PEARSON EDEXCEL GCSE CHEMISTRY · 1CH0

CHEMISTRY



MARK SCHEME

TOPIC 8: FUELS AND EARTH SCIENCE (PACK 1)

SCORE	PERCENTAGE
/104	%

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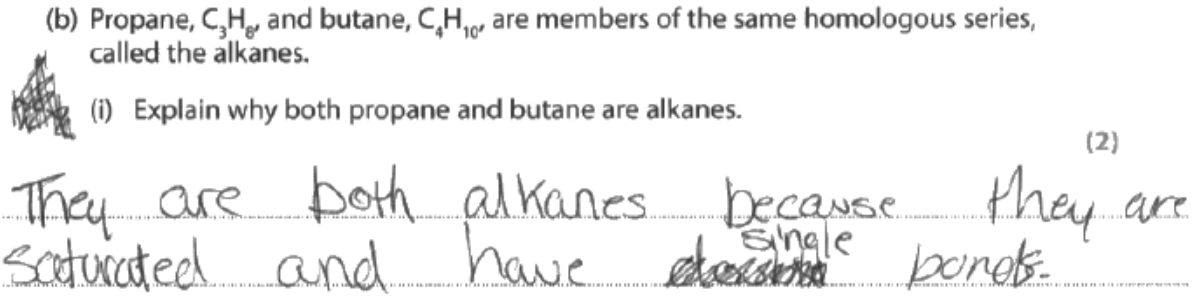
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Q2.

(i)

Generally candidates were able to score at least 1 of the 2 marks available. With the wide range of possible marking points, most candidates referred to '(both) contain hydrogen and carbon (only)' and/or that '(both only) have single bonds/no double bonds'. Pleasingly, examiners noted that many candidates were able to recall the general formula for alkanes. Common errors seen throughout were: responses referring to alkanes having 'similar properties' as opposed to specifically 'similar chemical properties', or to alkanes having the 'same formula' as opposed to 'same general formula'. In many responses there was a clear misunderstanding of the terms 'saturated' and 'unsaturated', such as stating incorrectly that alkanes are unsaturated hydrocarbons and contain only single bonds. Consequently, these responses did not score this marking point.



(b) Propane, C_3H_8, and butane, C_4H_{10}, are members of the same homologous series, called the alkanes.

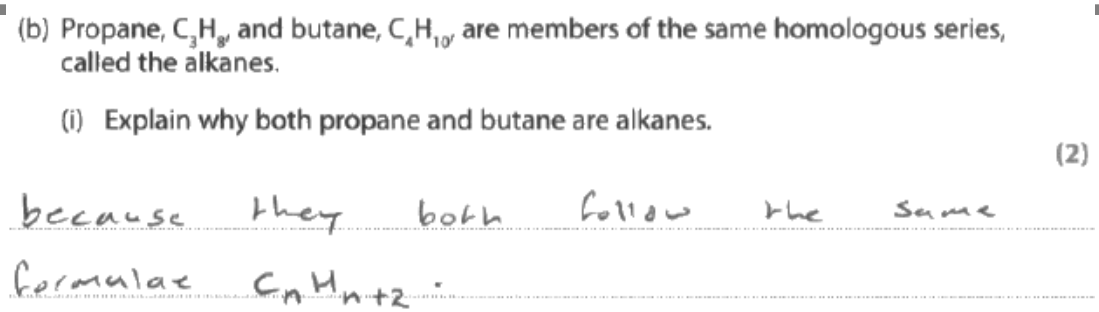
(i) Explain why both propane and butane are alkanes.

(2)

They are both alkanes because they are saturated and have single bonds.

Results Plus: Examiner Comments

This response only scored 1 mark, since by stating the fact that both alkanes are 'saturated' and 'have single bonds' is effectively the same marking point.



(b) Propane, C_3H_8, and butane, C_4H_{10}, are members of the same homologous series, called the alkanes.

(i) Explain why both propane and butane are alkanes.

(2)

because they both follow the same formulae C_nH_{n+2}.

Results Plus: Examiner Comments

This response did not score. A reference to the alkanes having the 'same formula' is incorrect. Also, although very close, the attempt at the general formula, 'C_nH_{n+2}' for an alkane, is also incorrect.

Results Plus: Examiner Tip

Make sure you learn the key definitions of a homologous series, such as the alkanes. If stated, check the general formula for the alkanes is correct.

(b) Propane, C_3H_8, and butane, C_4H_{10}, are members of the same homologous series, called the alkanes.

(i) Explain why both propane and butane are alkanes.

(2)

Propane and butane both have the same general formula and chemical properties.

Results Plus: Examiner Comments

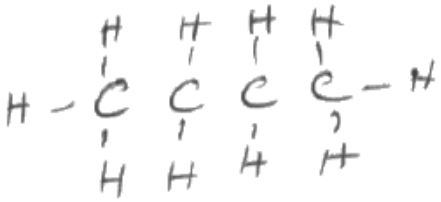
This response scored 2 marks for correct references to 'same general formula' and 'same chemical properties'.

(ii)

The majority of candidates were able to draw the fully correct structure for butane. Occasionally, some candidates were unable to score since they missed out bonds between the carbon atom skeleton or had drawn double bonds in the carbon skeleton.

(ii) Draw the structure of a molecule of butane, C_4H_{10}, showing all covalent bonds.

(2)

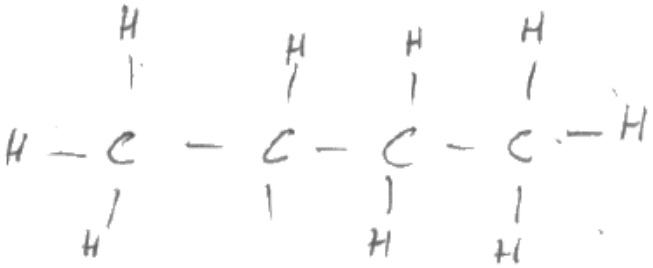


Results Plus: Examiner Comments

This response did not score. The first marking point was not scored since the single covalent C-C bonds have been omitted from the carbon skeleton. Unfortunately, even though all the C-H bonds are shown, this cannot score the second marking point since it is dependent on the first having been scored.

(ii) Draw the structure of a molecule of butane, C_4H_{10}, showing all covalent bonds.

(2)

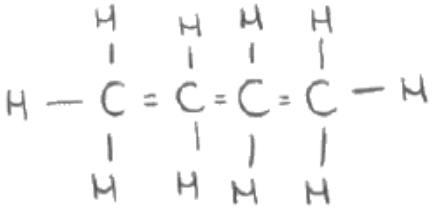


Results Plus: Examiner Comments

This response scored 1 mark only, for the first marking point, since there are four carbon atoms joined by single bonds. The second marking point was not scored since one 'H' has been omitted from the structure.

(ii) Draw the structure of a molecule of butane, C_4H_{10}, showing all covalent bonds.

(2)



Results Plus: Examiner Comments

This response did not score. The first marking point was not scored since there are double carbon to carbon (C=C) bonds shown in the carbon skeleton. Even though all the C-H bonds have been shown, since the second marking point is dependent on the first, this cannot gain credit.

Q3.

(a)

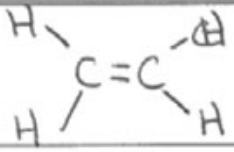
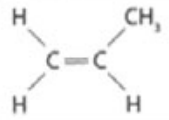
This question elicited a relatively poor response, with a few candidates scoring both marks (and a large number scoring none at all). Some perfect answers were seen for the structure of ethene, but, as one examiner commented, every possibility was seen. Errors included only showing a single bond between the carbons; showing methane; carbons with more or less than four bonds; carbons (and hydrogens) looking like an 'E' or 'e'. Overall, there were a significant number of very untidy/careless diagrams with bonds not clearly drawn. The better candidates did score 1

mark for naming propene. One common error was methene.

4 (a) The table shows information about two alkenes.

Complete the table to show the names and structures of these alkenes.

(2)

name	structure of a molecule
ethene	
~~Ethene~~ Propene	

Results Plus: Examiner Comments

This candidate was lucky to score 2 marks as the top right symbol is not clear.

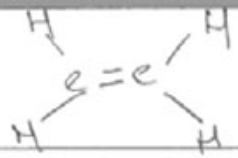
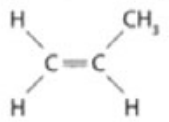
Results Plus: Examiner Tip

Take time to draw clear structures.

4 (a) The table shows information about two alkenes.

Complete the table to show the names and structures of these alkenes.

(2)

name	structure of a molecule
ethene	
carbon hydrogen	

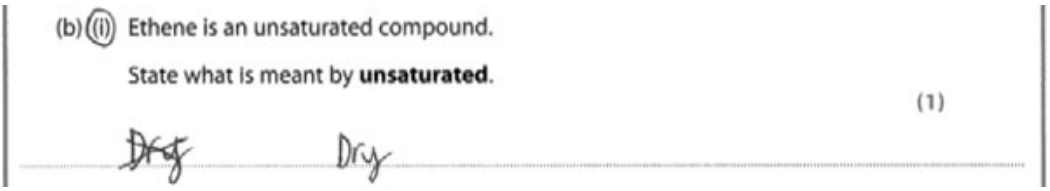
Results Plus: Examiner Comments

Are these C or e?

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

State what is meant by **unsaturated**.

(1)

~~Dry~~ Dry

Results Plus: Examiner Comments

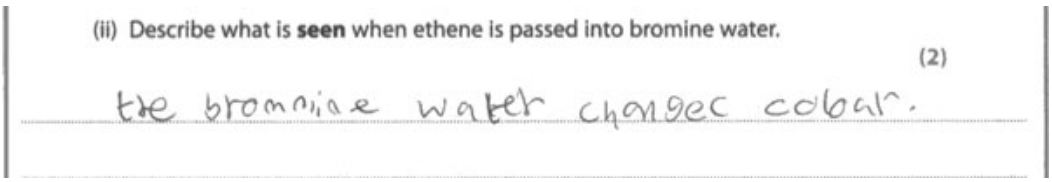
This was not acceptable as an answer to a question on a chemistry paper.

Results Plus: Examiner Tip

Learn the meaning of common chemical terms.

(b) (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 changes colour.

Results Plus: Examiner Comments

Correct - but the colours must be given.

Results Plus: Examiner Tip

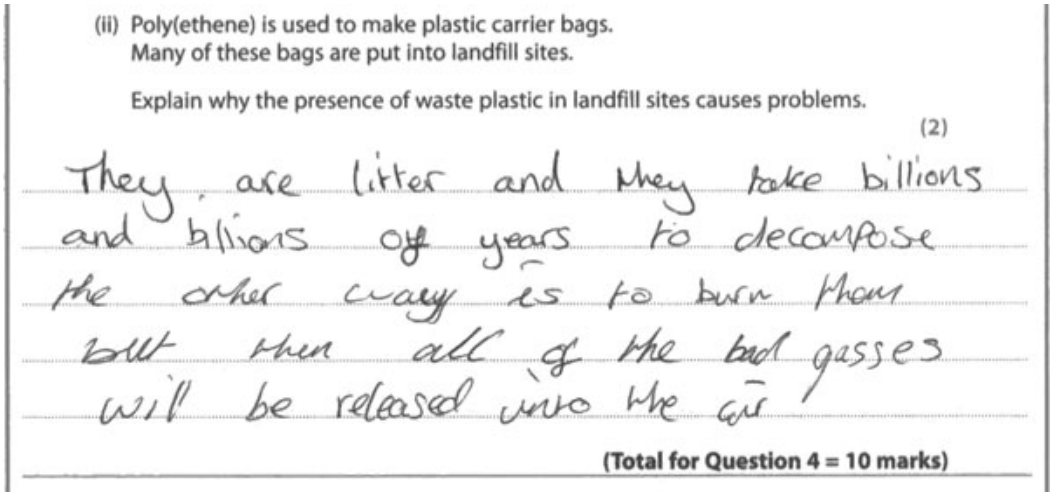
Tests occur often in exams and learning these carefully will be credited.

