PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

CHEMISTRY



MARK SCHEME

TOPIC 8: FUELS AND EARTH SCIENCE: EARTH AND ATMOSPHERIC SCIENCE (PAPER 2)

SCORE	PERCENTAGE
/105	%

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(Total for question = 2 marks)

(**QU03c 1SC0/2CF, June 2023**)

Mark Scheme

Q1.

Question number	Answer	Mark
(i)	**A** 19% is the only correct answer **B**, **C** and **D** are incorrect because 3.5/18.0 x 100 = 19 to nearest whole number	(1) AO3 1

Question number	Answer	Additional guidance	Mark
(ii)	a description linking • leave (for more time) (1) • until volume of gas stops changing (1) OR • take repeated readings at different times (1) • which must be the same (1) OR • use more (iron) wool (1) • so iron in **excess** (1)	ignore references to testing oxygen ignore so oxygen fully reacts ignore repeat the experiment alone add excess (iron) wool scores 2	(2) AO3 3b

(**QU04a 1SC0/2CH, June 2024**)

Q2.

Question number	Answer	Additional guidance	Mark
(i)	(416.56 – 371.17 =) 45.39 (1) = 45 (1) (to nearest whole number)	answer of 45 alone with or without working scores (2) 1 mark for correct rounding (has to use only the numbers 416.56 and 371.17 in any calculation)	**(2) AO2-1**

Question number	Answer	Additional guidance	Mark
(ii)	eg global warming / {ice caps/glaciers} melting / changing habitats / rising sea levels	allow {**enhanced/increased**} greenhouse effect / increased global temperatures / climate change / allow effects of climate change eg more extreme weather allow more photosynthesis ignore references to pollution / less oxygen in the air reject references to ozone layer / deforestation / acid rain	**(1) AO1-1**

(**QU03d 1SC0/2CF, June 2023**)

Q3.

Question number	Answer	Additional guidance	Mark
	360/100 (1) = 3.6 78 x 3.6 = 281 (1)	allow full marks for correct answer with no working	**(2)**

(**Q03a 1SC0/2CH/S2, SAM**)

Q4.

Question number	Answer	Mark
(i)	allow 2 for correct answer with or without working change in concentration = 410.83 - 407.96 (= 2.87) (1) = 3 (1)	(2)

Question number	Answer	Additional guidance	Mark
(ii)	volcanic activity / burning of fossil fuels / deforestation / respiration	allow more vehicles on road ignore global warming / ice-caps melting / farming	(1)

(**Q01d 1SC0/2CF, Nov 2020**)

Q5.

Question number	Answer	Mark
(i)	0.0401 - 0.0318 (1) = 0.0083	(1)

Question number	Answer	Additional guidance	Mark
(ii)	• other factors may change (1) • both rising does not prove one causes the other (1)	ignore references to anomalies	(2)

(**Q01d 1SC0/2CF/S2, SAM**)

Q6.

	Answer	Acceptable answers	Mark
	D less than 0.5%		(1)
	A explanation linking any **two** of • dissolves /is absorbed (1) • in the oceans (1) • incorporated into marine		(2)

	organisms (1) • formed carbonate rocks (1) • increase in (green) plants/plants start growing • photosynthesis /plants remove carbon dioxide	reject references to plants respiring/breathing	
	traps <u>heat</u>	reflects <u>heat back to Earth</u> reject references to the ozone layer	(1)

(**Q30 1SC0/2CH, June 2013**)

Q7.

Question Number	Answer	Mark
	change in the amount of carbon dioxide in the atmosphere: increase; decrease process causing the change: carbon dioxide absorbing the Sun's energy; carbon dioxide dissolving in oceans; volcanic emissions; using argon in light bulbs; burning hydrogen reject multiple lines from a box	**(2)** AO 1 1

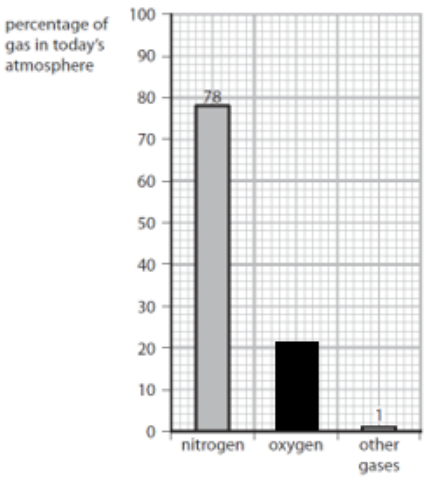
(**Q18 1SC0/2CF, June 2018**)

Q8.

