AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.7.1.1

Crude oil, hydrocarbons and alkanes

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**12**
Available paper years	**2018–2025**

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.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 01 · Mark scheme June 2018 | 8464/C/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	condenses		1	AO1 5.7.1.2
06.2	the fractions have different boiling points		1	AO1 5.7.1.2 5.7.1.3
06.3	propane	do **not** accept propene	1	AO2 5.7.1.1
06.4	C_nH_{2n+2}		1	AO1 5.7.1.1
06.5	$CH_4 + \mathbf{2}\ O_2 \rightarrow CO_2 + \mathbf{2}\ H_2O$	allow multiples	1	AO2 5.1.1.1 5.7.1.3
06.6	bromine water		1	AO1 5.7.1.4
06.7	to assess the environmental impact (of the stages in the life of a product)	allow to see the effect / harm / damage on the Earth / environment / planet ignore references to energy, pollution, carbon footprint, carbon dioxide, sustainability	1	AO1 5.10.2.1

5.7.1.1 Crude oil, hydrocarbons and alkanes

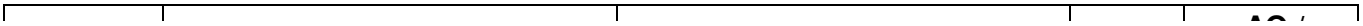
Answer 01 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
06.8	**Level 2:** Scientifically relevant features are identified; the ways in which they are similar / different is made clear and the magnitude of the similarity / difference noted.	3–4	AO3
	Level 1: Relevant features are identified and differences noted.	1–2	AO2
	No relevant content	0	
	Indicative content • burning 10 000 bags produces 10 kg more of carbon dioxide than landfill • putting 10 000 bags in landfill produces 0.02 kg more of solid residue than burning. • putting 10 000 bags in landfill produces 50% more sulfur dioxide than burning • burning 10 000 bags produces 25 kg of carbon dioxide, but landfill only produces15 kg • putting 10 000 bags in landfill produces 0.07 kg of solid residue but burning only produces 0.05 kg • landfill produces less carbon dioxide than burning • landfill produces more solid residue than burning • burning produces less sulfur dioxide than landfill		5.10.2.1 5.10.2.2 5.9.2.2
Total			**11**

