PEARSON EDEXCEL GCSE CHEMISTRY · 1CH0

CHEMISTRY



MARK SCHEME

TOPIC 8: FUELS AND EARTH SCIENCE (PACK 2)

SCORE	PERCENTAGE
/88	%

STEMUP

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Q1.

(ii)

Generally very well answered, with the majority of responses scoring the 2 marks available for a standard definition of a hydrocarbon.

This was another question that was similar to those set on the previous specification.

Common errors, omissions, misconceptions:

Although many candidates made the point that alkanes contain only hydrogen and carbon, some spoilt their answer answers by incorrectly using the terms 'mixture of hydrogen and carbon' or 'hydrogen molecules and/or carbon molecules'.

(ii) Explain why alkanes are described as hydrocarbons.

(2)

Alkanes are described as hydrocarbons as they have single bonds between hydrogen and carbon atoms, where it is a saturated molecule, formula of C_nH_{2n+2}

Results Plus: Examiner Comments

This response scored 1 mark only.

The correct reference to 'carbon and hydrogen atoms' is credited in the second line of this response. The fact that it mentions that these are bonded together with single bonds is correct in alkanes and can be ignored. The second marking point is not scored since the response does not mention 'only' which is pertinent to the fully correct definition of a hydrocarbon. Stating the general formula of an alkane is insufficient.

Results Plus: Examiner Tip

The definitions of a hydrocarbon, saturated and unsaturated are in the specification and you should be able to recall them.

(ii) Explain why alkanes are described as hydrocarbons.

(2)

An alkane is described as a hydrocarbon as it only consists of molecules that are hydrogen and carbon.

Results Plus: Examiner Comments

This response was not creditworthy.

Although both hydrogen and carbon have been referred to, the use of 'molecules that are hydrogen and carbon' is not correct, so the response did not score.

Results Plus: Examiner Tip

When defining a hydrocarbon the use of 'carbon molecules' and/or 'hydrogen molecules' is incorrect.

Q2. No Examiner's Report available for this question

Q3. No Examiner's Report available for this question

Q4. No Examiner's Report available for this question

Q5.

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.

Cracking is important because cracking can break down less useful long hydro carbon chain molecule to into a more useful small hydrocarbon chain Molecule. also which has more demand.

Results Plus: Examiner Comments

A good answer which scores full marks.

It is important because the molecules ~~the~~ need to be different sizes so they can be seperated to be used in different things.

Results Plus: Examiner Comments

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

Q6.

Generally, candidates knew that hydrocarbons contained hydrogen and carbon. Unfortunately, it was often said to be a mixture, and only a limited number of candidates mentioned that a hydrocarbon consisted of hydrogen and carbon only (but a good number of these had clearly learnt the answer accurately as a definition). In general, it seemed that many candidates were not at all clear about the meaning of basic chemical terms such as atom, molecule, element, mixture and compound so were likely to lose marks through their misuse. One other common answer was "made of hydro and carbon".

(a) Methane is a hydrocarbon.
The formula of a molecule of methane is CH_4.

Explain what is meant by a **hydrocarbon**.

(2)

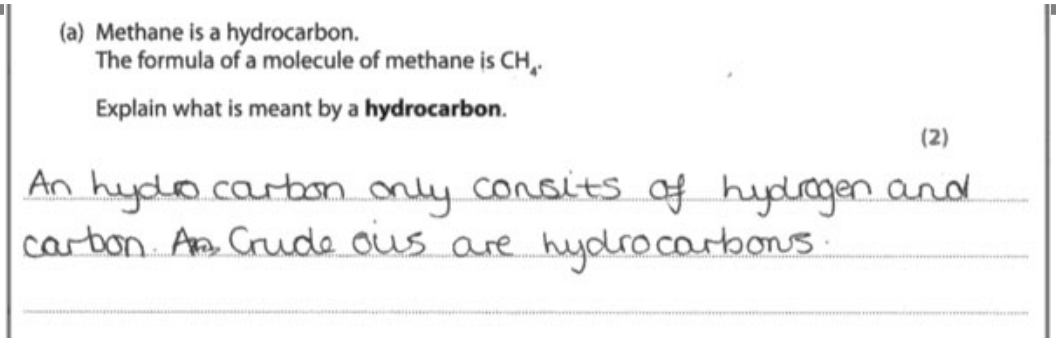
hydrocarbon is a mixture of hydrogen and carbon which then makes hydrocarbon.

Results Plus: Examiner Comments

A common wrong answer.

Results Plus: Examiner Tip

Understand the difference between mixtures and compounds - a molecule cannot be a mixture.



(a) Methane is a hydrocarbon.
The formula of a molecule of methane is CH_4.

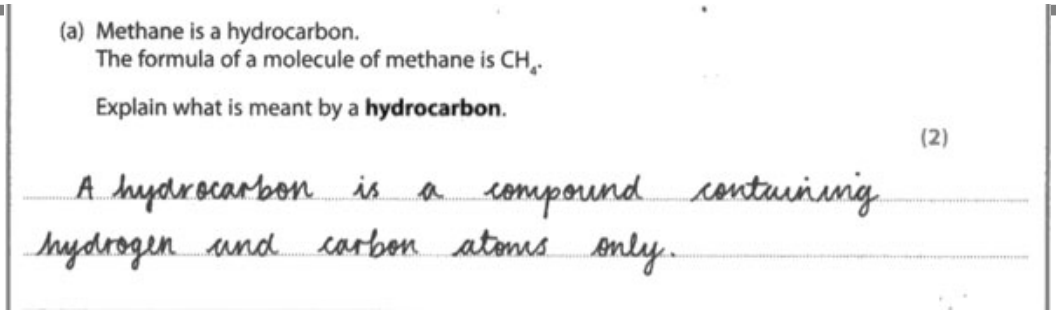
Explain what is meant by a **hydrocarbon**.

(2)

An hydrocarbon only consits of hydrogen and carbon. Ans. Crude oils are hydrocarbons.

Results Plus: Examiner Comments

The critical word 'only' is here.



(a) Methane is a hydrocarbon.
The formula of a molecule of methane is CH_4.

Explain what is meant by a **hydrocarbon**.

(2)

A hydrocarbon is a compound containing hydrogen and carbon atoms only.

Results Plus: Examiner Comments

The perfect answer.

Results Plus: Examiner Tip

It is worth learning definitions like this.

Q7. No Examiner's Report available for this question

Q8. No Examiner's Report available for this question

Q9. No Examiner's Report available for this question

Q10. No Examiner's Report available for this question

Q11. No Examiner's Report available for this question

Q12. No Examiner's Report available for this question

Q13. No Examiner's Report available for this question

Q14. No Examiner's Report available for this question

Q15. No Examiner's Report available for this question

Q16. No Examiner's Report available for this question

Q17.

(i)

Generally very well answered with most candidates able to score the 2 marks available.

A question very similar to this has appeared on many papers in the previous specification where candidates performed well. This calculation was quite straightforward taking the difference in volume and converting that into a percentage.

Common errors, omissions, misconceptions:

Some candidates simply took the 40 divided by 50 and converted that into a percentage giving the value of 80% and failed to relate that back to the first line where it stated that the apparatus was used to find the percentage of oxygen in dry air. However, about half the candidates carried out a correct calculation to obtain a value of 20%. Some carried out both the correct (to give 20%) and the incorrect (to give 80%) calculations but did not then commit themselves. For that they were not credited with full marks. In a very few cases, candidates obtained a final answer of 25% (they had mistakenly divided by 40, not 50, in their calculation).

(i) The following results were obtained

initial volume of air in apparatus = 50 cm^3

final volume of gas in apparatus = 40 cm^3

Calculate the percentage of oxygen in this sample of dry air.

(2)

$\frac{40}{50} = \frac{4}{5} = 0.8$

20%

100% - 80% = 20%

percentage oxygen in the air = 20%

Results Plus: Examiner Comments

This response scored the 2 marks available.

A correct final answer of 20% scored. There are two ways of calculating this value. In this method, the candidate has calculated the percentage of gas remaining in the apparatus and then subtracted this from 100, to arrive at the percentage of oxygen in the sample of dry air.

(i) The following results were obtained

initial volume of air in apparatus = 50 cm^3

final volume of gas in apparatus = 40 cm^3

Calculate the percentage of oxygen in this sample of dry air.

(2)

$\frac{40 - 50}{40} \times 100 = -25$

%

percentage oxygen in the air = 25%

Results Plus: Examiner Comments

A typical response which scored 1 mark only.

One mark was credited for a correct subtraction of the initial and final volumes to find the difference giving '40 – 50' (the sign can be ignored, namely -25%). The expression for calculating the percentage of oxygen is incorrect as the candidate has divided by 40 rather than 50.

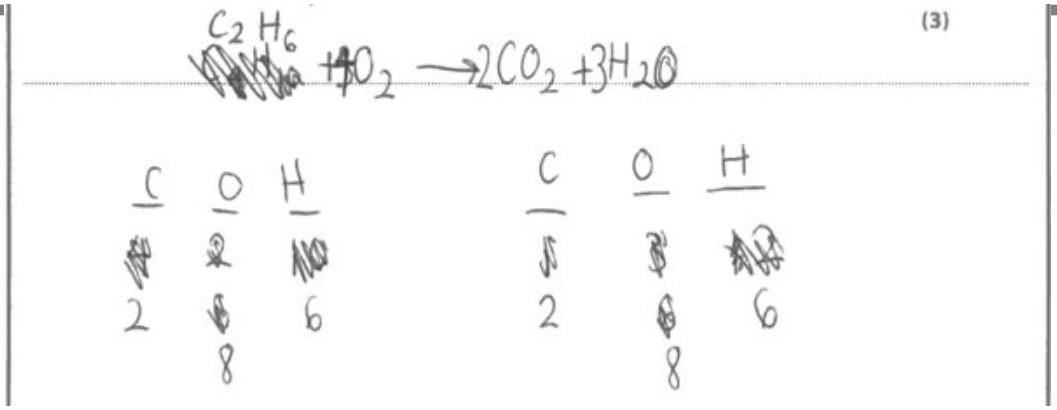
Q18.

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.



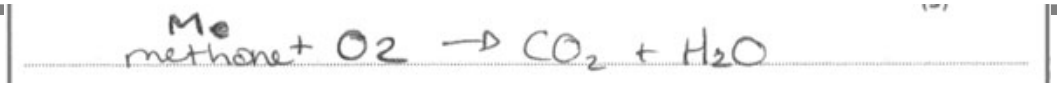
Results Plus: Examiner Comments

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.

Q19. No Examiner's Report available for this question

Q20. No Examiner's Report available for this question

Q21.

Many candidates read the question carefully and realised that the gas produced was oxygen, often scoring the mark by simply stating that the splint relights.

However, quite a large proportion thought that the gas produced was hydrogen and therefore gave incorrectly 'squeaky pop'. Some stated that the splint would go out. A few stated that bubbles would be seen.

Q22. No Examiner's Report available for this question

Q23.

A large number of candidates were able to score at least 1 mark on this question, often for showing an understanding that plants/ trees were responsible for causing the change in the amount of oxygen in the atmosphere since the Earth's early atmosphere.

