Questions matter

GCSE

Combined Science: Trilogy

8464/C/2F Combined Science: Trilogy Chemistry Paper 2F

Report on the exam

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Contents

The below table is interactive. You can press the control button click on the title of the question to go directly to that page.

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Overview

Commented [JB2]: This is the generic copy for the Foundatio tier paper. Only material that should be altered is that highlighte yellow. Delete if the report is for the Higher tier paper.

This paper is one of the six examined components for Combined Science: Trilogy. All of these papers follow a similar structure and test the same assessment objectives.

This paper has 70 marks available to students and is made up of six questions.

- Approximately 40% of marks assess AO1; 40% of marks assess AO2; and 20% of marks assess AO3.
- Approximately 60% of marks target Low demand and 40% of marks target Standard demand.

Questions 5 and 6 on this paper and questions 1 and 2 on the Higher Tier paper are common. These questions are identical and are targeted at standard demand.

Questions are set at two levels of demand for this paper:

- **Low demand** questions are designed to broadly target grades 1–3.
- **Standard demand** questions are designed to broadly target grades 4–5.

A student's final grade is based on their attainment across all six papers.

Summary of overall performance

Students generally found this paper accessible, especially questions 1 to 4. The more demanding questions, 5 and 6, saw an increase in the number of students not attempting a response with question 6 causing most difficulties.

In question **04.4**, the first extended response question on the paper, students found it difficult to use the correct comparative terminology needed to explain advantages of both wool and poly(propene) and were thus often limited to Level 1.

In the extended response question common with the Higher tier (question **06.2**) students were often able to state comparisons in data from a given table, however they found it more difficult to then explain these differences.

Many responses throughout the paper lacked the correct terminology and precision of language needed to answer the question effectively. For example, in question **06.4**, students needed to state 'fossil fuels' not just 'fuels'. Likewise, in question **03.6** referring to 'flooding' or 'wildfires' was insufficient for the mark. Comparative statements such as 'more flooding' or 'more wildfires' were needed.

Students found some recall questions difficult. Standard tests for the common gases, hydrogen and oxygen (**03.5** and **06.1,**) were often mixed up or not answered at all.

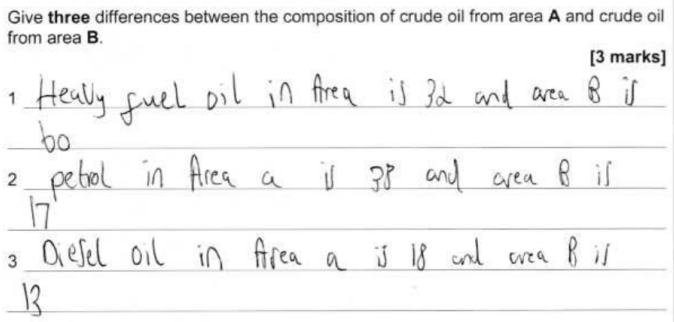
The calculation questions, **02.7** and **04.3**, were particularly well answered.

Question 1 (Low and Standard demand)

01.1 By selecting plankton, 70% of students answered correctly. The most common incorrect response was microbes.

01.2 Nearly 90% of students answered correctly, selecting hydrocarbons.

01.3 Statements had to be comparative, and many students answered this question well. Those who did not gain credit often just quoted figures from the table or used incorrect comparative words such as 'better' or 'worse'. A small number of students listed the difference between percentages but did not indicate which was greater/smaller, e.g. 'the difference between Area A and Area B for diesel is 5%'.


Give **three** differences between the composition of crude oil from area **A** and crude oil from area **B**.

