AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.9.1.4

How carbon dioxide decreased

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**7**
Available paper years	**2018–2024**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

5.9.1.4 How carbon dioxide decreased

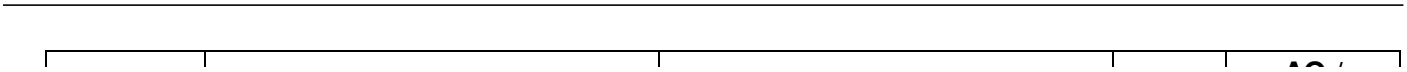
Answer 01 · Mark scheme June 2018 | 8464/C/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	16		1	AO2 5.1.1.5
01.2	8 e^- in 2nd shell 6 e^- in 3rd shell	allow ●, x ,e^- or any combination	1	AO2 5.1.1.7
01.3	oxygen → sulfur dioxide	allow = in place of → do **not** accept sulfur oxide ignore symbols	1	AO2 5.1.1.1 5.9.3.1
01.4	acid rain		1	AO1 5.9.3.2
01.5	yes / no any **two** from: • increases • constant • decreases correct date range for any one of the above • (increases) 1984–1987 • (constant) 1987–1990 • (decreases) 1990–2014	 allow goes up allow similar allow goes down allow levels off (at the end)	 2 1	 AO3 5.9.3.1 AO2 5.9.3.1
01.6	(69 + 6 =) 75 100 – 75 = 25(%)	an answer of 25(%) scores **2** marks allow a final percentage calculated from an incorrect value in the first step	 1 1	AO2 5.9.3.1
Total			**9**	

5.9.1.4 How carbon dioxide decreased

Answer 01 · Mark scheme

June 2018 | 8464/C/2F | Original Q1



5.9.1.4 How carbon dioxide decreased

Answer 02 · Mark scheme

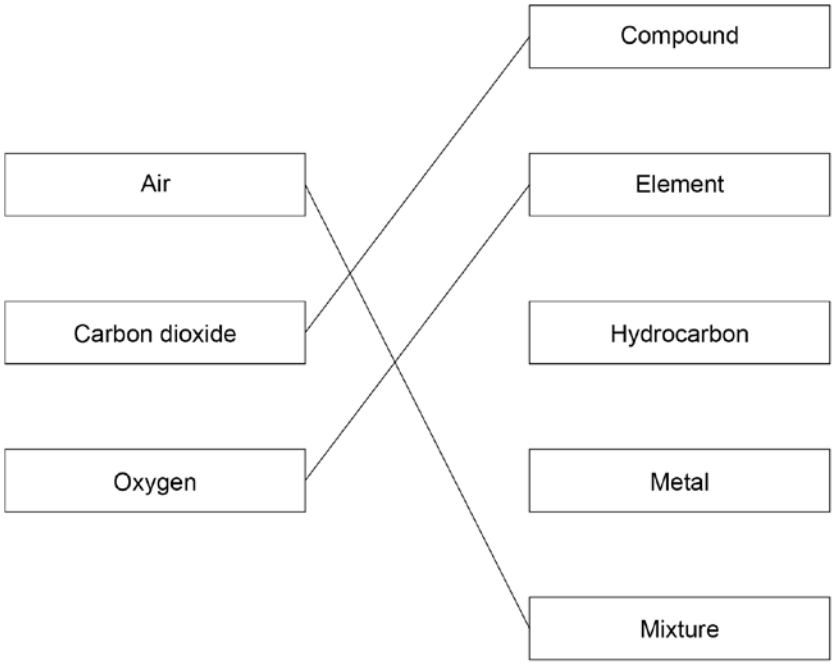
Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	methane		1	AO1 5.9.2.2
07.2	any **two** examples from: • rising sea levels • melting ice • agricultural problems • extremes of weather • loss of habitats	allow effects from the same bullet point ignore global warming ignore acid rain ignore global dimming do **not** accept reference to ozone	2	AO1 5.9.2.3
07.3	$\frac{6.0}{4.1} \times 0.0235$ = 0.0344(kg)	an answer of 0.0344(kg) scores **2** marks allow correct rounding allow calculator reading if no mark awarded: allow **1** mark for 34.4 or 0.344 allow **2** marks for 34.4 g	1 1	AO2 5.9.2.4
07.4	use less plastic **or** use recycled plastic	allow carbon capture ignore any reference to energy / fuels	1	AO1 5.9.2.4 5.10.2.2