(c)

Many of the answers identified that something was 'broken down', however most did not identify that a long chain alkane is broken down into a smaller chain alkane and an alkene. A lot of candidates scored a mark for being aware of the idea that this is done to create products that are more useful. Some candidates had clearly learned a specific definition to gain full marks. There was much unclear language and answers could refer equally to fractional distillation as much as to cracking ("split up the fractions" or "fractions are separated"). Confusion occurred between alkanes and alkenes, alkenes being broken down. Other things being broken down included atoms or elements.

(d) (ii)

Most answers scored 2 marks here, with almost everyone scoring 1 mark, mainly for saying that plastic does not biodegrade. There were very few blanks – everyone had a view! It was clear that some candidates did not direct themselves to the question, and did not focus specifically on plastics or on landfill, by writing about landfill problems in general, such as noise, machinery or by advocating recycling as a better alternative. Others failed to answer the question by going off at a tangent about the effect of burning on plastic, giving toxic gases.



(ii) Poly(ethene) is used to make plastic carrier bags.
Many of these bags are put into landfill sites.

Explain why the presence of waste plastic in landfill sites causes problems.

(2)

They are litter and they take billions and billions of years to decompose the other way is to burn them but then all of the bad gasses will be released into the air

(Total for Question 4 = 10 marks)

Results Plus: Examiner Comments

This answer has identified one relevant issue but has given much irrelevant material.

Results Plus: Examiner Tip

It's worth reading the question twice to check that you know what is being asked. Burning is not asked about in this question.

Q4.

(i)

Candidates found this question difficult with quite a low number able to write the correct word equation.

Some did not read the question carefully and tried to give a symbol equation. If symbol equations were given they were expected to be fully correct, which was rarely achieved.

Hydrogen oxide was not accepted as an alternative for water and in some cases candidates also had the word equation the wrong way around with the reactants and products mixed.

(i) Substance **C** can be formed by burning an element in oxygen.

Write the word equation for this reaction.

(1)

Hydrogen + oxygen → hydroxide

Results Plus: Examiner Comments

The oxide of hydrogen is water.

(ii)

This question was attempted reasonably well. Some candidates did not read the question carefully. Some gave only one letter, or included C in their answer, when they had been told to consider only A, B and D.

Q5. No Examiner's Report available for this question

Q6. No Examiner's Report available for this question

Q7.

(i)

This question was very well answered on the whole with most candidtes scoring the 2 marks available.

The majority of candidates clearly subtracted the numbers of carbon atoms and hydrogen atoms in butene from those in decane, to arrive at the correct answers, 6 and 14 respectively.

(ii)

This question was very poorly answered on the whole, with only a fifth of responses scoring the 1 mark available.

The majority of responses were often left blank.

It is evident that extremely few candidates understood how the law of conservation of mass applies to a chemical reaction.

Q8.

In general, this question was answered well with candidates using variety of methods to calculate the number of barrels of fuel oil present in the 850 000 barrels of crude oil.

Most students used the 'chunking' method to find the percentage. In this case this was reasonably straightforward, if not very efficient.

A good proportion of candidates were able to calculate the 382 500. Of these, fewer were able to write this correctly to 2 significant figures. In most cases they did not attempt to round the number; a few rounded to 38 rather than 380 000.

A few gave answers based on 55% rather than 45%.

In January 2015 the United Kingdom produced 850 000 barrels of crude oil per day.
45% of this crude oil was fuel oil.

Calculate the number of barrels of fuel oil present in the 850 000 barrels of crude oil.

Give your answer to two significant figures.

(3)

850 000 ÷ 10 = 10% = 85000 85000 x 4 = 40% = 340000

85000 ÷ 2 = 5% = 42500 340000 + 40% + 5% + 42500 = 382500

382500 = 45%

382500 barrels

Results Plus: Examiner Comments

This method works...but is very long-winded. No attempt has been made to round to two significant figures.

In January 2015 the United Kingdom produced 850 000 barrels of crude oil per day.
45% of this crude oil was fuel oil.

Calculate the number of barrels of fuel oil present in the 850 000 barrels of crude oil.

Give your answer to two significant figures.

(3)

850 000 X 0.45 = 382500

400000 barrels

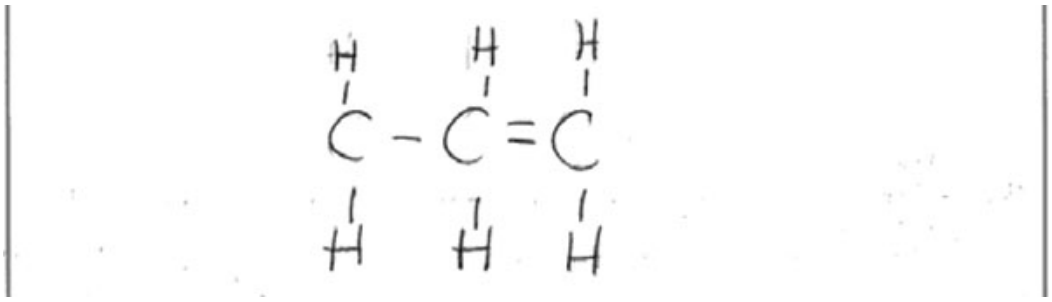
Results Plus: Examiner Comments

A more succinct calculation of percentage (with working shown). Unfortunately, not rounded correctly.

Q9.

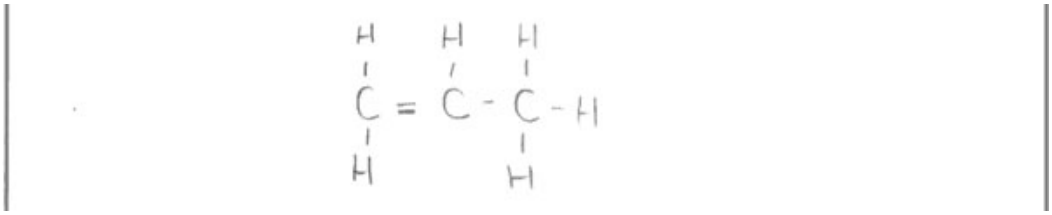
b

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.

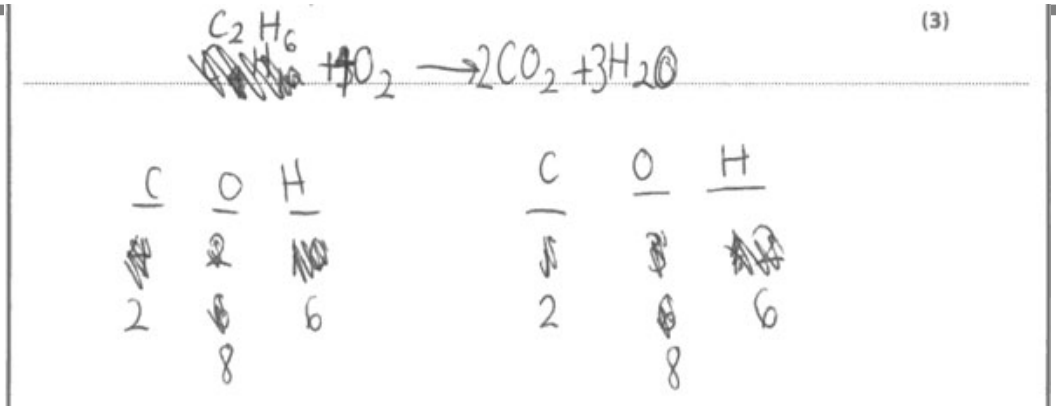
c

Many candidates lost out here as they did not know the formula of methane, with many writing it as Me. Many candidates gained one mark for the correct formula of carbon dioxide and water, however only the very best candidates were able to score full marks for writing the complete balanced equation successfully.



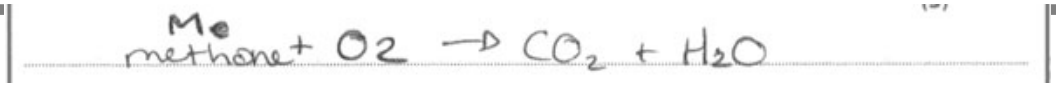
Results Plus: Examiner Comments

Perfect for 3 marks, reactants (1), products (1) balancing (1).



Results Plus: Examiner Comments

Just one mark here for the correct formulae for the products.



Results Plus: Examiner Comments

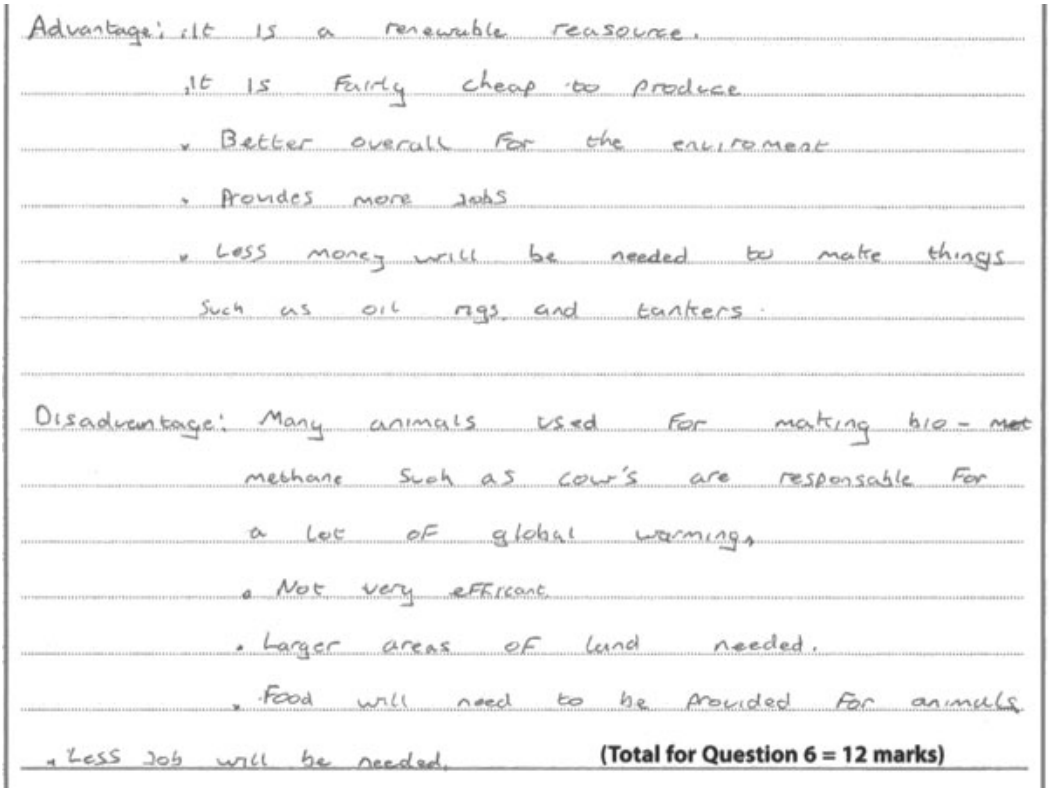
Just one mark here, for the formulae of the products.

Results Plus: Examiner Tip

It is important that the formulae of the common compounds in the unit are learnt.

d

Candidates performed well on this extended writing question, most gave a good set of advantages and disadvantages of using bio-methane over natural gas as a form of energy. Candidates are still showing the misconception that bio-methane does not produce any carbon dioxide when it is burnt.



Advantage: it is a renewable reasource.
it is fairly cheap to produce
• Better overall for the enviroment
• Provides more jobs
• Less money will be needed to make things such as oil rigs and tankers.