5.7.1.1 Crude oil, hydrocarbons and alkanes

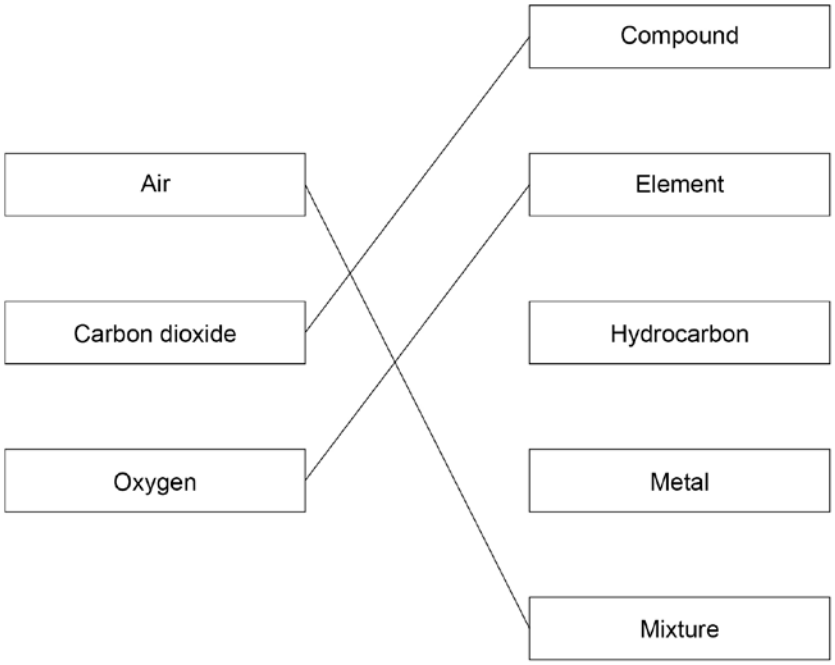
Answer 01 · Mark scheme

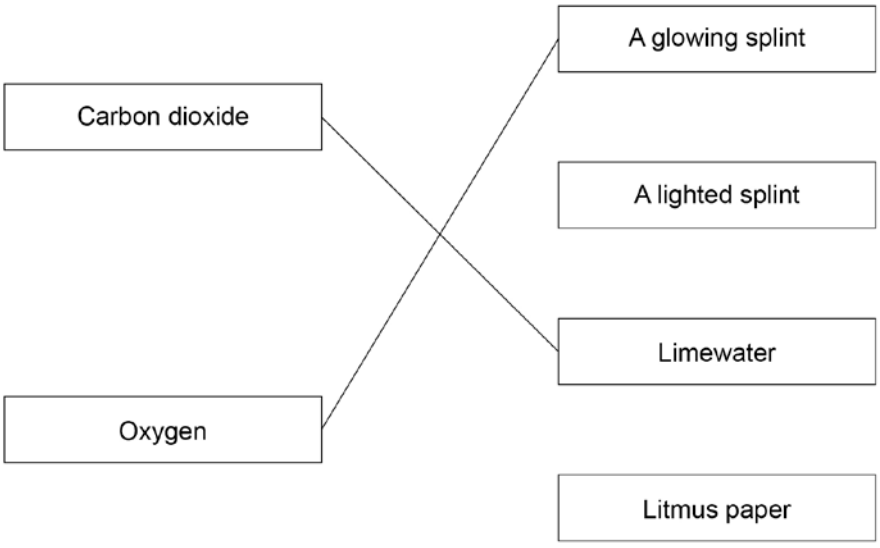
June 2018 | 8464/C/2F | Original Q6



5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 02 · Mark scheme June 2019 | 8464/C/2F | Original Q1

01.1	 If more than one line is drawn from any one substance and not crossed out, no mark is given for that substance. The other marks can be awarded.	1 1 1	AO2.1 5.1.1.2 5.8.1.1 5.1.1.1

01.2	 If more than one line is drawn from any one gas and not crossed out, no mark is awarded for that gas. The other mark can be awarded.	1 1	AO1.1 5.8.2.2 5.8.2.3

01.3	dissolved in oceans photosynthesis		1 1	AO1 5.9.1.2 5.9.1.4

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 02 · Mark scheme

01.4	⇌	ignore any other words, formulae or symbols	1	AO1.1 5.6.2.1
01.5	endothermic (reaction)	spelling must be correct do **not** accept exothermic	1	AO1.1 5.6.2.2
01.6	rate (of reaction)	allow speed or velocity do **not** accept any other response	1	AO1 5.6.2.3
Total			**10**	

5.7.1.1 Crude oil, hydrocarbons and alkanes

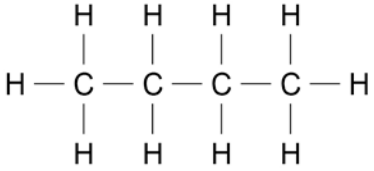
Answer 02 · Mark scheme

June 2019 | 8464/C/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 03 · Mark scheme June 2019 | 8464/C/2F | Original Q4

04.1	any **two** from: • high temperature • catalyst • steam • high pressure • low oxygen atmosphere	 ignore heat / hot allow a temperature between 400 °C and 900 °C allow aluminium oxide, alumina, porous pot, zeolites	2	AO1 5.7.1.4
04.2		all bonds and atoms must be present	1	AO1 5.7.1.1
04.3	 carbon dioxide water	in either order allow CO_2 allow H_2O	 1 1	AO1.1 5.7.1.3
04.4	bromine (water) turns (from orange / brown / yellow to) colourless	do **not** accept bromide MP2 is dependent on MP1 allow decolourises ignore clear	1 1	AO1 5.7.1.4
04.5	sustainable development		1	AO1 5.10.1.1
Total			**8**	

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 03 · Mark scheme

June 2019 | 8464/C/2F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 04 · Mark scheme November 2020 | 8464/C/2F | Original Q1

01.1	plankton mud	must be in this order	1 1	AO1 5.7.1.1
01.2	**B or** crude oil is heated **A or** hydrocarbons evaporate **C or** vapours condense	must be in this order all correct for **1** mark	1	AO1 5.7.1.2
01.3	fractional distillation		1	AO1 5.1.1.2 5.7.1.2
01.4	C_3H_8		1	AO2 5.7.1.1
01.5	covalent bond		1	AO2 5.2.1.4 5.2.2.4
01.6	C_nH_{2n+2}		1	AO1 5.7.1.1
01.7	6.7 (billion)	allow 6 700 000 000	1	AO2 5.10.2.2
Total			**8**	

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 04 · Mark scheme

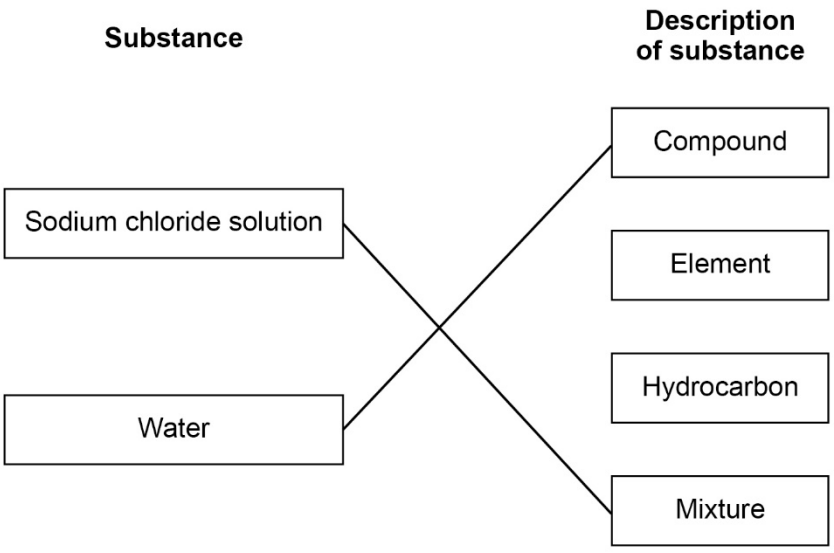
November 2020 | 8464/C/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 05 · Mark scheme