[3 marks]

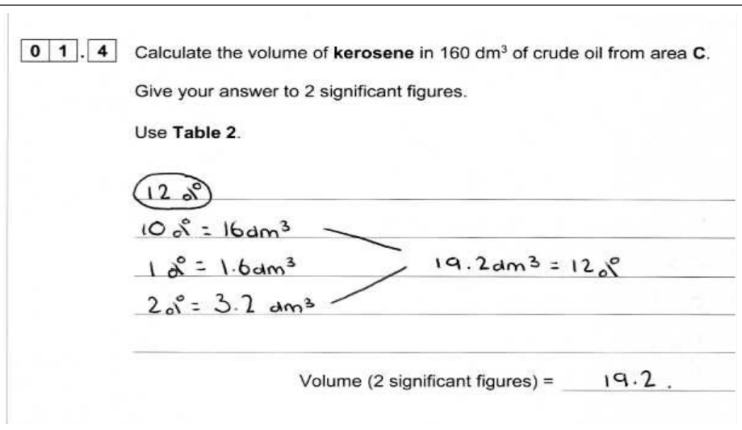
1 Heavy fuel oil in Area is 72 and area B is 60

2 petrol in Area a is 38 and area B is 17

3 Diesel oil in Area a is 18 and area B is 13

This student has simply quoted data from the table with no comparisons and therefore cannot be credited any marks. A minor change such as the addition of 'only' in appropriate places would have increased the potential mark (e.g. 'Petrol in area A is 38 and in area B is only 17' shows a correct difference).

01.4 The vast majority of students used the correct component, but many struggled to use the numbers correctly. The most common error was the failure to use 100 in their calculations.


0 1 . 4 Calculate the volume of **kerosene** in 160 dm^3 of crude oil from area **C**.

Give your answer to 2 significant figures.

Use **Table 2**.

12 %

10 % = 16 dm^3

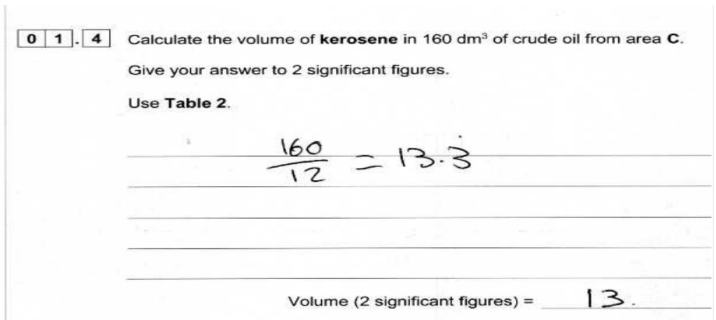
1 % = 1.6 dm^3

2 % = 3.2 dm^3

19.2 dm^3 = 12 %

Volume (2 significant figures) = 19.2

This student has used a correct method (possibly without a calculator) to calculate 12% of 160 but has not given their answer to 2 significant figures. Only 2 marks can be awarded.



This student has carried out a calculation using the correct fraction (12), but the calculation is incorrect. However, they have written their answer correctly to 2 significant figures and have been awarded the mark for converting their (incorrectly) calculated answer to 2 significant figures.

01.5 This question was well answered. The vast majority of students labelled their bars and plotted them correctly. Although many were drawn without a ruler, most still managed to keep the top of the bar within tolerance.
The most common mistake was to complete the scale incorrectly. Some used a non-linear scale at the higher levels, in particular.

Question 2 (Low and Standard demand)

02.1 Just under one third of responses were correct. Correct responses were roughly equally divided between 'balance' and 'scales'. A large number of students stated 'scale' (singular) which is not equivalent to 'scales' and this terminology error resulted in no mark being awarded. The most common incorrect equipment given was 'measuring cylinder'.

02.2 The vast majority of students were able to read the scale correctly as 42.

02.3 Half of all students chose the correct response of concentration of hydrochloric acid.

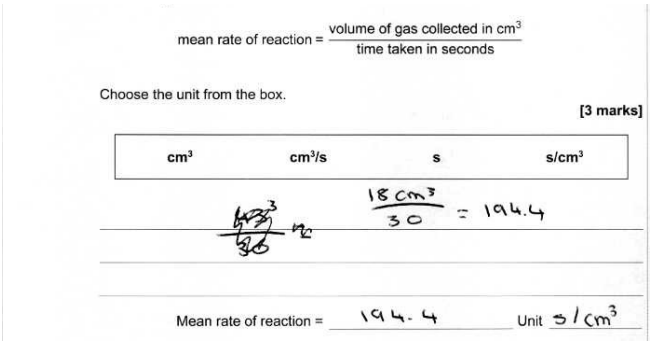
02.4 The majority of students failed to recognise that the reaction would start immediately and that some gas would inevitably escape from the conical flask. They therefore answered in terms of an absolute such as 'to stop gas escaping' or 'prevent the gas escaping' rather than expressing the fact that the insertion of the bung would 'minimise' or 'reduce' the volume of gas lost. Consequently, less than 10% of students gained this mark.

