbon dioxide and energy.

$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$

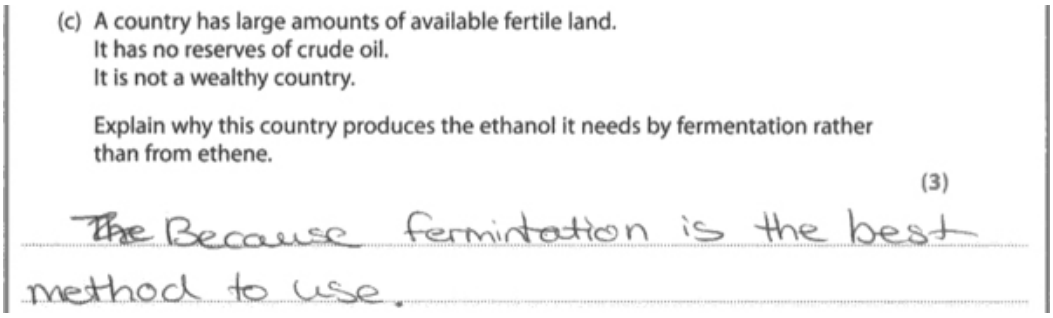
Yeast has enzymes which do this.

Results Plus: Examiner Comments

This is a very good answer, scoring both marks.

(c)

The majority of candidates were able to score at least two marks for this question as they could use the information given. A few candidates thought that the land would be useful for growing crops of yeast or for building the fermentation plant. Some candidates did not link the crude oil being used to produce ethene.



(c) A country has large amounts of available fertile land.
It has no reserves of crude oil.
It is not a wealthy country.

Explain why this country produces the ethanol it needs by fermentation rather than from ethene.

(3)

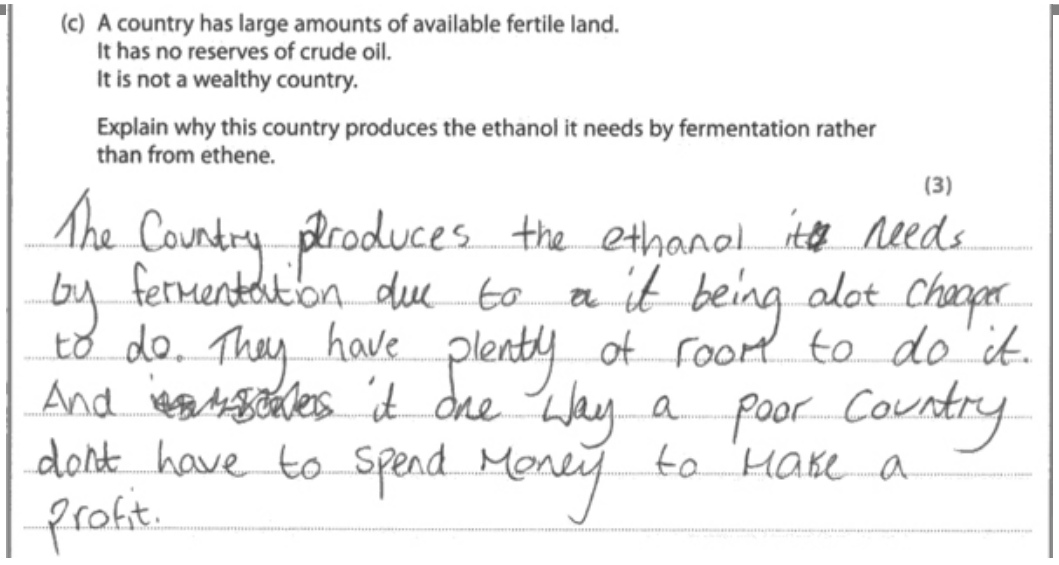
~~The~~ Because fermintation is the best method to use.

Results Plus: Examiner Comments

This type of answer did not use the information given in the question so did not score any marks.

Results Plus: Examiner Tip

Use the information given in the question.



(c) A country has large amounts of available fertile land.
It has no reserves of crude oil.
It is not a wealthy country.

Explain why this country produces the ethanol it needs by fermentation rather than from ethene.

(3)

The Country produces the ethanol it needs by fermentation due to it being alot cheaper to do. They have plently of room to do it. And it one way a poor country dont have to spend Money to Make a profit.

Results Plus: Examiner Comments

This candidate has scored 1 mark for comparing the costs of the processes. They have mentioned 'plenty of room to do it', but this is too vague. If they had mentioned plenty of land to grow the crops needed to produce the sugar for fermentation, they would have scored another mark.

(c) A country has large amounts of available fertile land.
It has no reserves of crude oil.
It is not a wealthy country.

Explain why this country produces the ethanol it needs by fermentation rather than from ethene.

(3)

Fermentation is used to produce ethanol rather than from ethene because the county has fertile land. This land can be used to grow sugar beet or sugar cane to produce glucose for fermentation. The county also has no reserves of crude oil, meaning the crude oil can't be cracked to produce ethene, so no ethene is available in this county. Moreover, it is not wealthy therefore it cannot afford to produce ethanol from ethene as this is expensive (due to ~~crude~~ crude oil being a non-renewable resource of energy).

Results Plus: Examiner Comments

This is a very good answer and scored 3 marks.

(d)

Some excellent answers were seen to this question showing a clear understanding of the term 'homologous series'. A few candidates just wrote vague answers such as they all end in -ol or all contain the elements carbon, hydrogen and oxygen and these were not given any credit. A few candidates were also confused between the hydroxyl group and hydroxide ions. Some candidates gave an incorrect general formula, although the formulae for the alcohols were given in the question.

(d) Ethanol is a member of the homologous series of alcohols.
The first three members of the series are

methanol	CH_3OH
ethanol	C_2H_5OH
propanol	C_3H_7OH

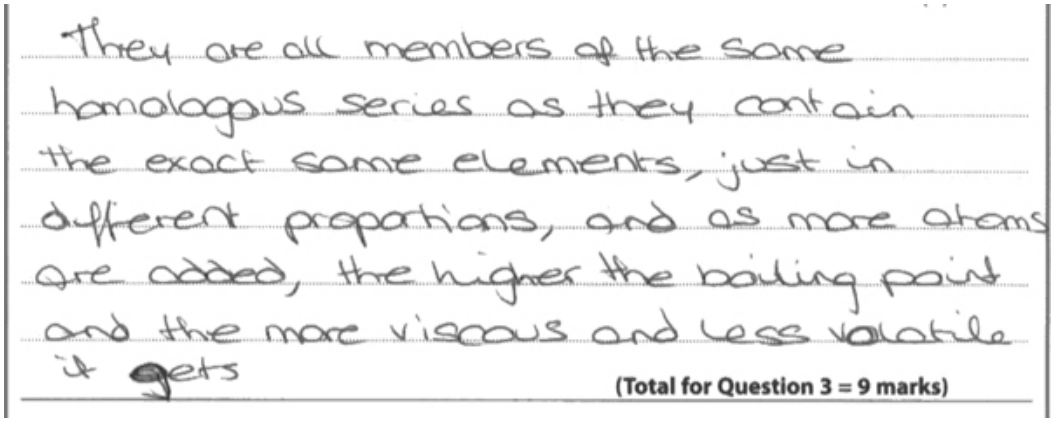
Use the formulae of these molecules to explain why these alcohols are members of the same homologous series.

