AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.9.3.1

Atmospheric pollutants from fuels

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**74**
Available paper years	**2007–2024**

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.

4.9.3.1 Atmospheric pollutants from fuels

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

4.9.3.1 Atmospheric pollutants from fuels

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

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

Answer 03 · Mark scheme March 2007 | CHY1A | Original Q7 | Legacy

Seven	**3**	**2**	**4**	**2**

Answer 04 · Mark scheme March 2007 | CHY1B | Original Q9 | Legacy

Nine	**2**	**2**	**2**	**4**

4.9.3.1 Atmospheric pollutants from fuels

Answer 04 · Mark scheme

March 2007 | CHY1B | Original Q9 | Legacy

CHY1B (Oils, Earth and Atmosphere) Higher Tier

Question	Key		
One	**A**	hydrocarbons undergo thermal decomposition	**3**
	B	hydrocarbons are heated	**1**
	C	hydrocarbons vaporise	**2**
	D	small hydrocarbon molecules	**4**
Two	**A**	**2**	
	B	**4**	
	C	**3**	
	D	**1**	

	A	B	C	D
Three	**3**	**4**	**4**	**1**
Four	**2**	**2**	**2**	**4**
Five	**4**	**4**	**3**	**1**
Six	**3**	**2**	**4**	**2**
Seven	**2**	**3**	**3**	**2**
Eight	**4**	**4**	**2**	**3**
Nine	**4**	**1**	**3**	**4**

4.9.3.1 Atmospheric pollutants from fuels

Answer 05 · Mark scheme June 2007 | CHY1A | Original Q8 | Legacy

Eight	**1**	**3**	**2**	**3**

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

Three	**1**	**4**	**2**	**3**

Answer 07 · Mark scheme November 2007 | CHY1B | Original Q9 | Legacy

Nine	**1**	**2**	**3**	**4**

Answer 08 · Mark scheme January 2008 | CHY1H | Original Q5 | Legacy

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

Answer 09 · Mark scheme March 2008 | CHY1AP | Original Q4 | Legacy

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

Answer 10 · Mark scheme March 2008 | CHY1AP | Original Q8 | Legacy

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

4.9.3.1 Atmospheric pollutants from fuels

Answer 11 · Mark scheme March 2008 | CHY1AP | Original Q9 | Legacy

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

Answer 12 · Mark scheme March 2008 | CHY1BP | Original Q4 | Legacy

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

Answer 13 · Mark scheme March 2008 | CHY1BP | Original Q8 | Legacy

Eight	**1**	**2**	**4**	**4**

Answer 14 · Mark scheme June 2008 | CHY1AP | Original Q2 | Legacy

Two	**A** carbon monoxide **3** **B** carbon particles **4** **C** oxygen **1** **D** carbon dioxide **2**			
	A	**B**	**C**	**D**

Answer 15 · Mark scheme June 2008 | CHY1AP | Original Q4 | Legacy

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

Answer 16 · Mark scheme June 2008 | CHY1AP | Original Q5 | Legacy

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

4.9.3.1 Atmospheric pollutants from fuels

Answer 17 · Mark scheme

June 2008 | CHY1H | Original Q6 | Legacy

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

4.9.3.1 Atmospheric pollutants from fuels

Answer 17 · Mark scheme June 2008 | CHY1H | Original Q6 | Legacy

COMPONENT NUMBER: CHY1H

COMPONENT NAME: Science B / Chemistry

STATUS: Final

DATE: June 2008

Answer 18 · Mark scheme November 2008 | CHY1AP | Original Q3 | Legacy

Three	**4**	**2**	**3**	**3**

Answer 19 · Mark scheme November 2008 | CHY1AP | Original Q5 | Legacy

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

Answer 20 · Mark scheme November 2008 | CHY1AP | Original Q9 | Legacy

Nine	**1**	**2**	**3**	**4**

Answer 21 · Mark scheme November 2008 | CHY1BP | Original Q6 | Legacy

Six	**2**	**3**	**2**	**1**

4.9.3.1 Atmospheric pollutants from fuels

Answer 22 · Mark scheme March 2009 | CHY1AP | Original Q1 | Legacy

One	**A**	Molecule **A**	**2**
	B	Molecule **B**	**1**
	C	Molecule **C**	**3**
	D	Molecule **D**	**4**

Answer 23 · Mark scheme June 2009 | CHY1AP | Original Q1 | Legacy

One	**A**	Substance **A**	**1**
	B	Substance **B**	**2**
	C	Substance **C**	**3**
	D	Substance **D**	**4**

Answer 24 · Mark scheme June 2009 | CHY1AP | Original Q5 | Legacy

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

Answer 25 · Mark scheme June 2009 | CHY1AP | Original Q6 | Legacy

Six	**2**	**4**	**2**	**3**

4.9.3.1 Atmospheric pollutants from fuels

Answer 26 · Mark scheme June 2009 | CHY1H | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)(i)	3 / three		1
1(a)(ii)	5 / five		1
1(b)	any **one** from: • less / no transport • less / no (fossil) fuel used	 accept less / no distance ignore references to carbon dioxide / carbon emissions	1
1(c)(i)	carbon dioxide / CO_2 (causes) global warming / climate change / greenhouse gas **or** (cement) particles / smoke (1) (causes) asthma / dust / (global) dimming (1) **or** sulfur dioxide / SO_2 / nitrogen oxides / NO_x (1) (causes) acid rain (1)	for a correct emission explanation must be correct for named emission ignore ozone layer accept breathing problems do **not** accept nitrogen or water vapour for emissions do **not** accept no named emission	1 1

Question 1 continues on the next page…

4.9.3.1 Atmospheric pollutants from fuels

Answer 26 · Mark scheme

June 2009 | CHY1H | Original Q1 | Legacy

CHY1H

Question 1 Continued

question	answers	extra information	mark
1(c)(ii)	absorb / trap / capture / filter / pass through water / scrub / electrostatic attraction	ignore condense / off setting / different fuel	1
Total			**6**

4.9.3.1 Atmospheric pollutants from fuels

Answer 26 · Mark scheme June 2009 | CHY1H | Original Q1 | Legacy

CHY1H

Answer 27 · Mark scheme November 2009 | CHY1AP | Original Q2 | Legacy

Two	**A**	Formulae **A** ($ZnCO_3$)	**2**		
	B	Formulae **B** (C)	**4**		
	C	Formulae **C** (CO_2)	**3**		
	D	Formulae **D** (ZnO)	**1**		
	A		**B**	**C**	**D**

Answer 28 · Mark scheme November 2009 | CHY1AP | Original Q6 | Legacy

Six	**3**	**3**	**4**	**2**

Answer 29 · Mark scheme November 2009 | CHY1AP | Original Q7 | Legacy

Seven	**2**	**3**	**2**	**4**

Answer 30 · Mark scheme November 2009 | CHY1BP | Original Q9 | Legacy

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

4.9.3.1 Atmospheric pollutants from fuels

Answer 31 · Mark scheme

January 2010 | CHY3H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	energy of product greater than energy of reactants	allow converse allow energy = heat do **not** accept temperature for energy allow product / nitrogen oxide is higher than reactants allow less energy / heat given out than taken in allow energy / heat is taken in / gained allow ΔH is positive	1
6(b)	(minimum) energy needed to start the reaction / overcome energy barrier	accept (minimum) energy needed for a collision to be successful	1
6(c)(i)	bonds broken = 945 + 498 = 1443 (kJ) bonds made = 2 ×630 = 1260 (kJ) energy change = 1443 – 1260 = (+) 183	correct answer with or without working = **3** marks ignore sign allow ecf	1 1 1
6(c)(ii)	energy released forming new bonds is less than energy needed to break existing bonds owtte	allow converse accept energy change(ΔH) is + / positive do **not** accept energy <u>needed to form new bonds</u> is less than energy needed to break existing bonds	1
Total			**6**

