AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.9.1.1

The proportions of different gases in the atmosphere

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**33**
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.

4.9.1.1 The proportions of different gases in the 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 bed	do **not** accept 'into the oil' / 'under the sea'	1
total			10

4.9.1.1 The proportions of different gases in the atmosphere

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

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

Answer 03 · Mark scheme June 2007 | CHY1H | Original Q3 | Legacy

The full source mark scheme begins on page 58. Follow original question 3 in that document.

4.9.1.1 The proportions of different gases in the atmosphere

Answer 04 · Mark scheme January 2008 | CHY2H | Original Q7 | Legacy

(c)	7		1
(d)(i)	steeper line from around the same starting point and left of the points levelling off at 99	allow crosses if they are fully correct for **1** mark accept short level line at 99 ± ½ square	1 1
(d)(ii)	any **three** from: • particles / molecules / atoms/ ions have more energy • move faster • collide more often **or** more chance of collisions **or** bump into each other more • collide with more force / energy **or** more particles have the activation energy **or** more collisions result in reaction **or** more collisions are successful	allow given / gain / get energy ignore move about more ignore vibrate more / faster ignore collide quicker / faster	3
total			8

4.9.1.1 The proportions of different gases in the atmosphere

CHY2H

Question 2

question	answers	extra information	mark
(a)	any **one** from: • they are made of layers • atoms / ions / particles / layers (of atoms) can slide over each other	do **not** accept line / rows / lattice	1
(b)	any **one** from: • smaller / tiny **or** very small • correct size range 1 to 100 nanometres • a few hundred atoms in size	do **not** allow small alone if they state smaller and give a size outside range ignore size if it is less than 20,000	1
(c)	harder plus **one** from: • so does not wear as quickly / erode as quickly • less vulnerable to damage owtte • because they have a high surface area to volume ratio **or** stronger (1) plus **one** from: (1) • less likely to break / do not break • not as vulnerable to damage owtte • do not bend out of shape • because they have a high surface area to volume ratio	ignore corrode harder to wear down = **1** mark accept withstand pressure harder and stronger alone gains **1** mark	1 1
total			4

4.9.1.1 The proportions of different gases in the atmosphere

CHY2H

Question 3

question	answers	extra information	mark
(a)	N_2O		1
(b)	13.8 to 14	gains full marks without working if answer incorrect 13 gains **1** mark **or** 14/101 × 100 gains **1** mark	2
total			3

4.9.1.1 The proportions of different gases in the atmosphere

CHY2H

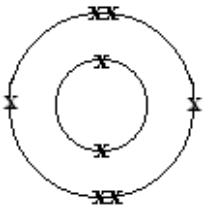
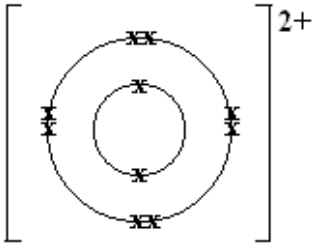
Question 4

question	answers	extra information	mark
(a)	electric current / electricity		1
	plus **one** from:		1
	• is passed through ionic compound / substance / electrolyte • passed through molten/aqueous compound / substance	must be linked to electricity allow liquid compound / substance do **not** allow solution / liquid alone	
	• causing decomposition	accept split up / breakdown / breaking up owtte ignore separated accept elements are formed ignore new substances form	
(b)	hydrogen	accept H_2 do **not** accept H / H^2	1
(c)	one electron from each atom	accept each carbon is bonded to three other carbon atoms leaving one (unbonded) electron owtte	1
	is delocalised / free (to move)	must be linked to electrons answers of delocalised / free electrons only, gains **1** mark accept each carbon is bonded to three other carbon atoms leaving delocalised / free electrons = **2** marks **maximum 1** mark if graphite described as a metal / giant ionic lattice	1
total			5