Fewer were able to take this further and explain that it was the photosynthesis of these plants that caused the change. In some cases, candidates thought that respiration was the process.

Some candidates did not read the question carefully and stated facts they knew about the atmosphere such as global warming, pollution, volcanoes, burning fossil fuels or greenhouse gases, that did not relate to the amount of oxygen increasing.

Q24.

Most candidates were able to score only 1 of the 2 marks available by describing the pattern in terms of the greater the number of carbon atoms in a molecule of alkane, the higher the boiling point.

Explanations in terms of increased intermolecular forces were rarely seen; often answers were given in terms of 'bonds' which limited the mark candidates could score to 1 mark.

Common errors, omissions, misconceptions:

In some responses, the main misconception was that candidates incorrectly discussed the breaking of alkane molecules or covalent bonds.

Figure 8 shows a graph of the boiling points of some alkanes against the number of carbon atoms in one molecule of each alkane.

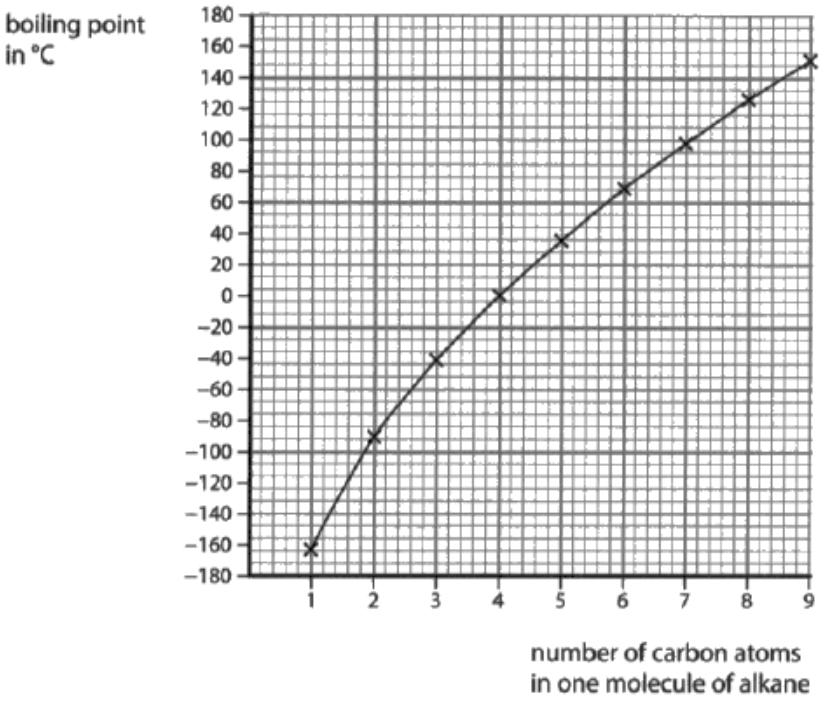


Figure 8

Explain the pattern shown by this graph.

(2)

The graph ~~o~~ shows that the more carbon atoms a hydrocarbon has the higher the melting point becomes. This is shown by the gradual increase with the graph.

Results Plus: Examiner Comments

This response was not creditworthy.

Although the response appears to have the right idea regarding the trend in the data for the first marking point, unfortunately the response is actually talking about melting point, rather than boiling point, so does not score.
The other marking points have not been scored since there is no mention of intermolecular forces.

Figure 8 shows a graph of the boiling points of some alkanes against the number of carbon atoms in one molecule of each alkane.

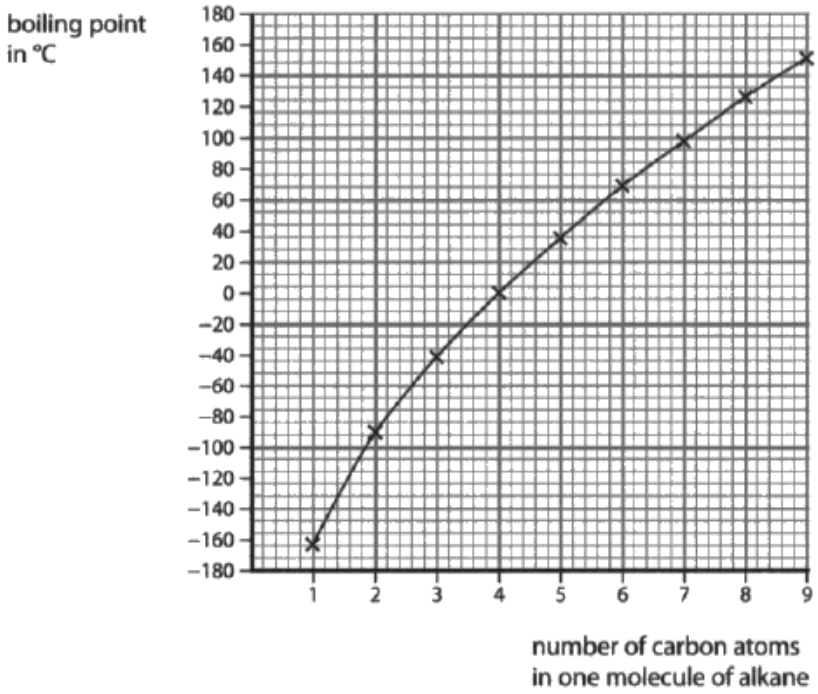


Figure 8

Explain the pattern shown by this graph.

(2)

Overall, as the number of carbon atoms in one molecule of alkane increases the boiling point increases. This is because, as the chain of carbon atoms increase, it means more energy is required to break the more and stronger intermolecular forces between the carbon atom. Hence, boiling point increases.

Results Plus: Examiner Comments

This response scored 1 mark and is typical of the many responses seen by examiners scoring 1 mark only.

The response has the right idea regarding the trend in the data, namely that of boiling point increasing with number of carbon atoms, so the first marking point is awarded.
The second marking point would have been scored for 'stronger intermolecular forces' but this is contradicted by the response mentioning that this force is between atoms, so cannot be awarded.

Results Plus: Examiner Tip

When explaining the trend in boiling points of simple covalent molecules, ensure that you refer

to forces between molecules.

Figure 8 shows a graph of the boiling points of some alkanes against the number of carbon atoms in one molecule of each alkane.

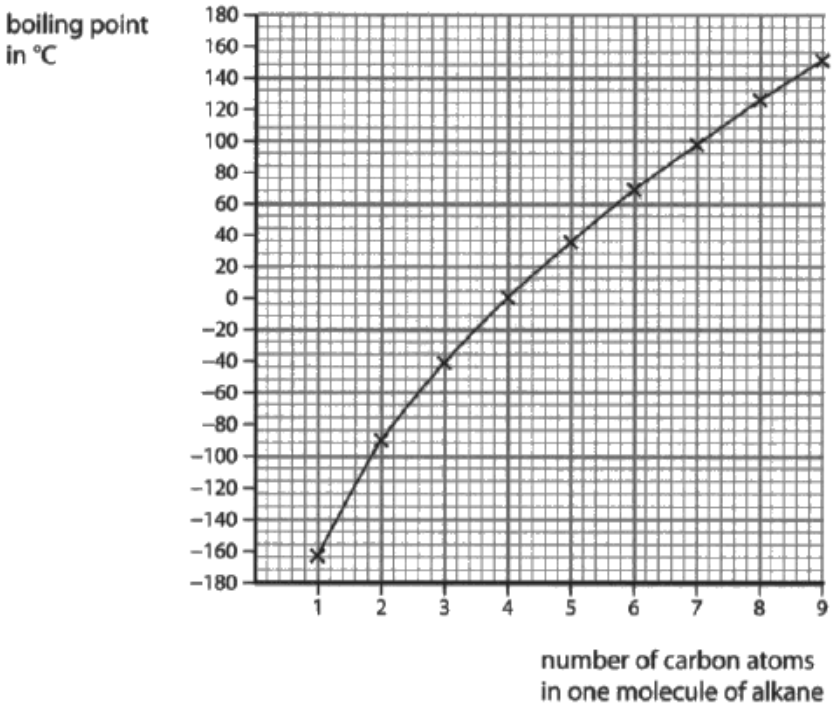


Figure 8

Explain the pattern shown by this graph.

(2)

The more carbon atoms in one molecule of alkane the higher the boiling point is. This is because the more atoms there are, the harder it is to break the strong intermolecular forces if there were less atoms it would be easier to break as there are fewer and will therefore have a lower boiling point

Results Plus: Examiner Comments

An example of a rarely seen and fully correct response which scored 2 marks.

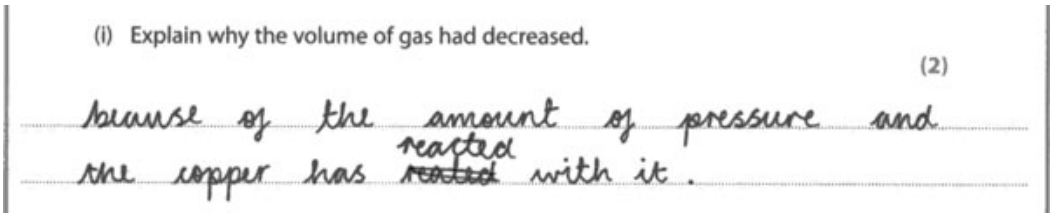
All the possible available marking points are awarded.

Q25.

(i)

This question was not well answered, and candidates showed a lack of understanding of the chemistry involved and hence why the volume would decrease. Some candidates may have understood what was occurring, but used unfortunate terminology, such as "the copper absorbed / took in the gas", not really showing they knew that a reaction had happened. Others talked about copper and "the gas" without identifying oxygen as the part of air that reacted. Only a few answers correctly stated that copper oxide was formed, or that copper had been oxidised.

Common wrong answers talked about the contraction of the gas (as the apparatus cooled), or gases escaping from the apparatus.


(i) Explain why the volume of gas had decreased.

(2)

because of the amount of pressure and the copper has ~~reacted~~ reacted with it.

Results Plus: Examiner Comments

It is a pity that this answer does not specify that the "it" is the oxygen in the air.

Results Plus: Examiner Tip

Try to understand the reason behind experiments - the question is about finding the percentage of oxygen in the air, so a reaction with oxygen is involved.

Q26. No Examiner's Report available for this question

Q27. No Examiner's Report available for this question

Q28.

Generally well answered with half the candidates scoring the 2 marks available.

In many responses candidates appreciated that the change resulted from the increased levels of oxygen, scoring the first mark, but then through incorrect terminology did not score the second one.

The Earth's earliest rocks contained iron sulfide and no iron oxide.
Later the rocks contained iron oxide as well as iron sulfide.

Explain what happened to allow this change to occur.

(2)

An increase in the amount of oxygen ~~it~~ in the air allowed for the (actual) formation of iron oxide. ~~This~~ Oxygen in the air increased due to the growth of plants (consuming carbondioxide, expelling oxygen).

Results Plus: Examiner Comments

This was a typical response scoring 1 mark only.