4.9.3.1 Atmospheric pollutants from fuels

Answer 31 · Mark scheme January 2010 | CHY3H | Original Q6 | Legacy

CHY3H

Answer 32 · Mark scheme March 2010 | CHY1AP | Original Q5 | Legacy

Five	**3**	**3**	**1**	**3**

Answer 33 · Mark scheme June 2010 | CHY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	nitrogen dioxide	**4**
	B	carbon monoxide	**3**
	C	carbon dioxide	**2**
	D	soot (carbon)	**1**

Answer 34 · Mark scheme June 2010 | CHY1AP | Original Q7 | Legacy

Seven	**2**	**3**	**3**	**1**

4.9.3.1 Atmospheric pollutants from fuels

Answer 35 · Mark scheme

June 2010 | CHY1H | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)(i)	C	must be correct symbol do **not** accept carbon any balancing must be correct	1
3(a)(ii)	Fe + CO_2 2…. + 3….	correct formulae correct balancing allow Fe_2 + $3CO_2$ for this mark	1 1
3(a)(iii)	layers / atoms in pure iron are able to slide over each other **or** layers / atoms in cast iron are unable to slide over each other (easily)	it = pure iron accept ions for atoms ignore molecules / particles	1

Question 3 continues on the next page

CHY1H

Question 3 continued

question	answers	extra information	mark
3(b)	any **three** from: • less iron ore used • less other metals extracted / used to make different steels • less fuel used • less specified pollution • less / no landfill space needed • less / no mining needed **or** fewer specified effects of mining	mention of ozone = max **2** accept the idea that ores would be conserved but not unspecified conservation accept the idea that ores would be conserved but not unspecified conservation accept the idea that fuels would be conserved ignore reduces energy requirements accept global warming / greenhouse effect / CO_2 / CO / carbon emissions / acid rain / SO_2 / global dimming / do **not** accept ozone layer ignore reduces waste accept effect such as eyesore / loss of habitat eg 'less mining iron ore' = **2** marks	3
Total			**7**

4.9.3.1 Atmospheric pollutants from fuels

Answer 35 · Mark scheme

June 2010 | CHY1H | Original Q3 | Legacy

CHY1H

4.9.3.1 Atmospheric pollutants from fuels

Answer 36 · Mark scheme

June 2010 | CHY1H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	(thermal) decomposition	allow it breaks down accept symbol equation or in words allow reaction with SO_2 (to form CO_2)	1
5(a)(ii)	calcium carbonate / calcium oxide / limestone / quicklime / it reacts with sulfur dioxide / forms calcium sulfate	accept it neutralises sulfur dioxide / neutralisation ignore references to sulfur do not accept 'calcium reacts with…'	1
5(b)	by incomplete / partial combustion (of the fuel) insufficient oxygen / *air* (to burn fuel)	 accept insufficient oxygen / *air* to burn fuel completely for **2** marks if no other marks awarded accept $C + CO_2 \rightarrow 2CO$ **or** $2C + O_2 \rightarrow 2CO$ **or** in words for **1** mark	1 1

Question 5 continues on the next page

CHY1H

Question 5 continued

question	answers	extra information	mark
5(c)(i)	any **two** from: • (CO_2) from the atmosphere • (CO_2) taken in millions of years ago **or** early (atmosphere) • (CO_2) was used to form the shells / skeletons of marine organisms / fossil fuels	allow thousands / billions allow rocks formed millions of years ago accept sedimentary rocks allow used to form correct named fossil fuel ignore limestone	2
5(c)(ii)	any **one** from: • *(*increases / enhances*)* global warming • is additional carbon dioxide **or** not able to be absorbed by oceans / seas **or** used by (green) plants • acidification of sea water	allow greenhouse gas / effect do **not** accept ozone layer / acid rain / global dimming ignore consequences of global warming	1
Total			**7**

4.9.3.1 Atmospheric pollutants from fuels

Answer 36 · Mark scheme June 2010 | CHY1H | Original Q5 | Legacy

CHY1H

Answer 37 · Mark scheme November 2010 | CHY1AP | Original Q6 | Legacy

Six	**3**	**2**	**1**	**4**

Answer 38 · Mark scheme November 2010 | CHY1BP | Original Q6 | Legacy

Six	**4**	**3**	**3**	**1**

4.9.3.1 Atmospheric pollutants from fuels

Answer 39 · Mark scheme

January 2011 | CHY1H | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	crude oil / it is evaporated / vaporised vapours / gases / fractions cool and condense (different) vapours / gases / fractions (condense) at different temperatures	ignore heated accept named fraction(s) accept (different) vapours / gases / fractions have different boiling points max **2** marks for description of laboratory method **or** mention of cracking	1 1 1
2(b)(i)	any **one** from: • range of boiling points • range of carbon atoms		1
2(b)(ii)	greater the number (of carbon atoms) the higher the boiling point	do **not** accept molecules / particles	1
2(c)(i)	burning / combustion	allow oxidation / redox	1
2(c)(ii)	any **two** from: • cracking / (thermal) decomposition • heat / vaporise • catalyst / aluminium oxide	reaction with hydrogen gains max of **1** mark only allow porous pot ignore names of other catalysts	2
Total			**8**

4.9.3.1 Atmospheric pollutants from fuels

Answer 39 · Mark scheme

January 2011 | CHY1H | Original Q2 | Legacy

CHY1H

4.9.3.1 Atmospheric pollutants from fuels

Answer 40 · Mark scheme

January 2011 | CHY1H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	carbon / diesel / it reacts / burns in oxygen / air		1
	limited supply (of oxygen / air)	accept incomplete combustion $2C + O_2 \rightarrow 2CO$ **or** $C + CO_2 \rightarrow 2CO$ gains **2** marks	1
6(b)	any **four** from: for biodiesel: • less global dimming (because fewer carbon particles) • less acid rain (because less sulfur dioxide) • renewable resource / sustainable • use waste vegetable oils / fats • vegetables / plants absorbed carbon dioxide / carbon neutral • uses land which could be used to produce food • third world countries can produce bio diesel • biodegrades easily • more NOx released justified conclusion	accept converse statements for fossil diesel. ignore cost / ease of manufacture / usage issues if neither point awarded, fewer carbon particles and less sulfur dioxide = **1** mark accept fossil fuel / diesel supplies are limited accept fossil fuel / diesel releases locked up carbon / is not carbon neutral	4 1
Total			**7**

4.9.3.1 Atmospheric pollutants from fuels

Answer 41 · Mark scheme

January 2011 | CHY2H | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)	gives out heat / energy **or** energy / heat transferred to the surroundings	allow release / loses allow the products have less energy ignore temperature rises allow more energy given out in forming bonds than taken in to break bonds	1
4(b)(i)	speed up the reaction (owtte)	accept changes the rate accept lowers activation energy accept increases successful collisions accept allows reaction to take place at a lower temperature	1
4(b)(ii)	nitrogen (N_2) / oxygen (O_2) / products are safe **or** not harmful / pollutant / toxic / dangerous / damaging **or** (harmful) nitrogen monoxide / NO is not released into the air.	ignore releases nitrogen / oxygen unless qualified accept prevents / less acid rain ignore greenhouse gas / ozone layer	1
4(b)(iii)	2 and 2	accept correct multiples or fractions	1
4(b)(iv)	idea of catalyst not being used up	allow not changed by reaction ignore catalyst does not take part ignore catalyst not used in the reaction	1

