AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.9.1.2

The Earth's early atmosphere

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**39**
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.

4.9.1.2 The Earth's early atmosphere

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

Question 2

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

4.9.1.2 The Earth's early atmosphere

Answer 02 · Mark scheme March 2007 | CHY1B | Original Q5 | Legacy

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

Answer 03 · Mark scheme June 2007 | CHY1B | Original Q2 | Legacy

Two	**A**	**2**
	B	**4**
	C	**1**
	D	**3**

	A	**B**	**C**	**D**

Answer 04 · Mark scheme June 2007 | CHY1B | Original Q5 | Legacy

Five	**2**	**4**	**3**	**3**

Answer 05 · Mark scheme June 2007 | CHY1B | Original Q8 | Legacy

Eight	**3**	**2**	**4**	**2**

Answer 06 · Mark scheme June 2007 | CHY1H | Original Q3 | Legacy

The full source mark scheme begins on page 43. Follow original question 3 in that document.

Answer 07 · Mark scheme March 2008 | CHY1BP | Original Q4 | Legacy

Four	**2**	**1**	**2**	**3**

Answer 08 · Mark scheme March 2008 | CHY1BP | Original Q7 | Legacy

Seven	**1**	**1**	**4**	**4**

Answer 09 · Mark scheme June 2008 | CHY1BP | Original Q1 | Legacy

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

4.9.1.2 The Earth's early atmosphere

Answer 10 · Mark scheme

June 2008 | CHY1BP | Original Q9 | Legacy

Nine	**1**	**3**	**3**	**2**

4.9.1.2 The Earth's early atmosphere

Answer 11 · Mark scheme June 2008 | CHY1H | Original Q7 | Legacy

question	answers	extra information	mark
7(a)	any **two** from:	asks for cause therefore no marks for just describing the change must link reason to a correct change in a gas	2
	carbon dioxide has decreased due to: • plants / micro organisms / bacteria / vegetation / trees	accept idea of 'used' to indicate a decrease	
	• photosynthesis	ignore respiration	
	• 'locked up' in (sedimentary) rocks / carbonates / fossil fuels		
	• dissolved in oceans	ignore volcanoes	
	oxygen has increased due to: • plants / bacteria / micro organisms / vegetation / trees	accept idea of 'given out / produced'	
	• photosynthesis	ignore respiration	
	nitrogen increased due to: • ammonia reacted with oxygen	accept idea of 'given out / produced'	
	• bacteria / micro organisms	ignore (increase in) use of fossil fuels / deforestation	
7(b)	(because methane's) boiling point is greater than the average / surface temperature **or** Titan's (average / surface) temperature is below methane's boiling point	ignore references to nitrogen **or** water	1
	any methane that evaporates will condense	accept boils for evaporates accept cooling and produce rain for condensing	1

Question 7 continued on next page…

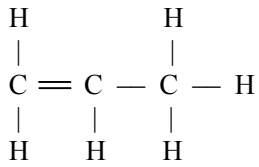
COMPONENT NUMBER: CHY1H

COMPONENT NAME: Science B / Chemistry

STATUS: Final

DATE: June 2008

Question 7 continued…

question	answers	extra information	mark
7(c)(i)		bonds must be displayed correctly ignore bond angles	1
7(c)(ii)	poly(propene) / polypropene / polypropylene any **two** from: • double bonds open up / break / become single • propene molecules / monomers / they join / undergo <u>addition</u> polymerisation • form chains / long molecules	do **not** allow polypropane correct chemical equation gains **2** marks ignore large using monomer incorrectly max **2** marks	1 2
Total			**8**

4.9.1.2 The Earth's early atmosphere

Answer 12 · Mark scheme

November 2008 | CHY1BP | Original Q1 | Legacy

One	**A**	carbon dioxide	**3**
	B	helium	**1**
	C	nitrogen	**2**
	D	oxygen	**4**

Answer 13 · Mark scheme

June 2009 | CHY1BP | Original Q8 | Legacy

Eight	**1**	**4**	**4**	**3**

4.9.1.2 The Earth's early atmosphere

Answer 14 · Mark scheme June 2009 | CHY1H | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)(i)	(gases from) volcanoes		1
3(a)(ii)	100	allow 99	1
3(a)(iii)	any **two** from: • photosynthesis • carbon dioxide used • oxygen produced	they = plants allow carbon dioxide decreased allow oxygen increased ignore nitrogen / respiration	2
3(b)(i)	any **one** from: • sea floor spreading • periodic measurements between continents • evidence from rocks / fossils on different continents • new mountain ranges	accept oceanic ridges / magnetic stripes accept continents move a few centimetres each year accept continents fit together accept new islands	1
3(b)(ii)	in the mantle any **two** from: • convection (currents) / movement • radioactivity / radioactive decay / nuclear reactions • releases heat / thermal energy	do **not** accept movement of the plates accept heat from core	1 2
Total			**8**