Disadvantage: Many animals used for making bio-~~met~~ methane such as cow's are responsable for a lot of global warming.
• Not very efficant
• Larger areas of land needed.
• Food will need to be provided for animals
• Less job will be needed.

(Total for Question 6 = 12 marks)

Results Plus: Examiner Comments

A level 2 answer, although many advantages and disadvantages have been given, many are not relevant to this question and so are not given credit.

Biomethane is a biofuel meaning it is a fuel made from living organisms. This doesn't release as much ~~CO2~~ carbon dioxide as fossil fuels. It doesn't increase pollution in the atmosphere. The space for growing crops would be taken up for fermentation to make biofuels.

Disadvantages are that it may ~~need~~ release ~~the~~ carbon dioxide to produce it when extracting and electricity. Not all cars ~~can~~ use biomethane meaning they would have to change the mechanics of cars releasing carbon dioxide in the making. Not much sufficient energy is being released.

(Total for Question 6 = 12 marks)

Results Plus: Examiner Comments

A level 1 answer, whilst some ideas are creditworthy, such as the space for growing crops is taken up, much of the answer has incorrect or irrelevant ideas.

Bio-methane, being produced by plants has the extremely important advantage of being renewable, it can be replaced. Natural gas took millions of years to form and so is non-renewable. The other truly large advantage of bio-methane is its carbon neutrality, that is that it photosynthesises and takes in carbon dioxide as a plant, then releases it again upon complete combustion, so overall, it has not released any additional carbon dioxide and thus does not contribute to global warming. However, due to the fermentation and transportation involved in the creation of bio-methane, some may argue it is not entirely carbon neutral. The other main disadvantage of bio-methane is that it needs growing space, which can increase demand for space and competition for space with food crops, natural gas doesn't need growing space, so using this would not cause food security.

(Total for Question 6 = 12 marks)

TOTAL FOR PAPER = 60 MARKS

I conclude that due to its renewability and (almost) carbon neutrality, bio-methane is the superior fuel and must play a role in fuel eventually as supplies of natural gas are limited and are running out. So bio-methane must be used despite its requirements for space.

Results Plus: Examiner Comments

A level 3 answer with lots of advantages and disadvantages of using bio-methane rather that natural gas as a source of energy.

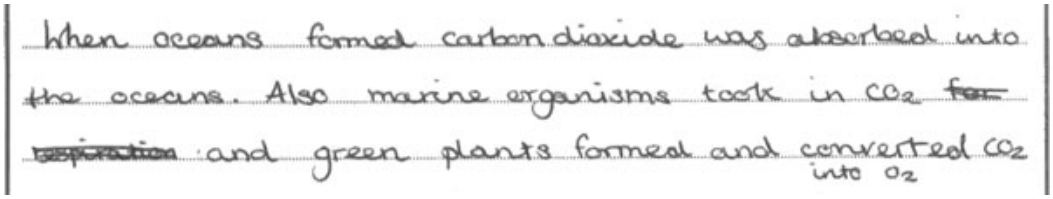
Q10. No Examiner's Report available for this question

Q11.

ii

Candidates performed well in this question, with many giving good descriptions of more than one process which have caused the percentage of carbon dioxide to decrease. Many stating

dissolution of carbon dioxide into the oceans and the increase of plants which removed carbon dioxide.

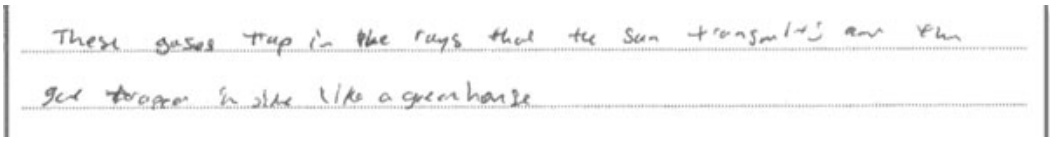


Results Plus: Examiner Comments

A very good answer, which explains more than one process that has caused the percentage of carbon dioxide to decrease.

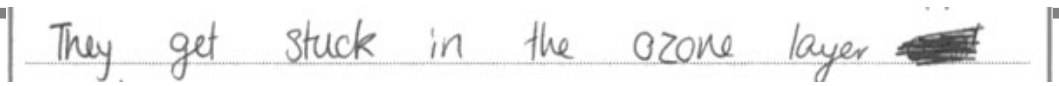
iii

Candidates did not perform so well in this question, many gave quite vague answers and a large proportion were confused between processes and stated that these gases were involved in the ozone layer.



Results Plus: Examiner Comments

The question asks about how the gases keep the Earth warm, this answer does not relate to the heat provided by the sun, just rays which is insufficient to get the mark.



Results Plus: Examiner Comments

Many candidates incorrectly referred to the ozone layer and scored no marks.

Q12.

Candidates found it reasonably straightforward to identify at least one of the two processes that caused the change in the amount of carbon dioxide in the atmosphere.

In some cases, candidates drew more than one line from each change and therefore scored no

marks.

Q13. No Examiner's Report available for this question

Q14. No Examiner's Report available for this question

Q15.

Many answers scored 1 or 2 marks as they knew the problems of carbon monoxide, but surprisingly fewer indicated problems with carbon dioxide (and less surprisingly any issues with carbon and water were largely ignored). It is important to note that a well-developed answer on either carbon oxide, with a relevant mention of the other, scored in the highest band.

Carbon monoxide

This was the best known. Some gave excellent answer stating the biological aspects of carbon monoxide's toxicity, how it prevents oxygen being circulated, with lots of reference to it being invisible and with no odour: the 'silent killer'.

Carbon dioxide

This was less commonly mentioned and not nearly as well understood. The idea that carbon dioxide is a greenhouse gas that causes global warming was mentioned, but the consequences of this were not well explained. There was much confusion with ozone depletion and formation of acid rain being caused by carbon dioxide.

Carbon

Some candidates mentioned that soot was produced, with some of these mentioning asthma.

Water

Fewer mentioned water. Those that did talked about condensation which damaged walls (reasonable) but also flooding which would lead to sea levels rising.

In general, many students just rewrote the stem of the question without explaining what the problems were, or giving meaningless vague answers in terms of pollution/ environmental problems. Others explained the difference in terms of oxygen causing the two types of combustion. Some answers referred to problems but did not state to which gas the problems were linked. Very few obtained full marks as they did not provide a detailed enough description. Several examples of response are included below for discussion with students.

*(e) When hydrocarbon fuels burn in a plentiful supply of air they undergo complete combustion, forming carbon dioxide and water vapour.

If the air supply is limited incomplete combustion occurs and carbon monoxide and carbon may be formed.

Describe the problems that can be caused by these products of complete and incomplete combustion.

(6)

Complet combustion - the problems that it causes a greenhouse gas which is carbon dioxide which is absorbed by the Ozone layer worsening the green house effect.

In complete combustion - the problems are that it Releases carbon monoxide which is potentially fatal and carbon which is a black substance like soot formed when Hydrocarbon combustion has occured

Results Plus: Examiner Comments

Three different issues mentioned (and the erroneous ozone layer reference) but not enough detail.

*(e) When hydrocarbon fuels burn in a plentiful supply of air they undergo complete combustion, forming carbon dioxide and water vapour.

If the air supply is limited incomplete combustion occurs and carbon monoxide and carbon may be formed.

Describe the problems that can be caused by these products of complete and incomplete combustion.

(6)

Carbon dioxide that is produced when fuels burn is very very dangerous, with the excessive amount of fuel used worldwide the carbon dioxide is very quickly polluting the atmosphere and therefore, speeding up the process of global warming. global warming caused by carbon dioxide has the potential to eventualy melt the polar ice caps. However is air is in short supply Carbon Monoxide can be produced. Carbon monoxide is an extremely deadly gas that can kill asby inhailing, with no sound, smell or colour it is very deadly.

Results Plus: Examiner Comments

Two problems mentioned here, but neither in enough detail to get full marks.

*(e) When hydrocarbon fuels burn in a plentiful supply of air they undergo complete combustion, forming carbon dioxide and water vapour.

If the air supply is limited incomplete combustion occurs and carbon monoxide and carbon may be formed.

Describe the problems that can be caused by these products of complete and incomplete combustion.

(6)

The problem that is caused when the air supply is limited and incomplete combustion occurs is carbon monoxide. Carbon monoxide is formed during incomplete combustion and is a deadly poisons gas. It stops your blood cells ability to carry oxygen around the body and practically suffocates you. The big problem with carbon monoxide is the fact that you can not smell it.

Results Plus: Examiner Comments

The answer only mentions carbon monoxide. However there is nearly enough for the middle mark band.

*(e) When hydrocarbon fuels burn in a plentiful supply of air they undergo complete combustion, forming carbon dioxide and water vapour.

If the air supply is limited incomplete combustion occurs and carbon monoxide and carbon may be formed.

Describe the problems that can be caused by these products of complete and incomplete combustion.

(6)

The problems occuring about complete combustion is alot of oxgyen is used up for it and it takes along time to do it and there is not enough oxygen to complete it. The problems with incomplete combustion is carbon monoxide is bad for the earths atmosphere so is carbon dioxide

Results Plus: Examiner Comments

Nothing of credit here.

Q16. No Examiner's Report available for this question

Q17.

Most gave a correct answer for the formula of the product as NO_2 with many scoring the second mark to balance the equation. Writing balanced equations is a skill that candidates should practice along with knowing the formulae of the common substances listed in the specification as well as using names clues to write the formula.

Q18. No Examiner's Report available for this question

Q19.

(i)

This question was very well answered on the whole with the vast majority of responses scoring the 1 mark available.

Most candidates were able to draw a bar between 20% and 22% on the given bar chart representing the percentage of oxygen in the atmosphere.

In the relatively few incorrect responses seen, common errors included: candidates having poorly drawn the line for the top of the bar at 22%, but with the bar going past into 23%; occasionally there was a bar that clearly wasn't being aimed at 21%, instead being almost 70%.

(ii)

This was not answered well on the whole, with approximately half of responses scoring at least 1 of the 2 marks available.

While many responses scored both marks with the correctly calculated volume, 93 cm^3, many blank responses were seen by the examining team. Very few candidates scored on the first marking point, namely 21/100. Several responses were able to score 1 mark from the allowable responses for 300/4.8 = 62.5 or 21 x 300 (=6300) or 300/100 (=3).

Commonly seen errors included: 300/21 = 14.3; 21/300 = 0.07.

(ii) Calculate the volume of oxygen present in 300 cm^3 of air.

(volumes are measured under the same conditions of temperature and pressure)

(2)

$300 \times 21 = 6300$

$300 \times 300 \times 300 = 27000000$

volume of oxygen = 6300 cm^3

Results Plus: Examiner Comments

A typical response which scored 1 mark only.

The percentage and volume from the question have been multiplied. However, this has not been divided by 100, so the final value is a factor of 100 greater than the correct answer.

Q20.

(i)

This question was very poorly answered on the whole, with a significant majority of responses not scoring the 1 mark available.

Very few responses correctly drew in four electrons between the two carbon atoms in the diagram presented.

The majority of responses were often left blank. The vast majority of candidates drew a double bond as two lines and did not add in electrons. It would appear that candidates were unfamiliar with dot and cross diagrams where there were no rings shown to represent the electrons shells, as demonstrated by a number of responses where candidates added them in, often incorrectly.

The structure of a molecule of ethene is shown in Figure 8.

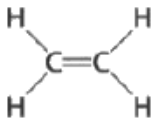


Figure 8

(i) Figure 9 shows the incomplete dot and cross diagram for a molecule of ethene.

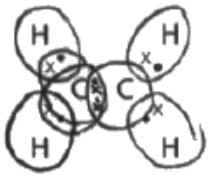


Figure 9

Complete Figure 9 to show the electrons of the C═C double bond.

Results Plus: Examiner Comments

An example of a fully correct response.