(2)

They have the same general formula ($C_nH_{2n+1}OH$) which is a property of the homologous series. They will also have similar chemical properties but show gradual change in their physical

Results Plus: Examiner Comments

This is an excellent answer, scoring both marks.


They are all members of the same homologous series as they contain the exact same elements, just in different proportions, and as more atoms are added, the higher the boiling point and the more viscous and less volatile it gets

(Total for Question 3 = 9 marks)

Results Plus: Examiner Comments

This candidate did not score any marks as 'contain the same elements in different proportions' is not the same as 'have the same general formula'.

Results Plus: Examiner Tip

Use correct scientific terminology, such as general formula' in your answers.

Q56.

(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.

Results Plus: Examiner Comments

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

Results Plus: 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.

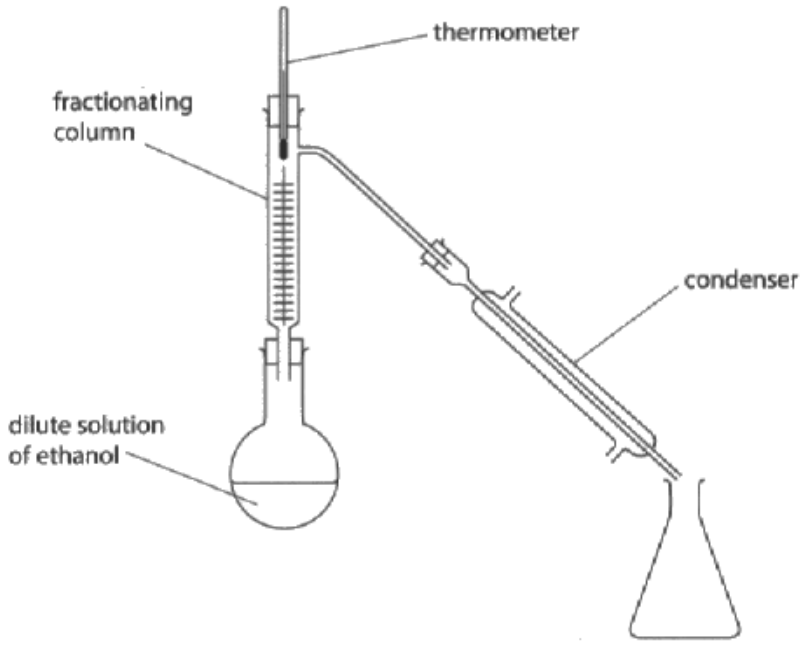
Results Plus: Examiner Comments

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

(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.

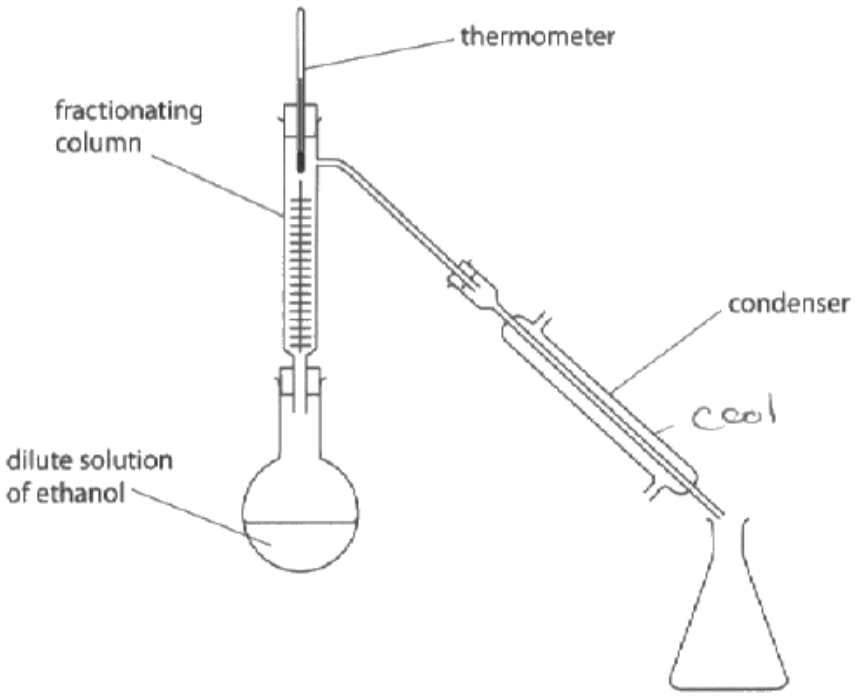
(2)

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.

Results Plus: 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.

ethanol has a lower boiling ~~bot~~ point (2) 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.

Results Plus: Examiner Comments

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

(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.

Results Plus: 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.

(d)

This part was quite low scoring, surprisingly.

Q57.

(i)

Surprising few candidates were able to recall that 'yeast' is needed for the fermentation of glucose solution. The most commonly seen incorrect answer was 'ethanoic acid', followed by a random selection of substances.

(iii)

This was poorly answered by the vast majority of candidates, with few correctly stating that a person's reaction time would increase as an effect of drinking alcohol. The vast majority of responses seen by examiners incorrectly stated that 'the reaction time would slow down'. Occasionally, it was evident that candidates had misread the question, when health problems linked to alcohol consumption were often stated, rather than the effect on reaction time.

(iii) Alcoholic drinks contain ethanol.

State the effect of drinking alcohol on a person's reaction times.

(1)

Drinking alcohol slows down the persons reactions which means it increases their reaction time.

Results Plus: Examiner Comments

A typical example of a good response which scored the 1 mark available, for a correct reference to 'it increases their reaction time'.

(iii) Alcoholic drinks contain ethanol.
State the effect of drinking alcohol on a person's reaction times.

