AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.9.1.4

# How carbon dioxide decreased

## Mark schemes and examiner comments

| | |
|---|---|
| Tier | **Higher** |
| Question groups | **41** |
| Available paper years | **2007–2025** |

## 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.

### 4.9.1.4 How carbon dioxide decreased

**Answer 01 · Mark scheme** January 2007 | CHY1H | Original Q2 | Legacy

**Question 2**

| | answers | extra information | mark |
|---|---|---|---|
| (a) | oxygen **and** nitrogen<br><br>20 – 21% **and** 78 – 80% | <br><br>accept any two correct responses in the correct space for **one** mark | 1<br><br>1 |
| (b)(i) | acid rain | accept toxic gas or consequence of acid rain | 1 |
| (ii) | idea of the removal or use of sulfur dioxide gas (from the waste gases) | do **not** accept remove sulfur from coal | 1 |
| (iii) | oxygen<br><br>water | accept $O_2$<br><br>accept $H_2O$<br>accept hydrogen oxide / steam | 1<br><br>1 |
| (c) | any **two** from:<br>• it's a 'greenhouse gas' or increase greenhouse effect<br>• causes global warming or increase in the Earth's temperature<br>• sea-levels rise or flooding<br>• climate change<br>• (polar) ice-caps melt<br>• extension of deserts | <br>accept action of a 'greenhouse gas'<br><br><br><br><br><br>mention of ozone / acid rain / global dimming = max **1** mark | 2 |
| (d) | idea trap / store / lock the carbon dioxide<br><br>in the oil reservoir **or** under the sea <u>bed</u> | <br><br>do **not** accept 'into the oil' / 'under the sea' | 1<br><br>1 |
| total | | | 10 |

### 4.9.1.4 How carbon dioxide decreased

**Answer 02 · Mark scheme** March 2007 | CHY1A | Original Q3 | Legacy

| | | | |
|---|---|---|---|
| Three | **A** | 0 | **3** |
| | **B** | 5 | **1** |
| | **C** | 8 | **2** |
| | **D** | 70 | **4** |

**Answer 03 · Mark scheme** March 2007 | CHY1B | Original Q5 | Legacy

| | | | |
|---|---|---|---|
| Five | **A** | analysis | **2** |
| | **B** | combustion | **4** |
| | **C** | condensation | **3** |
| | **D** | convection | **1** |

**Answer 04 · Mark scheme** June 2007 | CHY1A | Original Q3 | Legacy

| | | | | |
|---|---|---|---|---|
| Three | **1** | **2** | **2** | **3** |

**Answer 05 · Mark scheme** June 2007 | CHY1B | Original Q5 | Legacy

| | | | | |
|---|---|---|---|---|
| Five | **2** | **4** | **3** | **3** |

**Answer 06 · Mark scheme** November 2007 | CHY1A | Original Q3 | Legacy

| | | | | |
|---|---|---|---|---|
| Three | **1** | **4** | **2** | **3** |

**Answer 07 · Mark scheme** November 2007 | CHY1B | Original Q4 | Legacy

| | | | | |
|---|---|---|---|---|
| Four | **1** | **2** | **1** | **2** |

**Answer 08 · Mark scheme** November 2007 | CHY1B | Original Q8 | Legacy

| | | | | |
|---|---|---|---|---|
| Eight | **1** | **2** | **2** | **3** |

**Answer 09 · Mark scheme** March 2008 | CHY1BP | Original Q4 | Legacy

| | | | | |
|---|---|---|---|---|
| Four | **2** | **1** | **2** | **3** |

**Answer 10 · Mark scheme** March 2008 | CHY1BP | Original Q7 | Legacy

| | | | | |
|---|---|---|---|---|
| Seven | **1** | **1** | **4** | **4** |

**Answer 11 · Mark scheme** June 2008 | CHY1AP | Original Q4 | Legacy

| | | | | |
|---|---|---|---|---|
| Four | **2** | **4** | **2** | **2** |

### 4.9.1.4 How carbon dioxide decreased

**Answer 12 · Mark scheme**



| | | | |
|---|---|---|---|
| One | **A** | catalysis | **2** |
| | **B** | polymerisation | **3** |
| | **C** | combustion | **4** |
| | **D** | thermal decomposition | **1** |
| | | | |

### 4.9.1.4 How carbon dioxide decreased

**Answer 13 · Mark scheme**

June 2008 | CHY1H | Original Q6 | Legacy

| question | answers | extra information | mark |
|---|---|---|---|
| **6**(a) | any **two** environmental problems with linked explanations<br><br>• global warming (1)<br>caused by (formation of) carbon dioxide / greenhouse gas (1)<br><br>• acid rain (1)<br>caused by ( formation of) sulfur dioxide (1)<br><br>• global dimming (1)<br>caused by ( formation of) particles / particulates / fires / smoke / carbon / pm 10 (1)<br><br>• scarring of landscape (1)<br>caused by mining / quarrying of coal (1) | accept effects of global warming<br>ignore greenhouse effect<br><br>accept effects of acid rain<br>ignore respiratory problems<br><br>accept sulfur oxide<br>ignore sulfuric acid<br><br>ignore respiratory problems<br><br>ignore ozone layer | max 4 |
| **6**(b) | any **three** from:<br><br>• replant the trees / renewable / sustainable<br><br>• carbon dioxide is used by the trees / photosynthesis<br><br>• it's a (continuous carbon) cycle<br><br>• no '<u>new</u>' carbon (dioxide) is produced **or**<br>no locked up carbon (dioxide) is released | <br><br>ignore reusable<br><br>accept trees absorb carbon dioxide as they grow<br>do **not** allow respiration<br><br>accept 'carbon dioxide goes back into the air'<br>accept trees use $CO_2$ which is released when trees are burnt<br><br>accept no carbon (dioxide) from fossil fuels is produced | 3 |
| **Total** | | | **7** |