The candidate has correctly drawn in the four electrons representing the double bond between the carbon atoms. It is also worthwhile noting that shells have been added by the candidate to help clarify the bonding.

(i) Figure 9 shows the incomplete dot and cross diagram for a molecule of ethene.

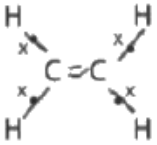


Figure 9

Complete Figure 9 to show the electrons of the C═C double bond.

(1)

Results Plus: Examiner Comments

A typical example of the many incorrect responses seen that did not score.

The candidate has simply drawn in a double bond between the carbon atoms and not followed the instructions in the question which is to show the electrons.

(ii)

This question was poorly answered on the whole, with only a fifth of responses scoring the 1 mark available.

Few candidates were able to recall the correct products, besides water, of the incomplete combustion of ethene.

The most commonly seen incorrect response was 'carbon dioxide'.

Q21.

The '2' was straightforward but the charge on the magnesium ion was much less well done, candidates apparently not knowing that charges must be balanced on both sides of an equation.

Q22. No Examiner's Report available for this question

Q23.

(i)

Generally well answered on the whole, with the majority of the candidates identifying 'fuel oil' as the fraction that was most likely to be cracked. Nearly all the incorrect responses, indicating a misunderstanding of the question, referred to petrol.

(ii)

Most candidates were able to score 2 of the 3 marks available.

The endothermic reaction profile was known only to about half the candidates. Most candidates managed to label the positions of reactants and products correctly. Only a small number could show the activation energy correctly on an endothermic reaction profile to score all the marks available.

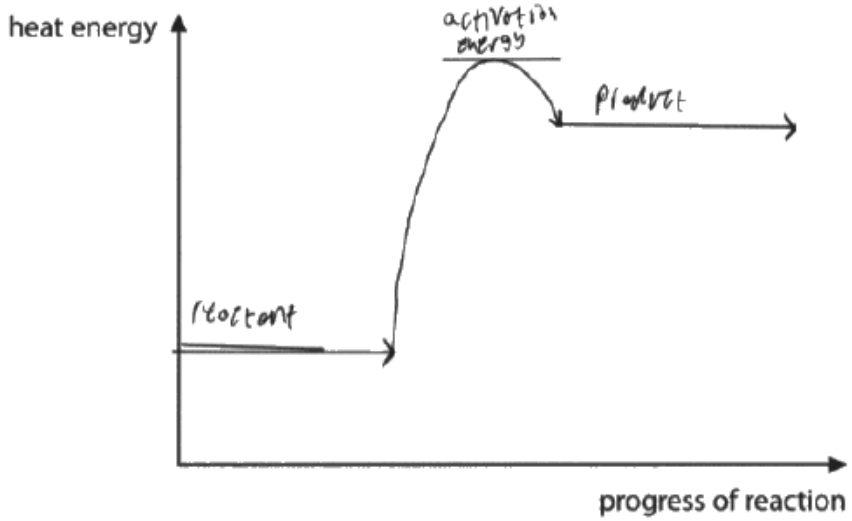
Consequential marking was in place for those who drew an exothermic reaction profile.

Incorrect diagrams included random straight lines starting from the origin, others drew a line similar to that produced from a rates of reaction curve and a few candidates drew curves to show what happened to the amount reactant and to the amount of product formed during a reaction.

(ii) In a cracking reaction, reactants are heated to form products.
This reaction is endothermic.

On the axes provided, draw the reaction profile of this reaction.
Label the energy of the reactants, the energy of the products and the activation energy of the reaction.

(3)



Results Plus: Examiner Comments

This response scored 2 of the 3 marks available.

A profile has been drawn for an endothermic reaction, with the relative positions of the reactants and products labelled and shown correctly. However, the activation energy is not labelled correctly, so limiting this response to 2 marks.

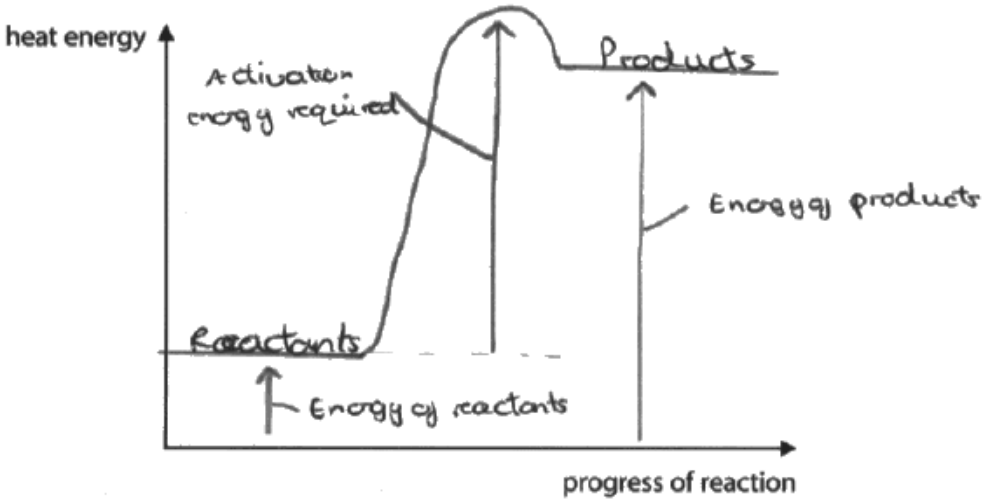
Results Plus: Examiner Tip

Make sure that not only can you draw the reaction profiles for both endothermic and exothermic reactions that you can label the activation energy on the profiles for both these types of reaction.

(ii) In a cracking reaction, reactants are heated to form products.
This reaction is endothermic.

On the axes provided, draw the reaction profile of this reaction.
Label the energy of the reactants, the energy of the products and the activation energy of the reaction.

(3)



Results Plus: Examiner Comments

An example of a fully correct response which scored 3 marks.

A profile has been drawn for an endothermic reaction, with the correct relative positions of the reactants and products labelled, with the activation energy also labelled correctly.

(iii)

Most candidates were able to work out the formula of the single product needed to balance the equation for the cracking of dodecane by writing C_6H_{14}. A common incorrect response seen here was to give $2C_3H_7$ as the answer, despite the question stating that the formula of a single molecule was needed to balance the equation.

Q24.

It was clear that many candidates had not performed this experiment as very few could state how they could successfully prevent suck-back occurring. Many candidates thought that removing the test tube as soon as it was full, altering the angle of the delivery tube or replacing the delivery tube with a longer version would prevent the suck-back.

you should take the delivery tube out before you stop heating. This will prevent it.

Results Plus: Examiner Comments

A good answer, which was rarely seen.

Put a bung in the test tube.

Results Plus: Examiner Comments

Many candidates did not know what to do and so guessed.

block off the delivery tube as soon as the experiment is complete.

Results Plus: Examiner Comments

Again, here the candidate has attempted to think of a solution but sadly unsuccessfully.

Q25.

a

It was clear that many candidates had not performed this experiment as very few could state how they could successfully prevent suck-back occurring. Many candidates thought that removing the test tube as soon as it was full, altering the angle of the delivery tube or replacing the delivery tube with a longer version would prevent the suck-back.

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Results Plus: Examiner Comments

Many candidates did not know what to do and so guessed.

block off the delivery tube as soon as the experiment is complete.

Results Plus: Examiner Comments

Again, here the candidate has attempted to think of a solution but sadly unsuccessfully.

c

The majority of candidates could correctly identify what is meant by the term unsaturated. Many candidates are still using the term 'spare bonds', which is insufficient to gain credit.

Unsaturated means the hydrocarbons aren't completely bonded.

Results Plus: Examiner Comments

Not completely bonded in sufficient to gain credit.

they have double bonds

Results Plus: Examiner Comments

Fine for one mark.

It has spare bonds.

Results Plus: Examiner Comments

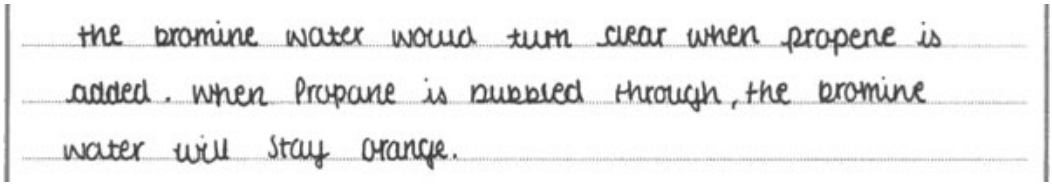
Spare bonds is not an acceptable alternative to double bonds, sadly many candidates responded using this term only and did not get the mark.

Results Plus: Examiner Tip

When stating what is meant by specific terms, ensure that correct scientific terminology is used rather than terms used to help teach or remember concepts.

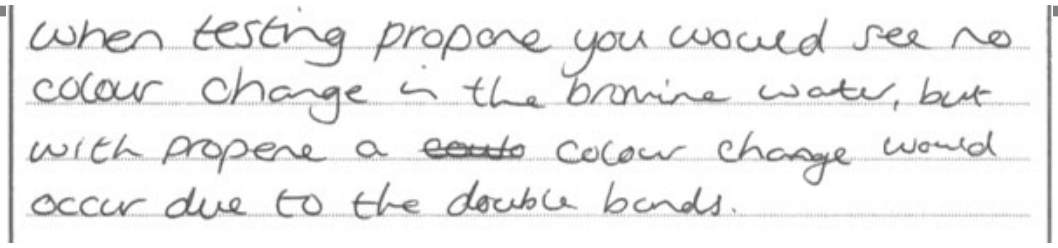
d

Many candidates scored well on this question, however some candidates lost marks due to their poor examination technique. It is important in questions like this when you are distinguishing between two tests that detail is given. For example candidates that state the one goes colourless and one changes colour, will not gain any marks as they are not making it clear which does what and are therefore are not answering the question.


the bromine water would turn clear when propene is added. when Propane is bubbled through, the bromine water will stay Orange.

Results Plus: Examiner Comments

This candidate scores two marks for the colour of bromine water and the fact that it remains orange when mixed with propane. Clear is not the same as colourless so the candidate has not scored the third marking point for what would be seen when bromine water is mixed with propene.

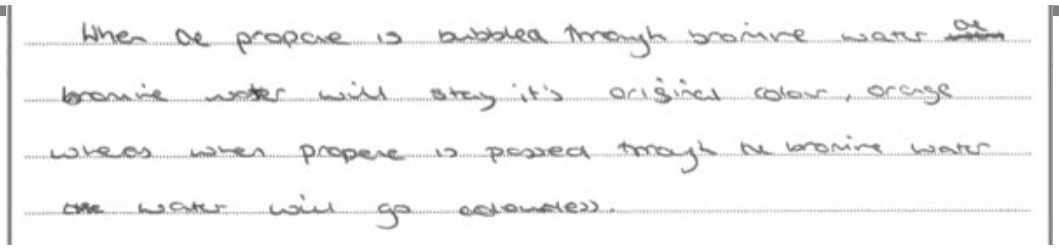

when testing propane you would see no colour change in the bromine water, but with propene a ~~could~~ colour change would occur due to the double bonds.

Results Plus: Examiner Comments

This response gains no marks, it does not state what colour the bromine water was seen to be at the beginning of the experiment nor does it state which colours either of the samples would go when mixed with the bromine water.

Results Plus: Examiner Tip

When asked for what is **seen**ensure that the answer states what is **seen.**Answers that relate to what reactions are happening such as the double bonds break will not answer the question and will therefore not gain credit.