(1)

It slows reaction times down.

Results Plus: Examiner Comments

A very typical example of an incorrect response, which did not score the mark. 'Slows reaction times down' is incorrect. It is not equivalent to 'slower reactions' or 'increases reaction times'.

Q58.

(i)

The question was well answered, with the most popular choice of conditions being anaerobic conditions and a warm temperature/ correctly specified temperature range.

Ethanol

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

Yeast is needed for the fermentation reaction.

(i) State **two** other conditions for fermentation.

(2)

~~Keep moist dark area~~ The temperature must be at the yeast optimum degree and there must be a good supply of nutrients.

Results Plus: Examiner Comments

Temperature is relevant, here, but needs to be specified or say 'warm'.

Results Plus: Examiner Tip

Please specify conditions carefully - what is the optimum temperature?

(iii)

This equation was poorly done. It is possible than many candidates did not think through working out the products and writing the formulae. Ethanol was, after all, mentioned in every other part of this question, yet a huge variety of formulae were given with no similarity to ethanol's formula at all. Photosynthesis and respiration equations were sometimes given.

Q59. No Examiner's Report available for this question

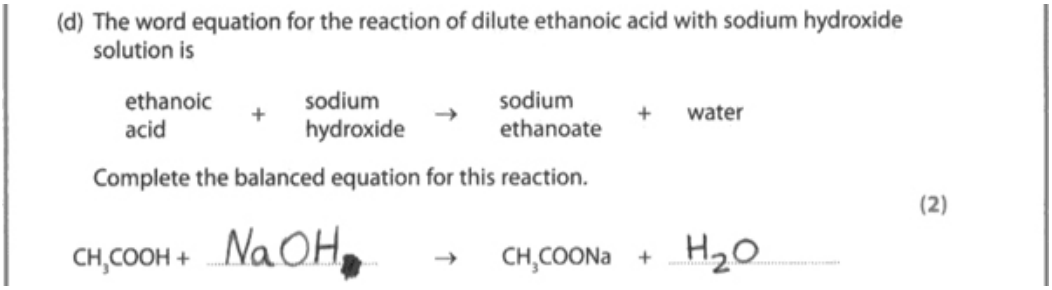
Q60.

(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.

(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

Results Plus: 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

Results Plus: 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.

(e)

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

(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

Results Plus: 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

Results Plus: 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 + carbon dioxide

Results Plus: 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.

(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.

Results Plus: 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.

Results Plus: 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.

Results Plus: Examiner Comments

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

Mark Scheme

Q1.

Question Number	Answer	Acceptable answers	Mark
(i)	**C** iodide, I^-		**(1)**

Question Number	Answer	Acceptable answers	Mark
(ii)	A description linking two points from • flame test / description of flame test mentioning **in** flame (1) • sodium gives a **yellow** flame (1) • potassium gives a {lilac/purple/violet} flame (1)	description can be using (nichrome) wire or damp splint Ignore: hold over/ around/under/above flame Ignore: yellow-orange, orange or any other colour	**(2)**

Q2.

	Answer	Acceptable answers	Mark
(a)(i)	A carbonate ion CO_3^{2-}		**(1)**
(a)(ii)	A description including warm / heat / boil (1) {**gas/ammonia**} turns (damp red/pink) litmus blue / (damp red/pink) litmus turns blue when held above (the mixture)(1)	maximum (1) if additional reagents added ignore any ppt allow pungent smell / smell of {ammonia/wet nappies} /alkaline **gas** /effect of ammonia on other named indicators /dense white fumes with	**(2)**

		conc hydrochloric acid ignore litmus turns blue in ammonium ions/sodium hydroxide/mixture do not allow gas/ammonia if blue litmus turns red/pink	
(b)	$Al^{3+} + 3OH^- \rightarrow Al(OH)_3$ OH^- (1) $Al(OH)_3$ (1) balancing 3, conditional on correct formulae (1)	allow multiples allow HO^- (1) allow $Al(HO)_3$ (1) do not allow $Al(HO)^3$/lower case h ignore state symbols/$3Na^+$ on both sides	**(3)**

		Indicative Content	
QWC	***(c)**	An explanation including some of the following points **test for cation** • flame test • if the flame is yellow/not lilac, sodium ions are • if the flame is lilac/not yellow, potassium ions **test for iodide ions** • make a solution of the crystals in water • add dilute nitric acid • add silver nitrate solution • if there is a yellow precipitate, iodide ions are • if there is no precipitate, sulfate ions are prese • $Ag^+ + I^- \rightarrow AgI$ OR • make a solution of the crystals in water • add chlorine water • then cyclohexane • if the cyclohexane/top layer turns purple, iodic present • if there is no colour change, sulfate ions are pr • $Cl_2 + 2I^- \rightarrow 2Cl^- + I_2$ **test for sulfate ions** • make a solution of the crystals in water • add dilute {hydrochloric/nitric} acid • add barium {chloride/nitrate} solution • if there is a white precipitate, sulfate ions are • if there is no precipitate, iodide ions are prese • $Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$	
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description of test for any 1 ion e.g. flame test, yellow flame,	

		sodium ions are present. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• a simple description to identify a cation and an anion e.g. if the substance is sodium sulfate, it will give a yellow flame in a flame test and a white precipitate with barium chloride solution. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description to identify at least 3 ions e.g. carry out a flame test, yellow flame, sodium ions present, lilac flame, potassium ions present, add silver nitrate solution to solution of substance, yellow precipitate, iodide ion. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q3.

Question Number	Answer	Additional Guidance	Mark
(i)	carbon dioxide	Allow CO_2 Reject carbon monoxide/ CO	**(1)** AO 1 1

Question Number	Answer	Mark
(ii)	carbonate / CO_3^{2-}	**(1)** AO 1 1

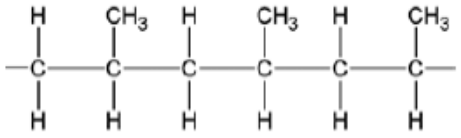
Q4.

Question number	Answer	Mark
	B glucose → ethanol + carbon dioxide **B** is the only correct answer. **A** is incorrect because water is not produced **C** is incorrect because hydrogen is not produced **D** is incorrect because water is not produced	**(1)**

Q5.

Question number	Answer	Mark
	D fluorine atom, chloride ion, nanoparticle is the only correct answer. **A** and **B** are not correct because the smallest particle is the atom **C** is not correct because the largest particle is the nanoparticle	**(1)**

Q6.