Question 4 continues on the next page

4.9.3.1 Atmospheric pollutants from fuels

Answer 41 · Mark scheme

CHY2H

Question 4 contd

question	answers	extra information	mark
4(b)(v)	idea of different reactions (require different catalysts)	accept catalysts work for specific reactions allow different gases	1
4(c)	• smaller / very small / or any indication of very small / 1–100 nanometres / a few (hundred) atoms • big(ger) surface area • less (catalyst) needed / small amount of catalyst needed	ignore just small ignore size of the converter	1 1 1
Total			**9**

4.9.3.1 Atmospheric pollutants from fuels

Answer 41 · Mark scheme

January 2011 | CHY2H | Original Q4 | Legacy

CHY2H

4.9.3.1 Atmospheric pollutants from fuels

Answer 42 · Mark scheme

January 2011 | CHY2H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)(i)	less drying time **and/or** less soaking time	allow it is quicker / faster allow converse if they state water	1
6(a)(ii)	forces of attraction / bonds between molecules are weak (owtte) **or** intermolecular forces / bonds are weak (owtte)	do not accept intramolecular forces / covalent bonds are weak forces of attraction are weak (without specifying between molecules / intermolecular) gains **1** mark (accept easily broken / not much energy needed to break instead of weak) bonds are weak without specifying intermolecular would **not** gain a mark and would be ignored. made of small molecules / simple molecular gain **1** mark an answer such as, it is made of small molecules with weak forces of attraction, would gain **2** marks	2
6(b)(i)	exothermic reaction (owtte)	accept answers based on Le Chatelier eg when temperature is low the reaction moves to increase the temperature accept reverse argument	1

Question 6 continued on the next page

Question 6 contd

question	answers	extra information	mark
6(b)(ii)	fewer product molecules / particles (than reactants molecules) (owtte)	accept three molecules / particles / volumes / moles on the left and one on the right (numbers given must be correct) accept answers based on Le Chatelier eg when pressure is high, reaction moves to the side with fewest molecules / smaller volume **or** when pressure is high, reaction moves to reduce the pressure do **not** accept reference to atoms do not accept more reactants than products unless qualified	1
6(b)(iii)	any **two** from: • molecules / particles / they move faster • collide more (often) / quicker • more of the collisions are successful **or** more have the activation energy (owtte) **or** more energetic collisions	 ignore move / vibrate more allow harder collisions allow collide with more force	2
6(c)(i)	16	correct answer with or without working accept correct rounding if the answer is incorrect then check the working. for **1** mark look for correct method in one line of the working. Moles of CO = 14/28 **or** 0.5 **or** Mass of CH_3OH = 0.5 × 32 **or** 28 → 32 **or** 14 → 32/2 **or** $\frac{32}{28} \times 14$	2

4.9.3.1 Atmospheric pollutants from fuels

Question 6 contd

question	answers	extra information	mark
6(c)(ii)	75	correct answer with or without working allow correct answer with ecf from (c)(i) for **2** marks if the answer is incorrect $\frac{12}{16}\times 100$ **or** $\frac{12}{\text{their (c)(i)}}\times 100$ gains **1** mark **OR if working from 18 g** 66.6 recurring or correctly rounded to a max of 67 = **2** marks incorrect rounding eg 66 = **1** mark **or** $\frac{12}{18}\times 100$ gains **1** mark	2
6(c)(iii)	reversible reaction **or** not all reactants converted to product (owtte) **or** other sensible reason such as: loss of product / reactant **or** impurities in reactants **or** side reactions / other products **or** temperature too high / pressure too low	 allow 'it did not all react' allow gas is lost ignore mass lost ignore some is lost	1
Total			**12**

4.9.3.1 Atmospheric pollutants from fuels

Answer 43 · Mark scheme March 2011 | CHY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	Carbon monoxide (CO) / Substance **A**	**4**
	B	Hydrogen (H_2) / Substance **B**	**2**
	C	Methane (CH_4) / Substance **C**	**1**
	D	Hydrogen sulfide (H_2S) / Substance **D**	**3**

Answer 44 · Mark scheme March 2011 | CHY1AP | Original Q6 | Legacy

Six	**3**	**1**	**4**	**2**

Answer 45 · Mark scheme March 2011 | CHY1AP | Original Q8 | Legacy

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

Answer 46 · Mark scheme March 2011 | CHY1BP | Original Q5 | Legacy

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

Answer 47 · Mark scheme June 2011 | CHY1AP | Original Q2 | Legacy

Two	**A**	CO		**1**
	B	CS_2		**4**
	C	C_2H_4		**2**
	D	C_3H_8		**3**
	A	**B**	**C**	**D**

Answer 48 · Mark scheme June 2011 | CHY1BP | Original Q2 | Legacy

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

4.9.3.1 Atmospheric pollutants from fuels

Answer 49 · 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

4.9.3.1 Atmospheric pollutants from fuels

Answer 50 · 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 . . .

4.9.3.1 Atmospheric pollutants from fuels

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**

4.9.3.1 Atmospheric pollutants from fuels

Answer 51 · Mark scheme

June 2011 | CHY1H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6	any **four** from: **Arguments for biodiesel** max **three** from: • sustainable / renewable • (carbon neutral) absorbs CO_2 when growing / during photosynthesis • burning biodiesel produces low amounts particulates / carbon monoxide • can use waste vegetable oils / fats (from food industry) **or** can use waste plant material • can be used to conserve crude oil (instead of / mixed with petroleum diesel) • produced by a low energy / temperature process • biodegrades (easily) **Arguments against biodiesel** max **three** from: • creates food shortages • deforestation to plant more crops leads to loss of habitat / biodiversity **or** deforestation leads to a reduction in absorption of CO_2 • burning biodiesel produces high amounts of nitrogen oxides • crops takes time to grow • vast areas of land needed to grow crops conclusion supported by the argument presented, which must give added value to the points for and against given above	to gain **4** marks both pros and cons should be given allow burning biodiesel produces little / low amount of global dimming ignore sulfur dioxide accept produced by a low tech process ignore engine effects accept price of food increases allow burning trees increases CO_2 allow deforestation increases global warming allow increases acid rain allow crops can fail	4 1
Total			**5**

The AQA UMS Conversion Calculator is available on the Results statistics page of the AQA Website

4.9.3.1 Atmospheric pollutants from fuels

Answer 52 · Mark scheme

November 2011 | CHY1AP | Original Q3 | Legacy

Three	**3**	**1**	**2**	**3**

Answer 53 · Mark scheme

November 2011 | CHY1AP | Original Q5 | Legacy

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

4.9.3.1 Atmospheric pollutants from fuels

Answer 54 · Mark scheme

January 2012 | CH1HP | Original Q2 | Legacy

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……..

4.9.3.1 Atmospheric pollutants from fuels

Answer 54 · 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**

4.9.3.1 Atmospheric pollutants from fuels

Answer 54 · Mark scheme

January 2012 | CH1HP | Original Q2 | Legacy

CH1HP

4.9.3.1 Atmospheric pollutants from fuels

Answer 55 · Mark scheme

January 2012 | CH1HP | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	limewater **or** calcium hydroxide solution		1
	(reacts with carbon dioxide and) turns cloudy / milky	linked to first point if no other mark awarded 'puts out lighted splint' gains **1** mark	1
6(b)(i)	any **two** from: • same volume / amount of the acids • concentration of the acids • temperature • same surface area / size / mass / amount of calcium carbonate • same measuring equipment		2

Question 6 continues on the next page…….