4.9.1.1 The proportions of different gases in the atmosphere

CHY2H

Question 5

question	answers	extra information	mark
(a)	any **one** from: • gives out heat / energy • transfers energy from a substance to the surroundings • ΔH / energy change / enthalpy change is negative	accept releases / gives off owtte ignore references to light	1
(b)	$2Mg + O_2 \rightarrow 2MgO$	accept correct multiples / fractions	1
(c)		electrons do not need to be paired accept dots / circles / e instead of crosses do **not** allow 2.6 without diagram	1
(d)		electrons do not need to be paired allow without brackets must have the charge accept dots / circles / e instead of crosses ignore extra empty outer shells ignore nucleus do **not** allow $[2.8]^{2+}$ without diagram	1

continued…

4.9.1.1 The proportions of different gases in the atmosphere

CHY2H

Question 5 continued…

question	answers	extra information	mark
(e)	oppositely charged (ions / atoms)	allow positive and negative(ions / atoms)	1
	(they) attract	must be in correct context accept held by electrostatic forces ignore ionic bonding **maximum 1** if they refer to intermolecular forces / attractions / covalent bonds	1
(f)	magnesium chloride	accept $MgCl_2$ (if correctly written)	1
total			7

4.9.1.1 The proportions of different gases in the atmosphere

CHY2H

Question 6

question	answers	extra information	mark
(a)	**Compound A** any **one** from: • sodium bromide • potassium bromide • ammonium bromide • hydrogen bromide • any metal bromide except silver and lead. **Compound B** silver nitrate	accept correct formulae accept silver sulfate	1 1
(b)	the silver compound will decompose / silver ions be reduced to silver (owtte)	accept film would darken owtte accept any idea of light changing silver bromide / silver ions / silver nitrate / silver sulfate allow 'forms a black solid' / it would turn black	1
(c)	precipitation	accept descriptions of precipitation reactions accept double decomposition accept precipitate do **not** allow displacement	1
(d)	electrons are gained	 the second mark **must** be linked to electrons accept it / silver / silver ions gains electrons for **both** marks ignore references to oxygen	1 1
total			6

4.9.1.1 The proportions of different gases in the atmosphere

CHY2H

Question 7

question	answers	extra information	mark
(a)	1213.8 to 1214.3 correct answer not given then check working 1) moles of N_2 = $\frac{1000}{28}$ = 35.7 mol 2) moles of NH_3 = 2 × (answer from (1)) = 71.4 mol 3) mass of NH_3 = (answer from 2) × 17 = 71.4 × 17 = 1214 g **or** • 28g of N_2 → 34g of NH_3 • 1g of N_2 → $\frac{34}{28}$ = 1.214g NH_3 • 1000 g of N_2 → 1000 × 1.214 = 1214g **or** • $1000 \times \frac{34}{28}$ **or** **other correct methods**	gains **3** marks without working **1** mark for each correct step do **not** penalise rounding errors in this part **1** mark for each correct step do **not** penalise rounding errors in this part allow error carried forward eg gains **2** marks if correct answer not given $1000 \times \frac{28}{34}$ gains **1** mark, **2** marks if correctly calculated (823.5g) $1000 \times \frac{28}{17}$ gains **1** mark if calculated correctly (1647.05g) look for the key ideas in the methods above	3

continued…

4.9.1.1 The proportions of different gases in the atmosphere

CHY2H

Question 7 continued…

question	answers	extra information	mark
(b)	25 / 25.035 **or** ecf from (a)	gains **2** marks even when there is no working incorrect answer then 304/(their answer from (a)) × 100 gains **1** mark	2
	or using figures from part (b) **27.6 / 28**	gains **2** marks even when there is no working accept 27 for **1** mark if answers incorrect then304/1100 × 100 gains **1** mark	
(c)(i)	increase yield reaction is exothermic **or** allow decreased yield because rate of reaction is slower / fewer collisions for **2** marks	 **must** get both points for **2** marks	1 1
(c)(ii)	increase yield plus **one** from: • more (gaseous) reactant molecules than (gaseous) product molecules (owtte) • increased rate of reaction / more collisions	 accept greater volume on the left than the right owtte	1 1

continued…

4.9.1.1 The proportions of different gases in the atmosphere

CHY2H

Question 7 continued…

question	answers	extra information	mark
(d)	any **one** from: **economic** • large town provides workforce • workers do not have to travel far to the factory. (owtte) • transport infrastructure already in place for large town. (owtte) • factory brings prosperity to town (owtte) • factory provides employment • reduced tourism • reduction in local house prices • any other sensible economic factor linked to town		1
	any **one** from: **safety** • <u>escape</u> of dangerous / harmful chemicals / gases (owtte) • <u>danger</u> of increased traffic • risk of explosion.(owtte) /danger of high pressure • consequences of an accident could be severe if the town is close • any other sensible safety idea	do **not** allow polluting gases unqualified	1

continued…

4.9.1.1 The proportions of different gases in the atmosphere

CHY2H

Question 7(d) continued…

question	answers	extra information	mark
	any **one** from: **environmental** • factory might be unsightly (owtte) • screening of factory (owtte) • loss of habitats (owtte) • plant trees/ hedges etc on and around plant site • pollution of water / air / soil could harm plants / animals **or** noise pollution • CO_2 is produced by burning fuels / heating • CO_2 causes global warming / any effect of global warming • eye sore • any other sensible environmental factor	must be explained	1
total			12