The correct reference to 'an increase in the amount of oxygen' in line one is worth 1 mark and likewise, the same marking point could also be awarded for lines three and four of this response. However, the reference to 'the formation of iron oxide' is not sufficient to score any further credit.

The Earth's earliest rocks contained iron sulfide and no iron oxide.
Later the rocks contained iron oxide as well as iron sulfide.

Explain what happened to allow this change to occur.

(2)

Oxygen wasn't very present in Earth's early atmosphere, but as plants began to evolve and started to photosynthesise, they released oxygen gas. This started to react with iron, leading to rocks containing iron oxide as well as iron sulfide.

Results Plus: Examiner Comments

This is a good response which scored 2 marks.

There are correct references to both photosynthesis releasing oxygen and the reaction of iron with oxygen.

Q29.

Generally well answered with most candidates able to score 1 or 2 of the 2 marks available.

A question very similar to this has appeared on many papers in the previous specification where they performed well. Likewise on this occasion it was pleasing to see that many candidates appreciated that as a result of the cooling Earth and its atmosphere that the water vapour would condense, fall as rain and form the seas and oceans.

Common errors, omissions, misconceptions:

Many candidates failed to mention the Earth cooling and simply mentioned formation of oceans to score just 1 mark. Sometimes this was accompanied by an incorrect reference to the Earth getting warmer, sometimes linked with global warming. Some candidates thought that as volcanic activity diminished, the amount of water vapour going into the atmosphere decreased and so the amount of water vapour in the atmosphere decreased. Others thought that the plants starting to grow on the Earth's surface used up the water vapour.

The Earth's atmosphere contains several gases.

Figure 1 shows the relative amounts of gases thought to be in the Earth's early atmosphere.

gas	relative amount in Earth's early atmosphere
oxygen	small
carbon dioxide	large
nitrogen	small
water vapour	large

Figure 1

The amount of water vapour in today's atmosphere is much less than the amount in the Earth's early atmosphere.

Explain why the amount of water vapour in the atmosphere has decreased.

(2)

The amount of water vapour has decreased as the vast more of the water vapour condensed forming oceans.

Results Plus: Examiner Comments

There is a correct reference to 'water vapour condensed forming oceans'. However, there is no reference to the Earth cooling, so this limited the score to 1 mark only.

Results Plus: Examiner Tip

The number of marks available to the question indicates the number of points required in the response to gain full credit. The changes in the chemistry of the atmosphere were a key feature of the previous specification and remains in this new specification. Use the past examination papers to practise this area of the specification.

The Earth's atmosphere contains several gases.

Figure 1 shows the relative amounts of gases thought to be in the Earth's early atmosphere.

gas	relative amount in Earth's early atmosphere
oxygen	small
carbon dioxide	large
nitrogen	small
water vapour	large

Figure 1

The amount of water vapour in today's atmosphere is much less than the amount in the Earth's early atmosphere.

Explain why the amount of water vapour in the atmosphere has decreased.

(2)

The earth cooled down so the water vapour in the air condensed into water to form oceans.

Results Plus: Examiner Comments

This response scored 2 marks.

There are correct references made to the 'Earth cooled down' and 'water vapour... condensed... to form oceans'.

Q30. No Examiner's Report available for this question

Q31. No Examiner's Report available for this question

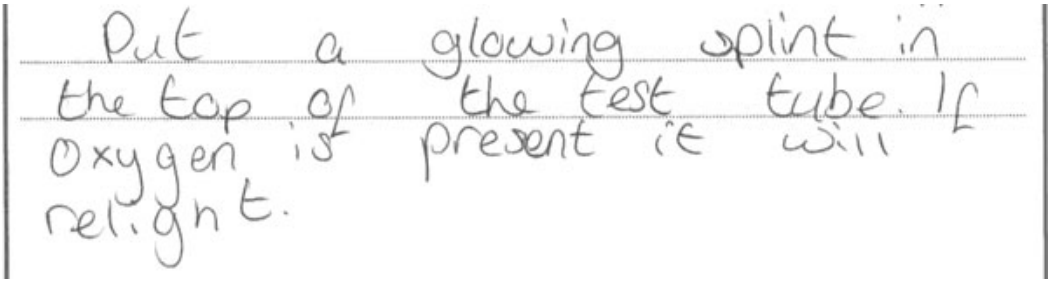
Q32.

Most candidates gave the correct answer here.

Q33. No Examiner's Report available for this question

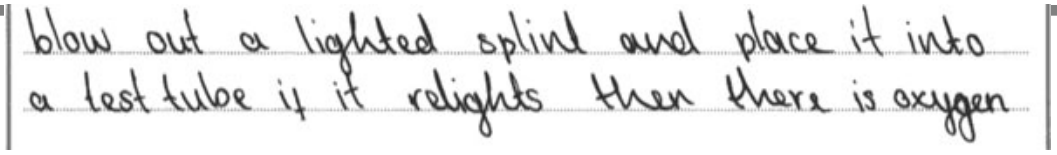
Q34.

In general candidates performed well in this question. However many lost marks as they referred to a blown out splint instead of a glowing splint. A 'blown out' splint would not relight.



Results Plus: Examiner Comments

A good answer.



Results Plus: Examiner Comments

This is an example of a very common mistake, the candidate has stated that the splint has been blown out, if the splint has been blown out, it will not relight if it was placed in a test tube of oxygen and so the whole response gains no credit.

Results Plus: Examiner Tip

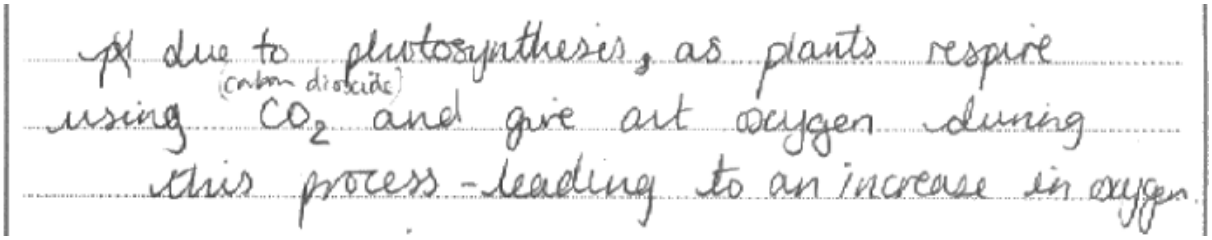
Scientific terms are important, ensure the correct terms are used as using less scientific terms can lead to answers that are inadequate as the science behind them would no longer be correct.

Q35. No Examiner's Report available for this question

Q36.

(b)(i)

This question was very well answered with the majority of candidates being able to state how the percentage of oxygen had increased due to plants photosynthesising. Where candidates lost marks it was because they confused plants respiring with plants photosynthesising or because they had read the question incorrectly and gave ways that the amount of carbon dioxide has decreased, such as dissolution in oceans.

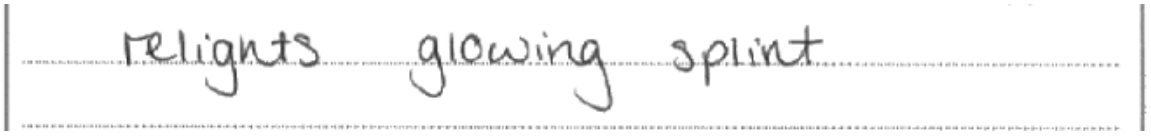


Results Plus: Examiner Comments

This candidate lost marks as they had included incorrect scientific terminology. If they had missed out the word respire, this would have been a sound 2 mark answer.

(b)(ii)

Whilst the majority of candidates were able to describe correctly the test for oxygen, many are still stating that a 'blown out splint' should be used to test for oxygen. This is not correct and therefore lost both marks.



Results Plus: Examiner Comments

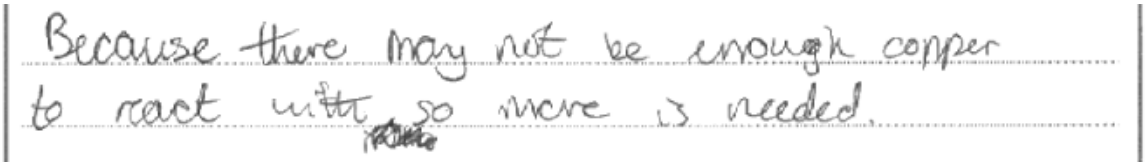
A concise response that gives both the test and the expected result for full marks.

Results Plus: Examiner Tip

It is important that when asked to describe the test for a gas, you give the test and the expected result of the test.

(c)(i)

It was pleasing to see that many candidates understood that an excess of copper must be used so that all of the oxygen is used up. Some candidates lost a mark here as they were not precise with their terms which therefore made their answer incorrect. For example, stating that an excess of copper must be used so that all the 'air' was used up. Some candidates lost marks as they confused the term 'excess' and stated that all the copper had to be used up. Some stated that it was so that the reaction was complete which was insufficient for the mark.

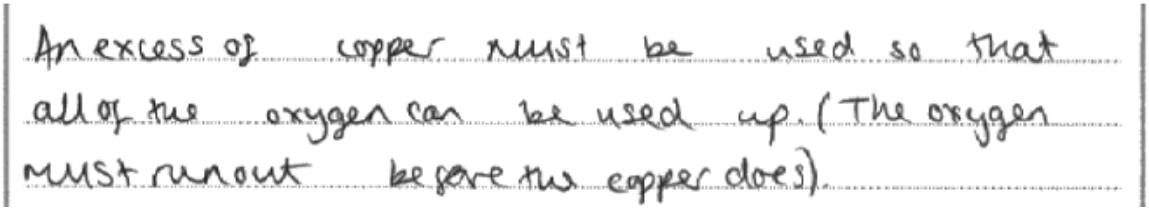


Results Plus: Examiner Comments

This candidate has not given enough detail in their answer. They understand that there may not be enough copper to react, but have not said with what or why?

Results Plus: Examiner Tip

It is important that your answers given are detailed so that you show your understanding of the chemistry of the question posed.

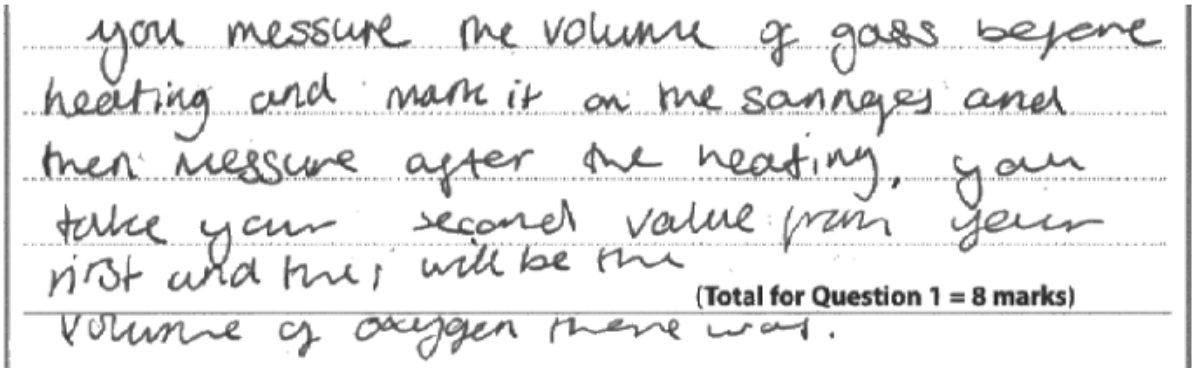


Results Plus: Examiner Comments

A good answer that shows that the candidate has seen or carried out the experiment and understands the chemistry behind it.