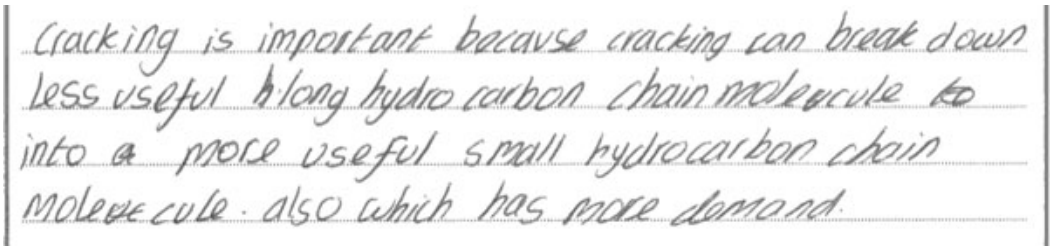


Results Plus: Examiner Comments

A good answer scoring all three marks.

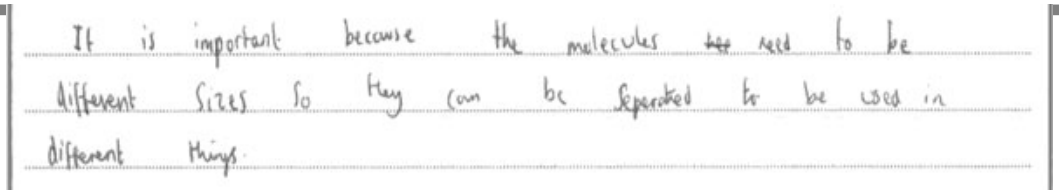
e

Candidates performed well in this question, many were able to state that there is a shortage of short chain fractions and that the process helps meet the demand.



Results Plus: Examiner Comments

A good answer which scores full marks.



Results Plus: Examiner Comments

Not enough detail in any of this to be able to give any credit.

Q26. No Examiner's Report available for this question

Q27.

Many of the answers identified that something was 'broken down', however most did not identify that a long chain alkane is broken down into a smaller chain alkane and an alkene. A lot of candidates scored a mark for being aware of the idea that this is done to create products that are more useful. Some candidates had clearly learned a specific definition to gain full marks. There was much unclear language and answers could refer equally to fractional distillation as much as to cracking ("split up the fractions" or "fractions are separated"). Confusion occurred between alkanes and alkenes, alkenes being broken down. Other things being broken down included atoms or elements.

Q28.

Most candidates were able to analyse the data in the table and recognise that fuel oil was the fraction for which the relative amount obtained exceeds the relative demand.

Q29.

(i) It was disappointing to see how many could not answer this question correctly. This is a gas test that candidates would meet at an earlier stage than GCSE. Errors seen here included 'put a lighted splint into the gas and it relights' and mixing the test with that for hydrogen along with a range of other non-scoring suggestions.

Q30. No Examiner's Report available for this question

Q31. No Examiner's Report available for this question

Q32.

Although this set-up has been used on past papers, only a few candidates managed to score marks here. The hint that zinc only reacts with oxygen above a particular temperature was ignored by most candidates, so only a few included the idea of heating the zinc. The most commonly scored mark was for passing the air over the (heated) zinc but very few made the point about no further change in gas volume.

Q33.

Candidates' discursive skills seem to be improving as most were able to write with a fair degree of coherence about the data they were presented with. Stronger candidates not only rehearsed the detail from Figure 9 accurately, but also related it to their pre-existing knowledge about the effect(s) of the various pollutants; they also explained a judgement as to which engine caused the most or least environmental damage. Weaker candidates did not discuss the effect(s) of the pollutants. Very weak candidates did not discuss all three cars. The best answers described the polluting effects, evaluated which of the cars were the most polluting and came to a conclusion about the most or least polluting car using evidence from the table.

Q34.

(b) (ii)

The number of candidates who correctly wrote the formula of carbon dioxide was disappointing. Many candidates simply wrote 'carbon dioxide', indicating a lack of understanding of the term formula. In other cases, candidates lost marks as, although they knew which elements in what proportions are present in carbon dioxide, they had not been successfully taught how to correctly represent this in a formula. The majority of candidates who scored zero marks did so because they wrote the '2' superscript rather than subscript, while others wrote a lower case 'O' for the oxygen rather than a capital.

(ii) Write the formula of a molecule of carbon dioxide.

(1)



Results Plus: Examiner Comments

Correct for 1 mark.

(ii) Write the formula of a molecule of carbon dioxide.

(1)



Results Plus: Examiner Comments

This example scored 0 marks as the oxygen in the formula has been written lower case rather than upper case.

Results Plus: Examiner Tip

When writing formula it is very important that the first letter of each element is capitalised.

(ii) Write the formula of a molecule of carbon dioxide.

(1)

CO^2

Results Plus: Examiner Comments

This very common answer scored zero marks.

(b) (iii)

The majority of candidates were able to explain that trees or plants absorb carbon dioxide from the atmosphere for use in photosynthesis. Fewer candidates explained, using the alternative marking route, that carbon dioxide is soluble in water and that it would be absorbed by oceans. This question was a two mark 'explain' type question, in some cases candidates lost marks as they gave a relevant fact to gain the first mark, but then failed to take this further to explain why this fact made carbon dioxide levels decrease. A common error was that deforestation or the burning of fossil fuels caused the amount of carbon dioxide in the atmosphere to decrease, this was most probably due to candidates misreading the question given.

(iii) The percentage of carbon dioxide in the atmosphere has decreased since the Earth's earliest atmosphere.

Explain what has caused the amount of carbon dioxide in the atmosphere to decrease.

(2)

photosynthesis in plants

Results Plus: Examiner Comments

A short, to the point answer, that scored two marks.

(iii) The percentage of carbon dioxide in the atmosphere has decreased since the Earth's earliest atmosphere.

Explain what has caused the amount of carbon dioxide in the atmosphere to decrease.

(2)

Plants Respiration taking carbon dioxide and replacing that for oxygen.

Results Plus: Examiner Comments

This response scored just 1 mark for showing an understanding that plants caused the decrease of carbon dioxide.

Results Plus: Examiner Tip

Care should be taken when using key scientific terms; respiration is not equivalent to photosynthesis and is rejected even though the correct exchange of gases is given.

(iii) The percentage of carbon dioxide in the atmosphere has decreased since the Earth's earliest atmosphere.

Explain what has caused the amount of carbon dioxide in the atmosphere to decrease.

(2)

The more plants and tree's have been planted.

Results Plus: Examiner Comments

This candidate has gained one mark for stating that the amount of carbon dioxide has decreased due to plants/trees but they have not gone to explain how for the second marking point.

Results Plus: Examiner Tip

When answering questions that ask you to explain, you must give a point, idea or fact and then try to explain the point.

(b) (iv)

The majority of candidates performed well in this question, with the most common correct responses stating that the burning of fossil fuels or deforestation would increase the amount of carbon dioxide in the air. Where candidates lost marks it was because they gave weak non-specific answers such as 'driving cars'.

(iv) State one human activity that increases the amount of carbon dioxide in the atmosphere today.

(1)

Burning of fossil fuels.

Results Plus: Examiner Comments

A good answer which scored 1 mark.

(iv) State one human activity that increases the amount of carbon dioxide in the atmosphere today.

(1)

Travel such as cars.

Results Plus: Examiner Comments

As this response does not give any extra detail it is not worthy of credit. If the candidate had included driving petrol fuelled cars or similar vehicles then credit could have been awarded.

(b) (v)

Candidates seemed to find this question difficult with few being able to give the correct test for carbon dioxide. Some candidates scored 1 mark for showing an understanding that limewater is required, but did not give the result of the test for the second mark. Many candidates confused the test for carbon dioxide with tests for other gases such as hydrogen. Some candidates stated that carbon dioxide would extinguish a lighted splint. Whilst this is true it would not prove that carbon dioxide was present and therefore would not serve as a test for carbon dioxide.

(v) Describe the test to show that a gas is carbon dioxide.

(2)

you do the squeky pop test we put Hydroagen into a ~~pen~~ test tube then we put the bunsen burner at the top if there is CO_2 then it will make a pop sound.

(Total for Question 2 = 8 marks)

Results Plus: Examiner Comments

A confused answer. The candidate has obviously confused the test for hydrogen with the test for carbon dioxide.

(v) Describe the test to show that a gas is carbon dioxide.

(2)

limewater ~~water~~ which goes cloudy to show that carbon dioxide is present

Results Plus: Examiner Comments

A good answer that scored the two marks available. The candidate has given the reagent for the test and the positive result for the test.

Results Plus: Examiner Tip

When describing the test for a gas, you should always include the test method or reagents such as limewater, followed by the positive result of that test.

Q35.

(i)

The most frequent answer seen was 'water vapour condensed' with many qualifying that by adding 'to form oceans'. A few thought that carbon dioxide condensed as well or instead of the water vapour. Several candidates added to an already correct answer that carbon dioxide dissolved in the oceans; a few candidates had the carbon dioxide condensing to give oceans.

(i) State how cooling changed the composition of the Earth's atmosphere.

(1)

CO_2 and oxygen cooled and formed seas

Results Plus: Examiner Comments

This candidate was not alone in thinking that carbon dioxide condensed to form the oceans.

(i) State how cooling changed the composition of the Earth's atmosphere.

(1)

Water vapour condensed to form oceans.
decreasing the amount of water vapour.

Results Plus: Examiner Comments

An almost text-book answer.

Results Plus: Examiner Tip

Make sure you learn the stages the changes taking place in the evolution of the atmosphere.

(ii)

Most candidates scored both marks by indicating that the level of carbon dioxide decreased and the level of oxygen increased as a result of photosynthesis.Several just mentioned what happened to the level of one gas; some just stated that carbon dioxide changed into oxygen (without explaining what happened to their amounts in the atmosphere. For these two possibilities, only one mark was awarded. A small number of candidates got the two gases the wrong way round and a few involved nitrogen in this process.The best answers gave a simple summary at the end of their answer, 'so oxygen levels rose and carbon dioxide levels fell'.

(ii) Explain how photosynthesis changed the composition of the Earth's atmosphere.

(2)

plants absorb carbon dioxide ~~in~~ through photosynthesis and release oxygen, so the oxygen increased and the carbon dioxide decreased.

Results Plus: Examiner Comments

A good clear answer explaining the changes that took place in the composition of the atmosphere as a result of photosynthesis.

(ii) Explain how photosynthesis changed the composition of the Earth's atmosphere.

(2)

Because there are more plants today then in the early atmosphere so more carbon dioxide is being taken in and changed to oxygen in the atmosphere.

Results Plus: Examiner Comments

The candidate explained what happened during photosynthesis, but did not explain how it changed the composition of the atmosphere.

Results Plus: Examiner Tip

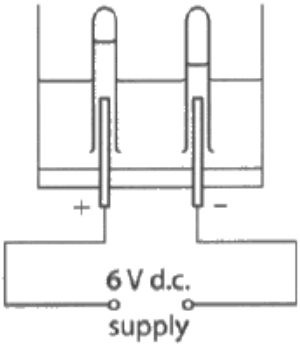
Pick out the key words in the question and make sure your answer fits the question.

Q36.

Some truly excellent answers were seen with half equations and discussions of preferential discharge. The formation of hydrogen from its ions was well described. The formation of oxygen was sometimes described from oxide ions, understandably, or even hydroxide ions forming oxygen and hydrogen. It is important to realise that in these extended writing questions the 'level' of answer is looked for, and perfection is not required. It is interesting to note the idea of the 'simpler' hydroxide ion being discharged was mentioned by some - an explanation for this is not required by the specification, but many candidates went into pleasing depth. The terms oxidation and reduction were deployed effectively. Candidates should be made aware that in a gas test a (brief) description is required - just 'the squeaky pop test' is not worth a mark.

Candidates should be careful of terminology in questions such as this - being clear to distinguish between hydrogen (gas) and hydrogen ions, for example.

(b) Sodium sulfate solution is electrolysed in the apparatus shown.