November 2021 | 8464/C/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	(the symbol) ⇌	allow description of reversible sign	1	AO1 5.6.2.1
01.2	white blue	must be in this order	1 1	AO1 5.6.2.2
01.3	to prevent reaction with water vapour (in the air)	allow to prevent reaction with moisture allow to keep water out	1	AO3 5.6.2.2
01.4	 do **not** accept more than one line from a box on the left		1 1	AO2 5.1.1.2
01.5	evaporation **or** crystallisation		1	AO1 RPA 13
01.6	(filtering) to remove solids (sterilising) to kill bacteria	 allow to kill microbes	1 1	AO1 5.10.1.2

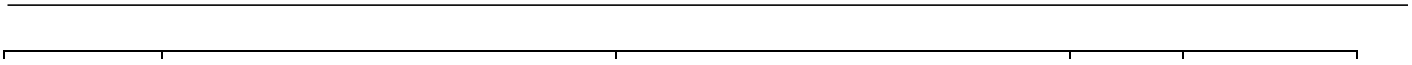
5.7.1.1 Crude oil, hydrocarbons and alkanes

01.7	ground water		1	AO1 5.10.1.3
01.8	screening and removal of grit		1	AO1 5.10.1.3
Total			**11**	

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 05 · Mark scheme

November 2021 | 8464/C/2F | Original Q1



5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 06 · Mark scheme

November 2021 | 8464/C/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	plankton **or** (ancient) biomass	allow microscopic plants / animals	1	AO1 5.7.1.1
07.2	propane	allow C_3H_8	1	AO1 5.7.1.1

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 06 · Mark scheme

November 2021 | 8464/C/2F | Original Q7

Question	Answers	Mark	AO / Spec. Ref.
07.3	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.	4–6	AO3
	Level 1: Relevant features are identified and differences noted.	1–3	AO1 AO2
	No relevant content	0	
	Indicative content • methane has 1 carbon atom, hexane has 6 • methane has 4 hydrogen atoms, hexane has 14 • both contain C – H bonds • only hexane contains C – C bonds • both are hydrocarbons • hexane has a higher melting point than methane (or converse) • hexane has a higher boiling point than methane (or converse) • methane is a gas at room temperature • hexane is a liquid at room temperature • both are small molecules • hexane has larger molecules than methane • weak forces between molecules • forces between hexane molecules stronger than between methane molecules • hexane is more viscous than methane • both are flammable • methane is more flammable than hexane (or converse) • possible products of combustion from both are: carbon, carbon monoxide, carbon dioxide, water • neither conduct electricity		5.2.2.4 5.7.1.1 5.7.1.3

5.7.1.1 Crude oil, hydrocarbons and alkanes

07.4	C_8H_{18}		1	AO2 5.3.1.1 5.7.1.4
07.5	bromine (water) turns (from orange / brown) to colourless	 MP2 is dependent on MP1 allow decolourises ignore clear	1 1	AO1 5.7.1.4
Total			**11**	

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 07 · Mark scheme

June 2023 | 8464/C/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	a limited resource		1	AO1 5.7.1.1 5.10.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	plankton		1	AO1 5.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	mixture		1	AO1 5.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	evaporate condense		1 1	AO1 5.2.2.1 5.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	fuels		1	AO1 5.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	burning splint		1	AO1 5.8.2.1

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 07 · Mark scheme

June 2023 | 8464/C/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	(percentage =) $\frac{1.53 \times 100}{5.20}$ = 29.42 = 29.4 (%)	 allow a correctly calculated answer to 3 significant figures from an incorrect calculation which uses values given in the question	1 1 1	AO2 5.7.1.2

Total Question 1	10

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 08 · Mark scheme

June 2023 | 8464/C/2F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	$CH_4 + \mathbf{2}\,O_2 \rightarrow CO_2 + \mathbf{2}\,H_2O$		1	AO2 5.7.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	hydrocarbon molecules in petrol have fewer carbon atoms than those in diesel petrol has a lower boiling point (range) than diesel	allow converse throughout allow petrol is more flammable than diesel allow petrol is less viscous than diesel	1 1	AO3 5.7.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	oxygen		1	AO1 5.8.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	air	allow the atmosphere allow from volcanoes	1	AO1 5.9.1.1 5.9.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	global dimming		1	AO2 5.9.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	(carbon monoxide is) colourless **or** (carbon monoxide is) odourless	ignore clear	1	AO1 5.9.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	(diesel) burns at a high temperature **or** (diesel) burns at a temperature greater than 100 °C		1	AO2
	(which is) above the boiling point of water		1	AO3 5.2.2.1 5.9.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.8	sulfur dioxide (is produced when diesel is burnt)		1	AO1 5.9.3.1 5.9.3.2
	(which causes) acid rain		1	
	(which results in) any **one** from: • damage to buildings / statues / bridges • damage to trees / plants • damage to aquatic life • acidification of lakes / rivers / soil • respiratory problems	allow (which affects) asthma	1	