Question number	Answer	Mark
	B carbon dioxide	**(1)**

(**Q01b 1SC0/2CF/S2, SAM**)

Q9.

Question Number	Answer	Additional guidance	Mark
(i)	Vertical bar for oxygen to just over 20% as shown in the bar chart (ignore width):  (1)	ignore bars touching each other ignore 21 above bar	(1)

Question Number	Answer	Additional guidance	Mark
	MP1 : $\frac{21}{100}$ (1) (=0.21) MP2 : 0.21 x 300 (1) (= 63) (cm^3)	63 (cm^3) with no working scores 2 marks 300/4.76 = 63 (2) 300/4.8 = 62.5 (2) allow 21 x 300 (1) (= 6300) allow $\frac{300}{100}$ (1) (= 3)	(2)

(**Q01b 1SC0/2CF, June 2019**)

Q10.

Question number	Answer	Additional guidance	Mark
	bar on bar chart for carbon dioxide to 95 %	allow ±½ small square ignore width of bar	(1) AO2-1

(**QU03a 1SC0/2CF, June 2023**)

Q11.

Question number	Indicative content	Mark
	$2CaCO_3 + Mg^{2+} \rightarrow CaMg(CO_3)_2 + Ca^{2+}$ 2 **(1)** Mg^{2+} **(1)**	**(2)**

(**Q04d 1SC0/2CH, Nov 2020**)

Q12.

Question number	Answer	Additional guidance	Mark
(i)	over the past 3 billion years the average surface temperature of the Earth **has decreased.**		**(1)** **AO2-1**

Question number	Answer	Additional guidance	Mark
(ii)	an explanation linking any **two** from • {the Earth / atmosphere / water vapour} cooled (1) • water vapour condensed / formed clouds (1) • {(liquid) water / rain} formed (1) • produced {oceans / seas / rivers / bodies of water} (1)	allow surface temperature has decreased allow lakes	**(2)** **AO2-1**

(**QU03b 1SC0/2CF, June 2023**)

Q13.

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

(**Q01a 1SC0/2CH, SAM 2016**)

Q14.

Question number	Answer		Mark
	A description including • (coastal ecosystems) store more (carbon/ carbon dioxide) (than forests) (1) • storing 2450 per unit area (for coastal) **AND** compared to 900 for non-coastal storage (1)	allow coastal mangrove trees and/or coastal salt marsh OR just "they" ignore seagrass in MP1 ORA allow 2400-2500 allow 850-950 allow 350-450 for forests allow any reasonable relative values (2.5-3 x as much as non-coastal, 6-6.5 x as much as forests)	(2) AO3 1

(**QU02d 1SC0/2CH, June 2024**)

Q15.

Question number	Answer	Additional guidance	Mark
(i)	A description to include • use of **glowing** splint (1) • (glowing splint) relights (1)	 2nd mark dependent on correct test	**(2)** **AO1**

Question number	Answer	Additional guidance	Mark
(ii)	potassium ion: 2.8.8 (1) oxide ion: 2.8 (1)	Allow other separators between the numbers including spaces	**(2)** **AO1**

(**Q03c 1SC0/2CH, Nov 2021**)

Q16.

Question number	Answer	Additional guidance	Mark
	A description to include • add **glowing** splint (1) • it relights (1)	reject lit splint/ flame ignore description of forming glowing splint e.g. light splint and blow it out MP2 depends on MP1	(2) AO1 2

(**QU02a 1SC0/2CH, June 2024**)

Q17.

Question number	Answer	Additional guidance	Mark
	A description to include • add **glowing** splint (1) • it relights (1)	reject lit splint/ flame ignore description of forming glowing splint e.g. light splint and blow it out MP2 depends on MP1	**(2)** **AO1 2**

(**QU06a 1SC0/2CF, June 2024**)

Q18.

Question number	Answer	Additional guidance	Mark
	A description to include glowing splint (1) relights (1)	 MP2 is dependent on MP1	**(2)** **AO1**

(**Q04b 1SC0/2CF, Nov 2021**)

Q19.