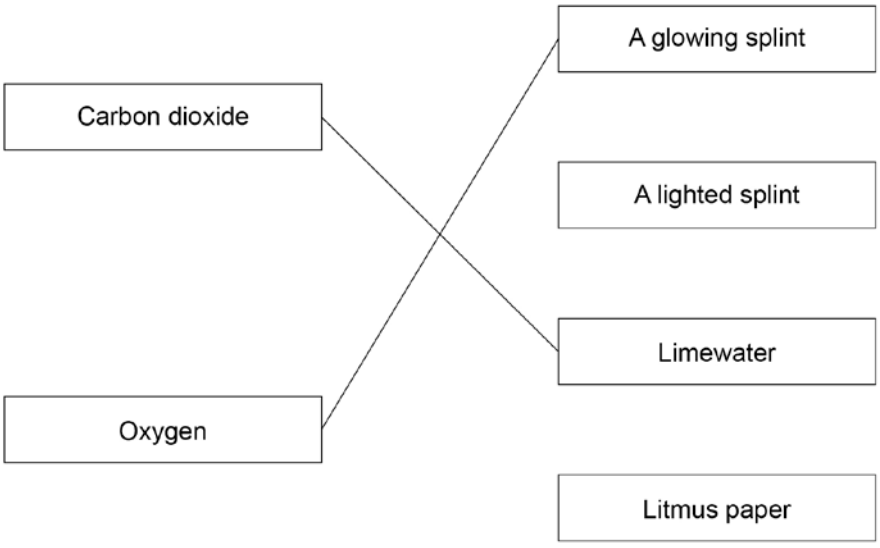
5.9.1.4 How carbon dioxide decreased

Question	Answers	Mark	AO / Spec. Ref.
07.5	**Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to give a clear account.	5–6	AO1 5.9.1.2 5.9.1.3 5.9.1.4
	Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logically linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content nitrogen increased • because volcanoes produced nitrogen • because (denitrifying) bacteria produced nitrogen • because ammonia was converted to nitrogen oxygen increased • because algae and plants produced oxygen • by photosynthesis carbon dioxide decreased • because algae and plants used carbon dioxide • by photosynthesis • because oceans formed and carbon dioxide dissolved in the water • because carbon dioxide formed carbonates, which precipitate as sediments or formed sedimentary limestone rocks • because algae / plants and animals formed fossil fuels / coal / crude oil / natural gas		
Total			**12**

5.9.1.4 How carbon dioxide decreased

Answer 03 · Mark scheme June 2019 | 8464/C/2F | Original Q1

01.1	 If more than one line is drawn from any one substance and not crossed out, no mark is given for that substance. The other marks can be awarded.	1 1 1	AO2.1 5.1.1.2 5.8.1.1 5.1.1.1

01.2	 If more than one line is drawn from any one gas and not crossed out, no mark is awarded for that gas. The other mark can be awarded.	1 1	AO1.1 5.8.2.2 5.8.2.3

01.3	dissolved in oceans photosynthesis		1 1	AO1 5.9.1.2 5.9.1.4

5.9.1.4 How carbon dioxide decreased

Answer 03 · Mark scheme

01.4	⇌	ignore any other words, formulae or symbols	1	AO1.1 5.6.2.1
01.5	endothermic (reaction)	spelling must be correct do **not** accept exothermic	1	AO1.1 5.6.2.2
01.6	rate (of reaction)	allow speed or velocity do **not** accept any other response	1	AO1 5.6.2.3
Total			**10**	

5.9.1.4 How carbon dioxide decreased

Answer 03 · Mark scheme

June 2019 | 8464/C/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.9.1.4 How carbon dioxide decreased