Question number	Answer	Mark
	B  is the only correct answer **A** is not correct because there are insufficient CH_3 groups attached to the carbon chain **C** is not correct because only one CH_3 group can be attached to a carbon atom **D** is not correct because there are no H atoms attached to the carbon chain	**(1)**

Q7.

Question number	Answer	Mark
(i)	**D** 100 **D** is the only correct answer because 17 / 0.16 ≈ 100 **A**, **B** and **C** are incorrect because 17 / 0.16 ≈ 100	**(1)**

Question number	Answer	Additional guidance	Mark
(ii)	allow 2 for correct answer with or without working surface area of 1 side of cube = 9 x 9 (1) (= 81 (nm^2)) total area of cube = 6 x (9 x 9) (1) (= 486 (nm^2))	 allow 9 x 9 (1) x 9 (= 729 (nm^2)) allow 6 x 9 (1) (= 54 (nm^2))	(2)

Question number	Answer	Mark
(iii)	damages cells/heart problems/get into the bloodstream/pass into cells/catalysing harmful reactions/harmful to aquatic life	(1)

Q8.

Question number	Answer	Mark
	C	(1)

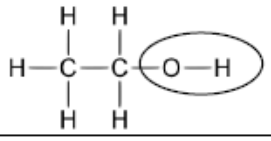
Q9.

Question number	Answer	Mark
	C	(1)

Q10.

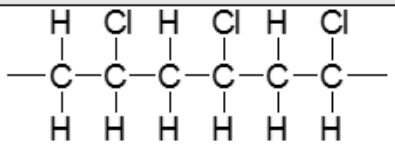
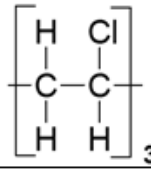
Question number	Answer	Mark
	C 2.5×10^{-8}	(1)

Q11.

Question number	Answer	Mark
		(1)

Q12.

Question number	Answer	Additional guidance	Mark
(i)	circle around C=C	or circle around C-Cl	(1) AO1

Question number	Answer	Additional guidance	Mark
(ii)	 (3)	chain containing 6 C atoms (1) single bonds between C atoms (1) rest of structure complete (1) allow alternative arrangements allow max 2 for 	(3) AO2

Question number	Answer	Additional guidance	Mark
(iii)	addition (polymer)		(1) AO1

Question number	Answer	Additional guidance	Mark
(iv)	relative formula mass C_2H_3Cl = 62.5 (1) 2850 x 62.5 (1) (=178125) 178000 (to 3 sig figs) (1)	without working 178000 (3) 178125 /178127 (2) allow TE on incorrect relative formula mass answer to 3 sig fig from calculation (1) (stand alone mark)	(3) AO2

Q13.

Question number	Answer	Mark
	A	(1)

Q14.

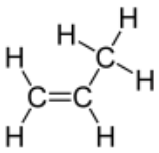
Question number	Answer	Mark
	A	(1)

Q15.

	Answer	Acceptable answers	Mark
(a)(i)	an explanation linking the following • decomposition (of compound/substance /electrolyte)(1) • using (direct) current (1)	 splitting up/breaking down/breaking up ignore separating reject splitting of atoms/elements/molecules for M1 using {electrical energy /electricity} reject alternating current/ac	(2)
(a)(ii)	• (damp blue) litmus (paper) (1) • (turns red then) {bleaches / goes white} (1)	 allow bleaches indicator for 1 mark ignore indicator goes lighter ignore smells of chlorine/swimming pools ignore any incorrect middle colour	(2)

		mentioned use of suitable named indicator with correct result e.g. (damp) universal indicator paper (1) (turns red then) bleaches (1) starch-iodide paper(1) turns blue-black(1)	
(a) (iii)	poly(chloroethene)	PVC/polyvinylchloride/ polychloroethene/poly(chlorethene)	(1)
(b)(i)	D AgCl(s)		(1)
(b)(ii)	same/no change		(1)
(b)(iii)	$HCl + AgNO_3 \rightarrow AgCl + HNO_3$ • reactant formulae (1) • product formulae (1)	$Ag^+ + Cl^- \rightarrow AgCl$ max 1 if any incorrect attempt to balance reject incorrect use of cases and non-subscripts	(2)

Q16.

Question Number	Answer	Mark
	 any 3 carbon molecule **and** one C=C (1) fully correct molecule with all bonds (2)	**(2)**

Q17.

Question number	Answer		Mark
	• name: sodium sulfate (1) • formula: Na_2SO_4 (1)	Allow formula consequential on incorrect name	**(2)**

Q18.

Question Number	Answer	Acceptable answers	Mark
	a description linking • bromine water is/starts orange (1) • (alkene) bromine water turns colourless/decolourises (1) • (alkane) bromine water remains/stays orange / no change (1)	allow red/brown/yellow for colour of bromine water ignore clear ignore discoloured	**(3)**

Q19.

Question number	**Answer**	**Additional guidance**	**Mark**
	An answer that provides a description by making reference to: • add (dilute) hydrochloric acid (1) • add barium chloride solution (1) • white precipitate forms (1)	3rd marking point consequential on 2nd marking point	**(3)**

Q20.

Question number	**Answer**	**Additional guidance**	**Mark**
	An answer that provides a description by making reference to: • add (dilute) hydrochloric acid (1) • add barium chloride solution (1) • white precipitate forms (1)	3rd marking point consequential on 2nd marking point	**(3)**

Q21.

Question number	Answer	Additional guidance	Mark
	An explanation that combines identification - application of knowledge (1 mark) and reasoning/justification - application of understanding (2 marks): • fractional distillation (1) • heat the solution (1) • repeated distillations occur on fractionating column (1) • vapour from top of column contains greater percentage of alcohol than original sample (1) • condense vapour to obtain concentrated solution (1)		**(3)**

Q22.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • poly(propene) is used to make e.g. plastic buckets / bowls • because it is (relatively) strong / tough / inert / easily moulded into shape • poly(propene) is used to make e.g. ropes / fabrics / carpets • because it can extruded / made into fibres / strong / tough / flexible / a good insulator • poly(chloroethene) is used to make e.g. plastic window frames / pipes / gutters • because it is tough / hard / inert / long lasting / waterproof /a good insulator • poly(chloroethene) is used to make e.g. insulation for wires • because it is a good insulator / inert / (relatively) strong / tough / flexible • PTFE is used for e.g. non-stick pans / kitchenware • because it is slippery / tough / inert /has a high melting point • PTFE is used for e.g. coating skis / stain proofing fabrics / carpets • because it is slippery • PTFE is used to make e.g. containers for corrosive substances • because it is inert allow any suitable use of the three polymers related to their properties	**Exp (6)**

Level	Mark	Descriptor
	0	• No awardable content
Level 1	1-2	• Demonstrates elements of chemical understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2)
Level 2	3-4	• Demonstrates chemical understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)
Level 3	5-6	• Demonstrates accurate and relevant chemical understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)

Q23.