### 4.9.1.4 How carbon dioxide decreased

**Answer 13 · Mark scheme** June 2008 | CHY1H | Original Q6 | Legacy

**COMPONENT NUMBER: CHY1H**

**COMPONENT NAME: Science B / Chemistry**

**STATUS: Final**

**DATE: June 2008**

**Answer 14 · Mark scheme** November 2008 | CHY1BP | Original Q4 | Legacy

| | | | | |
|---|---|---|---|---|
| Four | **3** | **4** | **2** | **1** |

**Answer 15 · Mark scheme** November 2008 | CHY1BP | Original Q6 | Legacy

| | | | | |
|---|---|---|---|---|
| Six | **2** | **3** | **2** | **1** |

**Answer 16 · Mark scheme** March 2009 | CHY1AP | Original Q7 | Legacy

| | | | | |
|---|---|---|---|---|
| Seven | **3** | **3** | **4** | **4** |

**Answer 17 · Mark scheme** June 2009 | CHY1AP | Original Q6 | Legacy

| | | | | |
|---|---|---|---|---|
| Six | **2** | **4** | **2** | **3** |

**Answer 18 · Mark scheme** June 2009 | CHY1BP | Original Q8 | Legacy

| | | | | |
|---|---|---|---|---|
| Eight | **1** | **4** | **4** | **3** |

**Answer 19 · Mark scheme** November 2009 | CHY1AP | Original Q6 | Legacy

| | | | | |
|---|---|---|---|---|
| Six | **3** | **3** | **4** | **2** |

**Answer 20 · Mark scheme** November 2009 | CHY1BP | Original Q9 | Legacy

No matching mark scheme was available in the supplied archive for this question.

**Answer 21 · Mark scheme** March 2010 | CHY1BP | Original Q8 | Legacy

| | | | | |
|---|---|---|---|---|
| Eight | **2** | **1** | **2** | **1** |

**Answer 22 · Mark scheme** June 2010 | CHY1AP | Original Q7 | Legacy

| | | | | |
|---|---|---|---|---|
| Seven | **2** | **3** | **3** | **1** |

### 4.9.1.4 How carbon dioxide decreased

**Answer 23 · Mark scheme**

June 2010 | CHY1BP | Original Q5 | Legacy

| | | | | |
|---|---|---|---|---|
| Five | **4** | **1** | **3** | **2** |

### 4.9.1.4 How carbon dioxide decreased

Answer 24 · Mark scheme

June 2010 | CHY1H | Original Q2 | Legacy

**Question 2**

| question | answers | extra information | mark |
|---|---|---|---|
| **2**(a)(i) | condensed | it = water vapour<br>accept temperature went below 100°C / boiling point of water<br>allow cooled to form liquid / water / rain<br>do **not** accept evaporated | 1 |
| | formed the oceans / seas | ignore rain<br>accept (water vapour) cooled and formed the ocean / sea for **2** marks | 1 |
| **2**(a)(ii) | any **two** from:<br>• used by (green) plants / algae<br>• changed into oxygen<br>• dissolved in oceans / seas<br>• (locked up) in carbonates / sedimentary rocks<br>• (locked up) in fossil fuels / named fossil fuel | ignore oxygen / nitrogen increased<br>ignore reference to volcanoes / respiration<br>accept photosynthesis / plants give out oxygen<br>accept (locked up) in shells / skeletons (of animals) | 2 |
| **2**(b)(i) | cannot get to / reach / drill to / see the core | accept the core is (too) far down (into the Earth) / do not know what happens under the crust / Earth's surface<br>accept it is (too) hot / radioactive<br>ignore lack of evidence<br>unqualified | 1 |

**Question 2 continues on the next page**

### 4.9.1.4 How carbon dioxide decreased



**CHY1H**

**Question 2 continued**

| question | answers | extra information | mark |
|---|---|---|---|
| **2**(b)(ii) | any **three** from:<br>• heat / energy released<br>• from radioactive decay / processes<br>• (causing) convection currents<br>• in the mantle | accept radioactivity / nuclear reactions | 3 |
| **Total** | | | **8** |

### 4.9.1.4 How carbon dioxide decreased

**Answer 24 · Mark scheme**

June 2010 | CHY1H | Original Q2 | Legacy

**CHY1H**

4.9.1.4 How carbon dioxide decreased

Answer 25 · Mark scheme



**Question 3**

| question | answers | extra information | mark |
|---|---|---|---|
| 3(a)(i) | any **two** from:<br>• used by plants<br>• used for photosynthesis<br>• absorbed / dissolved in oceans<br>• locked up in fossil fuels / limestone / sedimentary rocks | <br>allow specific plants and algae<br>ignore oxygen released / respiration<br>ignore oceans formed | 2 |
| 3(a)(ii) | calcium carbonate / $CaCO_3$<br>decomposed / thermal decomposition | <br>do **not** allow reaction with oxygen<br>accept quicklime / calcium oxide produced<br>$CaCO_3 \rightarrow CaO + CO_2$ gains **2** marks | 1<br>1 |
| 3(b) | increasing ($CO_2$ or global warming)<br><u>more rapid</u> increase recently<br>carbon dioxide causes global warming | <br><br>accept greenhouse gas **or** climate change / sea level rising **or** ice caps melting<br>do **not** accept ozone layer or acid rain or global dimming | 1<br>1<br>1 |