4.9.1.2 The Earth's early atmosphere

Answer 14 · Mark scheme June 2009 | CHY1H | Original Q3 | Legacy

CHY1H

Answer 15 · Mark scheme November 2009 | CHY1BP | Original Q9 | Legacy

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

Answer 16 · Mark scheme March 2010 | CHY1BP | Original Q4 | Legacy

Four	**4**	**4**	**2**	**3**

Answer 17 · Mark scheme March 2010 | CHY1BP | Original Q8 | Legacy

Eight	**2**	**1**	**2**	**1**

Answer 18 · Mark scheme June 2010 | CHY1BP | Original Q2 | Legacy

Two	**A** Formula **A**		**2**	
	B Formula **B**		**4**	
	C Formula **C**		**3**	
	D Formula **D**		**1**	
	A	**B**	**C**	**D**

Answer 19 · Mark scheme June 2010 | CHY1BP | Original Q5 | Legacy

Five	**4**	**1**	**3**	**2**

4.9.1.2 The Earth's early atmosphere

Answer 20 · Mark scheme

June 2010 | CHY1H | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)(i)	condensed	it = water vapour accept temperature went below 100°C / boiling point of water allow cooled to form liquid / water / rain do **not** accept evaporated	1
	formed the oceans / seas	ignore rain accept (water vapour) cooled and formed the ocean / sea for **2** marks	1
2(a)(ii)	any **two** from: • used by (green) plants / algae • changed into oxygen • dissolved in oceans / seas • (locked up) in carbonates / sedimentary rocks • (locked up) in fossil fuels / named fossil fuel	ignore oxygen / nitrogen increased ignore reference to volcanoes / respiration accept photosynthesis / plants give out oxygen 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 accept it is (too) hot / radioactive ignore lack of evidence unqualified	1

Question 2 continues on the next page

4.9.1.2 The Earth's early atmosphere

CHY1H

Question 2 continued

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

4.9.1.2 The Earth's early atmosphere

Answer 20 · Mark scheme June 2010 | CHY1H | Original Q2 | Legacy

CHY1H

Answer 21 · Mark scheme November 2010 | CHY1BP | Original Q8 | Legacy

Eight	**1**	**4**	**1**	**3**

4.9.1.2 The Earth's early atmosphere

Answer 22 · Mark scheme

Question 3

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

Question 3 continues on the next page

4.9.1.2 The Earth's early atmosphere

Answer 22 · Mark scheme

CHY1H

Question 3 contd

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

4.9.1.2 The Earth's early atmosphere

Answer 22 · Mark scheme January 2011 | CHY1H | Original Q3 | Legacy

CHY1H

Answer 23 · Mark scheme March 2011 | CHY1BP | Original Q9 | Legacy

Nine	**3**	**3**	**4**	**3**

Answer 24 · Mark scheme June 2011 | CHY1BP | Original Q3 | Legacy

Three	**3**	**3**	**3**	**2**

4.9.1.2 The Earth's early atmosphere

Answer 25 · Mark scheme June 2011 | CHY1BP | Original Q9 | Legacy

Nine	**3**	**3**	**3**	**3**

The AQA UMS Conversion Calculator can be found at the following web address:

http://www.aqa.org.uk/umsconversion

Answer 26 · Mark scheme November 2011 | CHY1BP | Original Q7 | Legacy

Seven	**4**	**1**	**1**	**3**

4.9.1.2 The Earth's early atmosphere

Answer 27 · Mark scheme

June 2012 | CH1HP | Original Q4 | Legacy

Question 4

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

Question 4 continues on the next page . . .