Question Number	Answer	Additional guidance	Mark
	Any three of the following • all have –OH group/ hydroxyl group / same functional group (1) • same **general formula**/ $C_nH_{2n+1}OH$ (1) • formulae differ by CH_2 units (1) • react similarly with oxygen/all burn to form carbon dioxide and water (1) • trend in physical properties	Ignore 'all alcohols' Do not allow 'hydroxide' Allow similar chemical reactions/ chemical properties/ a specified reaction Allow any sensible physical property e.g. increase in boiling point Ignore reference to containing C,H,O or single bonds or no double bonds	**(3)** AO 2 1

Q24.

Question Number	Answer	Additional guidance	Mark
	Any three of the following • all have –OH group/ hydroxyl group / same functional group (1) • same **general formula**/ $C_nH_{2n+1}OH$ (1) • formulae differ by CH_2 units (1) • react similarly with oxygen/ all burn to form carbon dioxide and water (1) • trend in physical properties	ignore 'all alcohols' do not allow 'hydroxide' allow similar chemical reactions / a specified reaction allow any sensible physical property *e.g.* increase in boiling point ignore reference to containing C,H,O or single bonds or no double bonds	**(3)** AO 2 1

Q25.

Question number	Indicative content	Mark
	An answer to include, in either order • use red litmus paper **(1)** • make litmus paper damp **(1)**	**(2)**

Q26.

Question number	Answer	Additional guidance	Mark
	Any **one** from the following points: polymer • is lighter/has a lower density (1) • is more resistant to shattering (1)	Ignore any reference to cost.	**(1)**

Q27.

Question number	Answer	Additional guidance	Mark
(i)	more {accurate / sensitive / reliable}	requires no judgement / can be quantitative	**(1)** **AO1**

Question number	Answer	Mark
(ii)	single straight line of best fit through points	**(1)** **AO3**

Question number	Answer	Mark
(iii)	value consistent with candidate's line of best fit	**(1)** **AO3**

Q28.

Question Number	Answer	Acceptable answers	Mark
(a)(i)	A explanation linking the following • contains carbon (atoms) and hydrogen (atoms) (1) • <u>only</u> (1) • <u>all</u> single bonds/no double bonds (1)	reject carbon molecules and hydrogen molecules ignore no spare bonds	**(3)**

Question Number	Answer	Acceptable answers	Mark
(a)(ii)	**A** remains orange		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(i)	cracking		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(ii)	any two reasons from insufficient petrol / supply (from crude oil) (1) higher demand for petrol (1) more fuel oil fraction than needed (1) petrol is more useful than fuel oil (1)	 not enough petrol too much fuel oil	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ (3) LHS (1) RHS (1) balancing correct formula (1)	correct multiples ignore state symbols	**(3)**

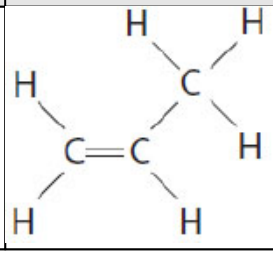
Q29.

Question Number	Answer	Acceptable answers	Mark
(a)	<u>burns</u> easily / <u>produces</u> little ash / <u>produces</u> little smoke / <u>produces</u> high heat energy (per unit mass) / <u>easy</u> to {store / transport}	'renewable' / few pollutants / few emissions / easy to ignite / burns cleanly Ignore references to cost	**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(i)	An explanation linking • an advantage • with a linked reason examples include • bioethanol is always available / crude oil is finite (1) • because more sugar beet can be grown / crude oil takes a long time to form / bioethanol conserves crude oil (1) OR • bioethanol produces less carbon dioxide (1) • because bioethanol is 'carbon neutral' / ora (1) OR • bioethanol uses less energy in production (1) • because fermentation does not require energy / crude oil must be heated to obtain petrol (1)	 allow crops (= sugar beet) allow renewable bioethanol is less polluting	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)(ii)	$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ (3) lhs (1) rhs (1) balancing correct formulae (1)	allow multiples ignore state symbols even if incorrect.	**(3)**

Q30.

	Answer	**Acceptable answers**	**Mark**
		carbon skeleton correct including double bond (1) rest of molecule correct (1) allow CH_3	(2)

Q31.

	Answer	Acceptable answers	Mark
	$Al^{3+} + 3OH^- \rightarrow Al(OH)_3$ OH^- (1) $Al(OH)_3$ (1) balancing 3, conditional on correct formulae (1)	allow multiples allow HO^- (1) allow $Al(HO)_3$ (1) do not allow $Al(HO)^3$/lower case h ignore state symbols/$3Na^+$ on both sides	**(3)**

Q32.

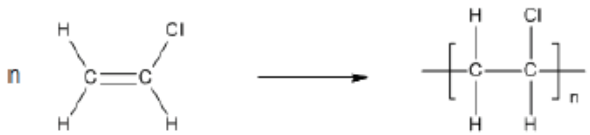
	Answer	Acceptable answers	Mark
	A description including any two from • dissolve sugar in water/sugar solution (1) • (add) yeast (1) • warm / any temperature or range within 15 to 40°C (1) • anaerobic / {no/little}{air/oxygen} can enter the apparatus (1)	 allow glucose solution ignore carbohydrate allow room temperature ignore heat unless specified temperature ignore optimum temperature do not allow just 'sealed container' ignore fractional distillation	**(2)**

Q33.