Question number	Answer	Additional guidance	Mark
	A plan to include • heating tube where zinc is (1) • pass {gas / air} over (heated) zinc (1) • until no further change in volume (1) • measuring volume of gas after experiment / calculate difference in volume (1)		**(4)** **AO3**

(**Q03d 1SC0/2CH, Nov 2021**)

Q20.

Question Number	Answer	Acceptable answers	Mark
(a)	**D** gases from volcanoes		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b) (i)	**A** less than 1%		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b) (ii)	CO_2	CO must be capitals Reject Co 2 must be subscript	**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(iii)	An explanation linking any two from **EITHER** • photosynthesis(1) • in (green) plants (1) • (carbon dioxide) absorbed (1) **OR** • (carbon dioxide) is soluble (in water) / dissolves (1) • in oceans (1)	Reject respiration Ignore breathe in (carbon dioxide) reference to formation of skeletons / carbonate rock	**(2)**

Question Number	Answer	Acceptable answers	Mark
(b)(iv)	burning fossil fuels / burning {petrol / fossil fuel} (in vehicles) /deforestation	ignore cars/driving unqualified allow breathing / respiration	**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)(v)	a description linking second marking point is dependent on first • limewater • (turning) cloudy/milky/white ppt		**(2)**

(**Q19 1SC0/2CF, June 2015**)

Q21.

Question Number	Answer	Acceptable answers	Mark
(i)	answer must refer to water vapour water vapour condensed / rain falls / water vapour removed / (water vapour) turns to water		**(1)**

Question Number	Answer	Acceptable answers	Mark
(ii)	An explanation linking • carbon dioxide (level) reduced (1) • so oxygen (level) increased (1)	carbon dioxide turned into oxygen (1)	**(2)**

(**Q02 5CH2H/01, June 2015**)

Q22.

Question number	**Answer**	**Mark**
	An answer that provides a description by making reference to: • adds carbon dioxide/adds water vapour (1) • removes oxygen (1)	**(2)**

(**Q01b 1SC0/2CH, SAM 2016**)

Q23.

Question Number		Indicative Content	Mark
QWC	*	A description / explanation including some of the following points marks can be scored from diagrams incorrectly balanced equations can be used as evidence of reaction occurring but po not otherwise credited **electrolysis process** • ions move when current passed • negative ions move to anode • overall decomposition of water • $2H_2O \rightarrow 2H_2+O_2$ **Anode/ positive electrode** • sulphate ions move to anode • hydroxide ions move to anode • hydroxide ions lose electrons/oxidation • hydroxide ions form oxygen • half equation: $4OH^- \rightarrow O_2 + 2H_2O + 4e^-$ • half volume gas at this electrode • oxygen test: glowing splint in gas relights **cathode/ negative electrode** • sodium ions move to cathode • hydrogen ions move to cathode • hydrogen ions gain electrons / reduction • hydrogen ions form hydrogen • half equation: $2H^+ + 2e^- \rightarrow H_2$ • double volume gas at this electrode • hydrogen test: lit splint in gas burns/ pops • hence double volume of hydrogen gas	**(6)**

Level	0	No rewardable content
1	**1 - 2**	• a limited description e.g. states which ions go to which electrode • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy
2	**3 - 4**	• a simple explanation e.g. explain formation of one product • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy
3	**5 - 6**	• a detailed explanation e.g. explaining formation of BOTH products at electrodes • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

(**Q07 5CH2H/01, June 2015**)

Q24.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. AO1 (3 marks) AO3 (3 marks) • carbon dioxide molecules absorb heat energy • likely carbon dioxide increase has caused temperature increase NATURAL PROCESSES • photosynthesis removes carbon dioxide • carbon dioxide dissolves into oceans • forming carbonate rocks • volcanoes release carbon dioxide HUMAN ACTIVITIES • burning fossil fuels releases carbon dioxide • deforestation means less carbon dioxide removed by trees • respiration DATA EVALUATION • from 1960-2000 steady increase in amount of carbon dioxide • from 1960-2000 general increase in mean temperature • correlation between carbon dioxide amount and temperature • increased mean temperature leads to a change in climate	**(6)** **AO1-1** **AO3-1**

Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	Read whole answer and ignore all incorrect material/ discard any contradictory material then:
Level 1	1–2	Additional Guidance Identifies processes that change atmospheric carbon dioxide **OR** Simple description of processes / global warming **OR** Simple statement about the data	Possible candidate response • Plants remove carbon dioxide from the atmosphere (1) • Plants, volcanoes and burning fossil fuels all change levels of carbon dioxide in the atmosphere (2) • As carbon dioxide levels have increased so has the temperature of the Earth (2) • Carbon dioxide levels have increased between 1960 and 2000 (1) • Carbon dioxide is emitted from volcanoes when they erupt (2)
Level 2	3–4	Additional Guidance Describes at least **two** processes that change levels of carbon dioxide **OR** Describes at least one process that change levels of carbon dioxide **AND** describes global warming **OR** uses the data in the graph to provide an evaluation	Possible candidate response • Burning fossil fuels and respiration of living things both release carbon dioxide into the atmosphere (3) • Photosynthesis removes carbon dioxide from the atmosphere and carbon dioxide dissolved in the oceans (3) • Plants remove carbon dioxide from the atmosphere during photosynthesis. Combustion of fossil fuels releases carbon dioxide into the atmosphere (4) • Deforestation means more carbon dioxide because less is absorbed by photosynthesis. As carbon dioxide levels have increased so has the temperature of the Earth (4) • Carbon dioxide absorbs IR, traps heat and reradiates it which links with the graphs showing increase of CO_2 and an increase in temperature (4)
Level 3	5–6	Additional Guidance Describes at least **two** processes that change levels of carbon dioxide **AND** uses the data in the graph to provide an evaluation **OR** Describes at least one process that change levels of carbon dioxide **AND** describes global warming **AND** uses the data in the graph to provide an evaluation	Possible candidate response • Increase in population has led to an increase in carbon dioxide levels through respiration, and the increase in population has also resulted in the increased burning of fossil fuels in cars. This has resulted in an increase in carbon dioxide levels from 1960 to 2000 (5) • Deforestation means more carbon dioxide because less is absorbed by photosynthesis, but carbon dioxide is removed when it dissolves in the oceans and forms carbonate rocks. The graphs show that carbon dioxide has increased over time AND so has the temperature which is a correlation (6)

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of chemical understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Interpretation and evaluation of the information attempted but will be limited with a focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3)
Level 2	3–4	• Demonstrates chemical understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Interpretation and evaluation of the information on both variables, synthesising mostly relevant understanding. (AO3)
Level 3	5–6	• Demonstrates accurate and relevant chemical understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3)

(**QU05d 1SC0/2CH, June 2025**)

Q25.

Question number	Answer	Additional guidance	Mark
	An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (1 mark): • as concentration of carbon dioxide increases the (mean global) temperature increases (overall) (1) • {but there is no evidence that the increase in (mean global) temperature is caused by the increase in concentration of carbon dioxide/other factors may cause the increase in (mean global) temperature} (1) OR • as concentration of carbon dioxide increases the (mean global) temperature increases (1) • so this does provide evidence that an increase in carbon dioxide is causing the Earth's temperature to rise (1) OR • as concentration of carbon dioxide increases the (mean global) temperature overall increases but {fluctuates/increases and decreases} (1) • so this does not provide evidence that an increase in carbon dioxide is causing the Earth's temperature to rise (1)	Award for conclusion (second mark) only given if reason given	**(2)**

(**Q01c 1SC0/2CH, SAM 2016**)

Q26.

Question number	Answer	Additional guidance	Mark
(i)	an explanation linking any **two** from: • volume of gas decreases (1) • because oxygen is used up (1) • there is a colour change (1) • due to {formation of zinc oxide / zinc oxidising} (1)	allow less {gas / oxygen / volume / air} (in syringe) ignore movement of plungers correct or otherwise ignore **zinc reacts with oxygen** allow any colour change even if incorrect ignore the gas changes colour allow zinc corrodes ignore zinc rusts ignore **zinc reacts with oxygen**	**AO2 2 (2)**

Question number	Answer	Additional guidance	Mark
(ii)	zinc oxide	allow ZnO, ZNO, oZn ignore Zn_2O	**AO2 2 (1)**

(**QU03c 1SC0/2CF, June 2025**)