02.5 Only a third of students knew the chemical name for limewater is calcium hydroxide solution. The most common incorrect response was sodium chloride solution.

02.6 Many students found completing the table difficult. Units were often listed against each number in the table rather than in the headings, although this was given credit if the headings were correct and all the values added to the table had the unit alongside them. Several responses mixed up minutes and seconds and often omitted at least one time or volume. Overall, however

over three quarters of students still gained at least one mark and very few did not attempt the question.

02.7 This was well answered overall. Many students substituted the numbers into the given equation correctly although they sometimes struggled with the units.
A significant number unfortunately used 18^3 rather than 18 cm^3.



This student has substituted the numbers correctly into the given equation but has then carried out an incorrect calculation to arrive at their answer. They have used 18^3. Incorrect units have been chosen. Only the mark for substituting values into the equation can be credited.

02.8 Only about 20% of students could identify both reasons why increasing the concentration increases the rate of reaction. A large number of students included ' the particles move faster' in their response.

Question 3 (Low and Standard demand)

03.1 Well over half of all students recognised screenwash as a formulation.

03.2 Nearly three quarters of students were able to work out the number of atoms in one molecule of glycerol correctly as 14.

03.3 Most students could state that carbon monoxide is a toxic gas. The most common incorrect response was that carbon monoxide is a greenhouse gas.

03.4 Many students were able to correctly balance the equation. A significant number however incorrectly added an H or CH in front of the CO_2
There was clear evidence of many pupils working out the numbers of individual atoms to correctly balance the equation.

03.5 Many students remembered that hydrogen burns with a pop or squeaky pop however far fewer identified that a burning/lit splint was needed in order for that to happen, therefore neither mark could be awarded.

The most common incorrect response referred to using a glowing splint, confusing the test for oxygen and hydrogen.
When students correctly identified a burning/lit splint as the correct test, most also then went on to state the correct result and gained both marks.

03.6 Many students were able to correctly give one effect of global climate change, but fewer were able to correctly give two. The most common creditworthy responses were for identifying 'melting ice caps' and 'rising sea levels'.
Many responses referring to floods, storms and wildfires but could not gain credit as they were not comparative. The question was looking for the idea that there would be '*more* floods' for example, as floods happen without climate change.
Very few students answered in terms of a reduction in biodiversity or changes to migration patterns.

03.7 Many students correctly recognised that the anhydrous cobalt chloride would change colour or described the correct colour change. Incorrect responses often referred to the water or solution changing colour, or included additional observations, such as 'fizzing' or 'bubbles'.

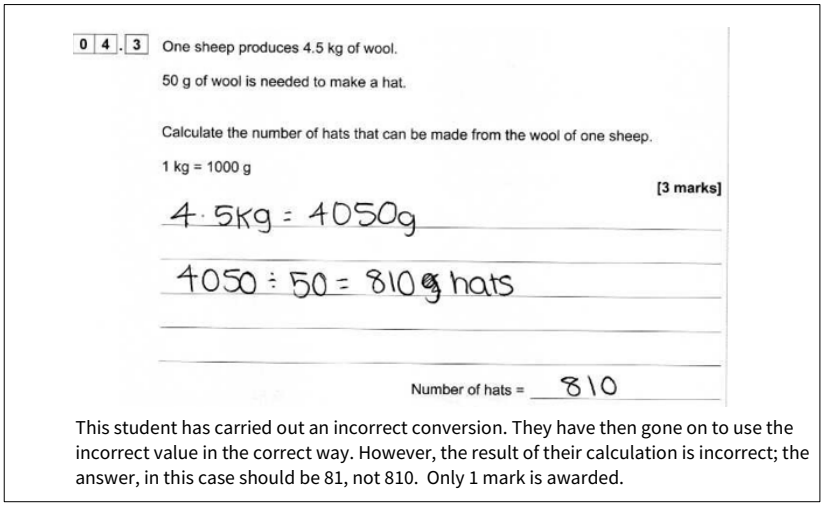
03.8 Many students correctly identified the type of reaction as being endothermic.