Total Question 5	**12**

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 09 · Mark scheme

June 2024 | 8464/C/2F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	(molecules) made up of carbon and hydrogen (atoms only)		1	AO1 5.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	$C_{10}H_{22}$		1	AO2 5.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	(crude oil) is heated		1	AO1 5.7.1.2
	(so some of the hydrocarbons) vaporise		1	
	the column has a temperature gradient	allow the column gets cooler going up	1	
	(so) the hydrocarbons / fractions condense at different heights / temperatures in the column **or** (and) the hydrocarbons / fractions condense at their boiling points		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	$C_{14}H_{30} \rightarrow C_8H_{18} + \mathbf{2}\,C_3H_6$		1	AO2 5.1.1.1 5.7.1.4

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 09 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	add bromine (water) (bromine water) changes (from orange) to colourless	 allow (bromine water) decolourises ignore clear MP2 is dependent on MP1 being awarded	1 1	AO1 5.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	polymer	allow plastic allow hydrocarbon	1	AO1 5.2.1.4 5.7.1.4

Total Question 6	10

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 10 · Mark scheme

June 2025 | 8464/C/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	plankton		1	AO1 5.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	hydrocarbons		1	AO1 5.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	any **three** from: (crude oil from area **A** contains) • more diesel (oil) • less heavy fuel oil • more kerosene • more petrol	allow converse if clearly stated as referring to area **B** allow the highest percentage in area **A** is petrol and in area **B** is heavy fuel oil	3	AO2 5.7.1.1 5.7.1.2

Answer 10 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	(volume of kerosene =) $\frac{12}{100} \times 160$		1	AO2 5.7.1.1 5.7.1.2
	= 19.2		1	
	= 19 (dm^3)	allow an answer correctly rounded to 2 significant figures from an incorrect calculation which uses 160 dm^3 and a component percentage	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	(*y*-axis 0, 10) 20, 30, 40 (50)	ignore intermediate values	1	AO2 5.7.1.1 5.7.1.2
	bar correctly plotted and labelled for kerosene	allow a tolerance of ± ½ a small square	1	
	bar correctly plotted and labelled for petrol	if both bars incorrectly / not labelled allow **1** mark for both bars correctly plotted	1	

Total Question 1	11

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 11 · Mark scheme

June 2025 | 8464/C/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	water that is safe to drink		1	AO1 5.10.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	to remove large solid objects		1	AO1 5.10.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	(conversion 4.5 kg =) 4500 (g) (number of hats =) $\frac{4500}{50}$ = 90 **alternative approach** (conversion 50 g =) 0.05 (kg) (1) (number of hats =) $\frac{4.5}{0.05}$ (1) = 90 (1)	 allow correct use of incorrect / no conversion allow correct use of incorrect / no conversion	1 1 1	AO2 5.10.1.1

Question	Answers	Mark	AO / Spec. Ref.
04.4	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account	3–4	AO3 5.10.1.1
	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
	
	(poly(propene) has)
	• higher level of insulation
	  ○ (so) keeps the wearer warmer
	
	• lower cost
	  ○ (so) the clothes are cheaper
	
	• higher durability
	  ○ (so) the clothes last longer
	
	(wool is)
	• sheep are a renewable resource
	  ○ so are sustainable
	
	for **Level 2** there must be an advantage for both poly(propene) and wool plus a linked explanation		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	reused	must be in this order	1	AO2 5.10.2.2
	recycled		1	

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 11 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	a catalyst steam		1 1	AO1 5.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	bromine water		1	AO1 5.7.1.4

Total Question 4	**14**

Answer 12 · Mark scheme

June 2025 | 8464/C/2F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	$C_{12}H_{26}$		1	AO2 5.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	any **one** from: • (a water bath) will control the temperature • (a water bath) will not set dodecane on fire	 allow dodecane is flammable	1	AO3 5.7.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	volume of dodecane		1	AO3 5.7.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	line extrapolated to 75 °C value at 75 °C read from extrapolated line	 allow a tolerance of ± ½ a small square	1 1	AO3 AO2 5.7.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	as the temperature increases the time taken decreases (so) the viscosity decreases	ignore references to rate	1 1	AO3 5.7.1.3

Total Question 5	7

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 05 · Examiner comments November 2021 | 8464/C/2F | Original Q1

Question 1 (low and standard demand)

The reversible symbol was well known, but many students did not recognise that the starting point for the reaction was the anhydrous form of copper sulfate, so were unable to identify the colours of the salts. They did not appreciate the link between the reversible reaction and the storage of the anhydrous salt. Most students referred incorrectly to the toxicity of the salt.