4.9.1.1 The proportions of different gases in the atmosphere

Answer 05 · Mark scheme

March 2008 | CHY1BP | Original Q5 | Legacy

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

Answer 06 · Mark scheme

March 2008 | CHY1BP | Original Q7 | Legacy

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

Answer 07 · Mark scheme

June 2008 | CHY1BP | Original Q9 | Legacy

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

4.9.1.1 The proportions of different gases in the atmosphere

Answer 08 · 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 • photosynthesis • 'locked up' in (sedimentary) rocks / carbonates / fossil fuels • dissolved in oceans	accept idea of 'used' to indicate a decrease ignore respiration ignore volcanoes
	oxygen has increased due to: • plants / bacteria / micro organisms / vegetation / trees • photosynthesis	accept idea of 'given out / produced' ignore respiration
	nitrogen increased due to: • ammonia reacted with oxygen • bacteria / micro organisms	accept idea of 'given out / produced' 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…

4.9.1.1 The proportions of different gases in the atmosphere

Answer 08 · Mark scheme

June 2008 | CHY1H | Original Q7 | Legacy

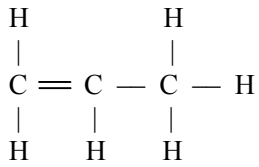
COMPONENT NUMBER: CHY1H

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 addition 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**

4.9.1.1 The proportions of different gases in the atmosphere

Answer 09 · Mark scheme

November 2008 | CHY1BP | Original Q1 | Legacy

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

Answer 10 · Mark scheme

June 2009 | CHY1BP | Original Q8 | Legacy

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

4.9.1.1 The proportions of different gases in the atmosphere

Answer 11 · 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**

4.9.1.1 The proportions of different gases in the atmosphere

Answer 11 · Mark scheme

June 2009 | CHY1H | Original Q3 | Legacy

CHY1H

Answer 12 · Mark scheme

November 2009 | CHY1BP | Original Q9 | Legacy

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

Answer 13 · Mark scheme

March 2010 | CHY1BP | Original Q8 | Legacy

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

4.9.1.1 The proportions of different gases in the atmosphere

Answer 14 · 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

4.9.1.1 The proportions of different gases in the 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**

4.9.1.1 The proportions of different gases in the atmosphere

Answer 14 · Mark scheme

June 2010 | CHY1H | Original Q2 | Legacy

CHY1H

4.9.1.1 The proportions of different gases in the atmosphere

Answer 15 · Mark scheme

January 2011 | CHY1H | Original Q3 | Legacy

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) more rapid 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

4.9.1.1 The proportions of different gases in the atmosphere

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**

4.9.1.1 The proportions of different gases in the atmosphere

Answer 15 · Mark scheme January 2011 | CHY1H | Original Q3 | Legacy

CHY1H

Answer 16 · 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

4.9.1.1 The proportions of different gases in the atmosphere

Answer 17 · 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 ignore melting points do **not** accept reference to greater number of molecules	1
5(b)(ii)	any **two** from: • low boiling point / volatile • low viscosity • high flammability • small molecules • burn completely	they = hydrocarbons from the graph it = $C_{30}H_{62}$ accept they are gases or liquids accept easier to burn / ignite accept short chains ignore number of carbon atoms 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) **or** from dead plants / animals allow dead sea creatures ignore shells	1

Question 5 continues on the next page . . .