Answer 04 · Mark scheme November 2020 | 8464/C/2F | Original Q2

02.1	96 (%)	allow a value in the range 95–97 (%)	1	AO2 5.9.1.1 5.9.1.2 5.9.1.4
02.2	formation of sedimentary rocks photosynthesis		1 1	AO1 5.9.1.1 5.9.1.2 5.9.1.3 5.9.1.4 5.9.2.2
02.3	carbon footprint		1	AO1 5.9.2.4
02.4	3.3 (g) 2 (g)	allow a value in the range 3.2 – 3.4 (g) allow a value in the range 1.9 – 2.1 (g)	1 1	AO2 5.9.1.2
02.5	(3.3 – 2 =) 1.3 (g)	allow ecf from question **02.4**	1	AO2 5.9.1.2
02.6	**D B C A**		1	AO1 5.9.2.1

5.9.1.4 How carbon dioxide decreased

02.7	any **two** from: • rising sea levels • melting ice (caps) / glaciers • agricultural problems • extremes of weather • (coastal) flooding / erosion • drought • forest fires • animal habitats change / lost	allow extinction of species allow global warming	2	AO1 5.9.2.3

Total			**10**

5.9.1.4 How carbon dioxide decreased

Answer 04 · Mark scheme

November 2020 | 8464/C/2F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.9.1.4 How carbon dioxide decreased

Answer 05 · Mark scheme

June 2022 | 8464/C/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	bar drawn to 21%		1	AO2 5.9.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	a glowing splint		1	AO1 5.8.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	(nitrogen) increased (oxygen) increased		1 1	AO2 5.9.1.2 5.9.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	dissolved in oceans formation of sedimentary rocks		1 1	AO1 5.9.1.2 5.9.1.4

5.9.1.4 How carbon dioxide decreased

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	9 (am) 5 (pm)	allow 0900 allow 1700	1 1	AO2 5.9.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	more cars / buses / lorries on the roads		1	AO3 5.9.3.1

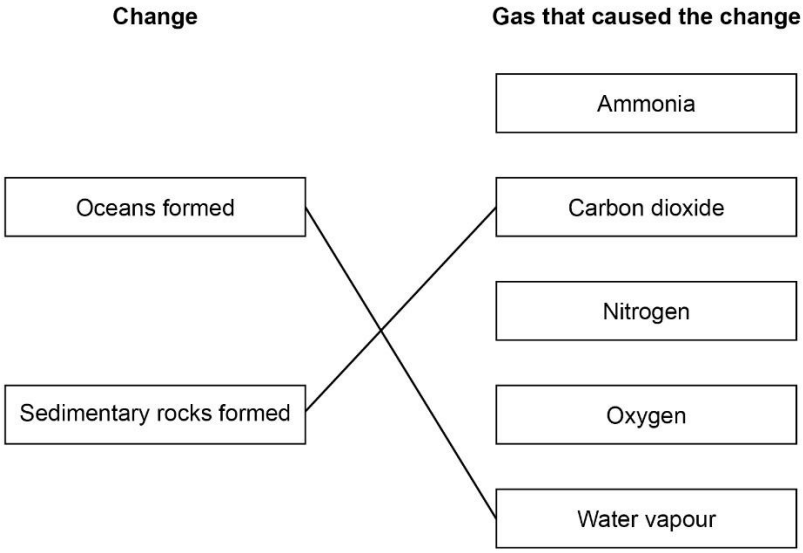
Total Question 1		**9**

5.9.1.4 How carbon dioxide decreased

Answer 06 · Mark scheme

June 2023 | 8464/C/2F | Original Q2

Question 2

Question	Answers	Mark	AO / Spec. Ref.
02.1	 do **not** accept more than one line from a box on the left	1 1	AO1 5.9.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	nitrogen		1	AO2 5.9.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	(number of times more =) $\frac{95}{0.04}$ = 2375 = 2.375×10^3	 allow a correctly calculated answer in standard form from an incorrect calculation which uses values given in **Table 1**	1 1 1	AO2 5.9.1.1

5.9.1.4 How carbon dioxide decreased

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	increased		1	AO2 5.9.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	(mass CO_2 =) $\frac{17.2}{4}$ = 4.3 (kg)		1 1	AO2 5.9.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	photosynthesis		1	AO1 5.9.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	any **two** from: (forest area) • increases in Africa • increases in Europe • decreases in South America • decreases in Asia		2	AO2 5.9.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	6 (%)		1	AO2 5.9.2.1 5.9.2.2