(c)(ii)

Only the best candidates got this question correct. Candidates seemed to have very little idea that an experiment had been carried out and answered the question by giving a calculation but made no reference to how the numbers had been obtained. Many students misinterpreted the question and tried to explain the theory behind the experiment. Many candidates simply stated the expected percentage of oxygen in the air without showing exactly how this could be determined using the equipment.


you messure the volume of gass before heating and mark it on the sannges and then messure after the heating, you take your second value from your first and that will be the volume of oxygen there was.

(Total for Question 1 = 8 marks)

Results Plus: Examiner Comments

This is a good response and shows that the candidate has seen or carried out this experiment and understands the chemistry behind it.

Results Plus: Examiner Tip

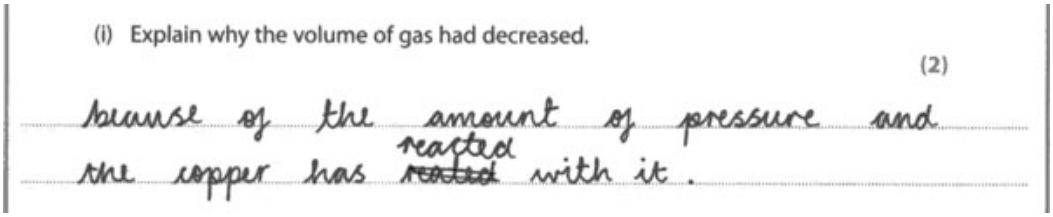
It is very important that when you are shown an experiment or are carrying out an experiment that you understand the chemistry behind why you are doing it and what you are observing.

Q37.

(a) (i)

This question was not well answered, and candidates showed a lack of understanding of the chemistry involved and hence why the volume would decrease. Some candidates may have understood what was occurring, but used unfortunate terminology, such as "the copper absorbed / took in the gas", not really showing they knew that a reaction had happened. Others talked about copper and "the gas" without identifying oxygen as the part of air that reacted. Only a few answers correctly stated that copper oxide was formed, or that copper had been oxidised.

Common wrong answers talked about the contraction of the gas (as the apparatus cooled), or gases escaping from the apparatus.


(i) Explain why the volume of gas had decreased.

(2)

because of the amount of pressure and the copper has ~~reacted~~ reacted with it.

Results Plus: Examiner Comments

It is a pity that this answer does not specify that the "it" is the oxygen in the air.

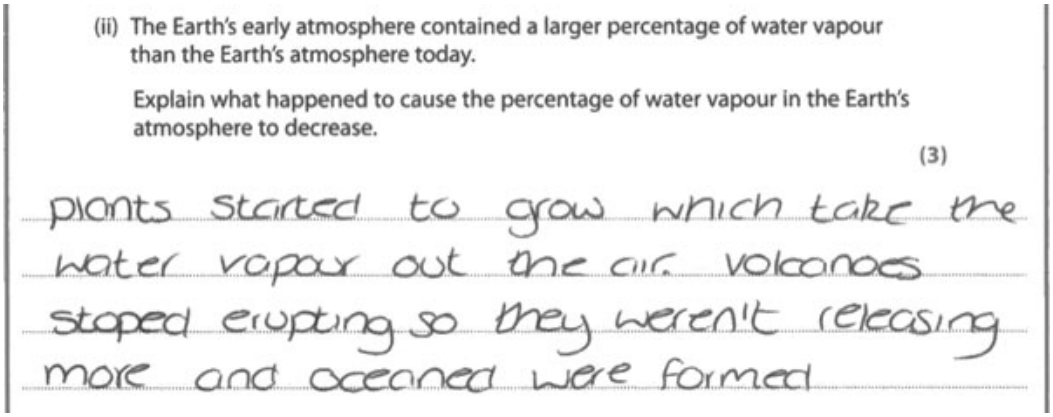
Results Plus: Examiner Tip

Try to understand the reason behind experiments - the question is about finding the percentage of oxygen in the air, so a reaction with oxygen is involved.

(b) (ii)

Many candidates produced a good answer to this question with clear points, well linked. Most achieved at least one mark, with many scoring two. A 3 mark answer was a good discriminator. The most popular response was that the water vapour condensed and formed the oceans, with a point lost for missing that the Earth/atmosphere cooled.

Some candidates did not appreciate the time scale and were talking about changes today and global warming. This included plants photosynthesizing and removing water; the water vapour evaporated as the Earth heated up due to global warming; volcanoes not erupting anymore. What is most critical is a clear understanding of the terms evaporate and condense.


(ii) The Earth's early atmosphere contained a larger percentage of water vapour than the Earth's atmosphere today.

Explain what happened to cause the percentage of water vapour in the Earth's atmosphere to decrease.

(3)

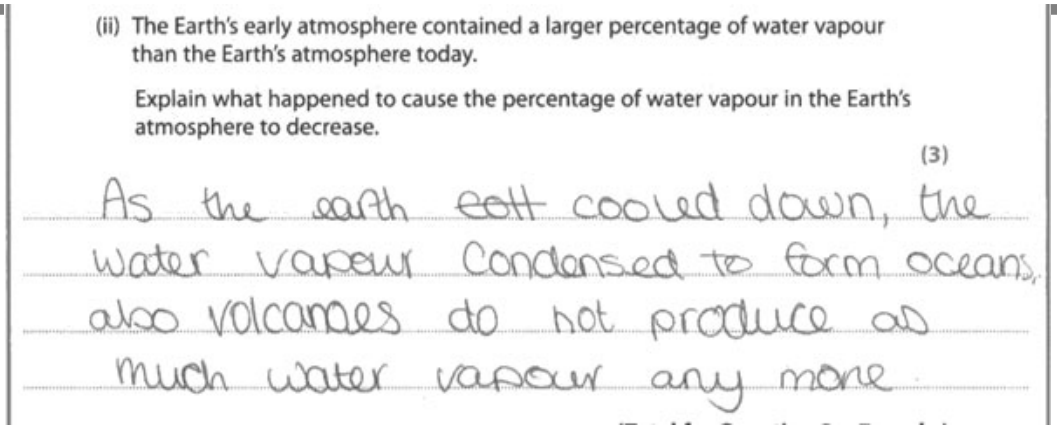
plants started to grow which take the water vapour out the air. volcanoes staped erupting so they weren't releasing more and oceaned were formed

Results Plus: Examiner Comments

This answer shows that oceans were formed, but does not say how.

Results Plus: Examiner Tip

The early atmosphere refers to the Earth before human history when the Earth was very hot, and it was the cooling down that caused the water vapour in the atmosphere to condense.



(ii) The Earth's early atmosphere contained a larger percentage of water vapour than the Earth's atmosphere today.

Explain what happened to cause the percentage of water vapour in the Earth's atmosphere to decrease.

(3)

As the earth ~~eatt~~ cooled down, the water vapour condensed to form oceans, also volcanoes do not produce as much water vapour any more.

Results Plus: Examiner Comments

The candidate has linked together clearly three ideas: cooled down.... condensed.... oceans. (The part about volcanoes is irrelevant and ignored).

Q38.

(ii)

Many candidates produced a good answer to this question with clear points, well linked. Most achieved at least one mark, with many scoring two. A 3 mark answer was a good discriminator. The most popular response was that the water vapour condensed and formed the oceans, with a point lost for missing that the Earth/atmosphere cooled.

Some candidates did not appreciate the time scale and were talking about changes today and global warming. This included plants photosynthesizing and removing water; the water vapour evaporated as the Earth heated up due to global warming; volcanoes not erupting anymore. What is most critical is a clear understanding of the terms evaporate and condense.

(ii) The Earth's early atmosphere contained a larger percentage of water vapour than the Earth's atmosphere today.

Explain what happened to cause the percentage of water vapour in the Earth's atmosphere to decrease.

(3)

plants started to grow which take the water vapour out the air. volcanoes stoped erupting so they weren't releasing more and oceaned were formed

Results Plus: Examiner Comments

This answer shows that oceans were formed, but does not say how.

Results Plus: Examiner Tip

The early atmosphere refers to the Earth before human history when the Earth was very hot, and it was the cooling down that caused the water vapour in the atmosphere to condense.

(ii) The Earth's early atmosphere contained a larger percentage of water vapour than the Earth's atmosphere today.

Explain what happened to cause the percentage of water vapour in the Earth's atmosphere to decrease.

(3)

As the earth ~~eett~~ cooled down, the water vapour condensed to form oceans, also volcanoes do not produce as much water vapour any more

Results Plus: Examiner Comments

The candidate has linked together clearly three ideas: cooled down.... condensed.... oceans. (The part about volcanoes is irrelevant and ignored).

Q39.

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.

Q40. No Examiner's Report available for this question

Q41.

(iii)

This question was answered well with the majority of candidates gaining both marks for being able to read the values from the graph and using them to calculate the change in the amount of carbon dioxide from 1990 to the beginning of 2000.

In some cases, candidates were able to read the values from the graph correctly but then divided rather than subtracted the numbers and therefore scored just the first marking point.The most common error was an inaccurate/ careless reading from the graph.

(iii) Calculate the change in the amount of carbon dioxide in the Earth's atmosphere from the beginning of 1990 to the beginning of 2000.

(2)

'90; 350ppm 365 - 350 = 15

'00; 365ppm

change in amount = 15 ppm

Results Plus: Examiner Comments

It is good to give very clear working.

(i) - (ii)

Some candidates didn't seem to read the question carefully – muddling the answers between part (i) and part (ii) or repeating the same information.

Giving a description of how the amount of carbon dioxide in the Earth's atmosphere varied within in a year proved more challenging for some candidates. Usually this was because they did not read the scale carefully and thought that the amount increased in one year and decreased the next.

Part (ii) was answered well. A few candidates offered explanations for the variation although this had not been requested. Some candidatesused numbers, which is fine if these are used to illustrate the point and the overall trend is stated.