4.9.1.2 The Earth's early atmosphere

Answer 27 · Mark scheme

June 2012 | CH1HP | Original Q4 | Legacy

CH1HP

Question 4 cont'd…

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

4.9.1.2 The Earth's early atmosphere

Answer 27 · Mark scheme June 2012 | CH1HP | Original Q4 | Legacy

CH1HP

4.9.1.2 The Earth's early atmosphere

Answer 28 · Mark scheme

January 2013 | CH1HP | Original Q4 | Legacy

question	answers	extra information	mark
4(a)(i)	(Iceland is) on a boundary between (tectonic) plates	allow where tectonic plates move apart / meet / collide	1
4(a)(ii)	any **one** from: • not all tremors (small earthquakes) indicate that the volcano will erupt • scientists cannot monitor what is happening below the Earth's crust or in the Earth's mantle	ignore tremors (small earthquakes) are random / have no pattern ignore difficult to predict / no evidence / no proof allow these tremors (small earthquakes) may be false alarms	1
4(b)	water vapour / steam released by volcanic activity condensed to form the oceans	allow a description of condensing do **not** accept other gases condensing	1 1
4(c)	earthquakes are caused by the sudden movement of the Earth's (tectonic) plates caused by convection currents in the Earth's mantle caused (by the heat released) by radioactive processes (within the Earth)	ignore collision (of tectonic plates)	1 1 1
Total			**7**

4.9.1.2 The Earth's early atmosphere

Answer 28 · Mark scheme

January 2013 | CH1HP | Original Q4 | Legacy

CH1HP

4.9.1.2 The Earth's early atmosphere

Answer 29 · Mark scheme

January 2013 | CH1HP | Original Q8 | Legacy

question	answers	extra information	mark
8(a)	methane		1
	because at the surface temperature of -179°C only methane has melted but has not boiled	accept a correct explanation using the boiling points(and melting points) of the gases **or** methane is a liquid **and** all the others are gases	1
8(b)	CH_4 is a hydrocarbon **or** methane / carbon monoxide contains carbon **or** carbon monoxide + hydrogen → hydrocarbon		1
	nitrogen **and** hydrogen are present in Titan's atmosphere **or** nitrogen + hydrogen → ammonia		1
	carbon monoxide contains oxygen **or** carbon monoxide + hydrogen / methane → water		1
	amino acids contain carbon, hydrogen, nitrogen + oxygen **or** amino acids can be made from (methane), hydrogen, carbon monoxide and nitrogen **OR** lightning / ultraviolet / electrical discharge / high energy needed for reaction		1
Total			**6**

UMS conversion calculator www.aqa.org.uk/umsconversion

4.9.1.2 The Earth's early atmosphere

Answer 30 · 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: • used by plants • dissolved in oceans • 'locked up' in fossil fuels **or** formed fossil fuels • 'locked up' in rocks **or** formed rocks	it = carbon (dioxide) accept photosynthesis	2

Question 5 continues on the next page

4.9.1.2 The Earth's early atmosphere

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**

4.9.1.2 The Earth's early atmosphere

Answer 31 · Mark scheme

June 2013 | CH1HP | Original Q6 | Legacy

Question 6

question	Answers	extra information	Mark
6(a)	Earth consists of crust, mantle and core		1
	relative positions (of crust, mantle and core) correctly given		1
	crust is thinner than the mantle and core	accept correct information from a labelled diagram	1
6(b)	continents were joined together	accept there was a supercontinent / Pangaea	1
	the continents then drifted apart **or** moved apart	ignore attempts at explanations for movement	1
Total			**5**

4.9.1.2 The Earth's early atmosphere

Answer 32 · Mark scheme

June 2013 | CH2HP | Original Q6 | Legacy

Question 6

question	Answers	extra information	Mark
6(a)	has simple / small molecules	accept molecular covalent	1
	the intermolecular forces / intermolecular bonds (are weak)	do **not** accept weak covalent bonds **or** reference to incorrect bonding	1
	only need a small amount of energy to be overcome	accept only need a small amount of energy to separate the molecules if no other mark awarded, allow it has a low boiling point for **1** mark	1
6(b)(i)	to separate		1
6(b)(ii)	(relative) molecular mass	allow M_r / (R)MM / relative mass / mass of molecule / (R)FM	1
6(c)(i)	any pH value from 0 to 6.9		1
6(c)(ii)	hydrogen	allow H^+ ignore H / H_2 / H^-	1
6(d)	any **three** from:		3
	• same number of protons	accept same atomic number numbers if given must be correct	
	• ^2H has one neutron • ^1H has no neutrons	accept different mass number **or** different number of neutrons for **1** mark ignore relative atomic mass	
	• same number of electrons	numbers if given must be correct	
Total			10