4.9.3.1 Atmospheric pollutants from fuels

CH1HP

Question 6 cont'd…

question	answers	extra information	mark
6(b)(ii)	any **three** from: • (after about 4 minutes) the sulfuric acid stops reacting **or** nitric acid continues to react • (initially) the reaction with sulfuric acid is faster • (the reaction stops) because calcium sulfate is a solid • (the reaction continues) because calcium nitrate is soluble / in solution / aqueous • because the calcium sulfate prevents the sulfuric acid reacting with the calcium carbonate • (the rate is faster) because sulfuric acid contains two hydrogens	accept more CO_2 with nitric acid at any time after 4 minutes allow sulfuric acid produces a solid allow nitric acid produces an (aqueous) solution	3
Total			**7**

4.9.3.1 Atmospheric pollutants from fuels

Answer 55 · Mark scheme

January 2012 | CH1HP | Original Q6 | Legacy

CH1HP

4.9.3.1 Atmospheric pollutants from fuels

Answer 56 · Mark scheme

June 2012 | CH2HP | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)	118		1
4(b)	it loses / transfers electrons three electrons	it = Au / gold atom sharing / covalency = max **1** mark	1 1
4(c)(i)	O_2 **2** CO and **2** CO_2 **or** correct balancing of equation from O	 accept correct multiples / fractions throughout	1 1
4(c)(ii)	 because carbon dioxide is simple molecular / small molecules there are intermolecular forces (between the molecules) so a small amount of energy needed (to separate molecules) **or** (intermolecular forces) are weak	reference to incorrect bonding = **1** mark max allow intermolecular bonds	 1 1 1

Question 4 continues on the next page . . .

4.9.3.1 Atmospheric pollutants from fuels

Answer 56 · Mark scheme

June 2012 | CH2HP | Original Q4 | Legacy

CH2HP

Question 4 cont'd…

question	answers	extra information	mark
4(d)	any **three** from: • gold is the only catalyst for some reactions • catalysts are not used up • improves speed of reaction • reduces amount of energy **or** process needs low(er) temperature • only small quantities (of catalyst) needed	if no mark awarded, allow catalyst reduce costs (of the process) for **1** mark	3
Total			**11**

4.9.3.1 Atmospheric pollutants from fuels

Answer 56 · Mark scheme

June 2012 | CH2HP | Original Q4 | Legacy

CH2HP

4.9.3.1 Atmospheric pollutants from fuels

Answer 57 · Mark scheme

June 2012 | CH2HP | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	because calcium is +2 and hydroxide is –1 **or** to make the compound neutral (in terms of charges)	accept to balance the charges allow calcium needs to lose 2 electrons and hydroxide needs to gain one electron	1
6(b)	particles of size 1-100 nm **or** particles with a few hundred atoms / ions **or** particles with a high surface area (to volume ratio) **or** as different properties to 'normal' size particles of the same substance	allow clear comparison to 'normal' size particles	1
6(c)	M_r CaO = 56 **and** M_r $Ca(OH)_2$= 74 2/56 (x74) **or** 0.036 (x74) **or** 74/56 (x2) **or** 1.3(214…) (x2) 2.6(428…) in range 2.6 to 2.96	 allow ecf from step 1 correct answer with or without working gains **3** marks allow ecf carried through from step 1 ignore final rounding to 3	1 1 1
Total			**5**

4.9.3.1 Atmospheric pollutants from fuels

Answer 57 · Mark scheme

June 2012 | CH2HP | Original Q6 | Legacy

CH2HP

4.9.3.1 Atmospheric pollutants from fuels

Answer 58 · 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

4.9.3.1 Atmospheric pollutants from fuels

Answer 59 · Mark scheme

June 2013 | CH1HP | Original Q7 | Legacy

Question 7

question	Answers	extra information	Mark
7(a)	ethanol is made up of only one type of molecule **or** ethanol is a compound	allow ethanol is pure	1
	diesel / petrol / rapeseed oil are mixtures	accept composition of diesel / petrol / rapeseed oil varies / changes allow different hydrocarbons have different melting points ignore diesel, petrol and rapeseed oil are impure	1
7(b)(i)	sugar is mixed with / dissolved in water	accept sugar cane for sugar	1
	yeast (is added)	allow enzymes are added if no other mark awarded, allow correct word or chemical equation for **1** mark	1
7(b)(ii)		accept carbon for carbon dioxide	
	(growing sugar cane / rapeseed) plants absorbs carbon dioxide	accept carbon dioxide is used for photosynthesis	1
	which is released (when the biofuel burns)	do **not** accept no carbon dioxide is released (when biofuels burn)	1
7(c)	nitrogen / N_2 **and** oxygen / O_2 (in the air)	do **not** accept fuels contain nitrogen	1
	react in the hot engine / at high temperature		1

Question 7 continues on the next page

4.9.3.1 Atmospheric pollutants from fuels

Question 7 continued

question	Answers	extra information	Mark
7(d)	any **three** from: • ethanol needs a higher temperature to burn than petrol **or** ethanol has a higher flashpoint than petrol • ethanol releases less energy (per litre) than petrol • sugar is renewable **or** crude oil is non-renewable / will run out • sugar cane growth is unreliable / slow **or** crude oil is a reliable supply • ethanol is made by a batch / slow process **or** petrol is made by a continuous / fast process • ethanol is carbon neutral **or** petrol contains 'locked up' carbon dioxide • sugar / sugar cane should be used for food not for fuels	ignore references to melting point allow ethanol is not readily available **or** petrol is readily available accept idea of food shortages	3
	a justified conclusion that adds value	accept one **additional** point from the list above as long as one comparison of replacing petrol with ethanol is made	1
Total			**12**

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

4.9.3.1 Atmospheric pollutants from fuels

Answer 60 · Mark scheme June 2014 | CH1HP | Original Q1 | Legacy

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

4.9.3.1 Atmospheric pollutants from fuels

Answer 60 · Mark scheme

June 2014 | CH1HP | Original Q1 | Legacy



4.9.3.1 Atmospheric pollutants from fuels

Answer 61 · Mark scheme

June 2014 | CH1HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
2(a)(i)	reaction with water / steam	allow add water / steam *(to produce ethanol)* *allow H_2O or hydrogen oxide for water* *ignore mix*	1	1 / 1.5.3a	E
2(a)(ii)	filter / decant (to remove the yeast)	*allow answers in either order* *accept description of decanting* *ignore sieve*	1	2 / 1.5.3b	E
	(fractional) distillation / distil	*accept evaporation then condensation*	1		