The topic of water treatment was not well understood. Credit was given for the idea of filtering removing large insoluble solid material from the water and sterilising removing bacteria and pathogens, but not germs.

Answer 06 · Examiner comments November 2021 | 8464/C/2F | Original Q7

Question 7 (low and standard demand)

Students found this question challenging, with a significant number of scripts left blank.

Knowledge of the hydrocarbons was very limited. Very few students knew what decomposed to form crude oil – many appeared to confuse “decomposition” with “composition” and gave hydrocarbons as their answer. Similarly, in question, 07.2 Lithium was a common answer as

students had used the Periodic Table to find the third element rather than naming the third hydrocarbon.

Students often failed to address the command word to compare the structure and properties of the two hydrocarbons. Many students rewrote the information provided in the rubric without elaboration, for which no credit was given.

Concluding Remarks

The demand of this paper was similar to that of papers set for this specification in previous series.

Students scored well on questions involving the use of data and knowledge of the Earth's atmosphere and climate change, but often had difficulty in making links between each stage of a question. Very few students recognised in question 01.3 that the anhydrous copper sulfate would react with any moisture in the air as in the equation in question 01.1.

Practical work is at the heart of the specification. The importance of the use of variables in experiments is paramount. In question 06.1, when identifying control variables students should refer back to the method provided, where in this instance the volume of hydrochloric acid was given. Many answers referred to the "amount" of acid or metal which is insufficient to gain credit, likewise, adding a "piece" of magnesium which does not indicate that either the length or mass has been controlled. Reading through the method will also reveal what is being changed in subsequent repeats as the independent variable.

Students adopted a range of methods to answer the mathematical questions, which is to be encouraged as credit can be gained by showing working. They should also take careful note of any additional instructions. In question 04.6, the final mark was often not gained because their answer was not given to 2 significant figures.

In questions, such as question 07.3, where comparisons are to be made from given data, students should be encouraged to answer accordingly using a comparative and not rewrite the information that is provided without any elaboration. This does not gain any credit as the student has not added any value to their answer. Some excellent answers were seen where the students expanded upon the data, for example, to explain why the molecules had different melting and boiling points or they deduced their physical states.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 07 · Examiner comments

June 2023 | 8464/C/2F | Original Q1

Question 1

01.1 Nearly three quarters of students were able to identify that a finite resource was a limited resource.

01.2 Around two thirds of students knew that coal came from plankton.

01.3 Just over half of students identified crude oil as a mixture.

01.4 Nearly four in ten students successfully identified both changes of state during fractional distillation. Three quarters of students gained at least one mark. There were few patterns in incorrect responses, however, the most common was evaporate and condense in the wrong order.

01.5 Just over half of students identified fuels, with a similar number choosing either of the two distractors.

01.6 Gas tests are not well known by students. Under half were able to identify the burning splint as a test for hydrogen.

01.7 Around a quarter of students gained all three marks for this percentage calculation. Fewer than one in ten correctly calculated the percentage without going on to expressing it to three significant figures. The remaining students attempted to calculate a percentage, frequently missing multiplying by 100, or getting the expression upside down. One in ten of students gained a mark for giving the answer to the calculation they had done to three significant figures.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 08 · Examiner comments — June 2023 | 8464/C/2F | Original Q5

Question 5

05.1 Around a third of students successfully balanced the equation. Having to balance two numbers in the equation led to many students trying to add other atoms, usually C and/or H to the equation.

05.2 One in five students gained both marks for comparing petrol and diesel. A further third gained one mark. On this occasion, students needed to interpret what the table headings meant, so many were not able to gain credit as they referred to the range of numbers of carbons, rather than the number of carbons and similarly, though more infrequent, for the boiling points.

05.3 Three in five students identified oxygen as the common element in the compounds released from a car engine.

05.4 Only 15% of students were able to identify that nitrogen came from the air. Much more common suggestions were from the engine or the diesel fuel.

05.5 This question tested a little known part of the specification, with fewer than one in twenty identifying global dimming as a consequence of particulates in the atmosphere. By far the most common incorrect response was for global warming.

05.6 Just below half of students could answer that carbon monoxide is either colourless or odourless. Many students gave both, despite being asked for one.

05.7 Fewer than one in ten gained any marks on this question, which was applying ideas from across the specification. Just a statement that water evaporates was insufficient for credit, as there needed to be a realisation that water is produced as a vapour, rather than turning into a vapour during the process.

Answer 08 · Examiner comments — June 2023 | 8464/C/2F | Original Q5

05.8 Around one in ten students gained at least one mark on this question, usually for recognising that sulfur is responsible for acid rain. The consequences of acid rain were not well known, and even fewer knew that sulfur enters the atmosphere as sulfur dioxide. Global warming was the most common incorrect response.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 09 · Examiner comments

June 2024 | 8464/C/2F | Original Q6

Question 6 (standard demand)

06.1 Few students knew the definition of a hydrocarbon. A ‘mixture’ and an ‘atom’ were seen frequently.

06.2 This AO2 determination of a formula of a hydrocarbon was not done very well, with fewer than a fifth of students gaining the mark. Many responses had ‘n’ in the formula, and it was expected that the tops of the numbers were clearly below the tops of the letters, following chemical convention in writing formulas.