UMS Conversion Calculator: www.aqa.org.uk/umsconversion

4.9.1.2 The Earth's early atmosphere

Answer 33 · Mark scheme

June 2015 | CH1HP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	
3(a)	any **one** from: • not enough evidence or proof • (life and the Earth were created) billions of years ago	allow no evidence or no proof allow a long time ago 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

4.9.1.2 The Earth's early atmosphere

Answer 33 · Mark scheme

June 2015 | CH1HP | Original Q3 | Legacy



4.9.1.2 The Earth's early atmosphere

Answer 34 · Mark scheme June 2017 | CH1HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	any **one** from: • all these gases / hydrogen / methane / water vapour / ammonia may not have been in the Earth's early atmosphere • the conditions of the reaction were not like those on early Earth • 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. allow nobody knows what was in the Earth's early atmosphere allow very little (0.5%) in the Earth's early atmosphere allow nobody knows what the conditions were on early Earth allow only simple amino acids **/** glycine were produced	1	**AO3** 1.7.2d;e
5(a)(ii)	any **three** from: • used by plants / algae **or** for photosynthesis • absorbed / dissolved by oceans • locked up in sedimentary rocks / carbonates / limestone • locked up in fossil fuels	ignore volcanoes allow stored in for locked up allow stored in for locked up mention of respiration: maximum two marks	3	**AO1** 1.7.2f;g;h
5(b)(i)	helium / He **and** neon / Ne	both needed	1	**AO2** 1.7.2j

4.9.1.2 The Earth's early atmosphere

Answer 34 · Mark scheme

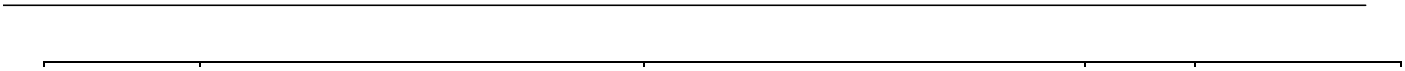
June 2017 | CH1HP | Original Q5 | Legacy

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

4.9.1.2 The Earth's early atmosphere

Answer 34 · Mark scheme

June 2017 | CH1HP | Original Q5 | Legacy



4.9.1.2 The Earth's early atmosphere

Answer 35 · 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 200 atm / atmospheres	allow values in the range 400– 500 °C allow values in the range 150– 250 atm / atmospheres allow **1** mark if both values within range but no units given	1 1	AO1 4.10.4.1
03.3	ammonia has a higher boiling point	allow the other gases have lower boiling points ignore references to melting point	1	AO3 4.10.4.1

4.9.1.2 The Earth's early atmosphere

Answer 35 · Mark scheme

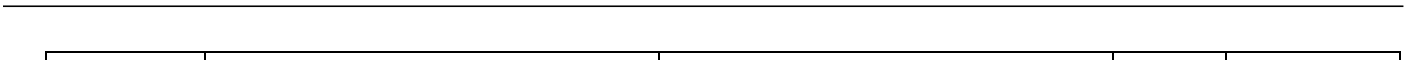
June 2018 | 8462/2H | Original Q3

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 **changes** • carbon dioxide has decreased • oxygen has increased **processes** • volcanic activity released water vapour • the water vapour condensed to form oceans • carbon dioxide dissolved in oceans • carbonates produce sediments • carbon locked up in sedimentary rocks • algae and plants evolved / appeared • algae / plants absorbed carbon dioxide • by photosynthesis • which also released oxygen • carbon locked up in fossil fuels			4.9.1.2 4.9.1.3 4.9.1.4
03.5	any **one** from: • occurred 4.6 billion years ago • limited or no evidence	allow any indication of billions of years allow limited or no proof ignore there was nobody there	1	AO1 4.9.1.2
Total			**11**	

