AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.9.2.3

Global climate change

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**7**
Available paper years	**2018–2025**

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.

5.9.2.3 Global climate change

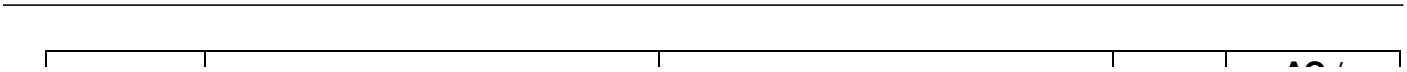
Answer 01 · Mark scheme June 2018 | 8464/C/2F | Original Q1

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**	

5.9.2.3 Global climate change

Answer 01 · Mark scheme

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



5.9.2.3 Global climate change

Answer 02 · Mark scheme June 2018 | 8464/C/2F | Original Q7

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

5.9.2.3 Global climate change

Answer 02 · Mark scheme

June 2018 | 8464/C/2F | Original Q7

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**

5.9.2.3 Global climate change

Answer 03 · 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

5.9.2.3 Global climate change

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**

5.9.2.3 Global climate change

Answer 03 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.9.2.3 Global climate change

Answer 04 · Mark scheme

November 2021 | 8464/C/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any **two** from: • global warming • melting polar ice caps • rising sea levels • flooding • crop failure **or** famine • extremes of weather • loss of habitats	do **not** accept acid rain do **not** accept global dimming do **not** accept references to ozone ignore temperature rise	2	AO1 5.9.2.3
03.2	constant (then) increases	allow no change allow stays same ignore values if given	1 1	AO2 5.9.2.2
03.3	(1950) 0.030 **and** (2000) 0.036 (0.036 – 0.030) = 0.006 (%)	 allow correct use of incorrectly determined percentage reading(s) ignore + or –	1 1	AO2 5.9.2.2
03.4	any **one** from: • combustion of fuel • deforestation • population increase	allow any named activity which burns fuel	1	AO1 5.9.2.2

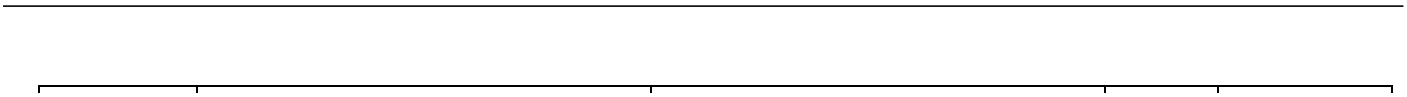
5.9.2.3 Global climate change

03.5	extrapolation on graph determine value from extrapolation at 2050	 allow a value in the range 0.044 to 0.050 allow a tolerance of ± ½ a small square	1 1	AO3 5.9.2.2
Total			**9**	