5.9.1.4 How carbon dioxide decreased

Answer 06 · Mark scheme

June 2023 | 8464/C/2F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.9	(**A**) reuse (**B**) recycle		1 1	AO2 5.10.2.2

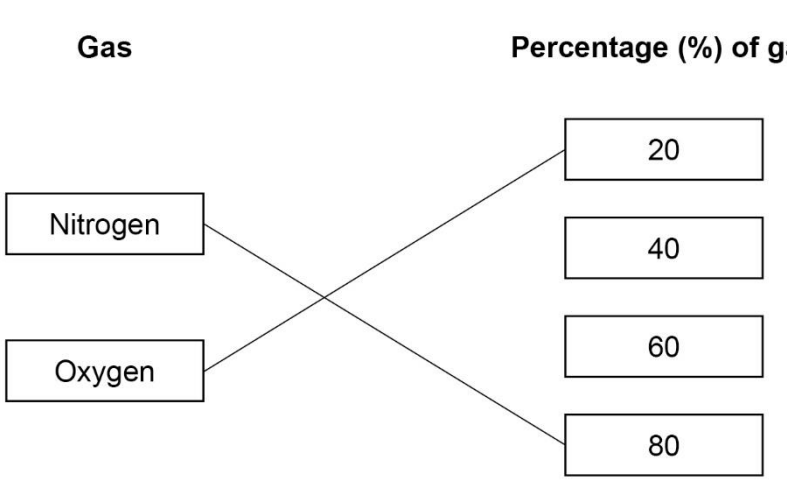
Total Question 2	**15**

5.9.1.4 How carbon dioxide decreased

Answer 07 · Mark scheme

June 2024 | 8464/C/2F | Original Q1

Question 1

Question	Answers	Mark	AO / Spec. Ref.
01.1	 do **not** accept more than one line from a box on the left	1 1	AO1 5.9.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	dissolving in oceans photosynthesis		1 1	AO1 5.9.1.2 5.9.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	(from 1800 carbon dioxide percentage is) constant until 1850 (then) increases (to 2020)	allow a value in the range 1850 to 1865	1 1 1	AO2 5.9.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	methane		1	AO1 5.9.2.2

5.9.1.4 How carbon dioxide decreased

Answer 07 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	climate change		1	AO1 5.9.2.2 5.9.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	(M_r =) 12 + (2 × 16) = 44		 1 1	AO2 5.3.1.2 5.9.2.2

Total Question 1	**11**

5.9.1.4 How carbon dioxide decreased

Answer 05 · Examiner comments June 2022 | 8464/C/2F | Original Q1

Question 1

A straightforward introduction to the paper which mainly relied on interpreting supplied information.

01.1 Only about half of all students achieved this mark. Many students misinterpreted the scale on the *y*-axis and drew the line at 22% rather than 21%. There was no tolerance allowed on this graph for that reason. It is advised that students bring a ruler to their exams to use when drawing bar charts.

01.2 Many students knew that a burning splint is required to test for oxygen in this question.

01.3 Information taken from the pie charts was answered correctly by most students, with over half gaining 2 marks and 95% gaining at least 1 mark.

01.4 Another question testing knowledge of specification content that was not always well known with just over 60% of students gaining at least 1 mark.

01.5 Almost all students answered this correctly gaining 2 marks. The most common incorrect responses stated the concentrations at the peaks rather than the times.

Answer 05 · Examiner comments June 2022 | 8464/C/2F | Original Q1

01.6 The mark scheme required a link between increased use of transport at these times and the emissions of oxides of nitrogen, with approximately a third of students recognising this. Students should be encouraged to read the stem of each question.

5.9.1.4 How carbon dioxide decreased

Answer 06 · Examiner comments June 2023 | 8464/C/2F | Original Q2

Question 2

02.1 Around a quarter of students gained both marks on this question. Half of all students gained one mark, most frequently for the idea that the oceans were formed from water. Far fewer were able to make the link between rock formation and carbon dioxide.