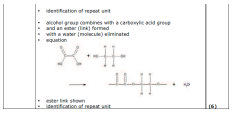
	Answer	Acceptable answers	Mark
(i)	A description including 2 points from add yeast (to the glucose solution) (1) anaerobic conditions/in absence of air/attach airlock/insert plug of cotton wool (1) warm / less than 40°C (1)	correctly named enzyme for fermentation eg zymase	**(2)**

(ii)	ethanol (1) carbon dioxide (1)	 C_2H_5OH CO_2	**(2)**
(iii)	C – fractional distillation		**(1)**
(iv)	any harmful effect eg alcoholism / liver damage / slows reactions / anti-social behaviour / injuries / become drunk / depression / damage to (suitable named) organs / damage to foetus	danger to others / alcohol poisoning ignore affects reaction times alone	**(1)**

Q34.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. Candidates choose appropriate monomers to illustrate the formation of different polymers. • polymer molecules are long chains • made up of simple repeating units • use chloroethene (only) • to form poly(chloroethene) • which is addition polymerisation • use ethane-1,2-diol and ethanedioic acid • to form a polyester • which is condensation polymerisation • one of the bonds in the double bond in chloroethene molecule breaks • and chloroethene molecules join together to form a long chain molecule • equation 	

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Level	Mark	Descriptor
	0	No awardable content.
Level 1	1–2	• The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2) • Lines of reasoning are unsupported or unclear. (AO2)
Level 2	3–4	• The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2) • Lines of reasoning mostly supported through the application of relevant evidence. (AO2)
Level 3	5–6	• The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2) • Lines of reasoning are supported by sustained application of relevant evidence. (AO2)

Q35.

Question number	Indicative content	Mark
	Answers will be credited according to candidates' deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic markscheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (3) and AO2 (3)** **Formula** • same general formula • $C_nH_{2n+1}COOH$ • same functional group • functional group is –COOH • members differ by CH_2 • formula mass increases by 14 • they are carboxylic acids **Physical properties** • trend in physical properties • density falls • boiling point increases **Chemical properties** • similar chemical {properties/ reactions} • all react with alcohols • form esters • all react with sodium hydroxide solution • form sodium salts • they are all acids	**(6)**

Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	e.g. they all have similar reactions they all have high/low density they have similar densities
Level 1	1–2	• Interpretation and evaluation of the information attempted but will be limited with a focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3) • The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2) States information from the table or states that are carboxylic acids.	they all have COOH (1) they are carboxylic acids because they all have COOH (2) they all react with alcohols and sodium hydroxide (2)
Level 2	3–4	• Interpretation and evaluation of the information on both variables, synthesising relevant understanding. (AO3) • The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2) Uses the table to draw deductions	The formula show that they differ by CH_2 each time and they all have the same functional group, COOH, so they are carboxylic acids (4) they all react with alcohols to form an ester and water, they all react with sodium hydroxide and they all have the same functional group (4)
Level 3	5–6	• Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3) • The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2) Uses the table to draw deductions and describes a **pattern**	e.g. they all react with alcohols to form an ester and water, they all react with sodium hydroxide and they all have the same functional group and as molecules get bigger…. density falls ….boiling point rises

Q36.

Question number	Answer	Additional guidance	Mark
	An explanation linking • yeast provides enzymes (1) • (at 80°C) the enzymes {not effective / denatured} (1)	 allow yeast provides a biological catalyst allow yeast provides zymase allow yeast {contains/is} an enzyme allow yeast is denatured ignore enzyme is killed allow yeast grows well at 30°C but yeast cells are killed at 80°C .	**(2)**

Q37.

Question number	Answer	Additional guidance	Mark
	An explanation linking • yeast provides enzymes (1) • (at 80°C) the enzymes {not effective / denatured} (1)	 allow yeast provides a biological catalyst allow yeast provides zymase allow yeast {contains/is} an enzyme allow yeast is denatured ignore enzyme is killed allow yeast grows well at 30°C but yeast cells are killed at 80°C .	**(2)**

Q38.

Question number	Answer	Additional guidance	Mark
	an explanation linking contains hydrogen and carbon **only** (1) contains a {double / multiple} bond (between two carbon atoms) (1)	 reject is a mixture of carbon and hydrogen reject contains hydrogen and carbon molecules ignore bonds that haven't been used	**(2)**

Q39.

Question number	Answer	Mark
	An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (1 mark): • the flame test only confirms the presence of lithium ions/Li^+ (1) • but another test is needed to confirm the identity of the anion/negative ion/CO_3^{2-} (1) OR • the red flame test shows the presence of calcium ions Ca^{2+} and not lithium ions/Li^+ (1) • the student did not test for carbonate ions (1)	**(2)**

Q40.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (3 marks) AO3 (3 marks)** • the chloride ion is justified as it produces a white precipitate with nitric acid and silver nitrate solution in K and L • Fe^{2+} ion is justified because it forms green precipitate with sodium hydroxide solution in M • in K ammonium ion is justified by adding more sodium hydroxide solution and heating • gas evolved turns damp red litmus paper blue • in L aluminium ion is justified by adding more sodium hydroxide solution • until in excess • precipitate dissolves • to give colourless solution • in M sulfate ion is justified by adding dilute hydrochloric acid • and barium {chloride / nitrate} solution • white precipitate	**(6)**

Level	Mark	Additional Guidance	General additional guidance – the decision within levels Eg - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	Additional guidance Two or more statements as to which ions are justified by the students conclusions (1) OR A full explanation of one of the students conclusions (2)	Possible candidate responses In K and L chloride ion is justified (1) in K chloride is justified, ammonium is not justified (1) in K chloride is justified, in M iron is justified (1) In K and L chloride ion is justified as test 1 shows a white precipitate. (2) In K chloride ion is justified as test 1 shows a white precipitate, for ammonium ion is justified as warm and test gas with damp litmus which turns blue (2)
Level 2	3–4	Additional guidance a partial explanation of the further work required to justify two of the ions and why chlorine or iron are justified (3) OR A full explanation of two of the students conclusions (4)	Possible candidate responses In L chloride ion is justified as test 1 shows a white precipitate but aluminium is not justified by test 2, add more sodium hydroxide which should dissolve the white precipitate. In M iron is justified by green precipitate (3) In K chloride ion is justified as test 1 shows a white precipitate, In L chloride ion is justified as test 1 shows a white precipitate, In M iron ion is justified as test 2 shows a green precipitate (3) In M sulfate is not justified by any test, add barium chloride white precipitate is formed, iron is justified by green precipitate in test 2. In K chloride ion is justified as test 1 shows a white precipitate, warm and test gas with damp litmus which turns blue to test for ammonium ion (4)
Level	5–6	Additional guidance An explanation of the further work required to justify three of the ions and a reason why at least and why chlorine or iron are justified (5) OR A full explanation of three of the students conclusions (6)	Possible candidate responses In K chloride ion is justified as test 1 shows a white precipitate, to test for the ammonium ion warm and test gas with damp litmus which turns blue. In L chloride ion is justified as test 1 shows a white precipitate but aluminium is not justified by test 2, add more sodium hydroxide which should dissolve the white precipitate. In M, the sulfate ion can be justified by adding dilute hydrochloric acid and barium chloride solution to get a white precipitate. (5) In K chloride ion is justified as test 1 shows a white precipitate, warm and test gas with damp litmus which turns blue to justify ammonium ion. In L chloride ion is justified as test 1 shows a white precipitate but aluminium is not justified by test 2, add more sodium hydroxide which should dissolve the white precipitate. In M, iron ion is justified because it forms green precipitate in test 2. The sulfate ion can be justified by adding dilute hydrochloric acid and barium chloride solution to get a white precipitate. (6)

Q41.