5.9.2.3 Global climate change

Answer 04 · Mark scheme

November 2021 | 8464/C/2F | Original Q3

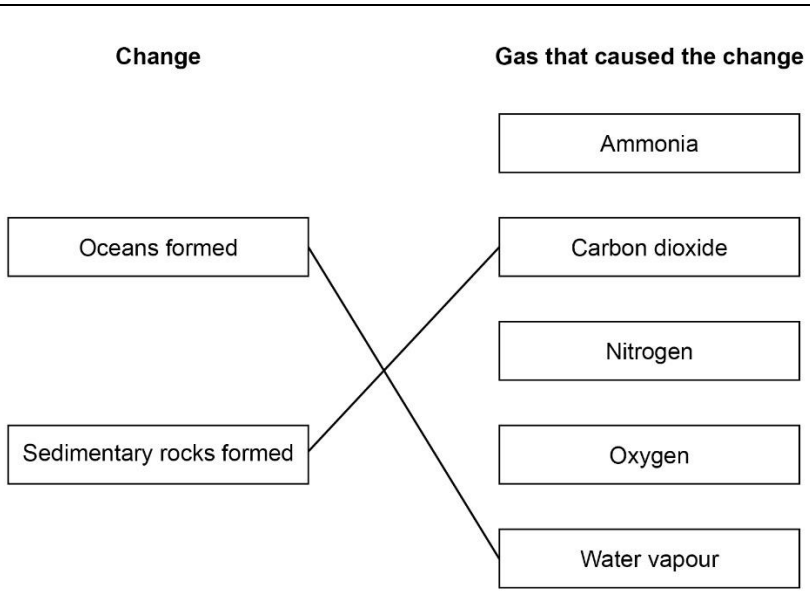


5.9.2.3 Global climate change

Answer 05 · 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

5.9.2.3 Global climate change

Answer 05 · 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

5.9.2.3 Global climate change

Answer 05 · 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

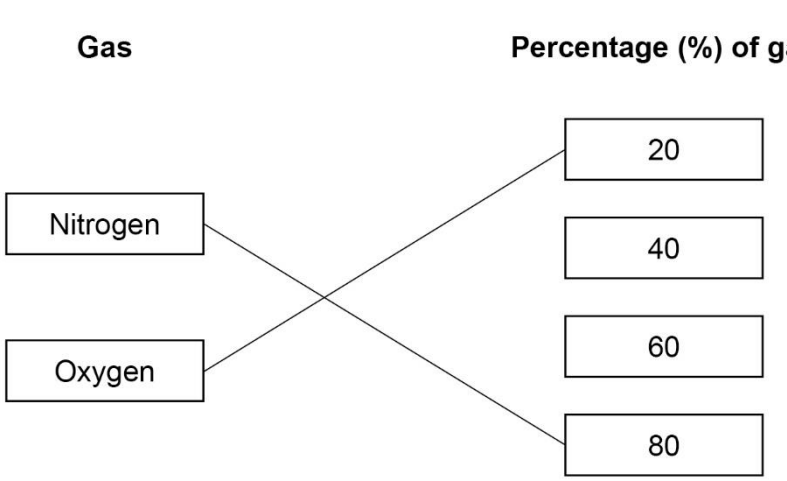
Total Question 2	**15**

5.9.2.3 Global climate change

Answer 06 · 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

5.9.2.3 Global climate change

Answer 06 · 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**

5.9.2.3 Global climate change

Answer 07 · Mark scheme

June 2025 | 8464/C/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	formulation		1	AO1 5.8.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	14		1	AO2 5.1.1.1 5.8.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	carbon monoxide is a toxic gas		1	AO1 5.9.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	$2\,CH_4O + 3\,O_2 \rightarrow 2CO_2 + 4\,H_2O$	allow multiples	1	AO2 5.1.1.1 5.3.1.1 5.7.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	(test) add a burning splint (result) (hydrogen burns with) a pop sound	do **not** accept glowing splint MP2 is dependent on MP1 being awarded	1 1	AO1 5.8.2.1

5.9.2.3 Global climate change

Answer 07 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	any **two** from: • melting ice caps • rising sea levels • more flooding • extremes of weather • increase in droughts • increase in wildfires • loss of habitats • reduction in biodiversity • change in migration patterns	allow increase in frequency of storms allow desertification ignore global warming do **not** accept acid rain do **not** accept global dimming do **not** accept deforestation do **not** accept natural disasters do **not** accept references to ozone	2	AO1 5.9.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	colour change (from blue to pink)		1	AO2 5.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	endothermic	allow (thermal) decomposition	1	AO2 5.6.2.2

Total Question 3	10

5.9.2.3 Global climate change

Answer 04 · Examiner comments — November 2021 | 8464/C/2F | Original Q3

Question 3 (low and standard demand)

Students generally answered this question well. The topic of climate change and its effects were well understood. The impact of increased temperature was well known. No credit was given for the

Answer 04 · Examiner comments — November 2021 | 8464/C/2F | Original Q3

common answer of “The Earth gets hotter” as the response needed to be a for consequence of this.

Many students were able to correctly describe the trend in the graph for 2 marks. However, a significant number ignored the initial section of the graph where the percentage was constant. The use of the data from the graph was good overall. Credit was not given for predictions made from the graph if the instruction to extend the graph line had not been followed, as the reading could not be checked and verified.

5.9.2.3 Global climate change

Answer 05 · 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.