Sodium sulfate solution contains sodium ions, Na^+, sulfate ions, SO_4^{2-}, hydrogen ions, H^+, and hydroxide ions, OH^-.

Hydrogen is produced at one electrode and oxygen is produced at the other electrode.

Explain how these products are formed from the ions in the electrolysis process, indicating how you would identify the products.

You may give ionic equations in your answer.

(6)

Because OH^- ions are simpler than SO_4^{2-} ions, the OH^- ion travels to the positive anode as opposite ~~ie~~ charges attract. Here it ~~to~~ is discharged, so it loses its electrons to form oxygen molecules. The hydroxide ion is oxidised $4OH^-_{(aq)} \longrightarrow O_{2(g)} + 2H_2O_{(l)} + 4e^-$

The You can identify that oxygen gas is produced as it will re-light a glowing splint.

Hydrogen ions are discharged at the cathode instead of sodium ions, as sodium is more reactive ~~and so is~~ than hydrogen. H^+ ions gain electrons, and share electron pairs to form hydrogen molecules.

~~$2H^+_{(aq)} + 2e^- \longrightarrow H_{2(g)}$~~ $2H^+_{(aq)} + 2e^- \longrightarrow H_{2(g)}$

This is a reduction reaction as hydrogen gains electrons. You can test for H_2 gas as it will ~~to~~ extinguish a lighted splint and make a squeaky pop.

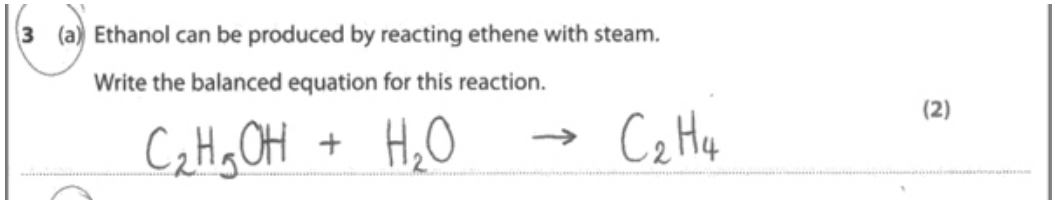
Results Plus: Examiner Comments

A well-constructed answer.

Q37.

(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.

(2)

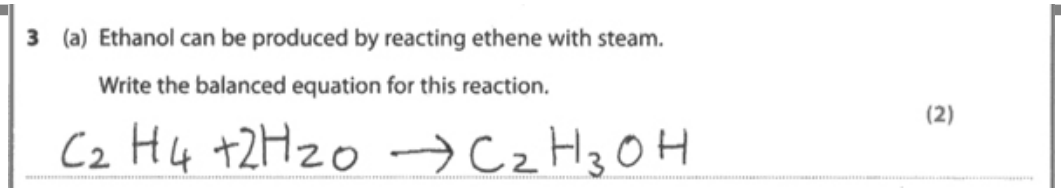
$C_2H_5OH + H_2O \rightarrow C_2H_4$

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.

(2)

$C_2H_4 + 2H_2O \rightarrow C_2H_3OH$

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.

$C_2H_4 + H_2O \longrightarrow C_2H_5OH$ **(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 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.

(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 plenty 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 country has fertile land. This land can be used to grow sugar beet or sugar cane to produce glucose for fermentation. The country 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 country. Moreover, it is not wealthy therefore it cannot afford to produce ethanol from ethene as this is expensive (due to 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.

Q38.

(b)

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

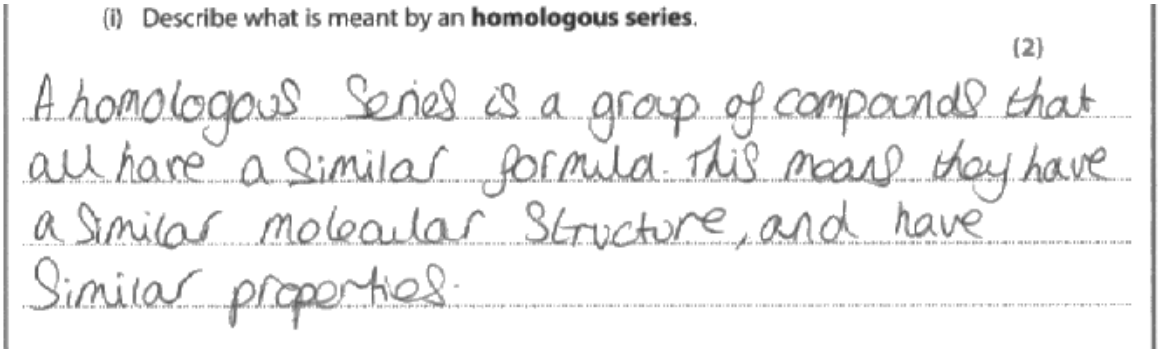
Despite the reactants being given in the question, a large number of candidates were unable to recall the formula for ethene. Often the formula of ethane, C_2H_6, was shown, or C_2H_5 was given. Occasionally, candidates got the reactants and products the wrong way round. Several even got the formula 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.

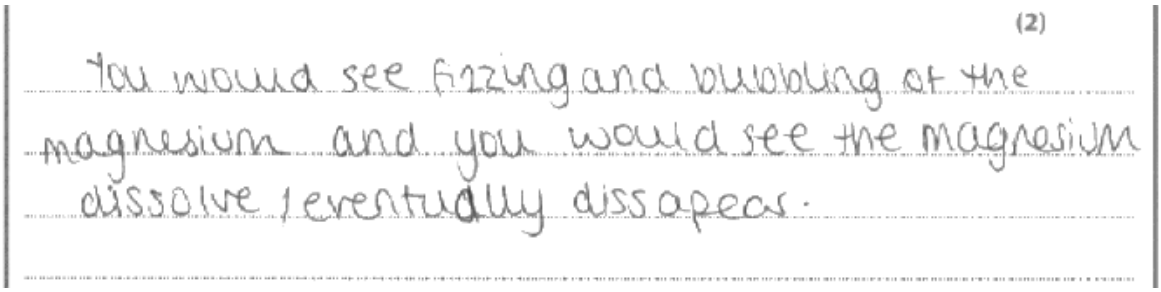
(d)(i)

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 of 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.

Q39. No Examiner's Report available for this question

Q40.

Although many identified carbon dioxide as being the product of combustion responsible for the greenhouse effect, many still had nitrogen dioxide in their mind from the previous item and tried to justify that as a product of combustion of diesel oil. Some were able to explain how carbon dioxide (and water vapour) help cause the greenhouse effect, but a good explanation was only seen by a few candidates. Most went down the route of 'carbon dioxide traps heat' with little amplification. A few wrote about the combustion gases (without identification) and how they got trapped in the atmosphere which warmed up the Earth.

Q41. No Examiner's Report available for this question

Q42. No Examiner's Report available for this question

Q43.

It was surprising how many candidates failed to tackle this question effectively, with not many securing all three marks. Too many candidates described what was happening, rather than explaining the observations as required. Some did not seem to realise that combustion is an exothermic chemical reaction that would produce oxidation products. There was confusion with cracking and mention of alkenes and alcohols.

Q44. No Examiner's Report available for this question

Q45.

This question was very pleasingly answered by many who, as intended, took the data in the figure and correctly explained the conclusions that could be drawn. Weaker candidates just asserted the conclusion without explaining how the data led to that conclusion (e.g. that there was a lot of carbon dioxide in Q without saying how that could be deduced). Other candidates used the limewater data but ignored the burning splint.

Q46.

(i) Although many candidates realised that carbon monoxide is produced when there is limited oxygen, but didn't quite finish the explanation as to why. There were some weak answers that just repeated the question – 'carbon monoxide is produced during incomplete combustion', showing they didn't understand what the question was about. There were a few candidates who misunderstood the word 'incomplete' in this context, by their thinking that not all the pentadecane had combusted.

(ii) Asking about why carbon monoxide is a toxic gas has appeared on several GCSE examination papers, so it was quite surprising to see how few scored full marks here. Many candidates did state that carbon monoxide combined with haemoglobin (or with red blood cells) but did not then develop that with a consequence. A few wrote about carbon monoxide being colourless and odourless so humans can't detect it which was why is was toxic.

Q47.

From the answers, it was clear that many did not appreciate that the question was about the products of combustion and subsequently cooling them produced droplets of water. Several tried to reason that it was somehow the water in the beaker that was evaporating and then condensing or that water vapour in the air was condensing.

Q48. No Examiner's Report available for this question

Q49.

This question showed that some candidates could not interpret a molecular formula correctly. In some cases, candidates did not read the question carefully and gave name of substance B rather than the formula.

Q50. No Examiner's Report available for this question

Mark Scheme

Q1.

Question number	Answer	Additional guidance	Mark
(i)	as the number of carbon atoms in the molecule increases, the boiling point increases (1)	accept reverse argument	(1)

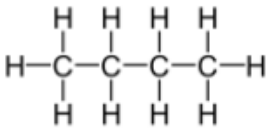
Question number	Answer	Additional guidance	Mark
(ii)	relative formula mass = (3 X 12) + (8 X 1) (1) = 44	Award mark if correct answer given with no working	(1)

Question number	Answer	Additional guidance	Mark
(iii)	propane + oxygen → carbon dioxide + water LHS (1) RHS (1)	ignore air allow reactants on LHS and products on RHS in either order allow $C_3H_8 + 5\,O_2 \rightarrow 3CO_2 + 4H_2O$ (2) incorrect balancing of correct species max 1 mark ignore state symbols even if incorrect allow = for →	(2)

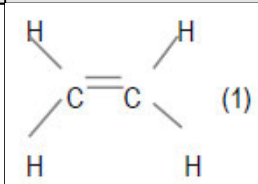
Question number	Answer	Additional guidance	Mark
(iv)	An explanation that combines identification - understanding (1 mark) and reasoning/justification - understanding (1 mark): **EITHER** carbon monoxide/CO formed (1) toxic/poisonous/restricts the amount of oxygen carried (by the blood) (1) **OR** carbon/smoke/soot formed (1) damages lungs/chokes people/breathing difficulties /makes things dirty (1)	 ignore carbon dioxide ignore dangerous/harmful allow the second mark if an incorrect gas is given *e.g.* methane allow second mark if 'gas' stated, but no name is given allow less energy released ignore dangerous/harmful allow blocks fuel jets allow less energy released	(2)

Q2.

Question Number	Answer	Acceptable answers	Mark
(i)	An explanation including any two of the following • same general formula (1) • have similar/same chemical reactions/properties (1) • both saturated/(both only) have single bonds / (both) have no double bonds (1)	C_nH_{2n+2} = 2 marks allow both hydrocarbons / both contain hydrogen and carbon (only) allow both end in -ane allow (molecular) formulae differ by CH_2	**(2)**

Question Number	Answer	Acceptable answers	Mark
(ii)	fully correct (displayed) formula of butane (2)  M1 four carbon atoms joined by single bonds (1) M2 rest of molecule correct (1)	M2 dependent on M1 If methylpropane drawn fully correctly 1 mark	**(2)**

Q3.

	Answer	Acceptable answers	Mark
(a)	 (1) Propene (1)	Allow $CH_2=CH_2$ Allow prope(e)n(e) only	**(2)**
(b)(i)	(molecule contains a) **double** bond	multiple bond(s)	**(1)**

		ignore spare bonds	
(b)(ii)	(colour change) from orange (1) to colourless (1)	red/yellow/brown decolorised ignore clear/ discoloured	**(2)**
(c)	**1st mark** long {molecules/ hydrocarbon / alkane/ chain} **or** break down/ decompose/ split (1) **2nd mark** into smaller {molecules / alkane / alkene / hydrocarbon/ chain} **or** more useful product		**(2)**
(d)(i)	**D**polymerisation		**(1)**
(d)(ii)	An explanation linking **two** of the following • poly(ethene) does not rot/biodegrade (1) • remains for many years in landfill/ fills up land(fill) (1) • (may) harm animals / landfill unsightly (1)		**(2)**

Q4.