Question 4 (Low and Standard demand)

04.1 Almost 70% of students correctly selected 'water that is safe to drink'.

04.2 Nearly three quarters of students knew that the metal grids in water treatment were to 'remove large solid objects'.

04.3 This question was answered well. Most students used the first approach where they converted 45 kg to 4500 g and then divided that number by 50 to arrive at 90 hats.
Some students who did the conversion incorrectly, usually by multiplying by 100 instead of 1000, could still access 2 marks providing the calculation was carried out correctly.


0 4 . 3 One sheep produces 4.5 kg of wool.

50 g of wool is needed to make a hat.

Calculate the number of hats that can be made from the wool of one sheep.

1 kg = 1000 g

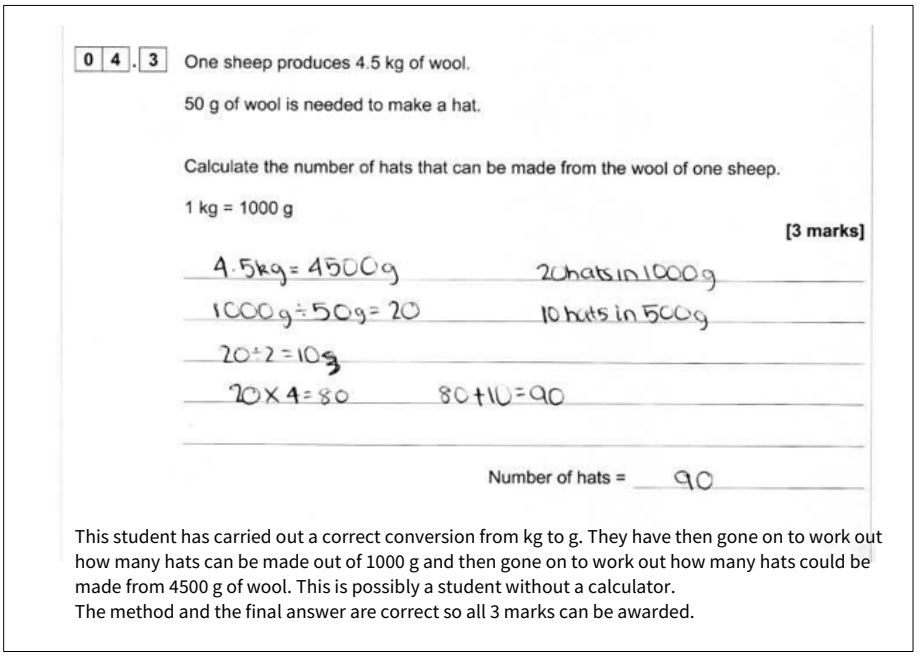
[3 marks]

4·5kg = 4050g

4050 ÷ 50 = 810 hats

Number of hats = 810

This student has carried out an incorrect conversion. They have then gone on to use the incorrect value in the correct way. However, the result of their calculation is incorrect; the answer, in this case should be 81, not 810. Only 1 mark is awarded.



0 4 . 3 One sheep produces 4.5 kg of wool.

50 g of wool is needed to make a hat.

Calculate the number of hats that can be made from the wool of one sheep.

1 kg = 1000 g

[3 marks]

4.5kg = 4500g
1000g ÷ 50g = 20
20 ÷ 2 = 10g
20 X 4 = 80
20 hats in 1000g
10 hats in 500g
80 + 10 = 90

Number of hats = 90

This student has carried out a correct conversion from kg to g. They have then gone on to work out how many hats can be made out of 1000 g and then gone on to work out how many hats could be made from 4500 g of wool. This is possibly a student without a calculator.
The method and the final answer are correct so all 3 marks can be awarded.