4.9.3.1 Atmospheric pollutants from fuels

Answer 61 · Mark scheme

June 2014 | CH1HP | Original Q2 | Legacy

<table>
<tr><td colspan="4">2(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.</td><td>1+2+3 / 1.4.3e</td><td>E</td></tr>
<tr><td>0 marks</td><td>Level 1 (1–2 marks)</td><td>Level 2 (3–4 marks)</td><td>Level 3 (5–6 marks)</td><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>No relevant content</td><td>There is a stated advantage or disadvantage of using biodiesel or petroleum diesel.</td><td>There is a stated advantage or disadvantage of using biodiesel or petroleum diesel with a linked consequence.</td><td>There is at least one stated advantage and at least one stated disadvantage of using biodiesel or petroleum diesel with a linked consequence for each.</td></tr>
<tr><td colspan="4">Examples of points made in the response could include:
Advantages of biodiesel:
• Produces less carbon dioxide
• Produces no sulfur dioxide
• Produces less particulates
• Sustainable / renewable
• Growing crops absorb carbon dioxide
• Carbon neutral
• Produces less acid rain
• Conserves the limited amount of petroleum diesel
Disadvantages of biodiesel:
• Produces more nitrogen oxides
• Deforestation for land
• Destruction of habitats for land
• Uses land that could be used for food crops
• Creates food shortages
• Crops are not reliable</td><td></td><td></td></tr>
</table>

Total			**9**

4.9.3.1 Atmospheric pollutants from fuels

Answer 61 · Mark scheme

June 2014 | CH1HP | Original Q2 | Legacy



4.9.3.1 Atmospheric pollutants from fuels

Answer 62 · Mark scheme June 2014 | CH2HP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
3(a)	O_2 in correct space		1	2 / 2.4	E
	correct balancing	accept multiples	1		
3(b)(i)		*incorrect reference to energy = max **2***		1 / 2.4.1d	E
		ignore references to equilibrium			
	rate increases		1		
	because particles are closer together	accept because there are more particles (per unit volume)	1		
		allow particles have less space / room to move around			
	so frequency of collisions increases	*accept particles are more likely to collide*	1		
		ignore more collisions			
		ignore more successful collisions			
3(b)(ii)	has a greater surface area		1	3 / 2.4.1f/g	E
	so the reaction is faster	*accept so more frequent collisions*	1		
3(c)	the (minimum) amount of energy (particles must have) to react ***or*** *to start a reaction*	accept the energy needed to break bonds	1	1 / 2.4.1b	E
		ignore references to heat			
3(d)(i)	(potassium is) too / *very* reactive	*ignore potassium is a Group 1 / alkali metal*	1	1 + 2 / 2.6.1b	E
	so dangerous / *violent reaction*	accept hydrogen produced rapidly	1		
3(d)(ii)		accept products in either order		2 / 2.6.2b	E
		ignore names of substances			
		*do **not** accept brackets or charges in the formulae*			
	$ZnSO_4$		1		
	H_2		1		

4.9.3.1 Atmospheric pollutants from fuels

Answer 62 · Mark scheme

3(d)(iii)	any **one** from: • increase concentration (of sulfuric acid) • increase temperature **or** heat it • increase surface area of zinc		1	1 / 2.4.1	E
Total			**13**		

4.9.3.1 Atmospheric pollutants from fuels

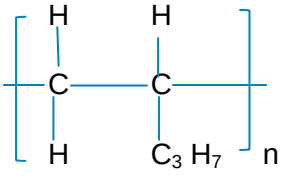
Answer 62 · Mark scheme

June 2014 | CH2HP | Original Q3 | Legacy



4.9.3.1 Atmospheric pollutants from fuels

Answer 63 · Mark scheme June 2015 | CH1HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	any **four** from: • (crude oil is) heated • to evaporate/vaporise/boil (the substances/ hydrocarbons) • the column is hotter at the bottom or is cooler at the top • (vapours/fractions) condense • at their boiling points or at different levels	marks can be taken from a diagram max 3 marks for reference to cracking allow fractional distillation allow vapours (enter the column) allow temperature gradient or (vapours) cool as they rise allow description e.g. vapour turns to liquid) allow they have different boiling points	4	1 / 1.4.1a/b / 1.4.2b
5(b)	acid rain is caused by sulfur dioxide or oxides of nitrogen they react with/are neutralised by calcium carbonate or limestone **OR** global warming is caused by carbon dioxide carbon dioxide will react or dissolve in suspension of limestone	allow consequences of acid rain second marking point is dependent on first marking point allow greenhouse effect is caused by or allow consequences of global warming	1 1 1	2+3 / 1.4.3a/b/c/d / 1.2.1f
5(c)(i)	C_2H_4	must be formula ignore any name	1	2 / 1.1.3b/c / 1.5.1b
5(c)(ii)	a single bond between carbon atoms other four bonds linking hydrogen atoms and C_3H_7 group plus two trailing/connecting bonds n at the bottom right hand corner of the bracket	 would score 3 marks	1 1 1	2 / 1.5.2a

4.9.3.1 Atmospheric pollutants from fuels

Answer 63 · Mark scheme

5(c)(iii)	has a shape memory or (a smart polymer) can return to original shape (when conditions change)		1	2 / 1.5.2b
Total			**12**	

4.9.3.1 Atmospheric pollutants from fuels

Answer 63 · Mark scheme

June 2015 | CH1HP | Original Q5 | Legacy

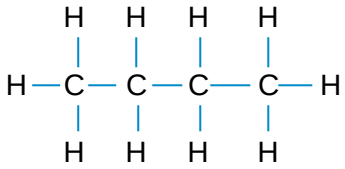


4.9.3.1 Atmospheric pollutants from fuels

Answer 64 · Mark scheme

June 2016 | CH1HP | Original Q2 | Legacy

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	high temperature catalyst or steam	allow heating / hot / 250-900 °C allow named catalyst eg zeolite, Al_2O_3, silica, ceramic allow in the absence of air / oxygen ignore any references to pressure	1 1	AO1 1.5.1a
2(a)(ii)	colourless	allow decolourised ignore clear / discoloured	1	AO1 1.5.1d
2(a)(iii)			1	AO2 1.4.2a
2(b)(i)	20.3(0) (kJ)	if answer incorrect allow **1** mark for 24.36/1.2	2	AO2 1.4.3b
2(b)(ii)	use a lid reduce energy / heat loss	allow insulate beaker or use draught shield ignore references to thermometer or repeats or distance of flame or loss of water vapour allow stir (1) to distribute energy / heat (1) allow use a metal can (1) as it's a better conductor (1)	1 1	AO3 4.3.2b/c/d
2(b)(iii)	carbon/soot (produced by) incomplete combustion	ignore tar, smoke allow from a limited supply of oxygen/air	1 1	AO1+AO2 1.4.3a/b
2(b)(iv)	hexane gives out the greatest energy (per 1.0 g) hexane produces the least smoke / carbon / soot	ignore more energy allow has the cleanest flame ignore less smoke / carbon / soot	1 1	AO3 1.4.2c; 1.4.3a/b

QWC Mark Scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(c)			6	AO1+AO2+ AO3 1.1.3b; 1.4.1b/c; 1.4.3a/b/c/d ;1.7.2h/i

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.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content	Statements made from the information that indicate whether at least one statement is an advantage **or** a disadvantage **or** a linked advantage or disadvantage	Descriptions of an advantage **and** a disadvantage with some use of their knowledge to add value.	Descriptions of advantages **and** disadvantages that are linked to their own knowledge.

Examples of the added value statements and links made in the response could include:
Note that link words are in bold; links can be either way round.
Accept reverse arguments and ignore cost throughout.