**Question 3 continues on the next page**

4.9.1.4 How carbon dioxide decreased



**CHY1H**

**Question 3 contd**

| question | answers | extra information | mark |
|---|---|---|---|
| **3(c)(i)** | any **one** from:<br>• Wegener had no evidence / proof<br>• other scientists had different ideas / views<br>• did not respect Wegener as a scientist / geologist | accept movement too slow to measure<br>accept continents / plates fixed or land bridge | 1 |
| **3(c)(ii)** | any **three** from:<br>• plates (move)<br>• heat energy / radioactivity (causes)<br>• convection currents<br>• in mantle | ignore continents | 3 |
| **Total** | | | **11** |

### 4.9.1.4 How carbon dioxide decreased

**Answer 25 · Mark scheme** January 2011 | CHY1H | Original Q3 | Legacy

**CHY1H**

**Answer 26 · Mark scheme** March 2011 | CHY1BP | Original Q8 | Legacy

| | | | | |
|---|---|---|---|---|
| Eight | 3 | 2 | 3 | 2 |

**Answer 27 · Mark scheme** June 2011 | CHY1BP | Original Q3 | Legacy

| | | | | |
|---|---|---|---|---|
| Three | 3 | 3 | 3 | 2 |

**Answer 28 · Mark scheme** June 2011 | CHY1BP | Original Q7 | Legacy

| | | | | |
|---|---|---|---|---|
| Seven | 2 | 2 | 3 | 2 |

4.9.1.4 How carbon dioxide decreased

Answer 29 · Mark scheme

June 2011 | CHY1H | Original Q5 | Legacy

**Question 5**

| question | answers | extra information | mark |
|---|---|---|---|
| **5(a)** | complete diagram with 2 carbon atoms and 5 hydrogen atoms each C–C and each C–H linked by a single line (bond) | | 1 |
| **5(b)(i)** | the greater the number of (carbon) atoms (in an alkane molecule) the greater its boiling point **or** vice versa | allow as the (carbon) chain gets longer the boiling point increases<br><br>ignore melting points<br><br>do **not** accept reference to greater number of molecules | 1 |
| **5(b)(ii)** | any **two** from:<br>• low boiling point / volatile<br>• low viscosity<br>• high flammability<br>• small molecules<br>• burn completely | they = hydrocarbons from the graph<br><br>it = $C_{30}H_{62}$<br><br>accept they are gases or liquids<br><br>accept easier to burn / ignite<br><br>accept short chains<br>ignore number of carbon atoms<br><br>ignore speed of burning | 2 |
| **5(c)(i)** | 16 ($CO_2$) + 18 ($H_2O$) | | 1 |
| **5(c)(ii)** | (carbon dioxide in the Earth's early) atmosphere | accept from volcanoes (millions of years ago)<br>**or** from dead plants / animals<br><br>allow dead sea creatures<br><br>ignore shells | 1 |

**Question 5 continues on the next page . . .**

4.9.1.4 How carbon dioxide decreased

Answer 29 · Mark scheme



**CHY1H**

**Question 5 continued . . .**

| question | answers | extra information | mark |
|---|---|---|---|
| 5(c)(iii) | increase in burning / use of fossil fuels | | 1 |
| | locked up carbon (carbon dioxide) is released | allow carbon / carbon dioxide from millions of years ago is released<br><br>accept extra carbon dioxide is not 'absorbed' (by the carbon cycle) | 1 |
| **Total** | | | **8** |

### 4.9.1.4 How carbon dioxide decreased

**Answer 30 · Mark scheme**

November 2011 | CHY1BP | Original Q7 | Legacy

| | | | | |
|---|---|---|---|---|
| Seven | **4** | **1** | **1** | **3** |

4.9.1.4 How carbon dioxide decreased

Answer 31 · Mark scheme



## Question 2

| question | answers | extra information | mark |
|---|---|---|---|
| 2(a)(i) | $C_7H_{16}$ | mark answer line first<br><br>answer may be given in the table | 1 |
| 2(a)(ii) | $C_nH_{2n+2}$ | | 1 |
| 2(b)(i) | carbon monoxide | do **not** accept carbon oxide<br><br>do **not** accept water<br><br>ignore CO | 1 |
| 2(b)(ii) | because of partial / incomplete combustion (in reaction 2)<br>**or** complete combustion (in reaction 1) | allow because there is less/insufficient oxygen (in reaction 2) **or** sufficient oxygen (in reaction 1)<br>allow different amounts of oxygen used (in the reactions) **or** $19O_2$ (in reaction 1) **and** $13O_2$ (in reaction 2)<br><br>ignore air | 1 |
| 2(c)(i) | 15 (%) | ignore units | 1 |
| 2(c)(ii) | water (vapour) / steam | allow $H_2O$ / $OH_2$ / hydrogen oxide | 1 |
| 2(c)(iii) | <u>sulfur</u> in petrol / crude oil (reacts with oxygen) | it = sulfur dioxide | 1 |
| 2(c)(iv) | because nitrogen **and** oxygen (are in the air and) react<br><br>at high temperature (inside a petrol engine) | allow nitrogen **and** oxygen burn<br><br>accept nitrogen + oxygen → nitrogen oxide **or** symbol equation<br><br>ignore air<br><br>allow heat/hot (engine) | 1<br><br>1 |