Figure 9 shows a graph of the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

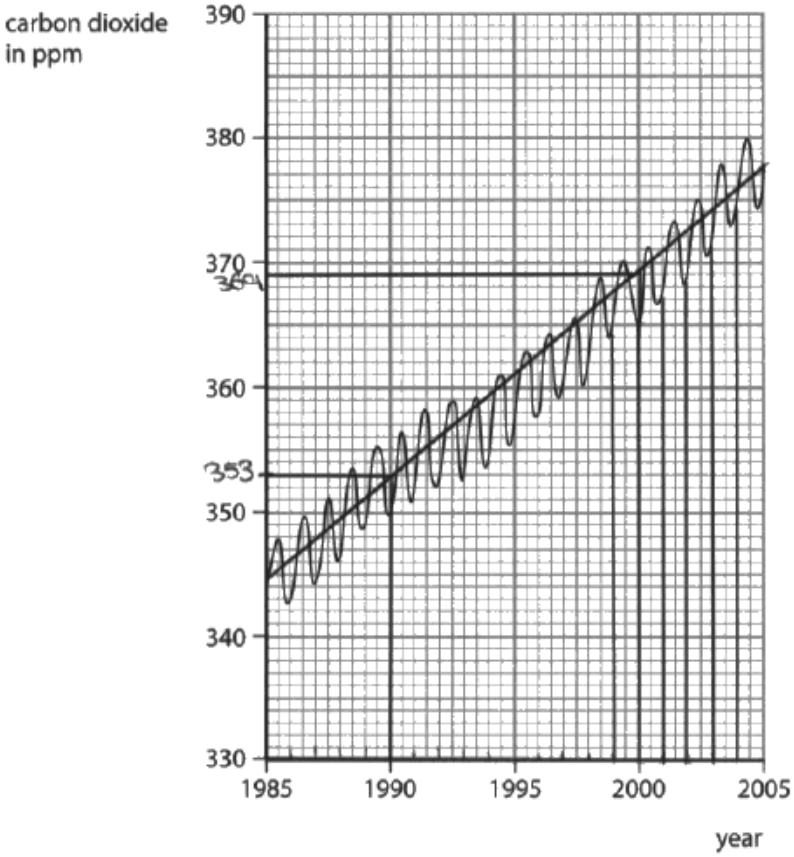


Figure 9

(i) Describe how the amount of carbon dioxide in the Earth's atmosphere varies within each year.

(1)

Each year, the amount of carbon dioxide starts low, rises significantly in the middle of the year then falls again at the end.

(ii) Describe the overall trend in the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

(1)

Over the amount of carbon dioxide in the Earths atmosphere since 1985 to 2005 has be rising, with rises and falls each year.

Results Plus: Examiner Comments

A clearly explained answer.

Figure 9 shows a graph of the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

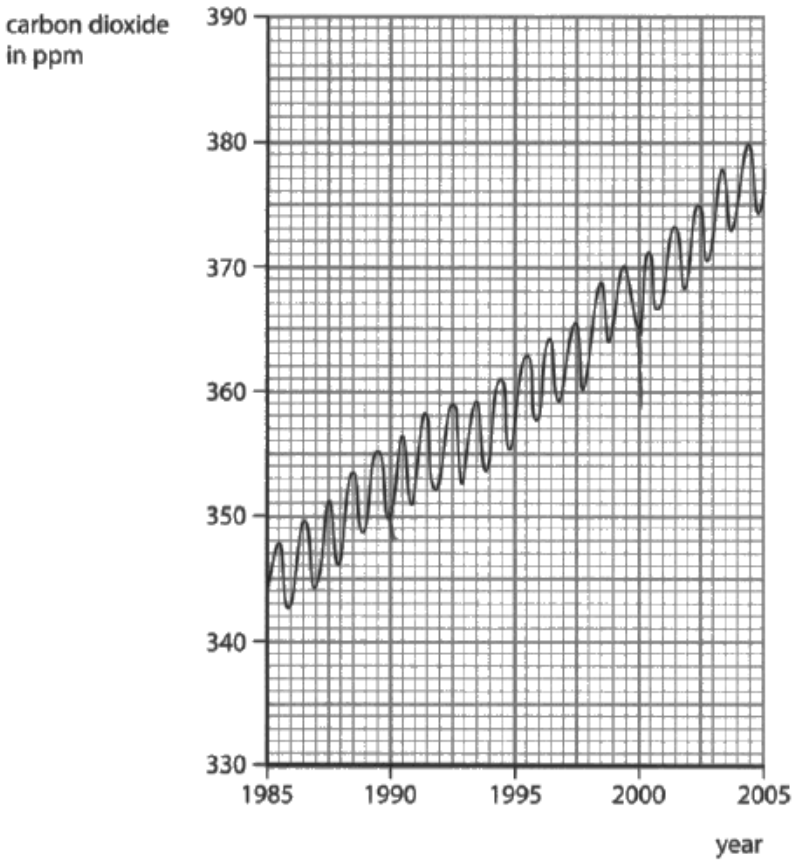


Figure 9

(i) Describe how the amount of carbon dioxide in the Earth's atmosphere varies within each year.

(1)

In each year, there tends to be a clear rise & fall in the amount of carbon dioxide in the atmosphere.

(ii) Describe the overall trend in the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

(1)

The amount is increasing.

Results Plus: Examiner Comments

This candidate has misread the scale. The amount rises and falls within one year.

Figure 9 shows a graph of the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

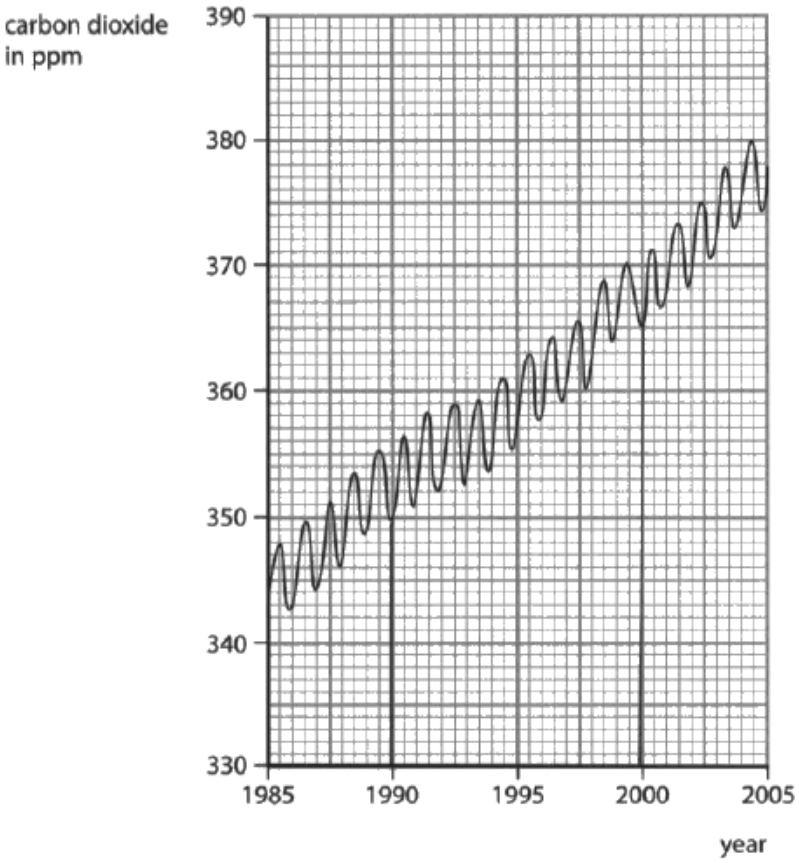


Figure 9

(i) Describe how the amount of carbon dioxide in the Earth's atmosphere varies within each year.

(1)

As the years have gone by, the amount of Carbon dioxide has increased year by year.

(ii) Describe the overall trend in the amount of carbon dioxide in the Earth's atmosphere from 1985 to 2005.

(1)

From 1985, the amount of CO_2 was around 340 - 350, but in 2005 it was around 370 - 380 ppm.

Results Plus: Examiner Comments

In part (i) the overall trend has been given. In part (ii), values have been quoted but the trend has not been stated.

Q42. No Examiner's Report available for this question

Q43. No Examiner's Report available for this question

Q44.

(i)

Many candidates only scored one mark as they just explained the meaning of 'unsaturated' and did not include the meaning of hydrocarbon in their answer.

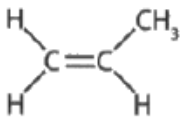
As a result the typical answer only stated it was a compound or a molecule with a double bond.

Although some candidates attempted to explain 'unsaturated' in terms of the presence of a double bond, this mark was not awarded where it was stated that a double bond existed between carbon and hydrogen or between 'carbon molecules'.

Many candidates also wrote about the reaction between bromine water and an unsaturated compound, but that could not score here. Some mentioned 'spare bonds' instead of double bonds so did not score the mark. Examiners reported seeing fewer 'mixtures' or 'molecules' of hydrogen and carbon this year.

Propene

2 The structure of a molecule of propene is



(a) Propene is an unsaturated hydrocarbon.

(i) Explain what is meant by **unsaturated hydrocarbon**.

(3)

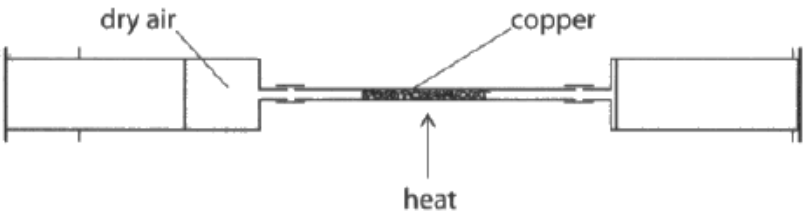
An unsaturated hydrocarbon is a molecule made only of hydrogen and carbon and has a double bond.

Results Plus: Examiner Comments

An excellent answer and one that was not seen that often. Many candidates did not explain both words in the term 'unsaturated hydrocarbon'; most focussed their answers on 'unsaturated'.

(b) In an experiment, dry air is passed backwards and forwards over hot, excess copper in the apparatus shown.

The oxygen in the air reacts with the hot copper to form copper oxide, CuO.



(i) Write the balanced equation for the reaction of copper with oxygen.

(3)

$2Cu + O_2 \rightarrow 2CuO$

Cu x 2 ✓ Cu x 2 ✓

O x 2 ✓ O x 2 ✓

Results Plus: Examiner Comments

Like the majority of the candidates, this answer just focussed on 'unsaturated' and forgot about the 'hydrocarbon' part.

Results Plus: Examiner Tip

Avoid using the term 'spare' as in 'spare bond' or as here, 'spare atoms', as it will not gain credit. In this type of question, make sure you answer all that is asked.

(iii)

There were a variety of colours for bromine water and most who described a colour opted for orange.

Several candidates did not include the initial colour of bromine within their answer.

The perennial problem of the term 'clear' to describe a colourless liquid still persists, but not as frequently as in the past. Those who were unsure gave the non-scoring answer of 'the bromine water changes colour'.

Only an extremely small number of candidates muddled the test and either reversed it going from colourless to orange or stated it stayed orange and some made reference to the mixture fizzing and bubbling and going cloudy. Despite all this, many candidates scored both marks.

(iii) Describe what is seen when a sample of propene is shaken with bromine water.

(2)

Bromine water it self has an orange colour, when propene which is an alkene is shaked with bromine water, it turns the bromine water transparent.

Results Plus: Examiner Comments

The colour of bromine water here scored a mark, but the change to 'transparent' was ignored, so scored only the one mark.

(iii) Describe what is seen when a sample of propene is shaken with bromine water.

(2)

The bromine water decolourises (turns from a brown-yellow colour to clear) as propene is an alkene, so it has a double-covalent bond meaning that bromine atoms can bond with it, forming a new compound which is clear leaving water (if an excess) is clear.