Advantages of using hydrogen:

- Combustion only produces water **so** causes no pollution
- Combustion does not produce carbon dioxide **so** this does not contribute to global warming or climate change
- Combustion does not produce sulfur dioxide **so** this does not contribute to acid rain
- Incomplete combustion of petrol produces carbon monoxide **that is** toxic
- Incomplete combustion of petrol produces particulates **that** contribute to global dimming
- Petrol comes from a non-renewable resource **but** there are renewable/other methods of producing hydrogen
- Hydrogen releases more energy **so** less fuel needed or more efficient

Disadvantages of using hydrogen:

- Hydrogen is a gas **so** is difficult to store or transfer to vehicles
- Hydrogen gas is very flammable **so** leaks cause a greater risk of explosion
- Most hydrogen is produced from fossil fuels **which** are running out
- Cannot be used in existing car engines **so** modification / development or replacement is needed
- Lack of filling stations **so** difficult to refuel your vehicle

Total			18

4.9.3.1 Atmospheric pollutants from fuels

Answer 65 · Mark scheme June 2017 | CH1HP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3			6	**AO2 AO3** 1.2.1a;b 1.4.2a 1.4.3a;b;c 1.7.2a;i

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 4 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
no relevant information given	discrete relevant points made about types of pollution **or** problematic effects **or** environmental impacts	an explanation of how an environmental impact is caused by the pollution from **or** the problematic effect of a linked process	detailed explanations of how environmental impacts are caused by the pollutions from **or** the problematic effects of linked processes

Examples of chemistry points made in the response could include:

Processes
- quarrying
- drilling
- thermal decomposition
- combustion of fossil fuel
- use of explosives

Types of pollution and problematic effects:
- visual pollution
- noise pollution
- dust pollution
- destruction of land
- air / atmospheric pollution (methane, carbon dioxide, sulphur dioxide, NO_x, particulates)
- water (rivers / lakes / seas) pollution
- earth tremors

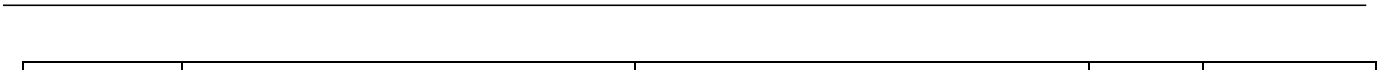
Environmental impacts:
- destruction of areas of natural beauty
- disturbance of people and animals
- breathing problems **or** asthmatic attacks
- destruction of habitats **or** biodiversity or kills wildlife and plants
- (CH_4 ; CO_2) greenhouse gases → global warming → consequences
- (particulates) global dimming → consequences including breathing problems
- (SO_2 ; NO_x) acidic gas / rain → consequences including breathing problems
- damage to buildings / infrastructure

Total			6

4.9.3.1 Atmospheric pollutants from fuels

Answer 65 · Mark scheme

June 2017 | CH1HP | Original Q3 | Legacy



4.9.3.1 Atmospheric pollutants from fuels

Answer 66 · 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

4.9.3.1 Atmospheric pollutants from fuels

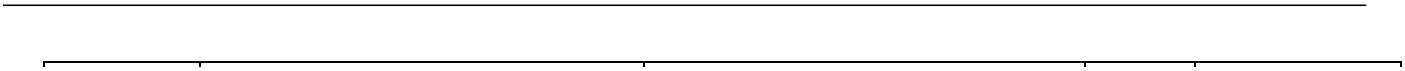
Answer 66 · Mark scheme

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**	

4.9.3.1 Atmospheric pollutants from fuels

Answer 66 · Mark scheme

June 2017 | CH1HP | Original Q5 | Legacy



4.9.3.1 Atmospheric pollutants from fuels

Answer 67 · Mark scheme June 2018 | 8462/2H | Original Q7

Question	Answers	Extra information	Mark	AO/Spec. Ref.
07.1	incomplete combustion (because) insufficient / limited oxygen supply		1 1	AO1 4.9.3.1
07.2	any **two** from: • carbon monoxide toxic / poisonous • greater public concern / awareness about pollution • more cars so otherwise there would be more carbon monoxide entering atmosphere • improved engine technology • catalytic converters have been introduced	allow description of how carbon monoxide is toxic / poisonous ignore carbon monoxide is harmful / dangerous / deadly ignore comments about the effects of other pollutants ignore unspecified comments about carbon monoxide pollution	2	AO1 AO3 4.9.3.2
07.3	any **one** from: • (to reduce) health problems • (to reduce) global dimming	allow (to reduce) specified health problems eg breathing difficulties, asthma, lung cancer allow (to reduce) the effects of global dimming eg reduced light levels allow (to reduce) smog allow (to reduce) the formation of particulates ignore global warming do **not** accept to reduce soot	1	AO1 4.9.3.1 4.9.3.2

4.9.3.1 Atmospheric pollutants from fuels

Answer 67 · Mark scheme

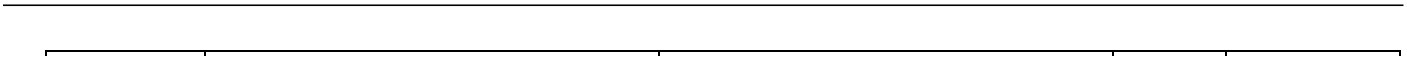
June 2018 | 8462/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	nitrogen (from atmosphere) reacts with oxygen (from atmosphere) at high temperature (in engine) **or** with a spark (from spark plug)	 ignore heat / hot	1 1	AO1 4.9.3.1
07.5	**2** $NO_2 \rightarrow N_2$ + **2** O_2	allow multiples if incorrect, allow N_2 for **1** mark	2	AO2 4.1.1.1 4.3.1.1
07.6	any **two** from: • acid rain • respiratory problems • carbon monoxide • global dimming **or** smog	**max 1** mark if global warming mentioned allow specific effects of acid rain allow specific respiratory problems eg breathing difficulties, asthma	2	AO1 4.9.3.2
07.7	transition metals		1	AO2 4.1.3.2
Total			**12**	

4.9.3.1 Atmospheric pollutants from fuels

Answer 67 · Mark scheme

June 2018 | 8462/2H | Original Q7



4.9.3.1 Atmospheric pollutants from fuels

Answer 68 · Mark scheme June 2018 | 8462/2H | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	enzyme		1	AO2 4.6.1.4
09.2	2.0×10^3 moles		1	AO2 4.3.2.1
09.3	smaller yield (because) favours endothermic reaction	allow less methanol is produced allow (because) favours reverse reaction allow equilibrium / reaction shifts to the left allow equilibrium / reaction shifts to reduce the temperature ignore reference to forward reaction is exothermic ignore references to rate	1 1	AO2 4.6.2.4 4.6.2.6

4.9.3.1 Atmospheric pollutants from fuels

Answer 68 · Mark scheme

June 2018 | 8462/2H | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	(yield) equilibrium position moves to the product side	allow converse arguments allow equilibrium / reaction moves to the right allow equilibrium / reaction shifts to reduce the pressure	1	AO2 4.6.1.3 4.6.2.4 4.6.2.7
	(because) fewer molecules / moles / particles on product side	allow (because) fewer molecules / moles / particles on the right allow (because) smaller volume on product side	1	
	(rate) more collisions per unit time	allow increases collision frequency / rate ignore more collisions alone ignore faster collisions do **not** accept any indication of more energetic / forceful collisions	1	
	(because) more molecules / particles per unit volume	allow (gas) molecules / particles closer together ignore more molecules / particles alone	1	
09.5	provides different reaction pathway	allow provides a different mechanism / route	1	AO1 4.6.1.4
	(which has a) lower activation energy	ignore references to collisions	1	