4.9.1.2 The Earth's early atmosphere

Answer 35 · Mark scheme

June 2018 | 8462/2H | Original Q3



4.9.1.2 The Earth's early atmosphere

Answer 36 · Mark scheme

November 2020 | 8462/2H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	**test:** (use a) glowing splint **result:** relights	do **not** accept burning splint dependent on correct test in MP1 ignore with a pop	1 1	AO1 4.8.2.2 4.9.1.3
09.2	starch cellulose	 allow glycogen	1 1	AO1 4.7.3.4
09.3	2		1	AO1 4.7.3.3
09.4	water	allow H_2O	1	AO1 4.7.3.3
09.5	ammonia nitrogen	 if no other mark awarded, allow **1** mark for NO / NO_2 / N_2O / NO_x or equivalent named compounds	1 1	AO3 4.7.3.3 4.9.1.2

4.9.1.2 The Earth's early atmosphere

Question 9 (continued)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	two polymer chains	allow two polymer strands	1	AO1 4.7.3.4
	four (different) monomers / nucleotides	allow four (different) bases allow cytosine, guanine, adenine and thymine allow C G A T	1	
	(double) helix	allow spiral	1	
		if no other mark awarded, allow **1** mark for DNA		
Total			**11**	

4.9.1.2 The Earth's early atmosphere

Answer 37 · Mark scheme

June 2022 | 8462/2H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	(the percentage of) nitrogen increased (because of intense) volcanic activity		1 1	AO3 AO1 4.9.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	(the percentage of) carbon dioxide decreased (because) carbon dioxide dissolved in oceans **or** (because of) formation of carbonate (precipitates / sediments)	do **not** accept references to photosynthesis	1 1	AO3 AO1 4.9.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	(the percentage of) carbon dioxide decreased **and** (the percentage of) oxygen increased the increase and decrease (in percentage) occur at the same / similar rate	allow the changes (in percentage) are the same / similar in the same period of time	1 1	AO3 4.9.1.3 4.9.1.4

4.9.1.2 The Earth's early atmosphere

Answer 37 · Mark scheme

Question	Answers	Extra information		AO / Spec. Ref.
06.4	photosynthesis	allow a description of photosynthesis	1	AO1 4.9.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	plankton (died)	allow tiny marine organisms (died)	1	AO1 4.9.1.4
	and (the organisms) were covered by sediments	allow and (the organisms) were buried allow and (the organisms) were in anaerobic conditions	1	
	and subjected to high temperature **and** high pressure (over millions of years)		1	

Total Question 6		**10**

4.9.1.2 The Earth's early atmosphere

Answer 38 · Mark scheme

June 2023 | 8462/2H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	water vapour		1	AO1 4.9.2.1

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

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

4.9.1.2 The Earth's early atmosphere

Answer 38 · Mark scheme

June 2023 | 8462/2H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	any **two** from: • melting ice • rising sea levels • flooding • extremes of weather • loss of habitats	ignore global warming do **not** accept acid rain do **not** accept global dimming do **not** accept references to ozone	2	AO1 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 allow the earth goes through cycles of temperature change	1	AO3 4.9.2.2

Total Question 4	8

4.9.1.2 The Earth's early atmosphere

Answer 39 · 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	

4.9.1.2 The Earth's early atmosphere

Answer 39 · Mark scheme

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

Total Question 4	9

Version 1.0: 0707

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1H Unit Chemistry 1

Mark Scheme

2007 examination - June series

4.9.1.2 The Earth's early atmosphere

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Dr Michael Cresswell, Director General.

4.9.1.2 The Earth's early atmosphere

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

4.9.1.2 The Earth's early atmosphere

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

4.9.1.2 The Earth's early atmosphere

CHY1H Question 1

	answers	extra information	mark
(a)	any **two** from: • nitrogen • carbon dioxide • water (vapour) / steam	 accept formulae N / N_2 accept formula CO_2 ignore CO accept formula H_2O	2
(b)	any **three** from: <u>limestone</u> • abundant / local • natural material **or** no 'processing' needed • relatively easy to cut • appearance better <u>concrete</u> • <u>raw materials</u> are abundant • can be reinforced (by steel rods) / strong(er) / supported (by steel rods) • concrete mixture can be poured / moulded / constructed on site • less reactive with acid rain / weathering / erosion	no mark for 'limestone' or 'concrete' on first line – mark advantages only ignore ideas of speed of production or easier to use accept 'can build higher' ignore density / extraction / quarrying / pollution / cost	3
total			5