Question number	Answer	Mark
	An explanation linking • metal (1) • good conductor (of electricity) (1)	**(2)**

Q42.

Question number	Answer	Additional guidance	Mark
	An explanation linking use hydrochloric acid (rather than sulfuric acid) (1) (as) sulfuric acid contains sulfate ions (1)	 Allow nitric acid allow use a different acid	**(2)** **AO3**

Q43.

Question number	Answer	Additional guidance	Mark
	An explanation linking any two of the following • **A** reacts with bromine (water) (1) • (therefore) **A** is unsaturated (1) OR • **B** does not react with bromine (water) (1) • (therefore) **B** is saturated (1)	 allow **A** is alkene / **B** is alkane (1) allow alkane does not decolourise / alkene does decolourise (1) allow A is saturated and B is unsaturated (2) allow A reacts and B does not react (2) ignore bromine water turns clear / is discoloured	**(2)**

Q44.

Question number	Answer		Mark
	An explanation linking two from • catalyst particles have much larger surface area (when made from nanoparticles) (1) • leads to increased reaction rate (1)		**(2)** **AO1**

Q45.

Question number	Answer	Additional guidance	Mark
	An explanation to a property with a linked reason non-toxic **(1)** so stops food being poisonous **(1)** OR unreactive **(1)** so it does not react with the food **(1)** OR flexible **(1)** so it can wrap all around the food **(1)**	MP2 depends on MP1 allow impermeable to air **(1)** stops food {**oxidation** / reaction with air} **(1)** ignore 'stops food going off' impermeable to water **(1)** stops dampening of food **(1)** high melting point (1) so can wrap hot food (without melting) (1) ignore: strong/ tough/ transparent/ cheap/ can seal	**(2)**

Q46.

Question number	Answer	Additional Guidance	Mark
	An explanation to a property with a linked reason non-toxic **(1)** so stops food being poisonous **(1)** OR unreactive **(1)** so it does not react with the food **(1)** OR flexible **(1)** so it can wrap all around the food **(1)**	MP2 depends on MP1 allow impermeable to air **(1)** stops food {**oxidation** / reaction with air} **(1)** ignore 'stops food going off' impermeable to water **(1)** stops dampening of food **(1)** high melting point (1) so can wrap hot food (without melting) (1) ignore: strong/ tough/ transparent/ cheap/ can seal	**(2)**

Q47.

Question number	Answer	Additional guidance	Mark
	An explanation linking • (molecules of X) contain double bonds / C=C (1) • **only** contain carbon and hydrogen atoms (1)	 allow multiple bond	**(2)**

Q48.

Question number	Answer	Additional guidance	Mark
	An explanation linking two from • do not know the risks fully / long term risk not yet known (1) • because they have not been used for a long time / are new technology / no long term research (1) • might pass into the body / through cell membranes / enter the skin / enter the bloodstream (1) • could {change / catalyse} reactions in body (1)	 allow 'cause a change'	**(2)** **AO1**

Q49.

Question Number	Answer	Additional guidance	Mark
(i)	{heat/energy} is lost/escapes	Allow anywhere heat is transferred e.g. can absorb heat, heat lost to air etc.	**(1)** AO 3 2b

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation including: • add a lid/ use of draught shield (1) • so more {heat/energy} goes to water/ less {heat/energy} escapes (1) MP2 dependent on MP1	Ignore altering distance between flame and can Allow any suitable insulating material Ignore burning more fuel/ less water	(2) AO 3 3b

Question Number	Answer	Additional guidance	Mark
(iii)	Final answer of 7308 with or without working scores 2 210 x 34.8 (1) = 7308 (1)	Allow 1 for 210 x (any temp change) **correctly evaluated with working** e.g. 210 x 82.4 = 17304 (1) Allow 7300, 7310; Do not allow 7000 Ignore any units	(2) AO 2 1

Q50.

Question Number	Answer	Additional guidance	Mark
(i)	{heat/energy} is lost/escapes	allow anywhere heat is transferred *e.g.* can absorb heat, heat lost to air *etc*	(1) AO 3 2b

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation including: • add a lid / use of draught shield (1) • so more {heat/energy} goes to water/ less {heat/energy} escapes (1) MP2 dependent on MP1	ignore altering distance between flame and can allow any suitable insulating material ignore burning more fuel/ less water	(2) AO 3 3b

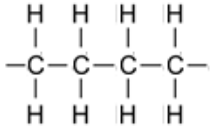
Question Number	Answer	Additional guidance	Mark
(iii)	final answer of 7308 with or without working scores 2 210 x 34.8 (1) = 7308 (1)	allow 1 for 210 x (any temp change) **correctly evaluated with working** *e.g.* 210 x 82.4 = 17304 (1) allow 7300, 7310 do not allow 7000 ignore any units	**(2)** AO 2 1

Q51.

	Answer	Acceptable answers	Mark
(i)	(molecule contains a) **double** bond	multiple bond(s) ignore spare bonds	**(1)**
(ii)	(colour change) from orange (1) to colourless (1)	red/yellow/brown decolorised ignore clear/ discoloured	**(2)**

Q52.

Question number	Answer	Additional guidance	Mark
(i)	$C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$ (2) LHS (1) RHS (1)	ignore state symbols	**(2)**

Question number	Answer	Additional guidance	Mark
(ii)	 (2)	allow 1 mark for four carbon atoms joined by single bonds allow 1 mark for correct formula without continuation bonds	**(2)**

Q53.

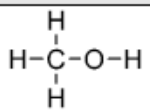
	Answer	Acceptable answers	Mark
	Coxidised		**(1)**

Q54.