Q27.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. AO1 (6 marks) **Natural: Origins:** • {carbon dioxide / water / gases} from volcanoes • the Earth cooled • so water vapour condensed (to form oceans/seas) reducing amount of water vapour • carbon dioxide {dissolves in/absorbed by} the oceans reducing amount of carbon dioxide • some carbon dioxide incorporated into sea animals' shells **Natural: Evolution** • plants evolved • photosynthesis • photosynthesis releases oxygen increasing amount of oxygen • photosynthesis absorbs carbon dioxide reducing amount of carbon dioxide **Human effects** • amounts of carbon dioxide in recent time increasing due to burning fossil fuels • amounts of carbon dioxide in recent time increasing due to agriculture • deforestation means less carbon dioxide absorbed • reforestation means more oxygen produced	**(6) AO1**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of chemical knowledge, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3–4	• Demonstrates chemical knowledge, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5–6	• Demonstrates accurate and relevant chemical knowledge throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	Read whole answer and ignore all incorrect material/ discard any contradictory material then: Information directly copied from the table is not credited e.g water vapour goes down Water vapour has gone down (0) Humans respire giving carbon dioxide (0)
Level 1	1–2	Additional Guidance Candidate gives basic ideas only, these may or may not be linked	Possible candidate response Carbon dioxide is produced by volcanoes (1) Water vapour decreased because the earth cooled (1) Water vapour in the atmosphere condensed to form oceans (2) Trees photosynthesise and absorb carbon dioxide (2) Trees take in carbon dioxide and produce oxygen (2) Plants release oxygen, burning fossil fuels release carbon dioxide (2)
Level 2	3–4	Additional Guidance candidate gives basic idea about two areas. OR candidate gives a detailed explanation about one process	Possible candidate response Carbon dioxide is absorbed during photosynthesis by plants and burning fossils produces carbon dioxide (3) Trees photosynthesise which absorb carbon dioxide and release oxygen. The Earth cooled and water condensed to produce oceans, these oceans absorbed carbon dioxide (4) Trees photosynthesise which absorb carbon dioxide and release oxygen (3) Primitive plants evolved in oceans and started to photosynthesise which decreased the amount of carbon dioxide and increase the amount oxygen in the atmosphere. (4)
Level 3	5–6	Additional Guidance candidate explains ideas about all **three** areas	Possible candidate response Trees photosynthesise which absorb carbon dioxide and release oxygen. The Earth cooled and water condensed to produce oceans, these oceans absorbed carbon dioxide. Cars produce carbon dioxide (5) Trees photosynthesise which absorb carbon dioxide and release oxygen. The Earth cooled and water condensed to produce oceans, these oceans absorbed carbon dioxide. Burning fossil fuels produces carbon dioxide and deforestation has led to fewer trees and therefore less carbon dioxide being absorbed (6)

(**QU06e 1SC0/2CF, June 2019**)

Q28.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. AO1 (6 marks) **Natural: Origins:** • {carbon dioxide / water / gases} from volcanoes • the Earth cooled • so water vapour condensed (to form oceans/seas) reducing amount of water vapour • carbon dioxide {dissolves in/absorbed by} the oceans reducing amount of carbon dioxide • some carbon dioxide incorporated into sea animals' shells **Natural: Evolution** • plants evolved • photosynthesis • photosynthesis releases oxygen increasing amount of oxygen • photosynthesis absorbs carbon dioxide reducing amount of carbon dioxide **Human effects** • amounts of carbon dioxide in recent time increasing due to burning fossil fuels • amounts of carbon dioxide in recent time increasing due to agriculture • deforestation means less carbon dioxide absorbed • reforestation means more oxygen produced	**(6) AO1**