**Question 2 continues on the next page……..**

4.9.1.4 How carbon dioxide decreased



**CH1HP**

**Question 2 cont'd….**

| question | answers | extra information | mark |
|---|---|---|---|
| **2(d)** | because carbon dioxide / it causes global warming **or**<br>because carbon dioxide / it has an impact on oceans<br><br>because this carbon dioxide / carbon / it was 'locked up' (in fossil fuels) **or**<br><br>because the percentage/amount of carbon dioxide/it in the atmosphere is increasing | allow because carbon dioxide/it causes greenhouse effect / climate change | 1<br><br>1 |
| **Total** | | | **11** |

### 4.9.1.4 How carbon dioxide decreased

**Answer 31 · Mark scheme**

January 2012 | CH1HP | Original Q2 | Legacy

**CH1HP**

### 4.9.1.4 How carbon dioxide decreased



**Question 4**

| question | answers | extra information | mark |
|---|---|---|---|
| **4(a)** | any **two** from:<br>• carbon dioxide dissolves in water/oceans<br>• marine organisms use (dissolved) carbon dioxide to form their shells/skeletons<br>**or**<br>limestone was formed from the shells/skeleton of marine organisms<br>• plants / algae photosynthesise/ absorb/use carbon dioxide | accept carbon dioxide became locked up in sedimentary rocks/carbonates/limestone<br>**or**<br>precipitation or formation of insoluble carbonates<br>accept remains of plants/algae/ marine organisms contain locked up carbon dioxide/carbon in the form of fossil fuels<br>do **not** accept plants use carbon dioxide for respiration | 2 |
| **4(b)(i)** | because these gases/molecules contain the elements / atoms in amino acids<br>**or** the gases / they contain carbon, hydrogen and nitrogen | ignore oxygen | 1 |

**Question 4 continues on the next page . . .**

### 4.9.1.4 How carbon dioxide decreased



**CH1HP**

**Question 4 cont'd…**

| question | answers | extra information | mark |
|---|---|---|---|
| 4(b)(ii) | any **two** from:<br>• nobody knows what was in the Earth's early atmosphere<br>• there may not have been (continuous) lightning<br>• Miller and Urey selected only the gases needed to produce amino acids | ignore small-scale / timescale<br>ignore references to water/oceans or other theories<br>accept these gases / hydrogen / methane / ammonia may not have been in the Earth's early atmosphere<br>accept carbon dioxide / nitrogen may have been in the Earth's early atmosphere<br>accept reference to Venus' present atmosphere<br>ignore concentration of gases | 2 |
| **Total** | | | **5** |

### 4.9.1.4 How carbon dioxide decreased

**Answer 32 · Mark scheme**

June 2012 | CH1HP | Original Q4 | Legacy

**CH1HP**

### 4.9.1.4 How carbon dioxide decreased

**Answer 33 · Mark scheme**

January 2013 | CH1HP | Original Q2 | Legacy

| question | answers | extra information | mark |
|---|---|---|---|
| 2(a) | time from when the heating is started until<br>the limewater turns cloudy / milky | | 1<br>1 |
| 2(b)(i) | the temperature was not high enough<br>the bubbles of gas were air | accept the copper carbonate had not started to decompose / react<br>accept it takes time to heat up the copper carbonate<br>accept no carbon dioxide produced | 1<br>1 |
| 2(b)(ii) | the copper carbonate was decomposing / reacting<br>so carbon dioxide was produced | accept the temperature was high enough to cause decomposition / a reaction<br>allow correct word / symbol equation | 1<br>1 |
| 2(b)(iii) | copper oxide was produced<br>because the copper carbonate had completely decomposed / reacted | allow correct word / symbol equation<br>ignore all of the carbon dioxide had been given off | 1<br>1 |
| **Total** | | | **8** |

### 4.9.1.4 How carbon dioxide decreased

**Answer 33 · Mark scheme**

January 2013 | CH1HP | Original Q2 | Legacy

**CH1HP**

### 4.9.1.4 How carbon dioxide decreased

**Answer 34 · Mark scheme** June 2013 | CH1HP | Original Q5 | Legacy

**Question 5**

| question | Answers | extra information | Mark |
|---|---|---|---|
| **5(a)(i)** | $H_2O$ | must be formula | 1 |
| | CaO | must be formula | 1 |
| **5(a)(ii)** | | it = carbon (dioxide) | |
| | carbon dioxide from the air / (Earth's early) atmosphere | accept carbon dioxide from millions of years ago | 1 |
| | formed (sedimentary) rocks **or** fossil fuels | ignore trapped / stored | 1 |
| **5(b)(i)** | | it = carbon (dioxide) | |
| | decreases rapidly at first | | 1 |
| | then slowly **or** levels off | | 1 |
| | | allow both marks if the description is correct using either 'rapidly' **or** 'slowly' | |
| | | allow correct use of figures for either marking point | |
| | | if no other mark awarded, allow $CO_2$ decreased for **1** mark | |
| **5(b)(ii)** | any **two** from:<br>• used by plants<br>• dissolved in oceans<br>• 'locked up' in fossil fuels **or** formed fossil fuels<br>• 'locked up' in rocks **or** formed rocks | it = carbon (dioxide)<br>accept photosynthesis | 2 |