Results Plus: Examiner Comments

The candidates gave an acceptable colour for bromine water, but then described the change in colour as 'decolourised' which was acceptable. Note the use of 'clear' was ignored.

Results Plus: Examiner Tip

Solutions could be colourless, pink, blue or even yellow, and they would all be 'clear' - that is, you can see through them. A solution or liquid that has no colour is described as being 'colourless' - 'clear' is not acceptable as a description here.

Q45.

(i)

Candidates performed well in this question, with the vast majority being able to state a use for kerosene and a use of diesel to gain both marks.

Crude oil is separated into several fractions by fractional distillation.
Two of these fractions are kerosene and diesel oil.

(i) State a use for each of these fractions.

(2)

kerosene used for fuel in planes

diesel oil for fuel in large trucks

Results Plus: Examiner Comments

A good example that gained both marks.

kerosene fuel for large transport systems (planes, trains)

diesel oil fuel for cars power stations

Results Plus: Examiner Comments

Where candidates did not score, it was often where they gave a list of uses that included incorrect answers that contradicted correct answers, as in this case. If the candidates had just stated planes, then a mark could have been awarded, however they then also gave an answer of trains and therefore a mark could not be awarded. Power station did not score for a use for diesel so no marks were scored here.

Results Plus: Examiner Tip

When asked to give 'a' or one use, do not give a list, as a contradictory answer will rule out the correct answer.

kerosene Petrol for aircraft

diesel oil fuel for cars and trains

Results Plus: Examiner Comments

A common error was to use the term petrol for fuel, which therefore made a nonsensical answer. As in this example where the candidate states that kerosene is petrol for aircraft.

(ii)

Again, candidates answered this question well with the majority being able to correctly compare a property of kerosene with that of diesel oil.

(ii) Figure 1 shows where the fractions kerosene and diesel oil are produced in the fractionating column.

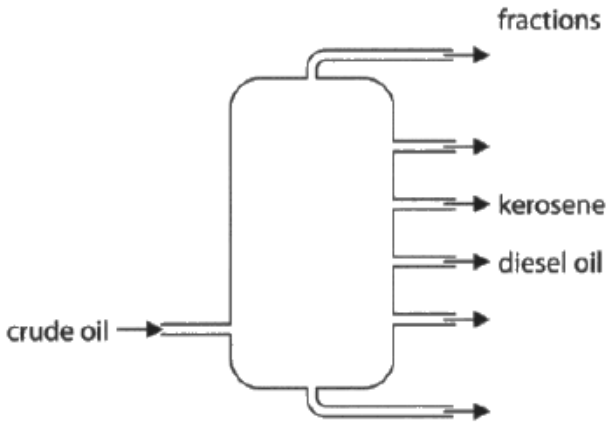


Figure 1

Kerosene is obtained higher up the column than diesel oil.
Kerosene and diesel oil fractions have slightly different properties.

Choose a property.
State how this property for kerosene compares with the property for diesel oil.

(1)

property Viscosity

comparison Diesel is more viscous than kerosene.

Results Plus: Examiner Comments

The most common correct answer seen was that the melting point of kerosene was lower than that of diesel or that the viscosity of kerosene was lower.

Choose a property.
State how this property for kerosene compares with the property for diesel oil.

(1)

property Length of carbon chain

comparison kerosene has a shorter chain length than diesel oil

Results Plus: Examiner Comments

Where candidates did not score the mark it was often as they had the comparison the wrong way around or that they gave an answer that referred to the length of the carbon change which was ignored.

Q46.

(i)

This question was generally very well answered on the whole with most responses gaining the 2 marks available.

Most candidates were able recall a correct the use of kerosene, usually for aircraft, a few suggested for cooking and lamps. The use of diesel oil for cars was most often mentioned, although lorries, trucks, trains and large vehicles were also seen frequently.

Some candidates confused kerosene with bitumen while others just wrote about it being used 'to start fires' or the very general 'for machines'.

The most commonly seen error occurred when candidates described diesel oil as 'petrol for cars'.

(ii)

This question was poorly answered on the whole with most responses not scoring the 1 mark available.

It was evident from the majority of responses that candidates simply did not understand what they were being asked to do. Many simply did not understand what is meant by the word property. Few candidates used the two lines of the question as intended, often repeating the ideas, e.g. many wrote '(property) it is flammable' followed by '(comparison) kerosene is more flammable'.

Where properties were discussed, the most common were boiling point and viscosity, the latter usually being in terms of thickness or runniness. Many, unfortunately, thought that the higher up the fractionating tower, the higher the boiling point. Surprisingly, many seemed to think that this was a repeat of the previous item and answered in terms of uses of the kerosene and diesel oil.

(ii) Figure 13 shows where the fractions kerosene and diesel oil are produced in the fractionating column.

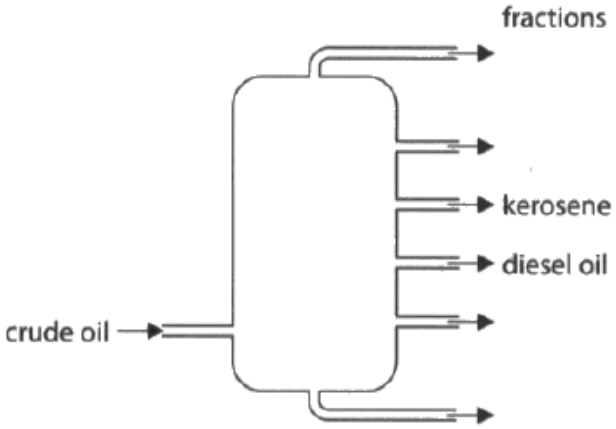


Figure 13

Kerosene is obtained higher up the column than diesel oil.
Kerosene and diesel oil fractions have slightly different properties.

Choose a property.
State how this property for kerosene compares with the property for diesel oil.

(1)

property viscosity

comparison kerosene is less viscous than diesel

Results Plus: Examiner Comments

A typical example of a commonly seen correct response, scoring 1 mark.

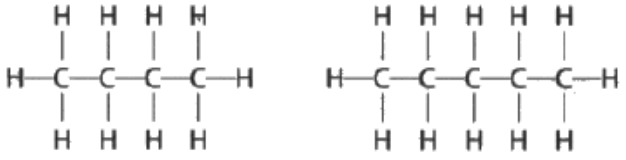
A correct property has been stated (which alone did not score a mark). There is a correct comparison, namely that kerosene is less viscous than diesel.

Q47.

(i)

Many candidates could score at least 1 mark on this question on homologous series for recognising that butane and pentane are in the alkane homologous series and then stated this or the general formula for an alkane to gain the second mark point. Fewer, however, could explain why they are neighbouring members to gain the second mark. Some candidates lost marks as they were not careful with their use of terms and used the term same chemical or same molecular formula rather than same general formula and so therefore did not gain the mark.

Figure 2 shows the formulae of a molecule of butane and of a molecule of pentane.
Butane and pentane are neighbouring members of the same homologous series.



butane

pentane

5 12

C_nH_{2n+2}

4 10

Figure 2

(i) Explain, using these formulae, why butane and pentane are neighbouring members of the same homologous series.

(2)

they have similar chemical properties and have the same general formula eg C_nH_{2n+2}. They are both hydrocarbons and they increase by CH_2

Results Plus: Examiner Comments

A good answer that gained both marks.

(i) Explain, using these formulae, why butane and pentane are neighbouring members of the same homologous series.

(2)

Butane has 4 carbons. Pentane has 5 carbons. Therefore they are neighbouring members. They are both alkanes and therefore both are part of the alkane homologous series

Results Plus: Examiner Comments

In some cases, candidates just re-stated the number of carbons in each of the molecules, rather than describing the difference. This was not deemed sufficient to gain the first marking point. A mark was still awarded for the fact that they are both alkanes.

(ii)

Calculation of the mass of carbon contained in 100g of butane was generally well answered by candidates with many gaining the full 3 marks available. Where candidates lost marks, it was

often as did not read the question carefully and did not give their answer to 3 significant figures.

(ii) Butane has the formula C_4H_{10}.

Calculate the mass of carbon in 100 g of butane.

Give your answer to three significant figures.

(relative atomic masses: H = 1.00, C = 12.0;
relative formula mass: C_4H_{10} = 58.0)

You must show your working.

Ma
Mo RAM

(3)

$C_4 = 12 \times 4 = 48$
$H_{10} = 1 \times 10 = 10$
$48 + 10 = 58$

$100 \div 58 = 1.724$
$1.724 \times 48 = 82.75862$

mass of carbon = 82.8 g

Results Plus: Examiner Comments

The correct answer given to 3 significant figures gained 3 marks.

You must show your working.

$\frac{100}{58} = 1.7$

$12.0 \times 1.7 = 20.7$

(3)

mass of carbon = 20.7 g

Results Plus: Examiner Comments

Another reason that candidates did not score full credit was where candidates had multiplied by 12 rather than 48. Where these answers were written correctly to 3 significant figures, these candidates were still able to score 2 of the 3 marks

Results Plus: Examiner Tip

It is important that you show your working on calculations so you can still obtain credit for method marks in the working.

Q48.

Candidates performed well in this question with many being able to fully explain two factors that cause the percentage of carbon dioxide in today's atmosphere to vary. Candidates that lost marks often did so as they were too vague with their answers, for example simply stating that trees take in carbon dioxide rather than specifying that it is the process of photosynthesis that takes places in trees that causes the carbon dioxide to be absorbed. Weak terms such as breathing in place of respiration were ignored.

(ii) The actual percentage of carbon dioxide in the Earth's atmosphere today varies.

Explain **two** factors that cause the percentage of carbon dioxide in today's atmosphere to vary.

(4)

factor 1 The amount of plants taking in carbon dioxide, if there are lots then the percentage will decrease.

factor 2 The amount of fires / fossil fuels being burnt. The more burning, the more carbon dioxide will be in our atmosphere.

Results Plus: Examiner Comments

This example gained three marks. Whilst there is no reference to photosynthesis, the plants taking in carbon dioxide did score the second of the marking points in the pair. Burning fossil fuels increasing carbon dioxide all gained the marking points.

Q49.

(i)

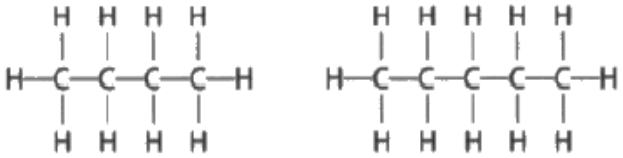
This question was poorly answered with only a third of responses scoring, generally just 1 mark of the 2 marks available.

In many responses, it was evident to examiners that candidates were unclear of what is meant by the term 'homologous series'. Candidates simply repeated information from the stem of the question, especially quoting the molecular formulae of the two alkanes, or simply stating the respective numbers of carbon and hydrogen atoms.

Most responses gaining 1 mark only scored by mentioning stating that pentane has one more carbon or that they differed by one carbon and two hydrogens.

Although the correct general formula was often seen, the term general formula was often confused with the term molecular formula. Many candidates simply gave a definition of a hydrocarbon.