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of chemical knowledge, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3–4	• Demonstrates chemical knowledge, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5–6	• Demonstrates accurate and relevant chemical knowledge throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	Read whole answer and ignore all incorrect material/ discard any contradictory material then: Information directly copied from the table is not credited e.g water vapour goes down Water vapour has gone down (0) Humans respire giving carbon dioxide (0)
Level 1	1–2	Additional Guidance Candidate gives basic ideas only, these may or may not be linked	Possible candidate response Carbon dioxide is produced by volcanoes (1) Water vapour decreased because the earth cooled (1) Water vapour in the atmosphere condensed to form oceans (2) Trees photosynthesise and absorb carbon dioxide (2) Trees take in carbon dioxide and produce oxygen (2) Plants release oxygen, burning fossil fuels release carbon dioxide (2)
Level 2	3–4	Additional Guidance candidate gives basic idea about two areas. OR candidate gives a detailed explanation about one process	Possible candidate response Carbon dioxide is absorbed during photosynthesis by plants and burning fossils produces carbon dioxide (3) Trees photosynthesise which absorb carbon dioxide and release oxygen. The Earth cooled and water condensed to produce oceans, these oceans absorbed carbon dioxide (4) Trees photosynthesise which absorb carbon dioxide and release oxygen (3) Primitive plants evolved in oceans and started to photosynthesise which decreased the amount of carbon dioxide and increase the amount oxygen in the atmosphere. (4)
Level 3	5–6	Additional Guidance candidate explains ideas about all **three** areas	Possible candidate response Trees photosynthesise which absorb carbon dioxide and release oxygen. The Earth cooled and water condensed to produce oceans, these oceans absorbed carbon dioxide. Cars produce carbon dioxide (5) Trees photosynthesise which absorb carbon dioxide and release oxygen. The Earth cooled and water condensed to produce oceans, these oceans absorbed carbon dioxide. Burning fossil fuels produces carbon dioxide and deforestation has led to fewer trees and therefore less carbon dioxide being absorbed (6)

(**QU06e 1SC0/2CF, June 2022**)

Q29.

Question number	Answer	Additional guidance	Mark
(i)	• 384 and 315 used from graph (1) • 384 – 315 = 69 (cm^3) (1)	Allow 384 to 385 in 2010 and 314 to 316 in 1960. Second mark consequential on values read from graph. Award full marks for correct numerical answer without working.	(2)

Question number	Answer	Additional guidance	Mark
(ii)	An answer that provides a description by making reference to one of the following linked pairs: • burning/(complete) combustion (1) • of carbon compounds/(fossil) fuels/wood/rubbish/plastic (1) OR • respiration/gas exhaled/breathing/ decaying (1) • from plants/animals/organisms (1) OR • eruption (releases gas) (1) • from volcanic activity/volcanoes (1)	Allow any type of fuel except hydrogen. Allow heating limestone.	(2)

(**Q01c 1SC0/2CF, SAM 2016**)

Q30.

Question number	Indicative content	Mark
	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material that is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (3 marks) and AO2 (3 marks)** Ignore any issues with methane itself e.g. it is a greenhouse gas. Ignore different colours of flame with open/ closed air hole. OPEN AIR-HOLE • air-hole open, allows lots of oxygen to mix with methane • therefore complete combustion takes place • $CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$ • carbon dioxide and water are produced. CLOSED AIR-HOLE • air-hole closed, less oxygen can enter to mix with methane • therefore incomplete combustion takes place • e.g $2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O$ (allow other correct examples) • carbon monoxide can be produced	**(6)**

	HARMFUL EFFECTS • CO is odourless and colourless • carbon monoxide combines with haemoglobin in place of oxygen/ reduces capacity of blood for oxygen • therefore toxic • carbon/ soot can also be produced • can aggravate asthma / respiratory problems • soot makes buildings dirty • carbon dioxide and water are greenhouse gases • absorb heat energy radiated from Earth which is re-radiated back into the atmosphere • increases greenhouse effect • causes global warming/ climate change • melt polar ice caps / sea levels rise	

Level	Mark	Descriptor
	0	No rewardable material.
Level 1 A description of open or closed air -hole or description of one harmful effect	1–2	closed air-hole gives less oxygen (1) closed air-hole gives less oxygen, open air-hole gives more oxygen (1) closed air-hole gives incomplete combustion (1) closed air-hole has less oxygen so incomplete combustion (2) complete combustion gives carbon dioxide (1) when the air-hole is open, oxygen allows complete combustion gives carbon dioxide and water (2)
Level 2 Description of two of: open air-hole/ closed air hole/ harmful effect	3–4	A closed air-hole gives less oxygen which produces soot and carbon monoxide which is toxic because it bonds to haemoglobin. (3) More oxygen gives carbon dioxide and water and incomplete combustion gives carbon monoxide and water. (4) Complete combustion produces carbon dioxide and water which are both greenhouse gases. Greenhouse gases absorb heat energy radiated from the earth and re-radiates it, this causes global temperatures to rise and leads to an increase in polar ice caps melting. (4)
Level 3 All **three aspects must be covered** Description of all three of: open air-hole/ closed air-hole/ harmful effect(s)	5–6	Incomplete combustion makes carbon monoxide but complete combustion produces carbon dioxide and water which are both greenhouse gases. Greenhouse gases absorb heat energy radiated from the earth and re-radiates it, this causes global temperatures to rise and leads to an increase in polar ice caps melting. (5) A closed air-hole gives incomplete combustion which produces carbon monoxide which is an odourless and colourless toxic gas. Complete combustion produces carbon dioxide and water which are both greenhouse gases. Greenhouse gases absorb heat energy radiated from the earth and re-radiates it, increases the greenhouse effect and temperature of the Earth's atmosphere. (6)

