AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.7.1.4

Cracking and alkenes

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**6**
Available paper years	**2019–2025**

Using this booklet

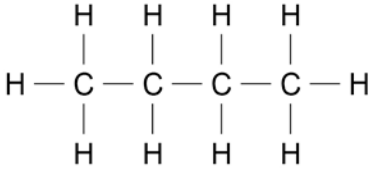
1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

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.

5.7.1.4 Cracking and alkenes

Answer 01 · 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**	

5.7.1.4 Cracking and alkenes

Answer 01 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.7.1.4 Cracking and alkenes

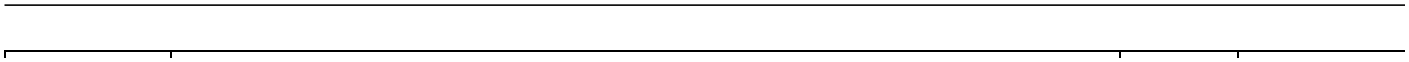
Answer 02 · Mark scheme November 2020 | 8464/C/2F | Original Q6

06.1	$C_3H_8 + 5\ O_2 \rightarrow 3\ CO_2 + 4\ H_2O$	allow multiples	1	AO2 5.1.1.1 5.7.1.3
06.2	(bubble gas through) lime water	MP2 is dependent upon correct response in MP1 allow (bubble gas through) calcium hydroxide (solution)	1	AO1.2 5.8.2.3
	turns milky / cloudy / white **or** white precipitate forms		1	
06.3	C_3H_6		1	AO2 5.1.1.1 5.7.1.4
06.4	burning / lit splint	MP2 is dependent upon correct response in MP1 allow flame do **not** accept glowing splint	1	AO1 5.8.2.1
	burns with a (squeaky) pop sound	allow pops	1	
06.5	bromine (water)	do **not** accept bromide	1	AO1 5.7.1.4
	(colour change) orange	allow 1 mark for colourless (to) orange	1	
	(to) colourless		1	
		ignore clear		
Total			**9**	

5.7.1.4 Cracking and alkenes

Answer 02 · Mark scheme

November 2020 | 8464/C/2F | Original Q6



5.7.1.4 Cracking and alkenes

Answer 03 · 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

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

5.7.1.4 Cracking and alkenes

Answer 03 · Mark scheme

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**	

5.7.1.4 Cracking and alkenes

Answer 04 · 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

5.7.1.4 Cracking and alkenes

Answer 04 · 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

5.7.1.4 Cracking and alkenes

Answer 05 · Mark scheme

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

5.7.1.4 Cracking and alkenes

Answer 05 · 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

5.7.1.4 Cracking and alkenes

Answer 06 · Mark scheme

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

5.7.1.4 Cracking and alkenes

Answer 06 · Mark scheme

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

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	

5.7.1.4 Cracking and alkenes

Answer 06 · 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

5.7.1.4 Cracking and alkenes

Answer 03 · 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.

Mark Ranges and Award of Grades

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

5.7.1.4 Cracking and alkenes

Answer 04 · 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.

Answer 05 · 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.

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5.7.1.4 Cracking and alkenes

Answer 05 · 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.

5.7.1.4 Cracking and alkenes

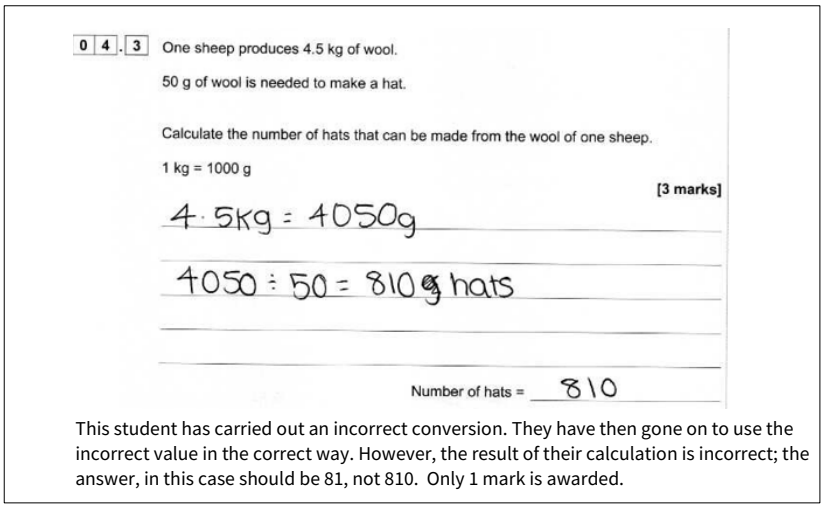
Answer 06 · Examiner comments June 2025 | 8464/C/2F | Original Q4

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.

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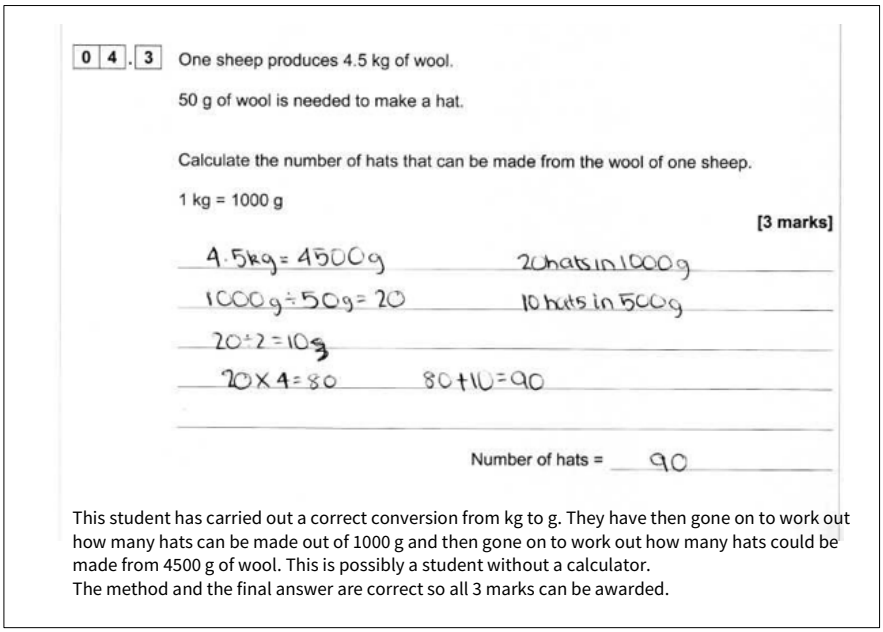
5.7.1.4 Cracking and alkenes

Answer 06 · 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.

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5.7.1.4 Cracking and alkenes

Answer 06 · Examiner comments

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

Explain the advantages of using poly(propene) and of using wool for clothing.

[4 marks]

The advatages for using poly(propene) is that the leveal of isalution is high the cost is low and the Durability is high and ~~sto~~ works for long. Also the advatage of wool is that its easy to get acesses to it as thier are many steep.

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.