© 2024 AQA and its licensors. All rights reserved.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 09 · Examiner comments June 2024 | 8464/C/2F | Original Q6

06.3 This question has typically been targeted at high demand in previous years. However, this year it was set at standard demand, with the diagram containing more detail and the mark scheme for loosened a little to separate the first two marking points. Most students were able to make a start on the explanation of fractional distillation.

Four marks were available for this question. Most students who gained 1 mark did so for correctly identifying that the crude oil is heated. Some students indicated that the crude oil was heated once it was in the fractional distillation column itself, which was not creditworthy. Fewer students were able to explain that some of the hydrocarbons were vaporised/evaporated/boiled or turned into a gas for marking point 2. Very few students explained that there was a temperature gradient in the column even though this could have been explained as a comparative statement, for example, the column is cooler at the top or by using sensible temperature values. Few students were able to explain that the hydrocarbons/fractions condensed or were able to give a clear description of condensation.

The most common responses that gained no marks referred to the different sizes and boiling points of the hydrocarbons/fractions.

06.4 Many students were able to correctly balance the equation. The most common incorrect response was to rewrite the formula C_3H_6 on the answer line.

06.5 The test for alkenes was not well known by students. The most common incorrect responses referred to using universal indicator, limewater or a lit splint.

When students correctly identified bromine (water) as the correct test most also then gained the second marking point for the correct colour change. The most common incorrect response identified bromine (water) as being red.

06.6 Given the prompts in the stem of this question it was expected that it would be well answered; however, this was not the case. The most common creditworthy answer was for identifying the poly(propene) as being a hydrocarbon with a few students identifying it as being a polymer or plastic. The most common incorrect response referred to it being an alkene.

Answer 10 · Examiner comments

June 2025 | 8464/C/2F | Original Q1

Question 1 (Low and Standard demand)

01.1 By selecting plankton, 70% of students answered correctly. The most common incorrect response was microbes.

01.2 Nearly 90% of students answered correctly, selecting hydrocarbons.

01.3 Statements had to be comparative, and many students answered this question well. Those who did not gain credit often just quoted figures from the table or used incorrect comparative words such as 'better' or 'worse'. A small number of students listed the difference between percentages but did not indicate which was greater/smaller, e.g. 'the difference between Area A and Area B for diesel is 5%'.

Give **three** differences between the composition of crude oil from area **A** and crude oil from area **B**.

[3 marks]

1 Heavy fuel oil in Area is 32 and area B is 60

2 petrol in Area a is 38 and area B is 17

3 Diesel oil in Area a is 18 and area B is 13

This student has simply quoted data from the table with no comparisons and therefore cannot be credited any marks. A minor change such as the addition of 'only' in appropriate places would have increased the potential mark (e.g. 'Petrol in area A is 38 and in area B is only 17' shows a correct difference).

01.4 The vast majority of students used the correct component, but many struggled to use the numbers correctly. The most common error was the failure to use 100 in their calculations.

0 1 . 4 Calculate the volume of **kerosene** in 160 dm^3 of crude oil from area **C**.

Give your answer to 2 significant figures.

Use **Table 2**.

12 dm^3

10 dm^3 = 16 dm^3

1 dm^3 = 1.6 dm^3

2 dm^3 = 3.2 dm^3

19.2 dm^3 = 12 dm^3

Volume (2 significant figures) = 19.2

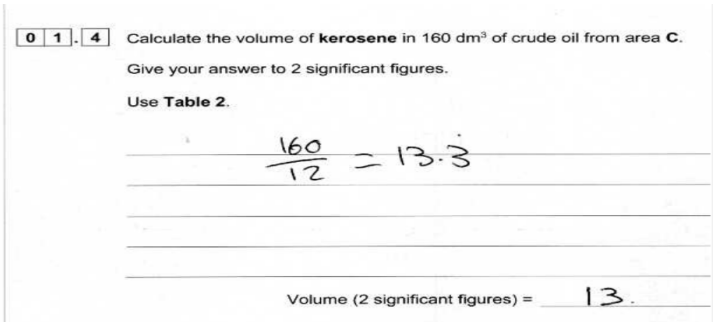
This student has used a correct method (possibly without a calculator) to calculate 12% of 160 but has not given their answer to 2 significant figures. Only 2 marks can be awarded.

© 2024 AQA and its licensors. All rights reserved.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 10 · Examiner comments

June 2025 | 8464/C/2F | Original Q1


0 1 . 4 Calculate the volume of **kerosene** in 160 dm³ of crude oil from area **C**.
Give your answer to 2 significant figures.
Use **Table 2**.
$\frac{160}{12} = 13.3$
Volume (2 significant figures) = 13.