4.9.1.1 The proportions of different gases in the atmosphere

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 accept extra carbon dioxide is not 'absorbed' (by the carbon cycle)	1
Total			**8**

4.9.1.1 The proportions of different gases in the atmosphere

Answer 18 · Mark scheme

November 2011 | CHY1BP | Original Q1 | Legacy

Question	Key		
One	**A**	abundance	**4**
	B	colour	**2**
	C	density	**3**
	D	reactivity	**1**

Answer 19 · Mark scheme

November 2011 | CHY1BP | Original Q6 | Legacy

Six	**2**	**1**	**4**	**4**

Answer 20 · Mark scheme

November 2011 | CHY1BP | Original Q7 | Legacy

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

4.9.1.1 The proportions of different gases in the atmosphere

Answer 21 · Mark scheme

Question 2

question	answers	extra information	mark
2(a)(i)	C_7H_{16}	mark answer line first 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 do **not** accept water ignore CO	1
2(b)(ii)	because of partial / incomplete combustion (in reaction 2) **or** complete combustion (in reaction 1)	allow because there is less/insufficient oxygen (in reaction 2) **or** sufficient oxygen (in reaction 1) allow different amounts of oxygen used (in the reactions) **or** $19O_2$ (in reaction 1) **and** $13O_2$ (in reaction 2) 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 at high temperature (inside a petrol engine)	allow nitrogen **and** oxygen burn accept nitrogen + oxygen → nitrogen oxide **or** symbol equation ignore air allow heat/hot (engine)	1 1

Question 2 continues on the next page……..

4.9.1.1 The proportions of different gases in the atmosphere

Answer 21 · Mark scheme

CH1HP

Question 2 cont'd….

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

4.9.1.1 The proportions of different gases in the atmosphere

Answer 21 · Mark scheme

January 2012 | CH1HP | Original Q2 | Legacy

CH1HP

4.9.1.1 The proportions of different gases in the atmosphere

Answer 22 · 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 . . .

4.9.1.1 The proportions of different gases in the atmosphere

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**

4.9.1.1 The proportions of different gases in the atmosphere

Answer 22 · Mark scheme

June 2012 | CH1HP | Original Q4 | Legacy

CH1HP

4.9.1.1 The proportions of different gases in the atmosphere

Answer 23 · Mark scheme

June 2012 | CH1HP | Original Q8 | Legacy

Question 8

question	answers	extra information	mark
8(a)	because the nitrogen from dry air contained noble/Group 0 gases **or** (because the nitrogen from dry air) contained argon / krypton / xenon	ignore other gases ignore helium and neon	1
	and three / some of these gases, (argon, krypton, xenon) have a greater density than nitrogen **or** and argon / krypton / xenon has a greater density than nitrogen	ignore helium and neon	1
8(b)(i)	carbon dioxide would form / is a solid **or** (solid) carbon dioxide would block pipes	accept carbon dioxide freezes or its freezing point is > –200°C ignore melting point	1
8(b)(ii)	helium (**and**) neon	both needed for **1** mark accept He and Ne	1
8(b)(iii)	argon (**and**) oxygen because there is only a difference of 3 °C in their boiling points	accept Ar and O_2 accept because they have boiling points that are almost the same	1 1
Total			**6**

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

4.9.1.1 The proportions of different gases in the atmosphere

Answer 24 · 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

4.9.1.1 The proportions of different gases in the 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**

4.9.1.1 The proportions of different gases in the atmosphere

Answer 25 · Mark scheme June 2014 | CH3HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
5(a)	$2NH_3$	allow NH_3 with incorrect or missing balancing for **1** mark *allow multiples*	2	2 / 3.5.1b	E
5(b)(i)	200		1	3 / 3.5	G
5(b)(ii)	rate of reaction (too) slow	*allow converse* ignore references to yield / *cost*	1	2 / 3.5.1f/h	E
5(b)(iii)	400		1	2 / 3.5	A
5(b)(iv)	lower yield	*allow converse* accept shifts equilibrium to left allow favours the backward reaction allow favours side with *more* (gaseous) molecules allow lower rate	1	2 / 3.5.1g/h	E
5(c)	(gases) cooled *ammonia* liquefied	*it = ammonia* accept *ammonia* condensed accept ammonia cooled below boiling point for **2** marks	 1 1	1 / 3.5.1b	E
Total			**8**		