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

(**QU06c 1SC0/2CH, June 2023**)

Q31.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **AO1 (6 marks)** **Photosynthesis** • plants/ trees absorb carbon dioxide • and release oxygen • in photosynthesis **Change in atmosphere** • plants/ trees overall increase amount of oxygen • plants/ trees overall reduce amount of carbon dioxide **Temperature** • carbon dioxide absorbs sun's energy that is radiated back from Earth • this increases Earth's temperature • called greenhouse effect • global warming **Changes in plant coverage over time** • plants evolved so more photosynthesis • in recent years less tree coverage • due to deforestation • so less photosynthesis • so carbon dioxide reduced from original levels but now increasing	**(6) AO 1**

Level	Mark	Descriptor	Additional Guidance
	0	No rewardable material.	Read whole answer and ignore all incorrect material/ discard any contradictory material then:
Level 1	1–2	Additional Guidance simple statement about the **change** of amounts gases in the atmosphere	Possible candidate response carbon dioxide has decreased **OR** oxygen has increased (1) carbon dioxide has been absorbed **OR** oxygen has been released (1) carbon dioxide has been absorbed and oxygen has been released (2) carbon dioxide levels have decreased, oxygen levels have increased (2)
Level 2	3–4	Additional Guidance the **change** in amounts of gases in the atmosphere is linked to **EITHER** the evolution of plants **OR** changes in plant coverage **OR** a change in temperature.	Possible candidate response since plants photosynthesise, this has caused carbon dioxide levels to decrease (3) plants cause carbon dioxide levels to decrease, and oxygen levels to increase (3) plants photosynthesise which causes carbon dioxide levels to decrease and oxygen levels to increase (4) photosynthesis of evolving plants caused carbon dioxide to be absorbed and oxygen to be released (4) as trees are cut down, less photosynthesis is occurring so less carbon dioxide is absorbed (3) as trees are cut down, less photosynthesis is occurring so less carbon dioxide is absorbed and less oxygen is released (4) as carbon dioxide levels have decreased the temperature of the Earth has decreased (3) as carbon dioxide levels have decreased the temperature of the Earth has decreased due to less greenhouse gases (4)
Level 3	5–6	Additional Guidance the **change** in amounts of gases in the atmosphere is linked to the evolution of plants **AND** an **explanation** of the change in temperature **OR** the **change** in amounts of gases in the atmosphere is linked to the changes in plant coverage **AND** an **explanation** of the change in temperature.	Possible candidate response since plants have started to evolve, photosynthesis has caused carbon dioxide levels to decrease, which has led to temperatures decreasing, due to less energy from the sun being trapped in the greenhouse layer (5) since more trees are being cut down, less photosynthesis has caused carbon dioxide levels to increase, which has led to temperatures increasing, due to more energy from the sun being radiated back to Earth (5) since plants have started to evolve, photosynthesis has caused carbon dioxide levels to decrease and oxygen levels to increase, but since the amount of land covered by trees has decreased, carbon dioxide levels are rising again, which has led to temperatures increasing, due to more energy from the sun being radiated back to Earth. (6)

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of chemical understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3–4	• Demonstrates chemical understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5–6	• Demonstrates accurate and relevant chemical understanding throughout. Understanding of the scientific ideas is detailed and fully developed. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

(**QU06d 1SC0/2CF, June 2024**)

Q32.

Question number	Answer	Additional guidance	Mark
	An explanation linking any two • Earth cooled (1) • water (vapour) condensed (1) • oceans formed /seas formed/ rainfall (1)	allow temperature decreased	(2)

(**Q01c 1SC0/2CF, Nov 2020**)

Q33.