This student has carried out a calculation using the correct fraction (12), but the calculation is incorrect. However, they have written their answer correctly to 2 significant figures and have been awarded the mark for converting their (incorrectly) calculated answer to 2 significant figures.

01.5 This question was well answered. The vast majority of students labelled their bars and plotted them correctly. Although many were drawn without a ruler, most still managed to keep the top of the bar within tolerance.
The most common mistake was to complete the scale incorrectly. Some used a non-linear scale at the higher levels, in particular.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 11 · Examiner comments

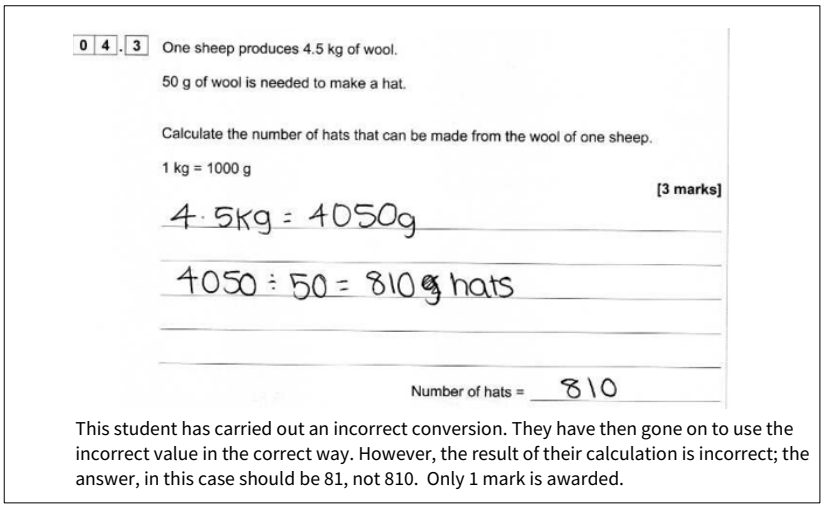
June 2025 | 8464/C/2F | Original Q4

Question 4 (Low and Standard demand)

04.1 Almost 70% of students correctly selected 'water that is safe to drink'.

04.2 Nearly three quarters of students knew that the metal grids in water treatment were to 'remove large solid objects'.

04.3 This question was answered well. Most students used the first approach where they converted 45 kg to 4500 g and then divided that number by 50 to arrive at 90 hats.
Some students who did the conversion incorrectly, usually by multiplying by 100 instead of 1000, could still access 2 marks providing the calculation was carried out correctly.



0 4 . 3 One sheep produces 4.5 kg of wool.

50 g of wool is needed to make a hat.

Calculate the number of hats that can be made from the wool of one sheep.

1 kg = 1000 g

[3 marks]

4·5kg = 4050g

4050 ÷ 50 = 810 hats

Number of hats = 810

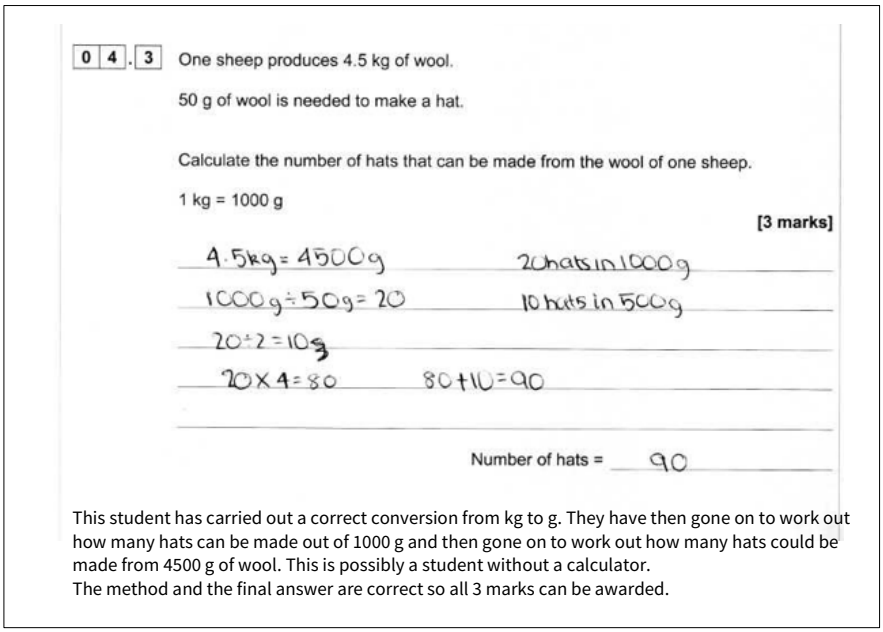
This student has carried out an incorrect conversion. They have then gone on to use the incorrect value in the correct way. However, the result of their calculation is incorrect; the answer, in this case should be 81, not 810. Only 1 mark is awarded.