04.4 This was an 'extended response' style of question. Such questions are marked holistically. There are overall generic descriptions for the two levels of response at the top of the mark scheme, giving a hierarchy of response. Within each level there are 2 marks.

Level 1 could be accessed simply by offering any relevant comparison of either poly(propene) or wool, and over half of all students were able to do this. A large number of responses however merely offered a repetition of the information given and consequently could not gain credit.

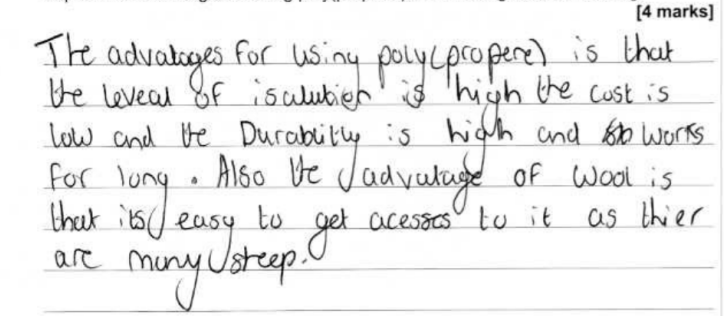
For Level 2 there needed to be an advantage of both poly(propene) and wool, with a linked explanation. The table offered more information on poly(propene) than wool and consequently very few students were able to access Level 2, as they focussed purely on poly(propene) and did not mention any advantages of using wool.

Many students abbreviated poly(propene) to either poly or propene. Poly was credited, however propene was not, which resulted in some responses which were otherwise good not accessing either Level.

There appeared to be a common misconception that we would 'run out of sheep' therefore making wool a non-renewable source. This limited students to Level 1.

Explain the advantages of using poly(propene) and of using wool for clothing.

[4 marks]



This student has not used any comparative terminology and has only copied information from the table. The question is looking for durability being 'higher' and therefore lasting 'longer' for example. No marks can be awarded.

04.5 This was well answered. All options were used by students, and over three quarters of all students gained both marks.

04.6 Less than a quarter of all students gained both marks in this question. A catalyst was the most common response, but it was often paired with sulfuric acid rather than with steam.

04.7 Half of all students were able to recall bromine water as the test for alkenes with all other answers being equally spread between the other 3 options.

Question 5 (Standard demand)

05.1 Students found it difficult to give the correct formula for dodecane. They frequently used wrong numbers or added additional letters in their response.
Where students did know the correct numbers of carbon and hydrogen atoms, the numbers were often not written as subscripts but the same size as the letters. The correct use of subscript and superscript is always a requirement in writing chemical formulae.
A significant minority of students wrote the general formula of the alkanes or simply substituted 12 for n without doing the necessary calculation for the number of hydrogen atoms.

05.2 Students found it difficult to explain why a water bath was used in preference to a Bunsen burner. Very few recognised that dodecane was flammable. Common incorrect responses included reference to speed of heating or the Bunsen / water bath being too hot. Only 10% of students recognised the idea of controlling the temperature.

05.3 A large number of students was able to state the volume of dodecane as either 40 cm^3, 100 cm^3, just cm^3 alone, or simply 'volume'. The most common response was using incorrect terminology, 'amount of dodecane', as amount is not equivalent to volume.

05.4 Students found the extrapolation of the line difficult. It was often horizontal or not extrapolated far enough. It was also often poorly drawn – many drew thick lines, double lines and feathery lines.
More of the students were able to read the value from their graph, although a common error was not being able to interpret the *y*-axis scale correctly.

05.5 Many students achieved one mark but very few achieved both marks. Students could often state the relationship between an increase in temperature and the time taken for the dodecane to flow, as they had the graph to help them. They struggled however to then link this to viscosity. The poor quality of written communication often resulted in students contradicting themselves in this question.

Question 6 (Standard demand)

06.1 The test for oxygen was not well known, there were a lot of blank scripts. Those who did attempt the question often referred to lit or burning splints, or sometimes both glowing and lit together. Also, a significant number of students referred to smouldering splints, or splints that had been previously lit as opposed to a glowing splint. This standard test needs to reference 'glowing'. A splint that has been previously lit and then blown out is not equivalent.
The most common incorrect response was students attempting to describe the test for hydrogen, with students referencing the squeaky pop test.