4.9.1.1 The proportions of different gases in the atmosphere

Answer 25 · Mark scheme

June 2014 | CH3HP | Original Q5 | Legacy



4.9.1.1 The proportions of different gases in the atmosphere

Answer 26 · Mark scheme June 2016 | CH3HP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
6(a)(i)	natural gas	allow fossil fuels / biogas generator	1	AO1 3.5.1a
6(a)(ii)	air contains oxygen this would react with / oxidise the hydrogen	 allow this would react with / oxidise the iron ignore nitrogen	1 1	AO3 3.5.1b
6(a)(iii)	cooled ammonia condenses / liquefies (so can be separated) nitrogen and hydrogen (remain as gases and) are returned to the reactor	 allow recycled	1 1 1	AO1 3.5.1b
6(b)(i)	200 °C **and** 1000 atmospheres		1	AO3 3.5.1b
6(b)(ii)	the reaction is reversible forward reaction is exothermic so increased temperature lowers the yield of ammonia a lower temperature would decrease rate of reaction a higher pressure would increase the yield of ammonia because the forward reaction produces the least number of (gaseous) molecules / moles higher pressures would involve high cost / energy	allow stated as equilibrium or forward / backward reaction anywhere in answer allow converse allow converse allow converse ignore risk / explosion	1 1 1 1 1	3AO1 / 2AO3 3.5.1d,e,f,g,h
Total			**12**	

4.9.1.1 The proportions of different gases in the atmosphere

Answer 27 · 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

4.9.1.1 The proportions of different gases in the atmosphere

Answer 27 · Mark scheme

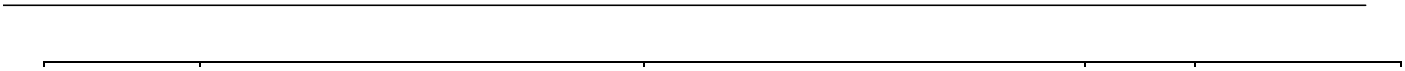
June 2017 | CH1HP | Original Q5 | Legacy

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**	

4.9.1.1 The proportions of different gases in the atmosphere

Answer 27 · Mark scheme

June 2017 | CH1HP | Original Q5 | Legacy



4.9.1.1 The proportions of different gases in the atmosphere

Answer 28 · 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

4.9.1.1 The proportions of different gases in the atmosphere

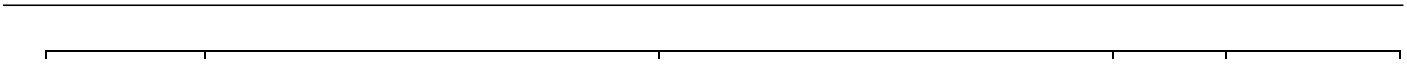
Answer 28 · Mark scheme June 2018 | 8462/2H | Original Q3

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**	

4.9.1.1 The proportions of different gases in the atmosphere

Answer 28 · Mark scheme

June 2018 | 8462/2H | Original Q3



4.9.1.1 The proportions of different gases in the atmosphere

Answer 29 · Mark scheme

June 2019 | 8462/2H | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	(Titan has) little / no oxygen	ignore references to respiration	1	AO3 4.9.1.3
	(so) photosynthesis has not occurred (on Titan)	allow (so) no plants / algae to produce oxygen (on Titan)	1	
	(therefore) little / no carbon dioxide present (on Titan) **or** (therefore) oxygen-using animals cannot have evolved (on Titan)		1	
08.2	(methane) allows short(er) wavelength radiation to pass through (from the sun)	allow (methane) allows uv / ultraviolet radiation to pass through (from the sun)	1	AO1 4.9.2.1
	(which is) re-emitted from the surface as long(er) wavelength radiation	allow (which is) re-emitted from the surface as ir / infra-red radiation	1	
	(which is) absorbed (by methane in the atmosphere)	allow (which is) trapped (by methane in the atmosphere) if no other mark is awarded, allow **1** mark for methane absorbs long(er) wavelength radiation **or** methane absorbs ir / infra-red radiation	1	
08.3	(add) bromine (water)	do **not** accept bromide	1	AO1 4.7.1.4 4.7.2.1 4.7.2.2
	(changes from) orange to colourless	dependent on correct test in MP1 allow (changes from) brown to colourless ignore clear	1	
Total			**8**	