**Question 5 continues on the next page**

4.9.1.4 How carbon dioxide decreased



**Question 5 continued**

| question | Answers | extra information | Mark |
|---|---|---|---|
| 5(c) | | it = percentage of carbon (dioxide) | |
| | (yes) | ignore yes or no | |
| | because the percentage of carbon dioxide is increasing | | 1 |
| | which causes global warming (to increase) | allow (carbon dioxide) causes greenhouse effect/climate change | 1 |
| | **or** | | |
| | (no) | | |
| | because the percentage of carbon dioxide is low (1) | | |
| | compared to millions of years ago (1) | allow global warming can be caused by other factors (e.g. Sun / water vapour / methane) | |
| **Total** | | | **10** |

### 4.9.1.4 How carbon dioxide decreased

**Answer 35 · Mark scheme** June 2014 | CH1HP | Original Q1 | Legacy

| Question | Answers | Extra information | Mark | AO / Spec. Ref. | ID |
|---|---|---|---|---|---|
| **1(a)(i)** | 2,4 drawn (as dots / crosses / $e^-$) | | 1 | 2 / 1.1.1h | E |
| **1(a)(ii)** | Water (vapour) / steam | allow hydrogen oxide / $H_2O$<br>*do **not** accept hydroxide* | 1 | 1 / 1.4.3b | G |
| **1(b)** | any **two** pairs from:<br>carbon dioxide (1)<br>causes global warming (1)<br>**or**<br>carbon (particles) / *soot* (1)<br>causes global dimming (1)<br>**or**<br>carbon monoxide (1)<br>is toxic (1)<br>**or**<br>sulfur dioxide (1)<br>causes acid rain (1) | *allow greenhouse effect / climate change / sea level rise / melting of polar ice caps*<br>*allow particulates*<br>*allow blocks out sunlight / smog / prevents plant growth / causes breathing difficulties*<br>*allow kills plants / erosion / acidifies water* | 4 | 1 / 1.4.3a/c | E |
| **Total** | | | **6** | | |

### 4.9.1.4 How carbon dioxide decreased

**Answer 35 · Mark scheme**

June 2014 | CH1HP | Original Q1 | Legacy



4.9.1.4 How carbon dioxide decreased

Answer 36 · Mark scheme

June 2015 | CH1HP | Original Q3 | Legacy

| Question | Answers | Extra information | Mark | AO / Spec. Ref. | |
|---|---|---|---|---|---|
| 3(a) | any **one** from:<br>• not enough evidence or proof<br>• (life and the Earth were created) billions of years ago | allow no evidence or no proof<br>allow a long time ago<br>ignore different beliefs or no one was there | 1 | 2 / 1.7.2d | |

**3(b)** Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.

1+2+3 / 1.7.1a/b/c / 1.7.2a/b/c/f/g/h

| 0 marks | Level 1 (1–2 marks) | Level 2 (3–4 marks) | Level 3 (5–6 marks) |
|---|---|---|---|
| No relevant content | Statements based on diagrams | Description of how one change occurred | Descriptions of how at least two changes occurred |

**Examples of chemistry points made in the response could include:**

**Main changes**

- oxygen increased because plants / algae developed and used carbon dioxide for photosynthesis / growth producing oxygen; carbon dioxide decreased because of this
- carbon dioxide decreased because oceans formed and dissolved / absorbed carbon dioxide; carbon dioxide became locked up in sedimentary / carbonate rocks and / or fossil fuels
- oceans formed because the Earth / water vapour cooled and water vapour in the atmosphere condensed
- continents formed because the Earth cooled forming a supercontinent / Pangaea which formed the separate continents
- volcanoes reduced because the Earth cooled forming a crust

**Other changes**

- nitrogen formed because ammonia in the Earth's early atmosphere reacted with oxygen / denitrifying bacteria

| Total | | | 7 |
|---|---|---|---|

### 4.9.1.4 How carbon dioxide decreased

**Answer 36 · Mark scheme**

June 2015 | CH1HP | Original Q3 | Legacy



### 4.9.1.4 How carbon dioxide decreased

**Answer 37 · Mark scheme**

June 2017 | CH1HP | Original Q5 | Legacy

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **5(a)(i)** | any **one** from:<br>• all these gases / hydrogen / methane / water vapour / ammonia may not have been in the Earth's early atmosphere<br>• the conditions of the reaction were not like those on early Earth<br>• many different amino acids are needed for life processes | ignore no proof / evidence **or** no one was there **or** references to religion **or** meteorites / comets.<br>allow nobody knows what was in the Earth's early atmosphere<br>allow very little (0.5%) in the Earth's early atmosphere<br>allow nobody knows what the conditions were on early Earth<br>allow only simple amino acids **/** glycine were produced | 1 | **AO3**<br>1.7.2d;e |
| **5(a)(ii)** | any **three** from:<br>• used by plants / algae **or** for photosynthesis<br>• absorbed / dissolved by oceans<br>• locked up in sedimentary rocks / carbonates / limestone<br>• locked up in fossil fuels | ignore volcanoes<br>allow stored in for locked up<br>allow stored in for locked up<br>mention of respiration: maximum two marks | 3 | **AO1**<br>1.7.2f;g;h |
| **5(b)(i)** | helium / He **and** neon / Ne | both needed | 1 | **AO2**<br>1.7.2j |