Question Number	Answer	Acceptable answers	Mark
(a)	**B** add yeast, temperature of 35°C		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)	C_2H_4 (1) + H_2O (1) → C_2H_5OH award one mark max if incorrectly balanced	allow correct molecular formula C_2H_6O allow H_4C_2 correct multiples ignore state symbols	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	A description linking any two from • same **general** formula (1) • same functional group (1) • (consecutive) compounds differ by CH_2 (1) • gradual variation in physical properties (1) • {similar / same} chemical {properties / reactions} (1)	 allow $C_nH_{2n+1}OH$ (2) allow C_nH_{2n} or any correct general formula (2) ignore same properties/physical properties allow a correct trend, e.g. bp increases with number of carbon atoms (1)	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)		allow –OH allow correct dot and cross diagram	**(1)**

Question Number	Answer	Acceptable answers	Mark
(d)(i)	oxidation		**(1)**

Question Number	Answer	Acceptable answers	Mark
(d)(ii)	A description including any two from • effervescence/fizzing/bubbling (1) • solid disappears (1) • colourless solution (1)	ignore incorrectly named gases ignore gas given off/evolved allow magnesium floats on surface of acid allow solid dissolves (1) ignore solution turns colourless ignore clear	**(2)**

Q55.

	Answer	Acceptable answers	Mark
(a)	$C_2H_4 + H_2o \rightarrow C_2H_5OH$ C_2H_4 as **reactant** (1) rest of equation correct conditional on C_2H_4 as a reactant (1)	do not allow H2O / H^2O / lower case h/HOH allow C_2H_6O for ethanol ignore state symbols	**(2)**
(b)	A description including any two from • dissolve sugar in water/sugar solution (1) • (add) yeast (1) • warm / any temperature or range within 15 to 40°C (1) • anaerobic / {no/little}{air/oxygen} can enter the apparatus (1)	allow glucose solution ignore carbohydrate allow room temperature ignore heat unless specified temperature ignore optimum temperature do not allow just 'sealed container' ignore fractional distillation	**(2)**
(c)	An explanation linking Marking point 1 – sugar- one from • sugar obtained from {plants /crops/specific crop} (1) • (plenty of) land available to grow {plants /crops/specific crop} (for fermentation)(1) Marking point 2 - ethene • ethene obtained from {crude oil / fractional distillation /cracking} (1)	ignore answers that just repeat the information in the question ignore vague answers such as carbon neutral/environmentally friendly for marking point 1 **OR**2, allow plants renewable/{crude oil/ethene} non-renewable (1)	**(3)**

	Marking point 3 – cost/energy – one from • cannot afford to buy crude oil (1) • crude oil is too expensive (1) • more expensive to {use/buy/produce} ethene (1) • cheaper to use fermentation (1)	allow {little/no} {heat/energy} required for fermentation (1) allow {high temperature /high pressure} required for hydration of ethene (1)	
(d)	An explanation including any two from • formulae differ by CH_2 • same general formula • all have {OH/hydroxyl group}	general formula is C_nH_{2n}+1OH (2) allow increase by {CH_2/1 carbon **and** 2 hydrogens} do not allow incorrect general formula allow have similar **chemical** {reactions /properties}/same functional group/OH from an incorrect general formula ignore 'hydroxide'/all end in (an)ol /all alcohols ignore physical properties maximum (1) if hydroxide ions /carboxyl group	**(2)**

Q56.

Question Number	Answer	Acceptable answers	Mark
(a)(i)	D provides enzymes		**(1)**

Question Number	Answer	Acceptable answers	Mark
(a)(ii)	An explanation linking any two of • {no/little/less} ethanol formed • {no/little/less} fermentation/ reaction • enzyme denatured/damaged/ does not work/ works less well/ changes shape	ignore enzyme killed/died	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)	A description linking • heat /use of Bunsen with any one of • ethanol has low(er) boiling point/ boils at 78°C • ethanol distils/ boils/ evaporates (first) • condenser cools the vapour / ethanol condenses	Ignore references to less water in the resultant liquid or to any prior or subsequent separation techniques.	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)	An explanation linking any two of • alcohol impairs thought processes/concentration/vision / judgment/coordination/ makes sleepy / dizzy • increases reaction times/thinking time/ affects motor skills/ makes more aggressive /slows your reactions • increases risk of accident/ driving would be more careless/ hazardous	Must be reasonably specific eg allow 'impairs thinking', do not allow 'affects the brain'	**(2)**

Question Number	Answer	Acceptable answers	Mark
(d)	alk**a**ne(s) Exact spelling required	reject alk**e**ne(s)	**(1)**

Q57.

Question Number	Answer	Acceptable answers	Mark
(i)	Yeast		**(1)**

Question Number	Answer	Acceptable answers	Mark
(ii)	**D** – fractional distillation		**(1)**

Question Number	Answer	Acceptable answers	Mark
(iii)	increases	slower reactions ignore slows down/slower reaction time	**(1)**

Q58.

Question Number	Answer	Acceptable answers	Mark
(i)	A description including two of the following • dissolve the sugar/aqueous solution (1) • **warm**/ 25-40°C (1) • in absence of air / no oxygen/ anaerobic / attach airlock (1) • pH neutral / slightly acidic /4-7 • **sterile** conditions ignore any mention of pressure	ignore incorrect answers ignore heat / hot allow any temperature or range within 25-40 allowed ignore clean etc ignore 'optimum' {temp/pressure/pH}	**(2)**

Question Number	Answer	Acceptable answers	Mark
(ii)	**B** fractional distillation		**(1)**

Question Number	Answer	Acceptable answers	Mark
(iii)	$C_6H_{12}O_6 \rightarrow 2\ C_2H_5OH + 2\ CO_2$ (2) correct formulae (<u>with no others</u>) (1) balancing <u>the three</u> formulae (1) ignore state symbols	allow C_2H_6O/ CH_3CH_2OH for C_2H_5OH reject CO2 / CO^2 allow multiples	**(2)**

Q59.

	Answer	Acceptable answers	Mark
	C oxidised		**(1)**

Q60.

	Answer	Acceptable answers	Mark
(a)	**C**oxidised		**(1)**
(b)	**D** preservative		**(1)**
(c)	yellow / orange /red (1)	Combinations of yellow/orange/red pink	**(1)**
(d)	(CH_3COOH +) NaOH (1) (→ CH_3COONa +) H_2O (1)	NaHO ignore attempts to balance	**(2)**
(e)	hydrogen	H_2 ignore H	**(1)**
(f)(i)	ethanoic acid + ethanol → ethyl ethanoate + water (2)	correct spellings only left hand side (1) right hand side (1)	**(2)**
(f)(ii)	An explanation linking use (1) property (1) eg perfumes /cosmetics (1) pleasant smelling (1) other uses include flavourings / solvents	property dependent on use ignore 'sweet smelling' use – nail varnish remover property – acts as solvent for polyester: use – (polyester) to make clothing property – can be made into fibres	**(2)**