02.2 Nine in ten students were able to identify nitrogen as having the highest percentage.

02.3 One in five students gained all three marks here. A quarter completed the calculation correctly without then expressing it in standard form. Of the remaining students, very few were able to make progress, with one in twenty achieving one mark, usually for expressing an incorrect calculation in standard form. There were all combinations of calculations seen by examiners using the numbers 95 and 0.04.

02.4 This question proved to be the easiest on this year's examination, with over 97% achieving the correct answer.

02.5 Three quarters of students correctly calculated the mass of carbon dioxide. The most common incorrect response saw students multiply rather than divide the two numbers.

02.6 Around half of students correctly identified photosynthesis as the correct answer. The most common incorrect responses were respiration, distillation and deforestation.

02.7 Approximately one third of students gained two marks for this question, with one in ten gaining one mark. Many students did not identify the direction of change, suggesting Africa or South America changed the most, which was not creditworthy. Also, students often responded with ideas about developing areas and industrialised areas, without talking about the continents on the bar chart.

02.8 Students were able to calculate the percentage of landfill methane emissions from the pie chart with over 85% of students completing the question correctly.

02.9 Around half of students achieved both marks for interpreting the graphic. Only one in ten gained one mark. The most common response that gained no credit was for reuse and recycle the wrong way round. However, all of the other responses were commonly seen.

5.9.1.4 How carbon dioxide decreased

Answer 07 · Examiner comments

June 2024 | 8464/C/2F | Original Q1

Question 1 (low demand)

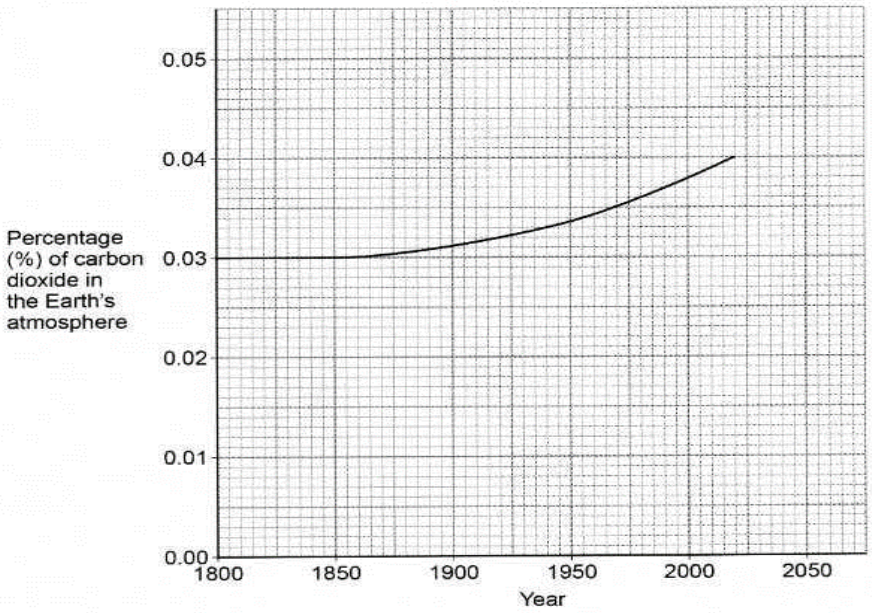
01.1 This AO1 question proved a challenging start to the paper, with just over a quarter of students gaining both marks and more than half of students not gaining any marks. Many students gave the percentage of oxygen in the air as 80%.

01.2 Two-thirds of students could identify at least one of the reasons why the percentage of carbon dioxide decreased in the Earth's early atmosphere, with photosynthesis being the most common correct answer. Deforestation and respiration were the most common incorrect responses.

01.3 About 40% of students were able to gain 1 mark on this AO2 question, often for recognising that the trend was increasing. Mention of the constant level from 1800 was less often seen, although about a third of students were able to gain all 3 marks. Some students not only described the trend but suggested reasons for it, which was not necessary for this 'describe' question; students would benefit from a clear understanding of the expectations of the command word.

0 1 . 3 **Figure 1** shows the change in the percentage of carbon dioxide in the Earth's atmosphere from 1800 to 2020.

Figure 1



Describe the trend in the percentage of carbon dioxide in the Earth's atmosphere from 1800 to 2020.