Question Number	Answer	Additional guidance	Mark
(i)	hydrogen + oxygen → **water**	allow $2H_2 + O_2 \rightarrow 2H_2O$: this must be fully correct and balanced with correct subscripts reject 'hydrogen and oxygen', hydrogen oxide, hydrogen hydroxide if word and symbol equation given or mixture of symbols and words, ignore all symbols allow = for →	**(1)** AO 2 1

Question Number	Answer	Additional guidance	Mark
(ii)	B **and** D	For B allow SO_2 For D allow CO_2 reject answers containing any other letters/ names	**(1)** AO 3 2a

Q5.

Question number	Answer	Additional guidance	Mark
	360/100 (1) = 3.6 78 x 3.6 = 281 (1)	allow full marks for correct answer with no working	**(2)**

Q6.

Question number	Answer	Mark
(i)	allow 2 for correct answer with or without working change in concentration = 410.83 - 407.96 (= 2.87) (1) = 3 (1)	**(2)**

Question number	Answer	Additional guidance	Mark
(ii)	volcanic activity / burning of fossil fuels / deforestation / respiration	allow more vehicles on road ignore global warming / ice-caps melting / farming	**(1)**

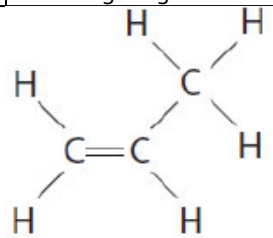
Q7.

Question number	Answer	Mark
(i)	x = 6 (1) y = 14 (1)	**(2)**
(ii)	25 (g)	**(1)**

Q8.

Question Number	Answer	Additional guidance	Mark
	380 000 with or without working scores 3 382 500 with or without working scores 2 OR 45/100 (1) = (0.45) (0.45) x 850 000 (1) = (382 500) = 380 000 (1) OR 850 000/100 (1) (= 8500) (8500) x 45 (1) (= 382 500) 380 000 (1) OR 4x10% = 340 000 **and** 1x5% = 42 500 (1) 340 000 + 42 500 (= 382 500) (1) 380 000 (1)	allow ECF throughout (answers based on 55%) 470 000 scores 2 467 500 scores 1 allow alternative chunking methods that add to 45% The clear rounding of any worked out final answer (using data provided) to 2 sig figs scores 1	**(3)** AO 2 1

Q9.

	Answer	Acceptable answers	Mark
(a)	C – CH_3CH_3		
(b)		carbon skeleton correct including double bond (1) rest of molecule correct (1) allow CH_3	(2)
(c)	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ • reactant formulae (1) • product formulae (1) • balancing of correct formulae (1)	accept multiples reject incorrect use of cases and non-subscripts	(3)

	Indicative Content	

QWC	***(d)**	advantages • renewable / sustainable • more plants can be grown • crops use up carbon dioxide and produce oxyg growing /photosynthesising • carbon neutral because the carbon produced c combustion is used when growing the plants • does not use up crude oil/non-renewable resou disadvantages • crops grown for bio-fuels use up land • land could otherwise be used to provide home farmland available for growing food crops • lots of crops required to provide a small amou bio-methane • bad season reduces availability • carbon emissions due to transport and produc qualified	

Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description e.g. using bio-methane conserves fossil fuels and uses up carbon dioxide when plants are grown • 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 e.g. growing plants to produce biomethane is sustainable and conserves fossil fuels but uses up lots of farm land which could be used to grow plants for food • 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**	• detailed description e.g growing plants remove carbon dioxide from the air during photosynthesis and conserves fossil fuels but lots of crops are required to make biomethane and this uses up farm land which could otherwise be used to grow crops for food • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q10.

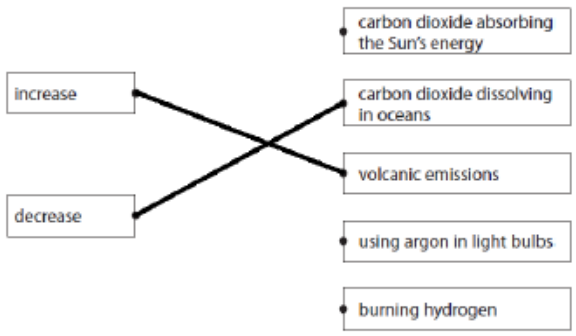
Question number	Answer	Mark
(i)	0.0401 - 0.0318 (1) = 0.0083	(1)

Question number	Answer	Additional guidance	Mark
(ii)	• other factors may change (1) • both rising does not prove one causes the other (1)	ignore references to anomalies	(2)

Q11.

	Answer	Acceptable answers	Mark
	D less than 0.5%		(1)
	A explanation linking any **two** of • dissolves /is absorbed (1) • in the oceans (1) • incorporated into marine organisms (1) • formed carbonate rocks (1) • increase in (green) plants/plants start growing • photosynthesis /plants remove carbon dioxide	reject references to plants respiring/breathing	(2)
	traps <u>heat</u>	reflects <u>heat back to Earth</u> reject references to the ozone layer	(1)

Q12.

Question Number	Answer	Mark
	change in the amount of carbon dioxide in the atmosphere process causing the change  reject multiple lines from a box	(2) AO 1 1

Q13.

Question number	Answer	Mark
	B carbon dioxide	(1)

Q14.

Question number	Answer	Mark
	C they have the same general formula **A**, **B** and **D** not correct as compounds in homologous series have different chemical, empirical and molecular formulae.	(1) AO1

Q15.

	Answer	Acceptable answers	Mark
QWC	*	An explanation including some of the following **water** • causes condensation • damp walls etc • damages decoration	(6)

		• greenhouse gas/ keeps in heat **carbon dioxide** • greenhouse gas/ keeps in heat • may contribute to global warming • consequences of global warming eg flooding/ drought / crop failure / disease/ melting ice caps / climate change etc **carbon** • soot • makes things dirty/ black • damages decoration • flues or jets could be blocked • can cause breathing problems • can cause fires **carbon monoxide** • toxic (ignore harmful etc) • (also) odourless and colourless • "silent killer" • (therefore) difficult to detect • combines with haemoglobin • in red blood cells • prevents oxygen being circulated In general references to pollution, environment etc are ignored	
Level	**0**	No rewardable content	
1	**1 - 2**	• a limited description (about one product) e.g. carbon monoxide is toxic because it joins to blood • 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 (developed description of one product) eg carbon dioxide absorbs sun's heat and causes global warming which means ice caps melt **or** (limited description of two) e.g. carbon monoxide combines with haemoglobin so is toxic and carbon dioxide is a greenhouse gas causing global warming. • 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 (developed description of one and limited description of one) or (limited description of three or more) e.g. toxic carbon monoxide cannot be detected and prevents the blood from carrying oxygen so is toxic: carbon dioxide is a greenhouse gas which causes global warming. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

Q16.

Question number	Answer	Additional guidance	Mark
	C_2H_4	Allow H_4C_2	**(1) AO2**

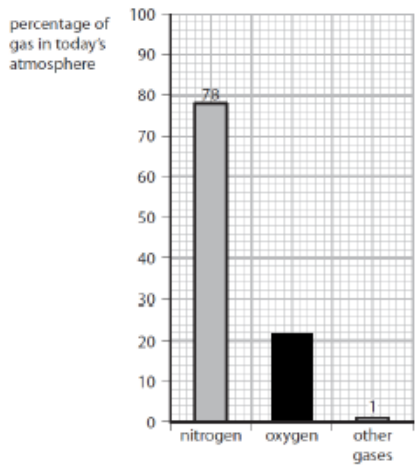
Q17.

Question number	Answer	Additional guidance	Mark
	$N_2 + 2O_2 \rightarrow 2NO_2$ (2) or NO_2 (1)	other incorrect balancing max 1	**(2) AO2**

Q18.

Question number	Answer	Additional guidance	Mark
	$N_2 + 2O_2 \rightarrow 2NO_2$ (2) or NO_2 (1)	other incorrect balancing max 1	**(2)** **AO2**

Q19.

Question number	Answer	Additional guidance	Mark
(i)	Vertical bar for oxygen to just over 20% as shown in the bar chart (ignore width):  (1)	ignore bars touching each other ignore 21 above bar	**(1)**
(ii)	MP1 : $\frac{21}{100}$ (1) (=0.21) MP2 : 0.21 x 300 (1) (= 63) (cm^3)	63 (cm^3) with no working scores 2 marks 300/4.76 = 63 (2) 300/4.8 = 62.5 (2) allow 21 x 300 (1) (= 6300) allow $\frac{300}{100}$ (1) (= 3)	**(2)**

Q20.

Question number	Answer	Additional guidance	Mark
(i)	4 electrons shown between the 2 carbon atoms	electrons may be shown as dots, crosses or as a mixture	**(1)**
(ii)	carbon monoxide / carbon / soot	allow CO / C ignore carbon dioxide	**(1)**

Q21.

Question number	Indicative content	Mark
	$2\ CaCO_3 + Mg^{2+} \rightarrow CaMg(CO_3)_2 + Ca^{2+}$ 2 **(1)** Mg^{2+} **(1)**	**(2)**

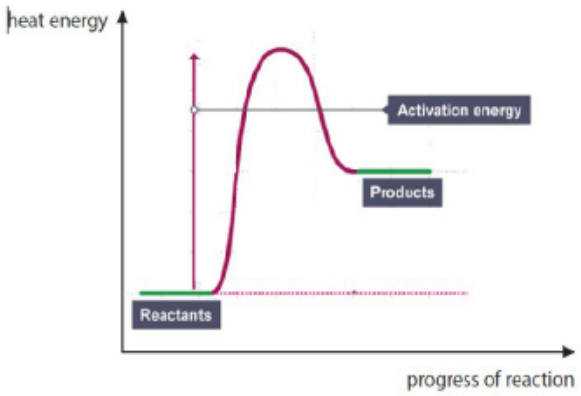
Q22.

Question number	Answer	Additional guidance	Mark
(i)	methane + oxygen (1) → water + carbon dioxide (1)	ignore symbols reject other substances on either side for that mark	**(2)**

Question number	Answer	Additional guidance	Mark
(ii)	limited supply of oxygen	ignore air	**(1)**

Q23.

Question Number	Answer	Mark
(i)	fuel oil	**(1)** AO 3 2a

Question Number	Answer	Additional guidance	Mark
(ii)	• reactant(s) and product(s) labelled in their correct positions (1)	example of diagram 	(3) AO 1 1
	• activation energy labelled (1)	ignore arrow heads	
	• energy of reactants lower than energy of products (1)	allow unlabelled diagram of an endothermic reaction showing the basic outline shape if exothermic reaction profile shown, allow (1) for reactants and products in correct position and (1) for correct labelling of activation energy	

Question Number	Answer	Additional guidance	Mark
(iii)	C_6H_{14}		(1) AO 2 1

Q24.

	Answer	Acceptable answers	Mark
	remove delivery tube from water <u>before stopping heating</u>	other words which make sequence clear use of (Bunsen) valve	(1)

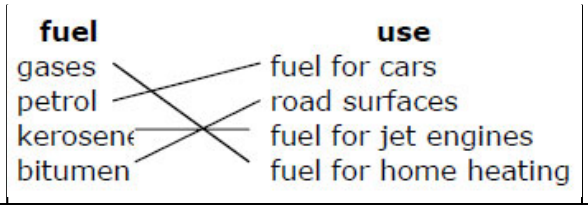
Q25.