Answer 06 · Examiner comments

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

Question 1 (low demand)

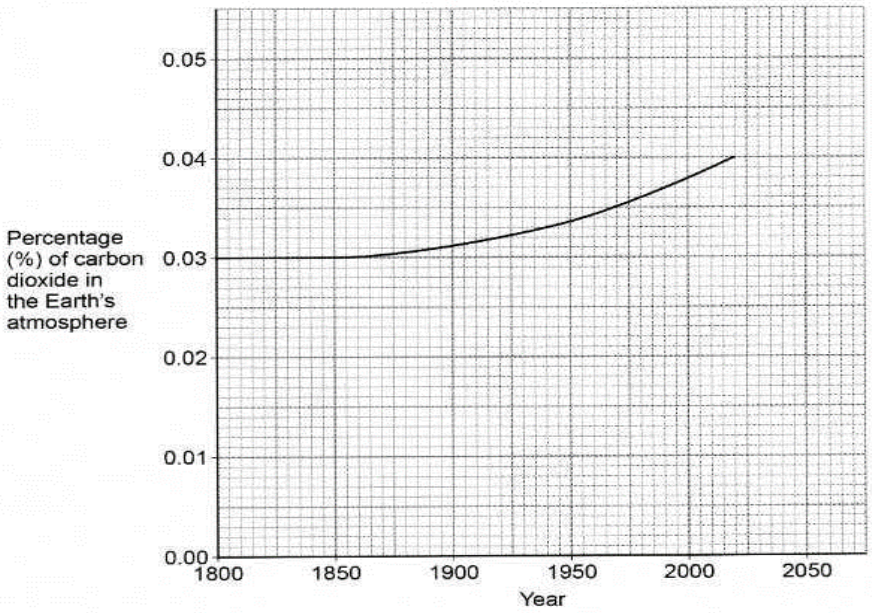
01.1 This AO1 question proved a challenging start to the paper, with just over a quarter of students gaining both marks and more than half of students not gaining any marks. Many students gave the percentage of oxygen in the air as 80%.

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]

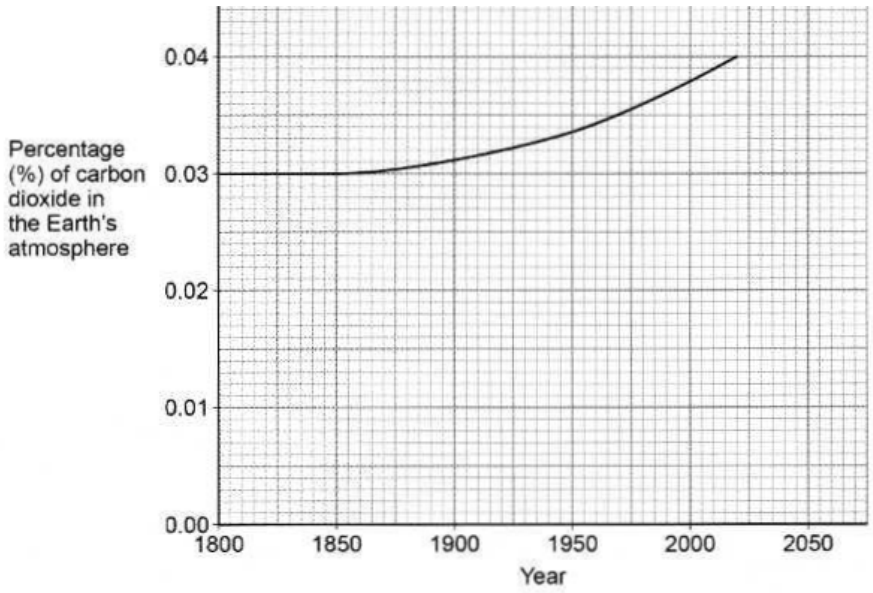
as the years go on, the percentage of carbon dioxide in the Earth's atmosphere increases slowly. from 0.03 in 1800 to 0.04 in 2020.

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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5.9.2.3 Global climate change

Answer 06 · 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.