### 4.9.1.4 How carbon dioxide decreased

**Answer 37 · Mark scheme**

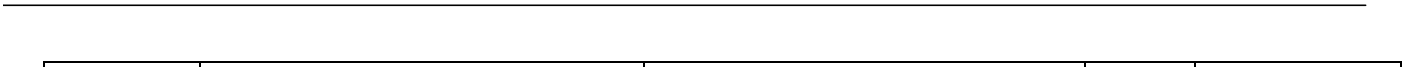


| | | | | |
|---|---|---|---|---|
| **5(b)(ii)** | carbon dioxide would be solid **or** would block pipes | ignore freezes<br>allow forms dry ice | 1 | **AO3**<br>1.7.2j |
| **5(b)(iii)** | <br>the other gas is argon / Ar<br>because they have similar boiling points **or** there is only 3 °C difference in boiling points | mark independently | <br>1<br>1 | **AO2**<br>1.7.2j |
| **5(c)** | <br>**stage 1:** oxygen reacts with carbon<br>so carbon content decreases **or** carbon forms carbon dioxide<br>**stage 2:** (other metals added) to form an alloy<br>so the steel has a specific property / specific use | mark independently<br><br>allow because cast iron is (too) brittle<br>allow to stop layers sliding<br>allow because pure iron is (too) soft | <br>1<br>1<br>1<br>1 | **AO1**<br>**AO2**<br>1.3.2a;b;c |
| **Total** | | | **12** | |

### 4.9.1.4 How carbon dioxide decreased

**Answer 37 · Mark scheme**

June 2017 | CH1HP | Original Q5 | Legacy



### 4.9.1.4 How carbon dioxide decreased

**Answer 38 · Mark scheme** June 2018 | 8462/2H | Original Q3

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **03.1** | hydrogen | allow $H_2$ | 1 | AO1 4.10.4.1 |
| **03.2** | 450 °C<br><br>200 atm / atmospheres | allow values in the range 400– 500 °C<br><br>allow values in the range 150– 250 atm / atmospheres<br><br>allow **1** mark if both values within range but no units given | 1<br><br>1 | AO1 4.10.4.1 |
| **03.3** | ammonia has a higher boiling point | allow the other gases have lower boiling points<br><br>ignore references to melting point | 1 | AO3 4.10.4.1 |

## 4.9.1.4 How carbon dioxide decreased

**Answer 38 · Mark scheme**

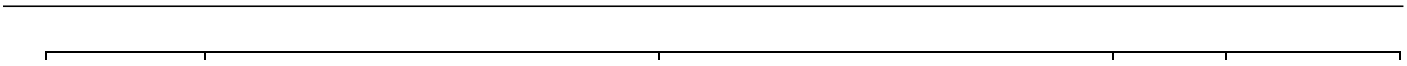
June 2018 | 8462/2H | Original Q3

| Question | Answers | | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 03.4 | **Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account. | | 5–6 | AO2 |
| | **Level 2:** Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear. | | 3–4 | AO1 |
| | **Level 1:** Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking. | | 1–2 | AO1 |
| | **No relevant content** | | 0 | |
| | **Indicative content**<br><br>**changes**<br><br>• carbon dioxide has decreased<br>• oxygen has increased<br><br>**processes**<br><br>• volcanic activity released water vapour<br>• the water vapour condensed to form oceans<br>• carbon dioxide dissolved in oceans<br>• carbonates produce sediments<br>• carbon locked up in sedimentary rocks<br><br>• algae and plants evolved / appeared<br>• algae / plants absorbed carbon dioxide<br>• by photosynthesis<br>• which also released oxygen<br><br>• carbon locked up in fossil fuels | | | 4.9.1.2<br>4.9.1.3<br>4.9.1.4 |
| 03.5 | any **one** from:<br>• occurred 4.6 billion years ago<br><br>• limited or no evidence | allow any indication of billions of years<br>allow limited or no proof<br><br>ignore there was nobody there | 1 | AO1<br>4.9.1.2 |
| **Total** | | | **11** | |

### 4.9.1.4 How carbon dioxide decreased

**Answer 38 · Mark scheme**

June 2018 | 8462/2H | Original Q3



4.9.1.4 How carbon dioxide decreased

Answer 39 · Mark scheme

June 2023 | 8462/2H | Original Q4

## Question 4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.1 | water vapour | | 1 | AO1<br>4.9.2.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.2 | (increased population so) more energy required<br><br>(so) more (fossil) fuels burned<br><br>**OR**<br><br>(increased population so) more farmland required (1)<br><br>(so) more deforestation (1) | allow (increased population so) more transport required<br><br>allow a named fossil fuel | 1<br><br>1 | AO3<br>4.9.2.2 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| 04.3 | (increased population so) more food required<br><br>(so) more methane-producing food production<br><br>**OR**<br><br>(increased population so) more waste produced (1)<br><br>(which) produces more methane on decomposition (1) | <br><br>allow more use of beef cattle (in food production)<br>allow more rice grown | 1<br><br>1 | AO3<br>4.9.2.2 |