4.9.1.2 The Earth's early atmosphere

CHY1H Question 2

	answers	extra information	mark
(a)(i)	$Cu_2S + 2O_2 \rightarrow 2CuO + SO_2$	accept fractions and multiples	1
(ii)	any **two** from: • sulfur dioxide • causes acid rain • consequence of acid rain eg kills fish / plants	 accept sulphur dioxide / sulphur oxide / SO_2 ignore other comments eg global warming / ozone / global dimming / greenhouse effect	2
(b)	any **two** from: • heat (copper oxide with carbon) • oxygen is removed by carbon **or** carbon monoxide / carbon dioxide is produced **or** carbon displaces copper • because carbon is more reactive than copper	 accept copper (oxide) loses oxygen **or** carbon gains oxygen accept carbon oxide accept a correct word or balanced symbol equation allow a correct comparison of reactivity	2
(c)(i)	electrolysis	accept electroplating	1
(ii)	(electrical) wiring / appliances / coins / pipes / cladding for buildings / jewellery / making alloys **or** named alloys		1

Continued on next page

4.9.1.2 The Earth's early atmosphere

Question 2 continued

	answers	extra information	mark
(d)	any **three** explanations from: <u>for recycling</u> • less acid rain (pollution) • copper reserves last longer / conserved **or** do not run out • energy for extraction (saved) **or** less energy required • less mining / quarrying • less waste (copper) / electrical appliances dumped **or** less landfill <u>against recycling</u> • collection problems • transport problems • difficult to separate copper from appliances • energy used to melt the collected copper	ignore electrolysis / pollution ignore ideas about less machinery / plant ignore idea of cost	3
total			10

4.9.1.2 The Earth's early atmosphere

CHY1H Question 3

	answers	extra information	mark
(a)(i)	core		1
(ii)	plate (boundaries)	accept parts of the crust ignore crust alone	1
	sudden movement / colliding **or** normally move a few centimetres per year	accept movement but ignore movement apart accept continental drift	1
	convection currents / driven by heat from radioactive processes / decay	idea of source of energy for the movement	1
	the idea of uncertainty with an explanation eg scientists do not know (with any certainty) • what happens under the crust • where the forces / pressure are building up • we cannot measure the forces • when the forces reach their limit	ignore references to volcanoes	1
(b)(i)	78		1

Continued on next page

4.9.1.2 The Earth's early atmosphere

Question 3 continued

	answers	extra information	mark
(ii)	marks awarded for any 2 gases from the following 3 gases	max **3** marks from CO_2	
	any **four** from: carbon dioxide has decreased: • used by plants / bacteria (stromatolites) • during photosynthesis (must be linked to CO_2 decrease) • 'locked up' in (sedimentary) rocks / carbonates / fossil fuels • dissolved in oceans **and / or** oxygen has increased because: • released by plants / bacteria (stromatolites) • during photosynthesis (must be linked to O_2 increase) **and / or** nitrogen has increased because • ammonia reacted with oxygen (to release nitrogen) • nitrogen is released by bacteria	ignore references to respiration	4
total			10

4.9.1.2 The Earth's early atmosphere

CHY1H Question 4

	answers	extra information	mark
(a)	permitted additive / (added) chemicals **or** names / types of additives	accept the chemical name ignore food additive alone	1
(b)(i)	water and oil do not mix / are immiscible **or** don't dissolve each other	ignore density ignore emulsifier alone	1
(ii)	any **two** from: • emulsifier • forms an emulsion • holds the two components together • by lowering the surface tension	 accept description of an emulsion accept stops them separating / they mix allow bonds / binds for holds accept a description of how an emulsifier works for **two** marks eg 'tadpole' diagram or dispersal of oil drops	2
(c)(i)	(because they contain) a double (carbon carbon) bond	accept unsaturated ignore poly or mono	1
(ii)	results suggest sunflower oil is best **or** 'the one that took the least time' because (sunflower oil) has the highest amount of unsaturation / most double bonds / least saturated	 ignore uses up I_2 most quickly second mark is dependent on first	1 1

Continued on next page

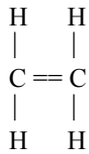
4.9.1.2 The Earth's early atmosphere

Question 4 continued

	answers	extra information	mark
(d)(i)	any **one** from: • have a higher melting point than (vegetable) oil • are solid at (room temperature) / hardened / harder	 accept useful as spreads **or** doesn't soak into bread ignore hard / soft(er)	1
(ii)	any **two** from: • hydrogen added • to carbon carbon double bond / to saturate • (nickel) catalyst / temperature 60 - 150°C	 do **not** accept 'water' wrong catalyst doesn't get this mark ignore high / warm temperature	2
total			10