Use data from **Figure 1**.

[3 marks]

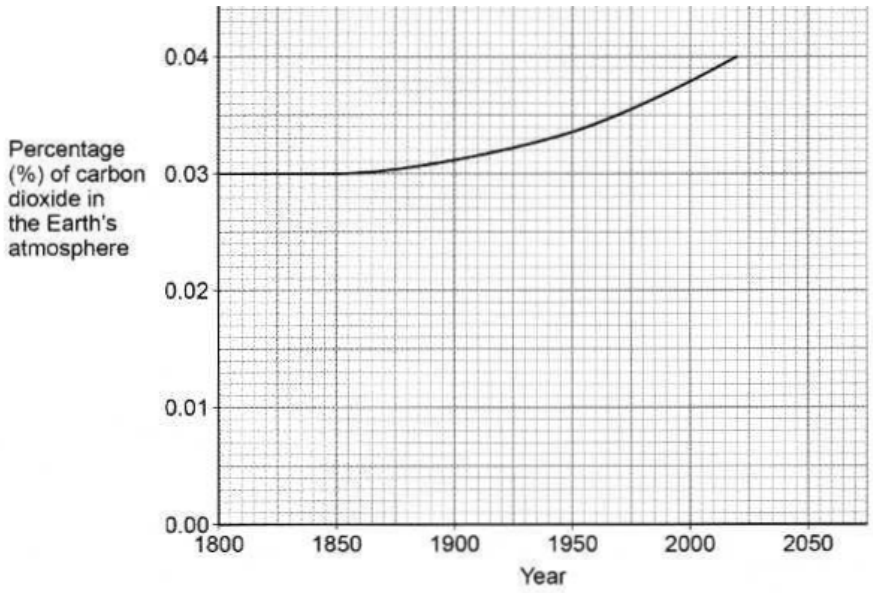
as the years go on, the percentage of carbon dioxide in the Earth's atmosphere increases slowly. from 0.03 in 1800 to 0.04 in 2020.

This is a typical response that only gained 1 of the 3 marks: the student has identified the upwards trend but has not described the constant levels nor the date at which the change happens.

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5.9.1.4 How carbon dioxide decreased

Answer 07 · Examiner comments June 2024 | 8464/C/2F | Original Q1



Describe the trend in the percentage of carbon dioxide in the Earth's atmosphere from 1800 to 2020.

Use data from **Figure 1**.

[3 marks]

from 1800 to 1850 the percentage of carbon dioxide in the earths atmosphere stayed the same however from 1850 - 2000 the percentage of carbon dioxide increased in the earths atmosphere

This student has gained all 3 marks, by identifying that the percentage was constant, then increased and giving the date (1850) where the change was observed.

01.4 Methane was well known as a greenhouse gas.

01.5 The link between climate change and greenhouse gases was also well known.

01.6 The method of calculating a relative formula mass as not well known, with fewer than a third of students correctly performing this calculation. Common mistakes were to add the two A_r values, multiply them together or subtract one from another.

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5.9.1.4 How carbon dioxide decreased

Answer 07 · Examiner comments June 2024 | 8464/C/2F | Original Q1

0 1 . 6 Calculate the relative formula mass (M_r) of carbon dioxide (CO_2).

Relative atomic masses (A_r): C = 12 O = 16

[2 marks]

16-12

Relative formula mass of carbon dioxide = 4

0 1 . 6 Calculate the relative formula mass (M_r) of carbon dioxide (CO_2).

Relative atomic masses (A_r): C = 12 O = 16

[2 marks]

12 x 16 = 192

C x O = 192

Relative formula mass of carbon dioxide = 192

0 1 . 6 Calculate the relative formula mass (M_r) of carbon dioxide (CO_2).

Relative atomic masses (A_r): C = 12 O = 16

[2 marks]

16 + 12 = 28

Relative formula mass of carbon dioxide = ~~4~~ 28

These examples demonstrate common errors shown by students in answering this question.

In the first response, the student has subtracted one A_r value from another; in the second the student has multiplied the two A_r values together; in the third the student has added the two A_r values together.

None of these responses gained any marks.

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