Figure 14 shows the formulae of a molecule of butane and of a molecule of pentane. Butane and pentane are neighbouring members of the same homologous series.



butane pentane

Figure 14

(i) Explain, using these formulae, why butane and pentane are neighbouring members of the same homologous series.

(2)

They are both alkanes and they are hydrocarbons because they include only hydrogen and carbon.

Results Plus: Examiner Comments

This response scored 1 mark only.

The correct reference to both the compounds being alkanes scored the mark. The definition of a hydrocarbon is also given but is not relevant.

(ii)

This question was very poorly answered with the majority of responses not scoring any of the 3 marks available.

Most candidates struggled with what was required in this calculation and where to start. In those responses that scored 1 mark only, this was often for writing 4 x 12 = 48, with no further creditworthy material seen afterwards. Very few responses correctly rounded their answers to 3 significant figures.

(ii) Butane has the formula C_4H_{10}.

Calculate the mass of carbon in 100 g of butane.

Give your answer to three significant figures.

(relative atomic masses: H = 1.00, C = 12.0;
relative formula mass: C_4H_{10} = 58.0)

You must show your working.

(3)

$4 \times 12 = 48$.

$\frac{48}{58} \times 100 = 82.75862\%$

mass of carbon = 83 g

Results Plus: Examiner Comments

This response scored 2 marks.

The calculation is correctly set out. However unfortunately the final answer has been incorrectly rounded to 2 significant figures, rather than 3 significant figures as required by the question.

(iii)

This question was well answered on the whole, with most responses scoring at least 1 of the 2 marks available.

Most candidates were abe to construct a word equation with the correct products on the right hand side, especially having been given those products in the stem of the question.

The most commonly seen errors included: writing 'butane + air' rather than 'butane + oxygen'; mixing and matching words and formulae, giving CO_2 or H_2O as one of the products. In some responses, candidates attempted to give a formula equation, some getting the correct formulae, and occasionally some candidates managed to balance it correctly.

(iii) Butane burns completely in air to form carbon dioxide and water.

Write the word equation for this reaction.

(2)

Butane + air → Carbon dioxide + water

Results Plus: Examiner Comments

This response scored 1 mark only.

The response highlights a commonly seen error. The left hand side of the equation does not score since 'air' as opposed to 'oxygen' has been included.

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Results Plus: Examiner Tip

Remember in combustion reactions, 'air' is not a reactant and it is 'oxygen' that should be included. Air is not a compound – it is a mixture of gases.



Results Plus: Examiner Comments

This response was awarded 1 mark.

One of the reactants in this combustion reaction, namely oxygen, has been omitted, most probably because it the only one of the species not given in the stem of the question.

Results Plus: Examiner Tip

Remember – oxygen is always included as a reactant in combustion reactions.

Q50. No Examiner's Report available for this question

Mark Scheme

Q1.

Question Number	Answer	Mark
(i)	**D** C_nH_{2n+2} **The only correct answer is D** ***A*** *is not correct because this is the general formula of an alkene* ***B*** *is not correct because this is not the general formula of an alkane* ***C*** *is not correct because this is not the general formula of an alkane*	**(1)** AO 1 1

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation linking • (compounds) containing **hydrogen** and **carbon** (atoms) (1) • only (1) MP2 is dependent on MP1	reject carbon molecules and hydrogen molecules /mixtures of carbon and hydrogen ignore symbols C and H	**(2)** AO 1 1

Q2.

Question number	Answer	Additional guidance	Mark
	carbon dioxide	allow CO_2	**(1)**

Q3.

Question number	Answer	Additional guidance	Mark
	An answer that combines knowledge (1 mark) and understanding (2 marks) to provide a logical description: • radiation from the sun heats the surface of the Earth (1) • the gases absorb heat radiated from the Earth (1) • heat is released back to the Earth (1)		**(2)**

Q4.

Question number	Answer	Additional guidance	Mark
	An explanation that combines identification - understanding (1 mark) and reasoning/ justification - understanding (1 mark) • photosynthesis occurs (1) • so more / increasing amount of oxygen (1)	 allow plants (take in carbon dioxide and) release oxygen ignore reference to breathing reject respiration ignore produce oxygen reference to increasing required /owtte	**(2)**

Q5.

	Answer	Acceptable answers	Mark
	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)

Q6.

	Answer	Acceptable answers	Mark
	An explanation linking the following • (compound of) carbon and hydrogen (1) • only (1)	Ignore C, H Do not allow mixture of carbon and hydrogen 2nd mark dependant on 1st	**(2)**

Q7.

Question number	Answer	Mark
	B gases, petrol, diesel oil This is the only correct answer. **A** is incorrect because only diesel oil has a relative demand greater than the relative amount obtained **C** is incorrect only gases and petrol have a relative demand greater than the relative amount obtained **D** is incorrect only petrol and diesel oil have a relative demand greater than the relative amount obtained	**(1)**

Q8.

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**

Q9.

Question number	Answer	Mark
	B Crude oil is a mixture of hydrocarbons is the only correct answer Answer **A**, **C** and **D** are factually incorrect	**(1)**

Q10.

Question number	Answer	Mark
	C	**(1)**

Q11.

Question number	Answer	Mark
	C photosynthesis is the only correct answer **A** and **B** are processes that required oxygen **D** is a process that does not involve oxygen	**1**

Q12.

Question number	Answer	Mark
	D	**(1)**

Q13.

Question number	Answer	Mark
	B a glowing splint will relight when placed in the gas is the only correct answer **A** describes the test for carbon dioxide **C** describes the test for hydrogen **D** describes the test for an alkaline gas such as ammonia	**(1)**

Q14.

Question number	Answer	Mark
(i)	**A** argon This is the only correct answer. **B** is incorrect because butane is not found in the air **C** is incorrect because chlorine is not found in the air **D** is incorrect because hydrogen is only found in the air in extremely small amounts	**(1)**

Question number	Answer	Mark
(ii)	**C** 21 This is the only correct answer. **A**, **B** and **D** are incorrect	**(1)**

Q15.

Question number	Answer	Mark
	D nitrogen, oxygen, argon is the only correct answer **A** is not correct because nitrogen is the most common gas **B** is not correct because hydrogen is not the third most common gas **C** is not correct because nitrogen is the most common gas	**(1)**

Q16.

Question number	Answer	Mark
	B Crude oil is a mixture of hydrocarbons is the only correct answer Answer **A**, **C** and **D** are factually incorrect	**(1)**

Q17.

Question Number	Answer	Additional guidance	Mark
(i)	final answer of 20 (%) with or without working (2) volume gas used = 50-40 (1) (= 10 (cm^3)) percentage = (50-40)/50 x 100 (1) = 20 (%)	allow ecf throughout allow 40-50 (1) (= -10cm^3) allow 40/50 x 100 = 80% (1) then 100 – 80 = 20% (1) if no other marks awarded allow 10/50 = 0.2 (1)	**(2)** AO 2 2

Question Number	Answer	Mark
(ii)	**C** the gas has expanded when it is hot **The only correct answer is C** ***A*** *is not correct because this is not true* ***B*** *is not correct because this is not relevant* ***D*** *is not correct because this is not true*	**(2)** AO 2 2

Q18.

	Answer	Acceptable answers	Mark
	$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$ • reactant formulae (1) • product formulae (1) • balancing of correct formulae (1)	accept multiples reject incorrect use of cases and non-subscripts	(3)

Q19.

	Answer	Acceptable answers	Mark
	C heat energy		**(1)**

Q20.

Question number	Answer	Additional guidance	Mark
(i)	bitumen	reject other fractions	(1)

Question number	Answer	Additional guidance	Mark
(ii)	gases	reject other fractions	(1)

Q21.

Question Number	Answer	Additional guidance	Mark
	(splint) (re)lights	allow alternatives indicating that splint burns e.g. flame allow glows more brightly reject squeaky pop	(1) AO 1 1

Q22.

Question Number	Answer	Acceptable answers	Mark
(i)	ethanol	C_2H_5OH / C_2H_6O / CH_3CH_2OH Do not allow superscript numbers in formula or non-capitals	(1)

Question Number	Answer	Acceptable answers	Mark
(ii)	ethene	C_2H_4 / CH_2CH_2 Do not allow superscript numbers in formula or non-capitals	(1)

Question Number	Answer	Acceptable answers	Mark
(iii)	ethene	C_2H_4 / CH_2CH_2 Do not allow superscript numbers in formula or non-capitals	(1)

Q23.

Question Number	Answer	Additional guidance	Mark
	An explanation including • plants (grow/ evolve etc.) (1) • **photosynthesis** occurs (1)	allow trees or any other reference to plants reject respiration/breathing for MP2 ignore all other information	**(2)** AO 1 1

Q24.

Question Number	Answer	Additional guidance	Mark
	An explanation including • boiling points increase as the number of carbon atoms (per molecule) increases (1) • because {stronger forces between molecules / (increased / more) intermolecular forces (1)	 ignore {positive correlation alone / proportional} allow 'longer chain' for more C atoms reject any reference to 'bonds' for MP2 allow van der Waals' forces/London forces	**(2)** AO 3 1a AO 3 1b

Q25.

	Answer	Acceptable answers	Mark
(i)	An explanation linking **two** of the following • copper reacts/ combines with/ added to (1) • **oxygen** (reacts/ removed/ decreased) (1)	Allow **copper** absorbs/ takes in **oxygen** for 1 Copper oxide formed / copper oxidised allow 2	**(2)**
(ii)	C 21		**(1)**

Q26.

Question number	Answer	Mark
	$C_5H_{11}OH$	**(1)**

Q27.

	Answer	Acceptable answers	Mark
	B C_4H_8		(1)

Q28.

Question Number	Answer	Additional guidance	Mark
	An explanation linking • oxygen increased (in atmosphere) (1) • (oxygen) {reacts / combines} with iron (sulphide) / iron is oxidised (1)	allow oxygen appears (1) photosynthesis produces oxygen (1) ignore oxygen reacts with rocks / sulfur in rocks replaced by oxygen / oxygen enters rocks / iron ore	**(2)** AO 2 1

Q29.

Question Number	Answer	Additional guidance	Mark
	An explanation linking • (Earth) cooled / temperature decreased (1) • (water vapour / steam) condensed / oceans formed (1)	allow temperature of atmosphere/ Earth decreased allow it rained (and formed oceans) allow lakes/seas	**(2)** AO 1 1

Q30.

	Answer	Acceptable answers	Mark
	fractional distillation		**(1)**

Q31.

Question Number	Answer	Mark
	C are in the same homologous series **The only correct answer is C** ***A*** *is not correct because they have different formulae* ***B*** *is not correct because they have different bpts* ***D*** *is not correct because they all form carbon dioxide and water*	**(1)** AO 2 1

Q32.

Question number	Answer	Mark
	fractional distillation / fractionation (1)	**(1)** **AO1**

Q33.

Question number	Answer	Mark
	fractional distillation / fractionation (1)	**(1)** **AO1**

Q34.

	Answer	Acceptable answers	Mark
	A description to include • glowing splint (1) M1 • relights (1) M2	 smouldering splint reject unlit splint ignore blown out splint M2 dependent on M1 but lighted splint burns brighter (2)	(2)

Q35.