### 4.9.1.4 How carbon dioxide decreased

**Answer 39 · Mark scheme** June 2023 | 8462/2H | Original Q4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.4** | any **two** from:<br>• melting ice<br>• rising sea levels<br>• flooding<br>• extremes of weather<br>• loss of habitats | ignore global warming<br><br>do **not** accept acid rain<br>do **not** accept global dimming<br>do **not** accept references to ozone | 2 | AO1<br>4.9.2.3 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.5** | there may be other reasons for changes in the (mean) temperature (of the atmosphere at the Earth's surface) | allow difficult to model<br><br>allow the earth goes through cycles of temperature change | 1 | AO3<br>4.9.2.2 |

| | |
|---|---|
| **Total Question 4** | **8** |

### 4.9.1.4 How carbon dioxide decreased

**Answer 40 · Mark scheme** June 2024 | 8462/2H | Original Q5

**Question 5**

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.1** | high temperatures<br><br>(cause) nitrogen (from air) and oxygen (from air) to react | ignore pressure | 1<br><br>1 | AO1<br>4.9.3.1 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.2** | | ignore references to water vapour | | |
| | less climate change | allow less global warming<br><br>allow an effect of climate change for climate change | 1 | AO1 |
| | (because) no carbon dioxide (produced) | | 1 | AO3<br><br>4.7.1.3<br>4.9.2.4 |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.3** | more oxides of nitrogen (produced) | | 1 | AO1 |
| | (so) more acid rain<br>**or**<br>(so) more respiratory problems | allow an effect of acid rain for acid rain<br>allow a named respiratory problem for respiratory problems<br><br>MP2 cannot be linked to an incorrect gas from MP1 | 1 | AO3<br><br>4.7.1.3<br>4.9.3.2 |

### 4.9.1.4 How carbon dioxide decreased

**Answer 40 · Mark scheme** June 2024 | 8462/2H | Original Q5

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.4** | (volume of oxygen = $3.50 \times \frac{1}{2}$ =) 1.75 ($dm^3$) | | 1 | AO2 4.3.5 4.9.1.1 |
| | (volume of air =) $1.75 \times \frac{100}{20}$ | allow correct use of an incorrectly determined volume of oxygen | 1 | |
| | = 8.75 ($dm^3$) | | 1 | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **05.5** | there is a temperature gradient in the (fractionating) column | allow the (fractionating) column gets cooler going up | 1 | AO1 |
| | (so) kerosene condenses | allow (so) the hydrocarbons / vapours condense | 1 | AO2 |
| | at the level (in the column) corresponding to kerosene's boiling point (range) | allow at the level (in the column) corresponding to the boiling point of the hydrocarbons / vapours<br><br>for the award of 2 marks for MP2 and MP3, a reference to kerosene must be made | 1 | AO1<br>4.7.1.2 |

| Total Question 5 | 12 |
|---|---|

### 4.9.1.4 How carbon dioxide decreased

**Answer 41 · Mark scheme** June 2025 | 8462/2H | Original Q4

## Question 4

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.1** | (the percentage of) nitrogen increased | | 1 | AO1 4.9.1.2 |
| | (because of intense) volcanic activity | | 1 | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.2** | (carbon dioxide) dissolved in water / oceans | | 1 | AO1 4.9.1.2 |
| | (carbonate) forming sediments / precipitates | do **not** accept formed shells of sea creatures | 1 | |
| | | do **not** accept photosynthesis | | |
| | | do **not** accept formed fossil fuels | | |

| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.3** | all four points plotted correctly | allow a tolerance of ± ½ a small square | 1 | AO2 4.9.1.2 4.9.1.4 |
| | line of best fit | | 1 | |

### 4.9.1.4 How carbon dioxide decreased

**Answer 41 · Mark scheme**



| Question | Answers | Extra information | Mark | AO / Spec. Ref. |
|---|---|---|---|---|
| **04.4** | | ignore dissolving in oceans<br>ignore sedimentation | | |
| | carbon dioxide decreased<br>**and**<br>oxygen increased | | 1 | AO3 |
| | (because of) photosynthesis | do **not** accept respiration | 1 | AO1 |
| | (by) algae / plants | allow (by) cyanobacteria | 1 | AO1<br>4.9.1.3<br>4.9.1.4 |

| | |
|---|---|
| **Total Question 4** | **9** |

4.9.1.4 How carbon dioxide decreased

Answer 38 · Examiner comments

June 2018 | 8462/2H | Original Q3

## Question 3 (standard demand)

**03.1** 80% of students realised that the other gas used in the Haber process is hydrogen.

**03.2** 44% of the students knew the temperature and pressure used in the process. This was made even more challenging as they had to give the correct units as well.

**03.3** 32% of students could explain why only the ammonia, and not the other gases, turn into a liquid: because its boiling point is higher.

**03.4** This was an 'extended response', 'level marked' question. There were three levels and the command word was 'explain'. The question was marked holistically. Students were given information about the current atmosphere of Venus, believed to be similar to that on the early Earth, and the Earth's atmosphere today.