06.2 This was an 'extended response' style of question. Such questions are marked holistically. There are overall generic descriptions for the three levels of response at the top of the mark scheme, giving a hierarchy of response. Within each level there are 2 marks.

Simply quoting the data from the table was not creditworthy. Students who did not use comparative language, such as higher, lower, only or just, to compare percentages failed to gain credit. Quoted figures needed to be correct.

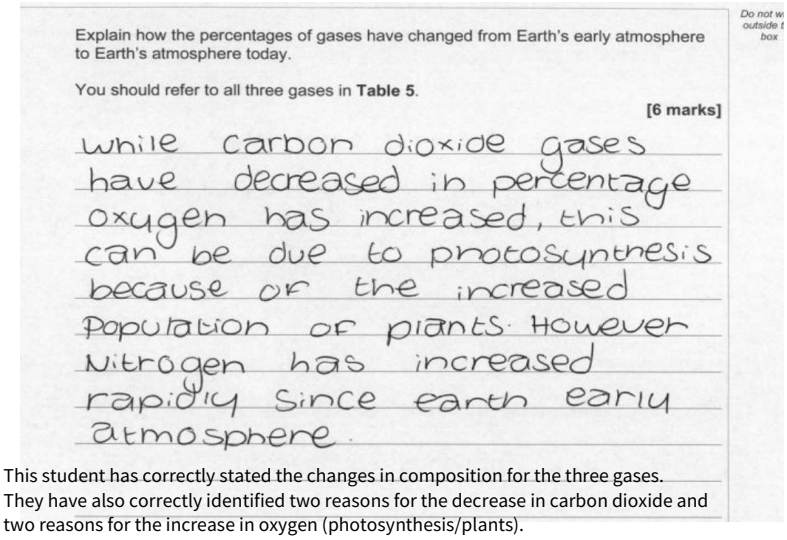
Simple comparative statements limited the student to Level 1.

To access Level 2, the student had to offer at least two comparisons of percentage composition along with some correctly linked explanations, although all three gases did not have to be addressed.

To access Level 3 students had to correctly identify the change in percentage composition for all three gases from the early atmosphere to the current day and explain at least two of them.

Many students simply copied out the given information and therefore failed to gain any marks. The majority of the responses were in Level 1, as students failed to explain how the changes that they had described, came about. Where they did, contradictions were made, and the credit was disqualified. Where credit was given, it was mainly as a result of a description of plants photosynthesising.

A significant number of students attempted to explain the changes in terms of climate change and the burning of fossil fuels, increased transport and pollution.



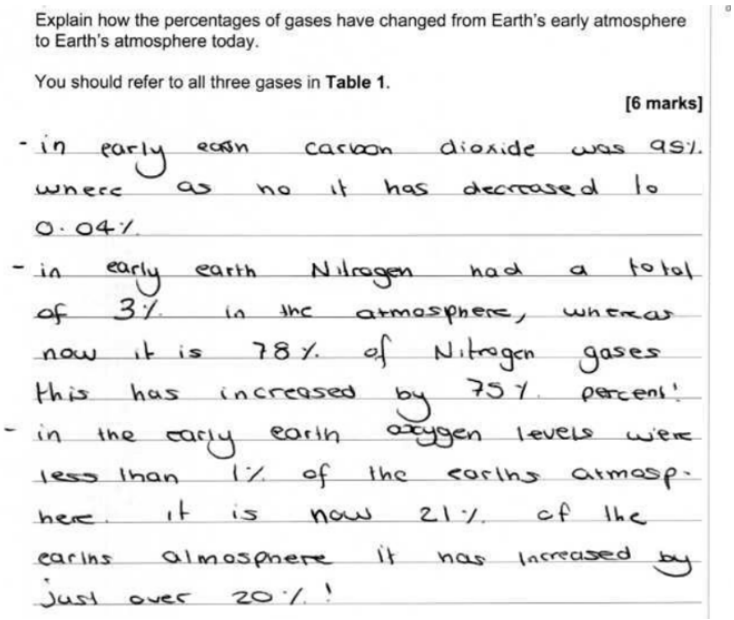
Explain how the percentages of gases have changed from Earth's early atmosphere to Earth's atmosphere today.