4.9.1.1 The proportions of different gases in the atmosphere

Answer 30 · Mark scheme

June 2019 | 8462/2H | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	$\frac{6}{34} \times 100$ = 17.6 (%)	an answer of 17.6470588 (%) correctly rounded to at least 2 significant figures scores **2** marks allow 17.6470588 (%) correctly rounded to at least 2 significant figures	1 1	AO2 4.3.3.2
10.2	higher yield (of hydrogen or carbon monoxide or product) (because) fewer moles / molecules / particles on left hand side **or** (because) more moles / molecules / particles on right hand side	allow converse arguments in terms of higher pressure ignore references to rate allow more hydrogen or more carbon monoxide or more product allow equilibrium moves to the right allow equilibrium moves in the forward direction allow (because) the reverse reaction produces fewer moles / molecules / particles **or** allow (because) the forward reaction produces more moles / molecules / particles do **not** accept fewer / more atoms	1 1	AO2 4.6.2.4 4.6.2.7
10.3	no effect (on yield of hydrogen)	allow position of equilibrium unaffected by pressure ignore references to rate of reaction	1	AO2 4.6.2.7

4.9.1.1 The proportions of different gases in the atmosphere

Answer 30 · Mark scheme

June 2019 | 8462/2H | Original Q10

		an answer of 2.25 scores **3** marks		AO2 4.10.4.1
10.4	350 (°C) and 285 (atmospheres) = 63 (%) **and** 450 (°C) and 200 (atmospheres) = 28 (%)	allow a value between 62 (%) and 64 (%) inclusive	1	
	$\frac{63}{28}$	allow a correct expression using incorrectly determined value(s) for percentage yield	1	
	= 2.25 (times greater)	allow a correct calculation using incorrectly determined value(s) for percentage yield correctly evaluated and rounded to at least 2 significant figures	1	
10.5	any **one** from: • the energy costs would be high(er) • the equipment would need to be strong(er) • high(er) pressures are (more) dangerous	allow converse arguments in terms of low(er) pressure ignore energy / cost unqualified allow the equipment would be (more) expensive (to build / maintain) allow (more) dangerous because (greater) risk of explosion	1	AO1 4.10.4.1
10.6	higher temperatures produce a lower (percentage) yield (of ammonia)	allow converse allow correct reference to shift in equilibrium ignore references to pressure	1	AO2 4.6.2.6 4.10.4.1
10.7	world population has increased any **one** from: • demand for fertiliser has increased • increased demand for other specified ammonia-based products e.g. nitric acid, drugs, dyes, explosives	allow more food needed	1 1	AO3 AO1 4.10.4.1 4.10.4.2
Total			**12**	

4.9.1.1 The proportions of different gases in the atmosphere

Answer 31 · 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

4.9.1.1 The proportions of different gases in the atmosphere

Answer 31 · 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**

4.9.1.1 The proportions of different gases in the atmosphere

Answer 32 · Mark scheme

June 2022 | 8462/2H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	(nitrogen) air (hydrogen) natural gas	allow atmosphere allow methane allow water / steam	1 1	AO1 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	there is only one product		1	AO2 4.3.3.2 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	(mixture is) cooled (so that only) ammonia liquefies	 allow (so that only) ammonia condenses	1 1	AO1 4.10.4.1

4.9.1.1 The proportions of different gases in the atmosphere

Answer 32 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	scale labelled at 100, 200, 300 and 400 (atm)	allow scale labelled at 50, 150, 250 and 350 (atm)	1	AO2 4.10.4.1
	all five points plotted correctly	allow a tolerance of ± ½ a small square allow **1** mark for three / four points plotted correctly	2	
	line of best fit		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5 View with Figure 5	extrapolation to 500 atmospheres		1	AO2 4.10.4.1
	percentage value at 500 atmospheres	allow a tolerance of ± ½ a small square	1	

4.9.1.1 The proportions of different gases in the atmosphere

Answer 32 · Mark scheme

June 2022 | 8462/2H | Original Q7

Question	Answers	Mark	AO / Spec. Ref.
07.6	**Level 3**: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.6.1.3 4.6.1.4 4.6.2.6 4.6.2.7 4.10.4.1
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content **rate** • higher temperature gives higher rate because of more frequent collisions • higher temperature gives higher rate because more particles have the activation energy • higher pressure gives higher rate because of more frequent collisions • use of catalyst gives higher rate because the activation energy is lowered **equilibrium** • higher temperature shifts the position of equilibrium to the left because reaction is exothermic • higher pressure shifts the position of equilibrium to the right because more molecules on left-hand side • use of catalyst has no effect on the position of equilibrium **other factors** • higher temperature (than 450°C) uses more energy so increases costs • higher pressure (than 200 atmospheres) uses more energy so increases costs • higher pressure (than 200 atmospheres) requires stronger reaction vessels so increases costs • use of a catalyst reduces energy costs **compromise** • the temperature chosen is a compromise between rate of reaction and position of equilibrium • the temperature chosen is a compromise between rate and cost • the pressure chosen is a compromise between yield / rate and cost		

