

GCSE Combined Science: Trilogy

Worksheet: Cracking and alkenes

TIME 35 min	TOTAL 32 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Cracking and alkenes

NAME _____

CLASS _____

DATE _____

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

0 1 . 1

Complete the sentence.

In catalytic cracking, the hydrocarbon is heated to vaporise it, and the vapour is passed over a hot _____.

.....

.....

.....

[1 mark]

0 1 . 2

Which conditions are used in steam cracking?

Tick (✓) **one** box.

The hydrocarbon vapour is mixed with steam and heated to a very high temperature.

☐

The hydrocarbon is dissolved in cold water.

☐

The hydrocarbon is mixed with water and an enzyme at 37 °C.

☐

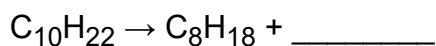
The hydrocarbon is heated with hydrogen and a nickel catalyst.

☐

[1 mark]

0 1 . 3

Complete the equation for cracking decane.



.....

.....

.....

.....

[1 mark]

0 1 . 4

Give **one** use of the alkenes produced by cracking.

.....

.....

[1 mark]

0 2

0 2 . 1

Which of these is the main economic reason why oil companies crack long-chain hydrocarbons?

Tick (✓) **one** box.

To make the hydrocarbons more colourful

☐

To match the supply of fractions to the demand for them

☐

To remove sulfur from crude oil

☐

To increase the boiling point of the fractions

☐

[1 mark]

0 2 . 2

Cracking produces shorter alkanes and another type of hydrocarbon.
Name this other type of hydrocarbon.

.....

.....

.....

.....

[1 mark]

0 3

0 3 . 1

What is meant by cracking?

.....

.....

[1 mark]

0 3 . 2

Cracking produces two types of hydrocarbon.
Name the **two** types.

.....

.....

.....

.....

[2 marks]

0 3 . 3

Give the test for an alkene and the result.

.....

.....

.....

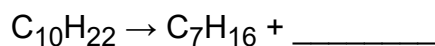
.....

[2 marks]

0 4

0 4 . 1

Complete the equation for the cracking of $C_{10}H_{22}$.



.....

.....

.....

.....

[1 mark]

0 4 . 2

Give **one** use of the alkenes produced by cracking.

.....

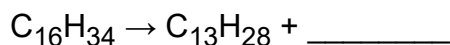
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[1 mark]

0 5

0 5 . 1

Complete the equation for the cracking of $C_{16}H_{34}$.



.....

.....

.....

[1 mark]

0 5 . 2

Which product of this reaction is an alkene?

Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 5 . 3

Describe the conditions used for catalytic cracking.

.....

.....

.....

.....

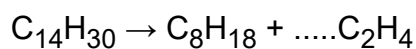
[2 marks]

0 6

Long-chain alkanes are cracked to produce shorter, more useful molecules.

0 6 . 1

Complete the equation.



.....

.....

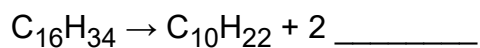
.....

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[1 mark]

0 6 . 2

Complete the equation.



.....

.....

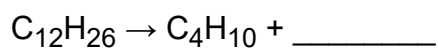
.....

.....

[1 mark]

0 6 . 3

Complete the equation.



.....

.....

.....

.....

[1 mark]

0 6 . 4

Cracking is an example of thermal decomposition.
What is meant by thermal decomposition?

.....

.....

[1 mark]

0 6 . 5

Is cracking exothermic or endothermic?
Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 7

Cracking $C_{16}H_{34}$ produces octane, C_8H_{18} , and an alkene, in a 1 : 1 ratio.

Relative formula masses (M_r): $C_{16}H_{34} = 226$ $C_8H_{18} = 114$

0 7 . 1

Write the balanced equation for this cracking reaction.

.....

.....

[1 mark]

0 7 . 2

Calculate the percentage, by mass, of the original alkane that becomes the alkene product.

Give your answer to 3 significant figures.

.....

.....

.....

.....

Percentage = %

[2 marks]

0 8

In a school laboratory, liquid paraffin is cracked by heating it and passing the vapour over a hot catalyst in a boiling tube. The gas produced is collected in test tubes over water, and each tube is tested with bromine water.

Table 1 shows the results.

Table 1

Test tube	1st tube collected	2nd tube collected	3rd tube collected
Result with bromine water	very little colour change	orange to colourless	orange to colourless

0 8 . 1

Explain why the gas in the 1st tube causes little colour change with bromine water, even though cracking has already started.

.....

.....