Generally, a level 1 response used the percentages given to say in which direction the amounts of these gases had moved. Level 2 moved beyond this, giving an explanation in terms of one process, such as photosynthesis or dissolving in oceans. Level 3 responses usually gave more than one process, for example both of the processes mentioned above.

Many students talked only about the changes in the last few centuries, which was not what the question was asking. 47% of students were able to provide a level 3 response.

**03.5** 39% of students seemed aware of the timescale under consideration here, namely the atmosphere of billions of years ago, or that there was a lack of evidence or proof. Many merely asserted that there was no-one there (to make measurements).

### 4.9.1.4 How carbon dioxide decreased

**Answer 39 · Examiner comments** June 2023 | 8462/2H | Original Q4

**Question 4 (standard and standard / high demand)**

**04.1** Around three-quarters of students knew that water vapour is a greenhouse gas. Nitrogen was the most popular distractor.

**04.2** Students who gained credit, usually did so by identifying that an increase in population creates an increased demand for energy. There were many references to the increase in the need for transportation in its various (specified) forms, which was creditworthy. However, students often did not gain the second mark as they failed to link the need for more energy to the outcome, that more (fossil) fuels are burned. Some students incorrectly stated that increased respiration by humans has caused the increase in the concentration of atmospheric carbon dioxide. Around 30% of students scored both marks.

**04.3** Over half of the students scored both marks. Students who gained only one mark usually did so because they simply stated that more cattle farming causes an increase in methane concentration, but did not explain that this was a result of an increased demand for food.

**04.4** This question was answered well, with more than 70% of students giving two effects. Students who did not gain credit often referred to climate change / the greenhouse effect / global warming, without describing the effect.

**04.5** Many students gave answers that were too vague, such as there is insufficient data or evidence. The usual creditworthy answers were in terms of previous cooling / warming cycles in the Earth's past. Only around one-quarter of students gained a mark here.

### 4.9.1.4 How carbon dioxide decreased

**Answer 40 · Examiner comments** June 2024 | 8462/2H | Original Q5

**Question 5 (standard and standard / high demand)**

05.1 This was not well understood. Some students knew that nitrogen and oxygen were reacting together. However, some thought that nitrogen came from the fuel and some that oxygen is a product of combustion. Only a minority mentioned high temperature although many said, 'very hot'. About 15% scored both marks.

05.2 Some students stated that no carbon dioxide is produced when hydrogen burns. However, many simply described what carbon dioxide does to the environment, rather than stating that burning hydrogen instead of methane **reduces** the rate of climate change. Many referred to the greenhouse effect without referencing the effect on the environment, ie climate change. Around 40% scored both marks.

05.3 Most realised that increased levels of nitrogen oxides would be produced. Although there were some good descriptions of what nitrogen oxides do to the environment, very few said that those effects would be increased by burning hydrogen instead of methane, ie **more** acid rain etc. Many thought that nitrogen oxides are greenhouse gases rather than a precursor of acid rain. Some suggested more nitrogen was released to the atmosphere, rather than oxides of nitrogen. Less than 10% of students scored both marks, although more than half scored one.

05.4 Over one-third of students gained all three marks. However, some students appeared to believe that the other 80% of the air was hydrogen. Some tried to involve the relative atomic masses, even though these were not provided. A few unnecessarily converted the volume of hydrogen to moles and then the moles of oxygen to volume, not realising that the mole ratio is the volume ratio for gases. This did score full marks if correct.

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**Answer 40 · Examiner comments** June 2024 | 8462/2H | Original Q5

05.5 Most scored the mark for kerosene, or the vapours condensing, and many also described the temperature gradient correctly. Far fewer scored the mark for linking the height in the column to the boiling point and the condensation of kerosene. Most did not mention the height or level in the column, while others seem to think that a vapour only condenses at a temperature below, rather than at, its boiling point. A few students thought that kerosene was either a product of cracking, or a polymer. Just over 10% scored all the marks.

### 4.9.1.4 How carbon dioxide decreased

**Answer 41 · Examiner comments** June 2025 | 8462/2H | Original Q4

## Question 4

04.1 Just over 40% of students scored both marks on this item. A further 40% were able to state that the percentage of nitrogen in the early atmosphere increased. A common mistake for those students who thought that nitrogen decreased was that it decreased because there has been less volcanic activity over time. A small number of pupils referred to nitrogen levels increasing because ammonia reacted with oxygen and because it is an unreactive gas.

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**Answer 41 · Examiner comments** June 2025 | 8462/2H | Original Q4

04.2 Students found linking the timeline of changes to the Earth's atmosphere challenging, with only 5% gaining both marks on this item. Half of the students gaining one mark, usually for identifying that the carbon dioxide dissolved in oceans, however, many of those did not gain the second mark because they incorrectly stated that carbon dioxide decreased because of photosynthesis. Students who tried to describe that carbon dioxide formed carbonate rocks, often did not achieve the mark because they used the phrases 'trapped in' and 'locked up in' which are not equivalent to formed.

04.3 Over 90% of students correctly plotted the points on the graph. The quarter of students who only scored one mark struggled with the line of best fir, with some drawing straight lines or missing plotted points by a wide margin.

04.4 Over half of students gained all three marks on this item. Where all three marks were not achieved, it was usually for not stated what happened to the concentrations on carbon dioxide and oxygen in the atmosphere. Many gave the description of photosynthesis, but this was insufficient for the mark.