4.9.1.2 The Earth's early atmosphere

CHY1H Question 5

	answers	extra information	mark
(a)(i)	by (fractional) distillation **or** fractionation	accept a description of the distillation process (heat and how separation works) eg heat **and** condense accept boil / vapourise etc for heat	1
(ii)	CO_2 H_2O	note the order of these products must be correct wrong way round = **1** mark	1 1
(b)(i)	(hexane) has been broken down (into smaller hydrocarbons / molecules)	accept (thermal) decomposition / cracked / split / broken up owtte	1
(ii)		accept $CH_2=CH_2$	1
(iii)	water / hydrogen oxide / steam	accept H_2O	1

Continued on next page

4.9.1.2 The Earth's early atmosphere

Question 5 continued

	answers	extra information	mark
(c)	candidates must include both sugar cane and crude oil in their evaluation **and** both an advantage and a disadvantage to gain full marks. if they do not then the maximum mark is three any **four** from: <u>advantages of using sugar</u> • country has no wealth to buy (large quantities of) crude oil • country has limited technological development **or** underdeveloped / third world country • able / suitable climate to grow sugar cane • enough land to grow sugar cane / land cannot be used to grow food / deforestation • sugar is a renewable source **or** crude oil is a non-renewable resource / finite resource / limited resources • CO_2 / carbon neutral <u>advantages of using alkanes:</u> • economic costs are low • continuous process • country has large oil resources • country has oil refineries / cracking plants • very pure product • faster process	not 'expensive' alone	4
total			10

Answer 35 · 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).

4.9.1.2 The Earth's early atmosphere

Answer 36 · Examiner comments

November 2020 | 8462/2H | Original Q9

Question 9 (standard / high and high demand)

09.1 This part was not very well attempted. Those students who gave the correct test almost always gave the correct result too. However, many tests for carbon dioxide were seen, because students had focused on the first bullet point rather than the whole question. Splints that have been **put out** do not relight. Nor do **lighted** splints as they are already burning.

Answer 36 · Examiner comments

November 2020 | 8462/2H | Original Q9

09.2 These polymers were not well known. Other naturally occurring polymers were frequently seen, such as DNA and proteins. Many students stated that water, oxygen and carbon dioxide are polymers.

09.3 The majority of students knew that there are two functional groups in amino acids.

09.4 The majority of students knew that water was the other product of the polymerisation.

09.5 The vast majority of students scored the mark for nitrogen. Very few scored the mark for ammonia.

09.6 Most students identified a double helix, fewer mentioned four monomers, nucleotides or bases and very few referred to two polymer chains.

4.9.1.2 The Earth's early atmosphere

Answer 37 · Examiner comments

June 2022 | 8462/2H | Original Q6

Question 6 (Standard, standard/high and high demand)

06.1 Some answers were seen which invoked theories about the evolution of the atmosphere other than the single theory given in the specification. Responses therefore in terms of ammonia were insufficient. Weaker responses did not identify nitrogen from the provided key, but even so, there were many responses which mentioned volcanic activity. Over a third of the students gained both marks.

06.2 As in **06.1** the gas (carbon dioxide) was sometimes not explicitly identified. There were no algae or plants this early and many students negated correct responses about dissolving in oceans or carboniferous sediments with a further comment about photosynthesis. As a result, only around 20% of students scored both marks here.

06.3 Having mentioned carbon dioxide in **06.2**, some students only felt the need to refer to an increase in oxygen, and omitted any reference to a further fall in carbon dioxide. The idea that the rates of change were the same or similar was much less often seen. Therefore the majority gained the first mark, but only a minority gained the second.

06.4 More than 80% of students were able to identify the process causing the change as photosynthesis.

06.5 Some students were insufficiently precise about the size of the organisms involved in natural gas formation, and there was some confusion with the formation of coal. Similarly, the idea of coverage by sediments was sometimes inaccurately described as ‘trapped under rocks’, which is not part of the process, only of the outcome. The third mark was often not awarded as heat was stated instead of high temperature. Fewer than 1 in 20 gained all three marks available.

4.9.1.2 The Earth's early atmosphere

Answer 38 · 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.

Answer 39 · 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.

4.9.1.2 The Earth's early atmosphere

Answer 39 · 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.