© 2024 AQA and its licensors. All rights reserved.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 11 · Examiner comments

June 2025 | 8464/C/2F | Original Q4



0 4 . 3 One sheep produces 4.5 kg of wool.

50 g of wool is needed to make a hat.

Calculate the number of hats that can be made from the wool of one sheep.

1 kg = 1000 g

[3 marks]

4.5kg = 4500g
1000g ÷ 50g = 20
20 ÷ 2 = 10g
20 × 4 = 80
20 hats in 1000g
10 hats in 500g
80 + 10 = 90

Number of hats = 90

This student has carried out a correct conversion from kg to g. They have then gone on to work out how many hats can be made out of 1000 g and then gone on to work out how many hats could be made from 4500 g of wool. This is possibly a student without a calculator.
The method and the final answer are correct so all 3 marks can be awarded.

04.4 This was an 'extended response' style of question. Such questions are marked holistically. There are overall generic descriptions for the two levels of response at the top of the mark scheme, giving a hierarchy of response. Within each level there are 2 marks.

Level 1 could be accessed simply by offering any relevant comparison of either poly(propene) or wool, and over half of all students were able to do this. A large number of responses however merely offered a repetition of the information given and consequently could not gain credit.

For Level 2 there needed to be an advantage of both poly(propene) and wool, with a linked explanation. The table offered more information on poly(propene) than wool and consequently very few students were able to access Level 2, as they focussed purely on poly(propene) and did not mention any advantages of using wool.

Many students abbreviated poly(propene) to either poly or propene. Poly was credited, however propene was not, which resulted in some responses which were otherwise good not accessing either Level.

There appeared to be a common misconception that we would 'run out of sheep' therefore making wool a non-renewable source. This limited students to Level 1.

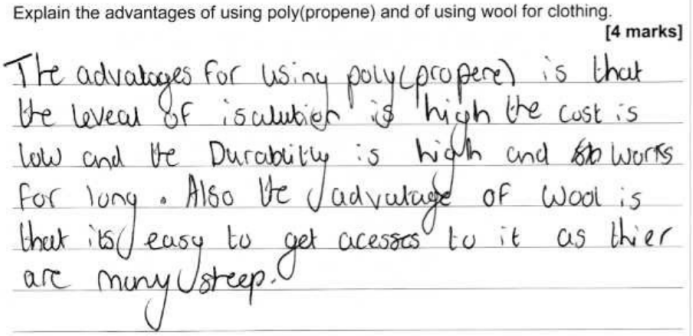
© 2024 AQA and its licensors. All rights reserved.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 11 · Examiner comments

June 2025 | 8464/C/2F | Original Q4

Explain the advantages of using poly(propene) and of using wool for clothing. **[4 marks]**



This student has not used any comparative terminology and has only copied information from the table. The question is looking for durability being 'higher' and therefore lasting 'longer' for example. No marks can be awarded.

04.5 This was well answered. All options were used by students, and over three quarters of all students gained both marks.

04.6 Less than a quarter of all students gained both marks in this question. A catalyst was the most common response, but it was often paired with sulfuric acid rather than with steam.

04.7 Half of all students were able to recall bromine water as the test for alkenes with all other answers being equally spread between the other 3 options.

5.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 12 · Examiner comments June 2025 | 8464/C/2F | Original Q5

Question 5 (Standard demand)

05.1 Students found it difficult to give the correct formula for dodecane. They frequently used wrong numbers or added additional letters in their response.
Where students did know the correct numbers of carbon and hydrogen atoms, the numbers were often not written as subscripts but the same size as the letters. The correct use of subscript and superscript is always a requirement in writing chemical formulae.
A significant minority of students wrote the general formula of the alkanes or simply substituted 12 for n without doing the necessary calculation for the number of hydrogen atoms.

05.2 Students found it difficult to explain why a water bath was used in preference to a Bunsen burner. Very few recognised that dodecane was flammable. Common incorrect responses included reference to speed of heating or the Bunsen / water bath being too hot. Only 10% of students recognised the idea of controlling the temperature.

05.3 A large number of students was able to state the volume of dodecane as either 40 cm^3, 100 cm^3, just cm^3 alone, or simply 'volume'. The most common response was using incorrect terminology, 'amount of dodecane', as amount is not equivalent to volume.

05.4 Students found the extrapolation of the line difficult. It was often horizontal or not extrapolated far enough. It was also often poorly drawn – many drew thick lines, double lines and feathery lines.
More of the students were able to read the value from their graph, although a common error was not being able to interpret the *y*-axis scale correctly.

© 2024 AQA and its licensors. All rights reserved.

Answer 12 · Examiner comments June 2025 | 8464/C/2F | Original Q5

05.5 Many students achieved one mark but very few achieved both marks. Students could often state the relationship between an increase in temperature and the time taken for the dodecane to flow, as they had the graph to help them. They struggled however to then link this to viscosity. The poor quality of written communication often resulted in students contradicting themselves in this question.