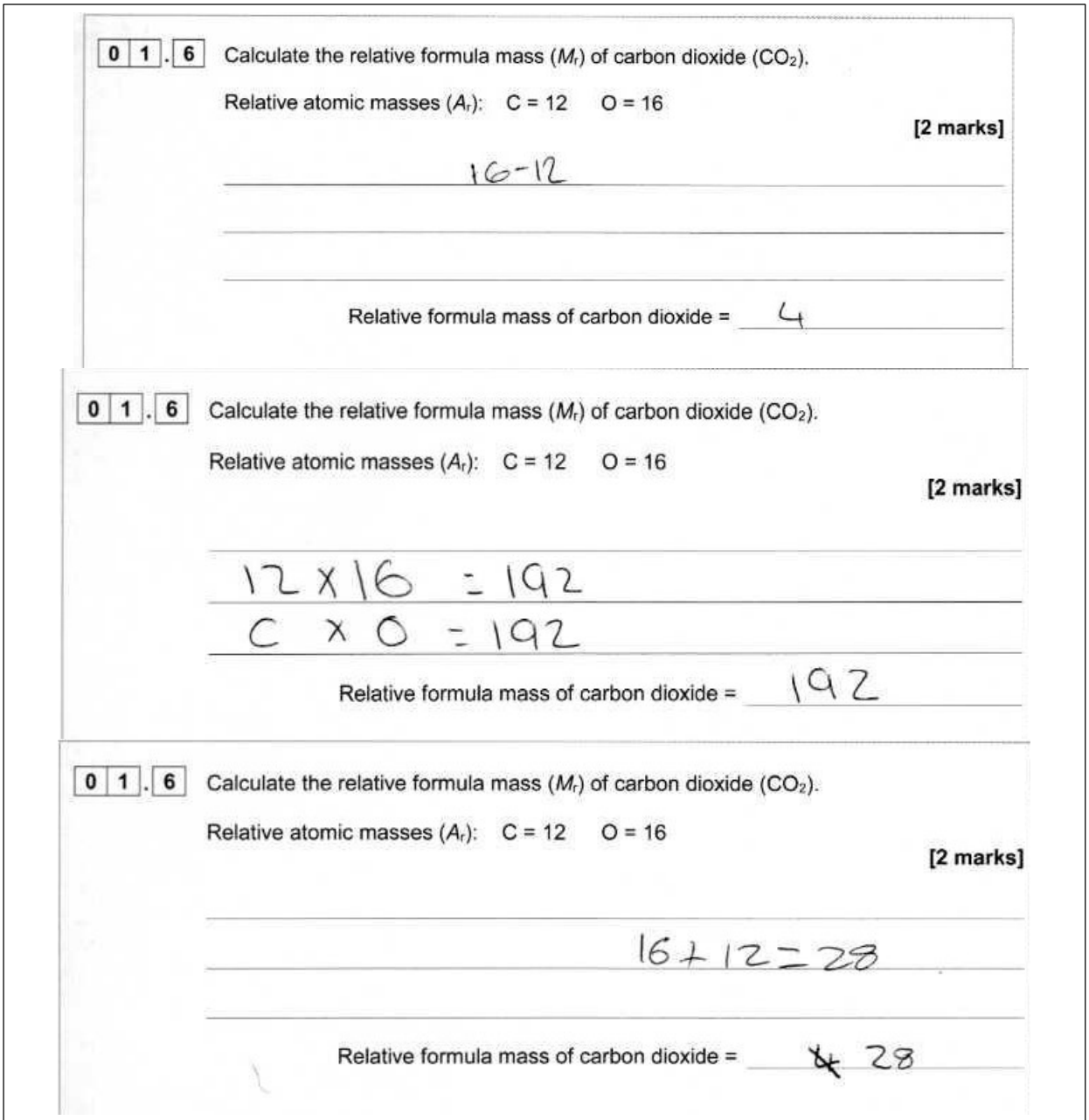
01.5 The link between climate change and greenhouse gases was also well known.

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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5.9.2.3 Global climate change

Answer 06 · 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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5.9.2.3 Global climate change

Answer 07 · Examiner comments June 2025 | 8464/C/2F | Original Q3

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.

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Answer 07 · Examiner comments June 2025 | 8464/C/2F | Original Q3

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.