4.9.3.1 Atmospheric pollutants from fuels

Answer 68 · Mark scheme

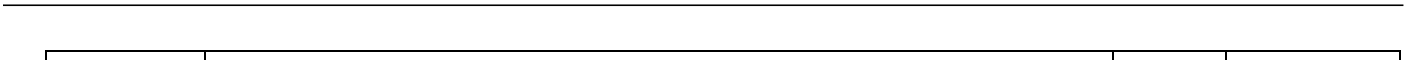
June 2018 | 8462/2H | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	less energy is needed	allow reduces the temperature required allow reduces costs ignore references to pressure ignore references to rate or time	1	AO2 4.6.1.4
09.7	no effect / change		1	AO3 4.6.1.4 4.6.2.3
Total			**12**	

4.9.3.1 Atmospheric pollutants from fuels

Answer 68 · Mark scheme

June 2018 | 8462/2H | Original Q9



4.9.3.1 Atmospheric pollutants from fuels

Answer 69 · Mark scheme

June 2019 | 8462/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	wood is renewable **or** (natural) gas is finite (burning) wood produces the same amount of carbon dioxide as the trees absorbed **or** (burning natural) gas increases the amount of carbon dioxide (in the atmosphere)	 allow wood is carbon-neutral allow wood does not add to global warming allow (burning natural) gas adds to global warming allow (burning natural) gas adds greenhouse gases (to the atmosphere) ignore references to energy / cost	1 1	AO3 4.9.2.2 4.10.1.1
05.2	not enough oxygen (so) incomplete combustion	allow not enough air do **not** accept no oxygen / air	1 1	AO1 4.9.3.1
05.3	$\mathbf{2}CH_4(g)+\mathbf{3}O_2(g)\rightarrow\mathbf{2}CO(g)+\mathbf{4}H_2O(g)$	allow correct multiples / fractions	1	AO2 4.9.3.1

4.9.3.1 Atmospheric pollutants from fuels

Answer 69 · Mark scheme June 2019 | 8462/2H | Original Q5

05.4	ratio of O_2 : CO_2 = 5 : 3 (oxygen needed = $\frac{3.60 \times 5}{3}$) = 6.0 (dm^3) (oxygen unreacted = 7.25 – 6.0) = 1.25 (dm^3) (oxygen unreacted = 1.25 × 1000) = 1250 (cm^3)	an answer of 1250 (cm^3 oxygen unreacted) scores **4** marks allow correct calculation using an incorrectly determined mole ratio allow correct subtraction of an incorrectly calculated volume of oxygen allow correct conversion to cm^3 anywhere in response **alternative approach for MP1 and MP2** moles CO_2 = 0.15 **and** moles O_2 = 0.25 (1) (0.25 x 24 =) 6.0 (dm^3 oxygen needed) (1)	1 1 1 1	AO2 4.3.5 4.7.1.3
Total			**9**	

4.9.3.1 Atmospheric pollutants from fuels

Answer 70 · Mark scheme

June 2019 | 8462/2H | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	$\frac{6}{34} \times 100$	an answer of 17.6470588 (%) correctly rounded to at least 2 significant figures scores **2** marks	1	AO2 4.3.3.2
	= 17.6 (%)	allow 17.6470588 (%) correctly rounded to at least 2 significant figures	1	
10.2	higher yield (of hydrogen or carbon monoxide or product)	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	1	AO2 4.6.2.4 4.6.2.7
	(because) fewer moles / molecules / particles on left hand side **or** (because) more moles / molecules / particles on right hand side	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	
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

		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**	

4.9.3.1 Atmospheric pollutants from fuels

Answer 71 · Mark scheme

November 2020 | 8462/2H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	incomplete combustion	max **1** mark if soot wrongly identified	1	AO1 4.9.3.1
	(because of) insufficient oxygen		1	
06.2	sulfur reacts with oxygen to form sulfur dioxide	allow SO_2 for sulfur dioxide allow sulfur burns to form sulfur dioxide	1	AO1
	(so) less sulfur dioxide emitted		1	AO1
	(so) less acid rain		1	AO2
	(so less) limestone reacts with acid rain		1	AO2 4.9.3.1 4.9.3.2
06.3	(car engines work at) high temperatures		1	AO1 4.9.3.1
	(so in the engine) nitrogen (from air) reacts with oxygen (from air)		1	
Total			8	

4.9.3.1 Atmospheric pollutants from fuels

Answer 72 · Mark scheme

November 2021 | 8462/2H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	use of oil has decreased by 0.8% **or** use of oil has decreased from 1.3% to 0.5%		1	AO2 4.10.1.1
	use of solar energy has increased by 3.4% **or** use of solar energy has increased from 0% to 3.4%	allow any value below 0.05% for 2007	1	
	any **one** from: • use of oil increased from 2007 to 2009 • no change in oil use between 2013 and 2015 • no change in solar energy use between 2007 and 2009 • use of solar energy increased most between 2013 and 2015 • between 2007 and 2011 more oil was used **and** between 2013 and 2017 more solar energy was used	allow use of oil was highest in 2009	1	
		if no other mark is awarded, allow **1** mark for oil decreased **and** solar energy increased		

Question 1 continued

Question	Answers	Mark	AO / Spec. Ref
01.2	**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 • carbon dioxide produced • (which is) a greenhouse gas • (therefore) surface temperature increases • (therefore) global warming • (so) climate change • (so) polar ice caps melt • (so) increasing sea levels • (so) flooding • (so) extreme weather events • (so) reduction in biodiversity • (so) famine **/** drought • sulfur dioxide produced • (which causes) acid rain • (so) damage to buildings / statues • (so) damage to trees • (so) damage to aquatic animals • (so) respiratory problems in humans • carbon **/** soot produced • (which are) particulates • (which cause) global dimming • (so) respiratory problems in humans • carbon monoxide produced • (which is) toxic		4.9.2.2 4.9.2.3 4.9.3.1 4.9.3.2

Question 1 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	solar is (a) renewable (source of energy)	allow oil is (a) finite (source of energy)	1	AO3 4.10.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	any **two** from: • sunshine is unreliable • increased demand for energy • lack of space	ignore references to cost	2	AO3 4.9.2.4 4.10.1.1

Total			**12**

4.9.3.1 Atmospheric pollutants from fuels

Answer 73 · Mark scheme

June 2024 | 8462/2H | Original Q5

Question 5

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

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

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

4.9.3.1 Atmospheric pollutants from fuels

Answer 73 · Mark scheme

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

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

Total Question 5	12

4.9.3.1 Atmospheric pollutants from fuels

Answer 74 · Mark scheme

June 2024 | 8462/2H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1		ignore (hydrochloric / nitric / sulfuric) acid		AO1 4.8.3.5
	(test) add barium chloride (solution)	allow add barium nitrate (solution)	1	
	(result) white precipitate		1	
		MP2 is dependent upon MP1 being awarded		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	the yield is smaller at higher temperatures because the reaction is exothermic		1	AO2 4.6.2.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3		allow converse		AO2 4.6.2.7
	there are more moles / molecules (of gas) on the left	ignore particles	1	
	(so the position of) equilibrium shifts to the right		1	

4.9.3.1 Atmospheric pollutants from fuels

Answer 74 · Mark scheme

June 2024 | 8462/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	any **two** from: • the yield is already high • more energy required • risk of explosion is increased • higher income from increased yield is outweighed by the extra expenditure • increased cost of safety precautions	allow requires stronger vessels allow requires thicker walls	2	AO3 4.6.2.7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	vanadium (V)		1	AO3 4.1.3.2

Total Question 7	**8**

4.9.3.1 Atmospheric pollutants from fuels

Answer 67 · Examiner comments

June 2018 | 8462/2H | Original Q7

Question 7 (standard & standard / high demand)

07.1 This was generally well answered with 72% of students achieving one or two marks. The mark most commonly not achieved was for an insufficient or limited oxygen supply. This was usually because the students either did not mention oxygen or failed to say the supply was limited. However a number of students did not achieve the mark by stating that **no** oxygen was present. Global warming was a frequent response but was not creditworthy.