Question number	Answer	Additional guidance	Mark
	an explanation linking • plants (1) • (produces oxygen by) photosynthesis (1)	allow cyanobacteria / stromatolites allow 'photosynthetic organisms' = 2 marks	**(2)** **AO1 1**

(**QU05a 1SC0/2CH, June 2022**)

Q34.

Question number	Indicative content	Additional guidance	Mark
	An explanation to include Q is early atmosphere (0) because • limewater ppt faster so contains {more/ large amount of} carbon dioxide **(1)** • splint goes out so {little/no oxygen} **(1)**	 If P given then (0) If neither P nor Q stated they must be clearly referring to Q to score.	**(2)**

(**Q04e 1SC0/2CH, Nov 2020**)

Q35.

Question Number	Answer	Acceptable answers	Mark
(a)	**B** the ease of ignition decreases		**(1)**

Question Number	Answer	Acceptable answers	Mark
(b)	A description linking either • {carbon monoxide / CO} (1) • is toxic / poisonous (1) or • {carbon / soot / C} (1) • causes respiratory problems /particles blocks jets (1)	 can kill combines with haemoglobin(in place of oxygen) blackens buildings	 **(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(i)	An explanation linking any two of • greenhouse gas (1) • traps heat (in atmosphere) (1) • may lead to increased (global) temperature / global warming (1)	 (increased) greenhouse effect traps infra-red radiation **reject** references to UV increased of global warming e.g climate change **reject** references to ozone layer	 **(2)**

Question Number	Answer	Acceptable answers	Mark
(c)(ii)	An explanation linking three from • (sulfur reacts/combusts/burns) with {oxygen/air} (1) • (forms) sulfur dioxide (1) • sulfur dioxide {dissolves/reacts} in {rain/water/clouds} / sulfur dioxide forms acid rain (1) • (acid rain) causes damage to buildings/plants/kills fish in lakes (1)		**(3)**

Question Number	Answer	Acceptable answers	Mark
(d)	A description including two of the following • biofuels are renewable / fossil fuels are finite/biofuels are sustainable /biofuels will not run out (1) • biofuels are produced from plants (1) • growing plants remove carbon dioxide from the atmosphere (1) • reduces demand for fossil fuels (1) • biofuels do not contain impurities such as sulfur (1)	reject biofuels are reusable ignore carbon neutral alone ignore references to cost	**(2)**

(**Q08 1SC0/2CH, June 2014**)

Q36.

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

(**Q01a 1SC0/2CF/S2, SAM**)

Q37.

	Answer	Acceptable answers	Mark
(a)(i)	**D** less than 0.5%		(1)
(a)(ii)	A explanation linking any **two** of • dissolves /is absorbed (1) • in the oceans (1) • incorporated into marine organisms (1) • formed carbonate rocks (1) • increase in (green) plants/plants start growing • photosynthesis /plants remove carbon dioxide	reject references to plants respiring/breathing	(2)
(a)(iii)	traps <u>heat</u>	reflects <u>heat back to Earth</u> reject references to the ozone layer	(1)
(b)	A description to include • glowing splint (1) M1 • relights (1) M2	smouldering splint reject unlit splint ignore blown out splint M2 dependent on M1 but lighted splint burns brighter (2)	(2)
(c)(i)	An explanation linking • volume of gas in bell jar decreases/water rises to fill the space (1) • oxygen is removed from the air (1)	{volume/amount} of air decreases accept oxygen is used up	(2)
(c)(ii)	(amount of gases remaining) 79% (1) $\text{(volume remaining)} = \frac{1000 \times 79}{100}$ (1) = 790 (cm^3)	ecf for incorrect percentage of volume of gases remaining in M1 correct answer or valid calculation alone scores (2)	(2)
(d)	magnesium sulphate	accept magnesium sulphate	(1)

(**Q23 1SC0/2CH, June 2013**)

Q38.

Question number	Answer	Mark
	D	(1)

(**Q01a 1SC0/2CF, SAM 2016**)

Q39.

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

(**Q01b 1SC0/2CF, Nov 2020**)

Q40.

Question number	Answer	Mark
(i)	photosynthesis	(1) AO1-1

Question number	Answer	Mark
(ii)	**B** put a glowing splint into the gas and it relights **A**, **C** and **D** are incorrect tests for oxygen	(1) AO1-2

(**QU03c 1SC0/2CF, June 2023**)