[1 mark]

0 8 . 2

Use the results for the 2nd and 3rd tubes to explain what type of hydrocarbon is present in the gas collected.

.....

.....

.....

.....

[2 marks]

0 8 . 3

At the end of the experiment, the delivery tube must be taken out of the water before the heating is stopped.
Explain why.

.....

.....

.....

.....

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Cracking and alkenes · 32 marks

Question 1 (4 marks)

01.1 [1 mark]

Answer: catalyst

- catalyst (1)
-

01.2 [1 mark]

Correct: The hydrocarbon vapour is mixed with steam and heated to a very high temperature.

01.3 [1 mark]

Answer: C₂H₄

- C₂H₄ (1)
-

01.4 [1 mark]

Answer: To make polymers.

- to make polymers / as a starting material for making other chemicals (1)
-

Question 2 (2 marks)

02.1 [1 mark]

Correct: To match the supply of fractions to the demand for them

02.2 [1 mark]

Answer: Alkenes

- alkenes (1)
-

Question 3 (5 marks)

03.1 [1 mark]

Answer: Breaking down large hydrocarbon molecules into smaller, more useful molecules.

- breaking down large hydrocarbon molecules into smaller (more useful) molecules (1)
-

03.2 [2 marks]

Answer: Alkanes and alkenes

- alkanes (1)
 - alkenes (1)
-

03.3 [2 marks]

Answer: Add bromine water: it changes from orange to colourless.

- add bromine water (1)
- orange to colourless (1)

Notes: Do not accept 'clear' for colourless.

Question 4 (2 marks)

04.1 [1 mark]

Answer: C_3H_6

- C_3H_6 (1)
-

04.2 [1 mark]

Answer: To make polymers (plastics).

- to make polymers / plastics / as a starting material (feedstock) for making other chemicals (1)
-

Question 5 (5 marks)

05.1 [1 mark]

Answer: C_3H_6

- C_3H_6 (1)

05.2 [2 marks]

Answer: C_3H_6 : it fits the general formula C_nH_{2n} .

- C_3H_6 (1)
- it fits the general formula C_nH_{2n} (twice as many hydrogen atoms as carbon atoms) (1)

05.3 [2 marks]

Answer: The long-chain hydrocarbon is heated to vaporise it, and the vapour is passed over a hot catalyst.

- the hydrocarbon is heated to vaporise it (1)
- the vapour is passed over a hot catalyst (1)

Question 6 (6 marks)

06.1 [1 mark]

Answer: 3

- 3 (1)

06.2 [1 mark]

Answer: C_3H_6

- C_3H_6 (1)

06.3 [1 mark]

Answer: C_8H_{16}

- C_8H_{16} (1)

06.4 [1 mark]

Answer: Breaking down a compound into simpler substances by heating it.

- breaking down a compound into simpler substances by heating (1)

06.5 [2 marks]

Answer: Endothermic: energy must be supplied (by heating) to break bonds.

- endothermic (1)
 - energy / heat must be supplied (continuously) to break bonds (1)
-

Question 7 (3 marks)

07.1 [1 mark]

Answer: $\text{C}_{16}\text{H}_{34} \rightarrow \text{C}_8\text{H}_{18} + \text{C}_8\text{H}_{16}$

- $\text{C}_{16}\text{H}_{34} \rightarrow \text{C}_8\text{H}_{18} + \text{C}_8\text{H}_{16}$ (1)

07.2 [2 marks]

Answer: 49.6%

- M_r of the alkene = $226 - 114 = 112$ (1)
- $112 \div 226 \times 100 = 49.6$ (%) (1)

Notes: Allow ECF from an incorrect alkene formula.

Question 8 (5 marks)

08.1 [1 mark]

Answer: The 1st tube is mostly air that was already inside the apparatus before cracking began, not the cracked gas.

- the 1st tube collected is mostly air pushed out of the apparatus at the start, not the product of cracking (1)

08.2 [2 marks]

Answer: An alkene is present: bromine water turning from orange to colourless shows that the gas is unsaturated (contains a C=C double bond).

- the gas contains an alkene (an unsaturated hydrocarbon) (1)
- shown by the bromine water changing from orange to colourless, indicating a C=C double bond is present (1)

08.3 [2 marks]

Answer: If the heating stops first, the gas in the hot tube cools and contracts, so cold water is sucked back into the hot boiling tube, which could crack it.

- otherwise, as the boiling tube cools, the gas inside contracts / the pressure falls, so water is sucked back up the delivery tube (suck-back) (1)
 - the cold water would reach the hot boiling tube and could crack (break) it (1)
-