You should refer to all three gases in **Table 5**.

[6 marks]

while carbon dioxide gases have decreased in percentage oxygen has increased, this can be due to photosynthesis because of the increased population of plants. However Nitrogen has increased rapidly since earth early atmosphere.

This student has correctly stated the changes in composition for the three gases.
They have also correctly identified two reasons for the decrease in carbon dioxide and two reasons for the increase in oxygen (photosynthesis/plants).
This achieves the lower mark in Level 3.



Explain how the percentages of gases have changed from Earth's early atmosphere to Earth's atmosphere today.

You should refer to all three gases in **Table 1**.

[6 marks]

- in early earth carbon dioxide was 95% whereas as no it has decreased to 0.04%.
- in early earth Nitrogen had a total of 3% in the atmosphere, whereas now it is 78% of Nitrogen gases this has increased by 75% percent!
- in the early earth oxygen levels were less than 1% of the earths atmosphere. it is now 21% of the earths almosphere it has increased by just over 20%!

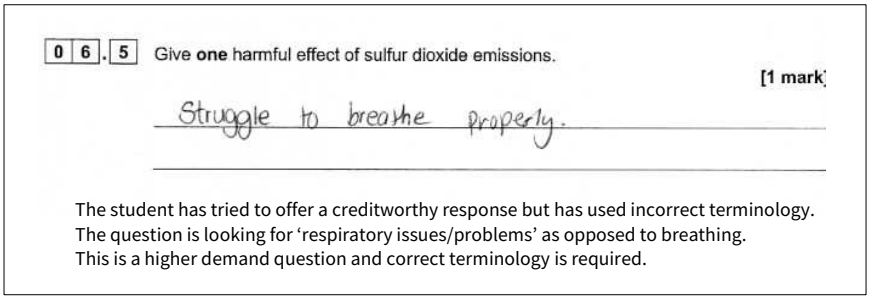
This student has correctly stated the changes in percentages for the three gases, but has not explained any reasons for this. This puts these responses at the upper mark in Level 1.

06.3 Many students appreciated that cattle farming leads to methane emissions but did not always refer to a reduction in this type of farming being required. There were many responses that answered as an absolute rather than a comparison which was insufficient for the mark. The question was looking for the idea that 'less' farming of livestock or 'less' use of fossil fuels would reduce methane for example, not stopping farming or stopping the use of fossil fuels altogether.

As they were told that methane is a greenhouse gas, some students confused the reduction of methane emissions with that of carbon dioxide and made suggestions such as planting more trees or burying methane underground.

06.4 How sulfur dioxide is released into the atmosphere was not well known, resulting in many blank scripts.
The most common insufficient response for marking point 1 was that 'fuels', rather than 'fossil fuels', were being burnt. Many students referred to the use of cars but did not link this to the burning of fossil fuels.
Students trying to explain the formation of sulfur dioxide often referred to the sulfur reacting with carbon dioxide rather than with oxygen. Very few students gained 2 marks.

06.5 Less than 20% of students could recall any problem associated with sulfur dioxide. There were many vague answers such as its toxic, causing difficulty in breathing, causing cancer, climate change, global warming, harms the environment and burns the skin. None of which gained any credit.
Acid rain was rarely mentioned and the correct terminology of 'respiratory' problems even less so.



The student has tried to offer a creditworthy response but has used incorrect terminology.
The question is looking for 'respiratory issues/problems' as opposed to breathing.
This is a higher demand question and correct terminology is required.

06.6 Students found this question difficult.
A common misconception appeared to be that sulfur itself is used as a fuel and we now do not use it as much.
Some students did attempt to link the reduction in sulfur dioxide to the use of electric vehicles. The common error here however was that they had to clearly imply 'increased' use of electric vehicles, and most did not.

Contact us

Our friendly team will be happy to support you between 8am and 5pm, Monday to Friday.

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