Question number	Answer	Additional guidance	Mark
(i)	An answer that combines the following points of understanding to provide a logical description: • glowing splint (1) • relights (1)	 second mark is dependant on first	(2)

Question number	Answer	Additional guidance	Mark
(ii)	49.7 - 42.5 (1) = 7.2 7.2/49.7 x 100 (1) = 14.486 14.5 (1) (to 3 sig figs)		(3)

Q36.

Question Number	Answer	Acceptable answers	Mark
(a)	C oxygen other gases nitrogen		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(i)	A description to include • Photosynthesis /absorb carbon dioxide and releases oxygen (1) • (green) plants (1)	reject respiration for photosynthesis ignore breathe in carbon dioxide ignore breathe out oxygen	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)(ii)	A description to include second marking is dependent on the first • a glowing splint (1) • relights (1)	smouldering splint reject a blown out splint lit splint glows brighter (2)	**(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	to ensure all the oxygen is removed/to ensure the oxygen is completely removed	ignore ensure all the air is removed	**(1)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	An explanation linking • measure the volume of gas in the syringe at the end of experiment (1) • subtract from {100 cm^3 / original volume} to give volume of oxygen (1)	e.g. 100-79 (= 21 cm^3)	**(2)**

Q37.

	Answer	Acceptable answers	Mark
(a)(i)	An explanation linking **two** of the following • copper reacts/ combines with/ added to (1) • **oxygen** (reacts/ removed/ decreased) (1)	Allow **copper** absorbs/ takes in **oxygen** for 1 Copper oxide formed / copper oxidised allow 2	**(2)**
(a)(ii)	C 21		**(1)**
(b)(i)	B carbon dioxide		**(1)**
(b)(ii)	An explanation linking **three** of the following • {the Earth / atmosphere} cooled (1) • water vapour condensed • {liquid/ water/ rain} formed (1) • produced {sea/oceans}(1)		**(3)**

Q38.

	Answer	Acceptable answers	Mark
(i)	B carbon dioxide		**(1)**
(ii)	An explanation linking **three** of the following • {the Earth / atmosphere} cooled (1) • water vapour condensed • {liquid/ water/ rain} formed (1) • produced {sea/oceans}(1)		**(3)**

Q39.

	Answer	Acceptable answers	Mark
	An explanation including any two from	general formula is C_nH_{2n}+1OH (2)	**(2)**

	• formulae differ by CH_2 • same general formula • all have {OH/hydroxyl group}	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	

Q40.

Question number	Indicative content	Mark
	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • plenty of air means complete combustion of methane • harmful products produced by incomplete combustion • complete combustion produces only carbon dioxide and water • incomplete combustion produces carbon/soot • soot may cause blocked jets in the boiler • soot causes health problems • incomplete combustion produces carbon monoxide • carbon monoxide is a colourless gas • therefore danger because it cannot be seen • carbon monoxide is odourless • therefore danger because it cannot be smelt • carbon monoxide is a toxic/poisonous gas • it combines with haemoglobin • and prevents blood carrying oxygen	**(6)**

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

Q41.

Question Number	Answer	Additional guidance	Mark
(i)	suitable description of variation (within a year) (1)	allow increases and decreases / goes up and down [or vice-versa] allow fluctuates reject a pattern described for a timescale other than a year e.g. goes up one year and down the next	**(1)** AO 3 2a

Question Number	Answer	Additional guidance	Mark
(ii)	increases (over time) (1)	ignore from (number) to (number) allow positive correlation, trend etc.	**(1)** AO 3 2a

Question Number	Answer	Additional guidance	Mark
(iii)	15 with no working or correct working scores 2 figures read from graph 364-366 and 349-351 (1) subtraction of numbers from above (1)	 negative answer does not score 2nd mark	**(2)** AO 2 1

Q42.

Question number	Answer	Mark
(i)	propane + oxygen → carbon dioxide + water • LHS (1) • RHS (1)	(2)

Question number	Answer	Mark
(ii)	to {release/produce} {heat/energy}	(1)

Q43.

Question number	Answer	Mark
	36 °C (±2)	(1)

Q44.

Question Number	Answer	Acceptable answers	Mark
(i)	An explanation linking (a compound containing) • hydrogen and carbon (1) • (hydrogen and carbon) only (1) • contains double / multiple bond (between carbon atoms) (1)	 ignore H and C reject {ions/molecule} of carbon and hydrogen reject mixture reject oxygen ignore 'spare bonds' allow carbon atoms not joined to the maximum number of other atoms	**(3)**

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

Question Number	Answer	Acceptable answers	Mark
(iii)	A description to include • (bromine water is) orange (1) • decolourises / turns colourless (1)	 allow brown / yellow or combinations eg orange-yellow ignore red (alone) ignore clear / changes colour / discolour	**(2)**

Q45.

Question number	Answer	Additional guidance	Mark
(i)	kerosene: (fuel for) aircraft / jets / lamps / cooking / heaters / fire lighters / rocket fuel (1) diesel oil: (fuel for) cars / trains / trucks / lorries / vehicles / tractors / generators / boats (1)	Ignore generic uses such as factories / machines / engines / fuel reject trains, boats allow ships	(2)
(ii)	any one of • boiling point: low(er) • melting point: low(er) • ignition: easy / easier • viscosity: low(er)/ {runny / runnier} / thin(ner) • flammability: high(er) • volatility: high(er) • density: low(er)	Note : unless otherwise stated, comparison is kerosene with diesel oil ignore lower number of carbons and hydrogens: lower length of chain: lower /shorter molecule / colour allow sootiness: diesel has sootier flame accept reverse argument for diesel oil note: property may be implicit in comparison	(1)

Q46.

Question number	Answer	Additional guidance	Mark
(i)	kerosene: (fuel for) aircraft / jets / lamps / cooking / heaters / fire lighters / rocket fuel (1) diesel oil: (fuel for) cars / trains / trucks / lorries / vehicles / tractors / generators / boats (1)	Ignore generic uses such as factories / machines / engines / fuel reject trains, boats allow ships	(2)
(ii)	any one of • boiling point: low(er) • melting point: low(er) • ignition: easy / easier • viscosity: low(er) / {runny / runnier} / thin(ner) • flammability: high(er) • volatility: high(er) • density: low(er)	Note : unless otherwise stated, comparison is kerosene with diesel oil ignore lower number of carbons and hydrogens: lower length of chain: lower /shorter molecule / colour sootiness: diesel has sootier flame accept reverse argument for diesel oil note: property may be implicit in comparison	(1)

Q47.

Question number	Answer	Additional guidance	Mark
(i)	An explanation linking • they differ **by CH_2** / differ by **one** carbon atom / pentane has **one** more carbon (1) • they have the **same** general formula / C_nH_{2n+2} / both alkanes (1)	ignore: similar chemical properties, quoting the two molecular formulae, they are both saturated, both have single bonds (only) reject carbon or hydrogen molecules for MP1 ignore same pattern of formula / **similar** general formula reject **same** {chemical / molecular} formula	**(2)**
(ii)	82.8 with or without working scores 3 correct answer but incorrectly rounded or not to 3sf scores 2 4 x 12 (1) (= 48) OR 100 / 58 (= 1.724...) (1) 48 / 58 x 100 (1) (= 82.759) = 82.8 (g) (1)	allow ecf but calculation must use 12, 58, 100 if working rounded to 1dp and carried forward, allow full marks eg 1.72 x 48 = 82.56 (2) or 82.6 (3) 100 / 58 (1) (= 1.72414) = 1.72 (1) (to 3 sf) OR 100 / 58 (1) x 12 (= 20.68966) = 20.7 (1) (to 3 sf) OR 4 x 12 (1) x 100 (= 4800) = 4.80×10^3 (1) (to 3 sf)	**(3)**

Q48.

Question number	Answer	Mark
(i)	**D** 95 decreased is the only correct answer **A** is incorrect as the percentage of carbon dioxide was thought to be 95% **B** is incorrect as the percentage of carbon dioxide was thought to be 95% **C** is incorrect as the amount of carbon dioxide has decreased	**(1)**

Question number	Answer	Additional guidance	Mark
(ii)	An explanation to include any two linked pairs **combustion/ burning** of fossil fuels (1) {increases/ gives out} carbon dioxide (1) **respiration** (1) increases carbon dioxide (1) increases in sea temperature (1) release of (dissolved) carbon dioxide (1) **photosynthesis** (1) {absorbs/ takes in/ reduces} carbon dioxide (1) carbon dioxide (dissolves) into the sea (1) carbon dioxide decreases (1) volcanic emissions (1) releases carbon dioxide (1) deforestation means **less photosynthesis** (1) carbon dioxide increases (1) use of alternative energy/ electric cars (1) less carbon dioxide release (1)	each pair to be separately marked; MP2 dependent on MP1 allow named fossil fuel / carbon compound that is burnt e.g. wood ignore 'use of fossil fuels' / 'use of cars' but allow MP2 ignore 'breathing'/ 'population increase' but allow MP2 ignore 'plants/ trees' etc but allow MP2 ignore 'deforestation' alone but allow MP2	**(4)**

Q49.

Question number	Answer	Additional guidance	Mark
(i)	An explanation linking • they differ **by CH_2** / differ by **one** carbon atom / pentane has **one** more carbon (1) • they have the **same** general formula / C_nH_{2n+2} / both alkanes (1)	ignore: similar chemical properties, quoting the two molecular formulae, they are both saturated, both have single bonds (only) reject carbon or hydrogen molecules for MP1 ignore same pattern of formula / **similar** general formula reject same {chemical / molecular} formula	**(2)**
(ii)	82.8 with or without working scores 3 correct answer but incorrectly rounded or not to 3sf scores 2 4 x 12 (1) (= 48) OR $\frac{100}{58}$ (= 1.724...) (1) $\frac{48}{58}$ x 100 (1) (= 82.759) = 82.8 (g) (1)	allow ecf but calculation must use 12, 58, 100 if working rounded to 1dp and carried forward, allow full marks eg 1.72 x 48 = 82.56 (2) or 82.6 (3) allow $\frac{100}{58}$ (1) (= 1.72414) = 1.72 (1) (to 3 sf) OR $\frac{100}{58}$ (1) x 12 (= 20.68966) = 20.7 (1) (to 3 sf) OR 4 x 12 (1) x 100 (= 4800) $= 4.80 \times 10^3$ (1) (to 3 sf)	**(3)**

Question number	Answer	Additional guidance	Mark
(iii)	butane + oxygen → carbon dioxide + water (2) butane + oxygen → (1) → carbon dioxide + water (1)	allow $C_4H_{10} + 6.5\ O_2 \rightarrow 4CO_2 + 5H_2O$ (2) allow multiples correct formulae no balancing (1) allow hydrogen oxide for water allow reactants and products in either order ignore state symbols allow = for →	**(2)**

Q50.

Question Number	Answer	Mark
	D the viscosities increase **The only correct answer is D** ***A*** *is not correct because average number of carbon atoms increases* ***B*** *is not correct because ease of ignition decreases* ***C*** *is not correct because boiling points increase*	**(1)** AO 1 1