07.2 This was less well answered with 5% of students achieving both marks. Many students realised that CO is toxic in some way, but were too vague using words like 'harmful' or 'dangerous'. However this was the mark which was most frequently awarded.

Many students struggled to find a second reason. Again specific responses were required. Responses such as 'improved technology', 'more efficient cars' were not, on their own, sufficient to gain the 'improved engine technology' mark.

Although the question specifically mentioned new cars, responses comparing old cars to new cars did not normally contain creditworthy material.

07.3 This was not well answered with 11% of students achieving the mark. Most students did not appear to have realised that the question was asking about unburned hydrocarbons. Many who did were side-tracked into talking about wasting petrol / resources, or the flammability of unburned hydrocarbons. Again, global warming was a frequent response which did not gain credit.

07.4 There were a few good responses, but many that were not. 11% of students achieved both marks.

Students did not have to state where the oxygen and nitrogen came from, but when they did this needed to be correct. Nitrogen coming from the petrol or from combustion was not an acceptable response. The second mark was frequently not given because of the use of vague terms such as 'hot', rather than naming the conditions required ('high temperature')

07.5 This was generally well answered, although ‘2N’ was a common incorrect response. Students need to remember that gases such as nitrogen, hydrogen and oxygen normally exist as diatomic molecules. 61% of students achieved both the marks.

07.6 Again global warming and other associated responses were frequently seen, and in this case lost credit. Vague responses were also frequently seen. However most responses referred correctly to acid rain and one mark was often awarded. Some good responses included details about the pollutants that contribute to these effects. 56% of students were able to gain at least one mark.

07.7 61% of students knew that the transition metal block was the most likely source of catalysts.

Answer 68 · Examiner comments

June 2018 | 8462/2H | Original Q9

Question 9 (standard, standard / high & high demand)

09.1 88% of students could identify an enzyme as a (biological) catalyst.

09.2 64% of students could use the equation to work out that 2.0×10^3 moles of carbon monoxide would react.

09.3 The endothermic nature of the backwards reaction was often identified as the reason the equilibrium position moved to the left; however many made no comment about the yield of methanol. Many students thought there would be a higher yield. 39% of students achieved both marks.

09.4 While many students did well, there were many others who demonstrated partial knowledge or who did not express themselves clearly. Many thought that an increase in pressure caused an increased yield of methanol because it was an exothermic reaction, rather than because the equilibrium moved to the position of fewer moles / molecules / particles.

The increased rate of reaction was better understood; students usually gave some indication that the particles are closer or there are **more particles** in a **fixed** volume or there are the **same number of particles** in a **smaller** volume. Simply saying there were more particles was insufficient.

In addition, students needed to link collisions **and** time to gain credit, usually by saying that the particles collide more often or there are more frequent collisions. Simply saying **more collisions** alone was insufficient. The idea that an increase in pressure supplied energy (and therefore increased the speed of the particles) was discounted.

73% of students were able to achieve some credit, with 12% of students achieving full marks.

09.5 Higher-attaining students achieved both marks for stating that catalysts reduce the activation energy by providing an alternative route or pathway, though the second point was less well known than the first. Sometimes one or other of these points was omitted. A popular incorrect idea was that catalysts supply energy.

09.6 47% of students knew that catalysts reduce costs, save energy or allow lower temperatures to be used. Others just mentioned that catalysts can be reused or that they speed up the reaction.

09.7 The effect of a catalyst on the equilibrium yield of methanol was not well understood. It was widely thought that a catalyst increased the yield of methanol because the reaction was faster and would, therefore, produce more of the product. 24% of students answered correctly.

4.9.3.1 Atmospheric pollutants from fuels

Answer 71 · Examiner comments November 2020 | 8462/2H | Original Q6

Question 6 (standard and standard / high demand)

06.1 A number of students knew that this was incomplete combustion but far fewer mentioned insufficient oxygen. Some thought the soot was a product of a reaction involving the limestone.

06.2 This item was poorly answered, with a very small number of students able to access all the marks. Many thought that sulfur itself is released to the atmosphere, rather than producing sulfur dioxide in the engine, which is then released. Of those who did, most got the link to acid rain, but a lot did not say there would be less sulfur dioxide and therefore less acid rain. The last point was rarely scored – many just repeated the word erosion or its variants. Very few stated that acid rain reacts with limestone.

06.3 Not very well answered by most students. Many thought that nitrogen comes from the fuel. Others just stated that nitrogen oxides are a product of combustion. Of those who did realise that oxygen and nitrogen were reacting, some thought that this was happening outside the car rather than in the engine and very few mentioned that a high temperature was needed, some just referring to heat.

Answer 72 · Examiner comments November 2021 | 8462/2H | Original Q1

Question 1 (standard demand)

01.1 Nearly all students were able to quantitatively describe one trend, while a quarter scored two marks. Marking point 3 was seldom mentioned.

01.2 Over a quarter of students provided a Level 3 response while over two thirds achieved at least Level 2. The main obstacle to Level 3 was not referencing the effect of the combustion of sulfur. Level 2 responses required some linkage between polluting gases and their named effects or impacts. There were very many uncreditworthy references to the Earth's ozone layer.

01.3 Three quarters of students knew that solar energy is renewable.

01.4 Two thirds of students identified one reason, usually the fluctuation in output, but very few students could give two reasons.

4.9.3.1 Atmospheric pollutants from fuels

Answer 73 · Examiner comments

June 2024 | 8462/2H | Original Q5

Question 5 (standard and standard / high demand)

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

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

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

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

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Answer 73 · Examiner comments

June 2024 | 8462/2H | Original Q5

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

4.9.3.1 Atmospheric pollutants from fuels

Answer 74 · Examiner comments June 2024 | 8462/2H | Original Q7

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

07.1 Around 40% of students scored two marks for this question. However, many students were not able to name the correct reagent for the test. White precipitate was often given as the result of the test, but this answer was not creditworthy unless the correct reagent had been named. Sodium hydroxide and silver nitrate were the most common incorrect reagents. A significant number of students left the answer space blank.

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Answer 74 · Examiner comments June 2024 | 8462/2H | Original Q7

07.2 This multiple-choice question was well answered with two-thirds of students gaining the mark.

07.3 Around 30% of students scored both the marks on this question. Clear descriptions about the numbers of moles / molecules on each side of the equation and the resulting shift in the position of equilibrium at higher pressure were seen. A number of students failed to score the first marking point because they did not give a comparison of the number of moles or molecules of gas on each side of the equation. Answers that focused on changes in the rate of reaction or particle collisions were not creditworthy, nor were those which stated that the equilibrium shifted to the side with lower pressure.

07.4 This question was not well answered and only around 2% of students were awarded both marks. The most common creditworthy responses were based on the idea that a higher pressure is not used because the yield is already high or because more energy would be required to achieve a higher pressure. Many answers could not be given credit because they were not comparative. Higher risk of explosion or higher cost of safety precautions were creditworthy responses that focused on the consequences of using higher pressure compared to using a lower pressure.

07.5 This multiple-choice question was answered correctly by around a quarter of students who used their periodic table to locate and identify vanadium as a transition metal.