	Answer	Acceptable answers	Mark
(a)	remove delivery tube from water <u>before stopping heating</u>	other words which make sequence clear	(1)

		use of (Bunsen) valve	
(b)	B C_4H_8		(1)
(c)	contains a {double/multiple} bond	ignore "spare bonds" ignore reference to number of hydrogen atoms attached.	(1)
(d)	A description to include • bromine water is orange (1) • propane: (remains) orange / no colour change (1) • propene: becomes colourless /decolourises (1)	 red / yellow / brown any combination of these ignore clear /discolours	(3)
(e)	An explanation linking any**two** of • shorter chain molecules are more useful ORA (1) • demand for shorter chain molecules ORA (1) • meets demand • reduces the excess of longer chain molecules (1) • (cracking) produces alkenes (1) • alkenes used to make polymers (1)	 reject long chain molecules are useless named fraction/use/fuel named fraction /use/fuel	(2)

Q26.

	Answer	**Acceptable answers**	**Mark**
	3 correct – 2 marks 1 or 2 correct – 1 mark		**(2)**

Q27.

	Answer	Acceptable answers	Mark
	1st mark long {molecules/ hydrocarbon / alkane/ chain} **or** break down/ decompose/ split (1) **2nd mark** into smaller {molecules / alkane / alkene / hydrocarbon/ chain} **or** more useful product		**(2)**

Q28.

Question Number	Answer	Mark
	fuel oil	**(1)** AO 3 2b

Q29.

Question number	Answer	Additional guidance	Mark
(i)	A description to include • use of **glowing** splint (1) • (glowing splint) relights (1)	 2nd mark dependent on correct test	**(2)** **AO1**

Question number	Answer	Additional guidance	Mark
(ii)	potassium ion: 2.8.8 (1) oxide ion: 2.8 (1)	Allow other separators between the numbers including spaces	**(2)** **AO1**

Q30.

Question number	Answer	Additional guidance	Mark
	A description to include glowing splint (1) relights (1)	 MP2 is dependent on MP1	**(2)** **AO1**

Q31.

Question number	Answer	Mark
(i)	x = 6	(1)

Question number	Answer	Additional guidance	Mark
(ii)	allow 2 for correct answer with or without working 170 (g) dodecane forms 114 (g) octane 1 (g) dodecane forms $\frac{114}{170}$ (g) octane (1) 340 (g) dodecane forms $\frac{114}{170}$ x 340 (1) (= 228(g))	 OR $\frac{340}{170}$ (1) (= 2) 2 x 114 (1) (= 228 (g))	(2)

Q32.

Question number	Answer	Additional guidance	Mark
	A plan to include • heating tube where zinc is (1) • pass {gas / air} over (heated) zinc (1) • until no further change in volume (1) • measuring volume of gas after experiment / calculate difference in volume (1)		**(4)** **AO3**

Q33.

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. **Pollutants** • carbon monoxide combines with haemoglobin so is toxic • nitrogen oxides are acidic / toxic • nitrogen oxides lead to acid rain • references to effects of acid rain – e.g. damages buildings/kills plants etc • carbon dioxide is a greenhouse gas • greenhouse gases cause global warming • references to effects of global warming – e.g sea levels rising etc • particulates cause breathing difficulties/ make buildings dirty **Petrol/diesel comparison** • compared to diesel, petrol: -releases less nitrogen oxides -releases less particulates • compared to diesel, petrol: -releases more carbon monoxide -releases more carbon dioxide **Catalytic converter** • reduces carbon monoxide • reduces nitrogen oxides **Overall comparison** • Petrol car improved with catalytic converter as two pollutants reduced • Diesel better than petrol for carbon oxides • Diesel is worse for particulates and nitrogen oxides	**(6)** **EXP** **AO3** **(6)**

Level	Mark	Descriptor	Example responses
	0	No rewardable material.	
Level 1	1–2	Demonstrates elements of chemical knowledge some of which is inaccurate. Presents a discussion with some structure and coherence. States differences between engines using information from the table or explains the problem of one of the pollutants.	e.g. The diesel engine gives off the least carbon dioxide (1) carbon dioxide causes the greenhouse effect (1) the diesel engine only gives off particulates which cause breathing problems (2)
Level 2	3–4	Demonstrates elements of chemical knowledge and understanding some of which is mostly relevant but which may contain some inaccuracies. Presents a discussion that has structure and is mostly coherent. Describes two or three differences between engines using information from the table and explains the problems of some of the pollutants.	e.g. the petrol engines give off carbon dioxide but the one with a catalytic converter gives off less nitrogen oxides. The carbon dioxide is a greenhouse gas which causes global warming and the nitrogen oxide cause acid rain (4)
Level 3	5–6	Demonstrates accurate and relevant chemical knowledge and understanding. Presents a discussion and comparison with some structure and coherence. Describes three or four differences between engines using information from the table and explains the problem of some of the pollutants. Explains why one of the engines causes the least/ most damage to the environment.	e.g. the petrol engines give off carbon dioxide but the one with a catalytic converter gives off less nitrogen oxides. The diesel engine gives off less carbon dioxide but more nitrogen oxides. The carbon dioxide is a greenhouse gas which causes global warming and the nitrogen oxide cause acid rain. The diesel engine gives off the least carbon monoxide which is toxic. Overall the petrol car with no catalytic converter because it gives off the a lot of carbon dioxide and more carbon monoxide so it would cause the most global warming and breathing problems from the CO (6)

Q34.

Question Number	Answer	Acceptable answers	Mark
(a)	**D** gases from volcanoes		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b) (i)	**A** less than 1%		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b) (ii)	CO_2	CO must be capitals Reject Co 2 must be subscript	**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(iii)	An explanation linking any two from **EITHER** • photosynthesis(1) • in (green) plants (1) • (carbon dioxide) absorbed (1) **OR** • (carbon dioxide) is soluble (in water) / dissolves (1) • in oceans (1)	Reject respiration Ignore breathe in (carbon dioxide) reference to formation of skeletons / carbonate rock	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)(iv)	burning fossil fuels / burning {petrol / fossil fuel} (in vehicles) /deforestation	ignore cars/driving unqualified allow breathing / respiration	**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(v)	a description linking second marking point is dependent on first • limewater • (turning) cloudy/milky/white ppt		**(2)**

Q35.

Question Number	Answer	Acceptable answers	Mark
(i)	answer must refer to water vapour water vapour condensed / rain falls / water vapour removed / (water vapour) turns to water		**(1)**

Question Number	Answer	Acceptable answers	Mark
(ii)	An explanation linking • carbon dioxide (level) reduced (1) • so oxygen (level) increased (1)	carbon dioxide turned into oxygen (1)	**(2)**

Q36.

Question Number		Indicative Content	Mark
QWC	*	A description / explanation including some of the following points marks can be scored from diagrams incorrectly balanced equations can be used as evidence of reaction occurring but po not otherwise credited **electrolysis process** • ions move when current passed • negative ions move to anode • overall decomposition of water • $2H_2O \rightarrow 2H_2+O_2$ **Anode/ positive electrode** • sulphate ions move to anode • hydroxide ions move to anode • hydroxide ions lose electrons/oxidation • hydroxide ions form oxygen • half equation: $4OH^- \rightarrow O_2 + 2H_2O + 4e^-$ • half volume gas at this electrode • oxygen test: glowing splint in gas relights **cathode/ negative electrode** • sodium ions move to cathode • hydrogen ions move to cathode • hydrogen ions gain electrons / reduction • hydrogen ions form hydrogen • half equation: $2H^+ + 2e^- \rightarrow H_2$ • double volume gas at this electrode • hydrogen test: lit splint in gas burns/ pops • hence double volume of hydrogen gas	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited description e.g. states which ions go to which electrode • 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 explanation e.g. explain formation of one product • 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 explanation e.g. explaining formation of BOTH products at electrodes • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Q37.

	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	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)**

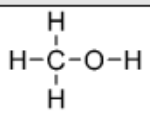
	• ethene obtained from {crude oil / fractional distillation /cracking} (1) Marking point 3 – cost/energy – one from • cannot afford to buy crude oil (1) • crude oil is too expensive (1) • more expensive to {use/buy/produce} ethene (1) • cheaper to use fermentation (1)	allow {little/no} {heat/energy} 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 $C_nH_{2n+1}OH$ (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)**

Q38.

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 <u>turns</u> colourless ignore clear	**(2)**

Q39.

Question num	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) AO2 (3 marks)** • sulfur burns at the same time as the hydrocarbon • sulfur reacts with oxygen • sulfur dioxide gas is formed • sulfur dioxide is an acidic gas • sulfur dioxide dissolves in clouds • to form sulfurous acid • which is then oxidised to form sulfuric acid • rain water becomes acidic • acid rain damages buildings / statues • damages plants/trees • runs into rivers / waterways • makes rivers/waterways acidic • kills fish/insects/waterlife • increases corrosion of metals	**(6)**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	acid rain damages plants and erodes buildings
Level 2	3–4	sulfur dioxide is formed which dissolves in clouds and then acid rain runs into waterways and kills fish
Level 3	5–6	sulfur burns to form sulfur dioxide which dissolves in clouds to form sulfuric acid, the acid rains can erode limestone statues and will increase corrosion of metals making them weaker.

Q40.

Question number	Answer	Additional guidance	Mark
	An explanation linking • {carbon dioxide / water} produced (1) • (the gases) absorb heat radiated from earth (1) • re-radiate heat back into the atmosphere (1)	 allow formula allow traps the heat	**(3)**

Q41.

Question number	Answer	Additional guidance	Mark
	An explanation linking • {carbon dioxide / water} produced (1) • (the gases) absorb heat radiated from earth (1) re-radiate heat back into the atmosphere (1)	 allow formula allow traps the heat	**(3)** **AO2**

Q42.

Question number	Answer	Mark
	An explanation that combines identification – improvement of the experimental procedure (1 mark) and justification/reasoning which must be linked to the improvement (1 mark): • reverse the boiling tubes/pass gas through the tube in ice water first (1) • so that if any liquid condenses in the tube it must have come from the burning wax (and not from the limewater) (1)	**(2)**

Q43.

Question number	Answer	Additional guidance	Mark
	• (funnel) heat (energy) released in reaction/ exothermic reaction (1) • (liquid) water (1) • (gas) sulfur dioxide / carbon dioxide (1)	ignore NOx	**(3)**

Q44.

Question number	Answer	Additional guidance	Mark
	An explanation linking any two • Earth cooled (1) • water (vapour) condensed (1) • oceans formed /seas formed/ rainfall (1)	allow temperature decreased	**(2)**

Q45.

Question number	Indicative content	Additional guidance	Mark
	An explanation to include Q is early atmosphere (0) because • limewater ppt faster so contains {more/ large amount of} carbon dioxide **(1)** • splint goes out so {little/no oxygen} **(1)**	If P given then (0) If neither P nor Q stated they must be clearly referring to Q to score.	**(2)**

Q46.

Question number	Answer	Mark
(i)	An explanation linking • insufficient oxygen (1) • to oxidise all carbon to carbon dioxide (1)	**(2)** **AO1**

Question number	Answer	Mark
(ii)	An explanation linking • carbon monoxide reacts with {haemoglobin (in blood) / blood / red blood cells} (1) • stops oxygen being carried by {haemoglobin / blood / red blood cells} / so less oxygen reaches brain (1)	**(2)** **AO1**

Q47.

Question number	Answer	Mark
	An explanation to include • water vapour forms during combustion (1) • (water vapour) condenses on cold surface (1)	**(2)** **AO2**

Q48.

Question Number	Answer	Mark
	A crude oil is a finite resource **The only correct answer is A** ***B*** *is not correct because crude oil is a mixture of compounds* ***C*** *is not correct because most molecules are chains* ***D*** *is not correct because crude oil must be fractionated first*	**(1)** AO 1 1

Q49.

Question Number	Answer	Additional guidance	Mark
	SO_2	allow O_2S reject SO2, SO^2	**(1)** AO 2 1

Q50.

	Answer	Acceptable answers	Mark
	C – CH_3CH_3		