Total Question 7		**17**

4.9.1.1 The proportions of different gases in the atmosphere

Answer 33 · 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 do **not** accept photosynthesis do **not** accept formed fossil fuels	1	

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	

4.9.1.1 The proportions of different gases in the atmosphere

Answer 33 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4		ignore dissolving in oceans ignore sedimentation		
	carbon dioxide decreased **and** oxygen increased		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

4.9.1.1 The proportions of different gases in the atmosphere

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

4.9.1.1 The proportions of different gases in the 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.

4.9.1.1 The proportions of different gases in the 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.

4.9.1.1 The proportions of different gases in the 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.

4.9.1.1 The proportions of different gases in the 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

4.9.1.1 The proportions of different gases in the 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

4.9.1.1 The proportions of different gases in the 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

4.9.1.1 The proportions of different gases in the 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

4.9.1.1 The proportions of different gases in the 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

4.9.1.1 The proportions of different gases in the 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

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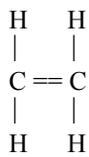
4.9.1.1 The proportions of different gases in the atmosphere

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

4.9.1.1 The proportions of different gases in the 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

4.9.1.1 The proportions of different gases in the 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

4.9.1.1 The proportions of different gases in the atmosphere

Answer 28 · 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).

4.9.1.1 The proportions of different gases in the atmosphere

Answer 31 · 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.

Answer 32 · Examiner comments June 2022 | 8462/2H | Original Q7

Question 7 (Standard, standard/high and high demand)

07.1 This was well answered with around half of the students scoring both marks. Incorrect responses included the atmosphere being a source of the hydrogen as well as the nitrogen. There were far fewer responses stating that biogas of any kind was suitable for the large-scale production of ammonia than in previous years.

07.2 About 25% of the students scored this mark. 'No by-products' was seen quite often and others stated there were the same number of atoms on both sides, which just means that the equation is balanced, not necessarily that there is only 1 product.

07.3 Roughly 1 in 10 students gained both marks. Many scored the second mark, but far fewer the first. This was often due to imprecise language rather than misunderstanding, but many stated that 'ammonia is cooled'. The distinction between **all** the gases being cooled but only ammonia condensing is important. A large proportion did not mention cooling at all. Some negated the second mark by stating that ammonia has a lower boiling point than the other two gases.

4.9.1.1 The proportions of different gases in the atmosphere

Answer 32 · Examiner comments June 2022 | 8462/2H | Original Q7

07.4 Labelling the scale and the plotting of the given points was nearly always correct. Some did not label on the major gridlines, while a few got the scale completely wrong by labelling the major gridlines in multiples of 60 atmospheres, which did not match the pre-plotted points and therefore denied access to the plotting marks. Most students drew good best-fit curves, although some inappropriately drew a straight line. Over half of the students gained all four marks.

07.5 Most students extrapolated their line correctly and read off the value of the percentage at 500 atmospheres. About two-thirds of the students scored both marks.

07.6 This high demand extended response question gave students the opportunity to demonstrate their knowledge of collision theory, Le Chatelier's Principle and catalytic action in the context of the Haber Process.

More able students seemed to understand that they needed to consider cost implications. Explaining that a compromise is made in the choice of the temperature and the pressure was important in accessing Level 3.

The compromises made for temperature and pressure that were related to cost were more commonly stated than the compromise for temperature in relation to rate and position of equilibrium.

There was a high proportion of responses with additional material producing comprehensive, high-scoring responses. There were also a good number of weaker responses containing isolated statements, most commonly relating the conditions to rate, or more rarely position of equilibrium, but without explaining these relationships. Such responses were usually confined to Level 1. The ratio of Level 1:2:3 marks was roughly 40:20:20 with the remainder failing to gain any marks on this question.

Answer 33 · 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.

4.9.1.1 The proportions of different gases in the atmosphere

Answer 33 · 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.