

# Alkenes

## Question Paper

Level	GCSE
Subject	Chemistry
Exam Board	Edexcel IGCSE
Module	Double Award (Paper 1C)
Topic	Organic Chemistry
Sub-Topic	Alkenes
Booklet	Question Paper

**Time Allowed:** 60 minutes

**Score:** /50

**Percentage:** /100

**Grade Boundaries:**

A*	A	B	C	D	E	U
>85%	75%	70%	60%	55%	50%	<50%

1 These are the displayed formulae of six organic compounds.

$\begin{array}{c} \text{H} \\   \\ \text{H}-\text{C}-\text{H} \\   \\ \text{H} \end{array}$	$\begin{array}{c} \text{H} \quad \text{H} \\   \quad   \\ \text{H}-\text{C}-\text{C}-\text{H} \\   \quad   \\ \text{H} \quad \text{H} \end{array}$	$\begin{array}{c} \text{H} \quad \text{H} \quad \text{H} \\   \quad   \quad   \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\   \quad   \quad   \\ \text{H} \quad \text{H} \quad \text{H} \end{array}$
<b>P</b>	<b>Q</b>	<b>R</b>
$\begin{array}{c} \text{H} \\   \\ \text{H}-\text{C}-\text{Br} \\   \\ \text{H} \end{array}$	$\begin{array}{c} \text{H} \quad \quad \text{H} \\ \diagdown \quad \diagup \\ \text{C}=\text{C} \\ \diagup \quad \diagdown \\ \text{H} \quad \quad \text{H} \end{array}$	$\begin{array}{c} \text{H} \quad \quad \text{H} \\ \diagdown \quad \diagup \\ \text{C}=\text{C} \\ \diagup \quad \diagdown \\ \text{H} \quad \quad \text{C} \\ \quad \quad \diagup \quad \diagdown \\ \quad \quad \text{H} \quad \quad \text{H} \end{array}$
<b>S</b>	<b>T</b>	<b>U</b>

(a) Use the letters above to select

(i) the compound that is **not** a hydrocarbon.

(1)

(ii) **one** compound with the empirical formula  $\text{CH}_2$

(1)

(iii) **one** compound that can form a polymer.

(1)

(b) Describe a test that will distinguish between compounds **Q** and **T**, and state the observation made with compound **T**.

(2)

Test .....

Observation with compound **T** .....



P 4 0 1 2 6 A 0 1 2 2 8

(c) Draw the displayed formula of an alkene containing four carbon atoms.

(1)

(d) Three of the compounds belong to the alkane homologous series.

All the alkanes in this homologous series have the same general formula.

(i) What is the general formula of the alkanes?

(1)

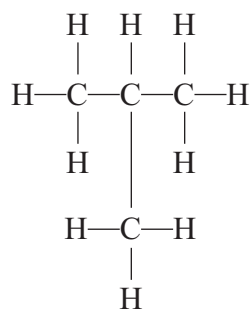
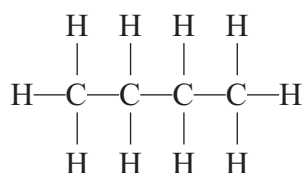
(ii) State **two** other features of a homologous series.

(2)

1 .....

2 .....

(e) The displayed formulae below represent isomers.



Explain what isomers are.

(2)

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(Total for Question = 11 marks)

2 (a) Explain what is meant by the term **isomerism**.

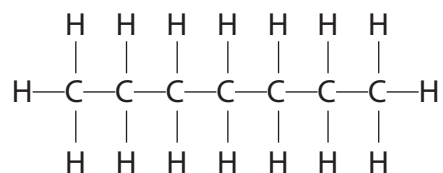
(2)

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(b) The displayed formula of heptane ( $C_7H_{16}$ ) is



Which one of the displayed formulae below does **not** represent an isomer of heptane?

Place a cross (☒) in the box to indicate your answer.

(1)

$\begin{array}{ccccccc} & & H & & & & \\ & &   & & & & \\ & & H-C-H & & & & \\ & &   & & H & & H \\ & H & & H & & H & \\ &   & &   & &   & \\ H & -C & -C & -C & -C & -C & -H \\ &   & &   & &   & \\ & H & & H & & H & \\ & & & & H-C-H & & \\ & & & &   & & \\ & & & & H & & \end{array}$	$\begin{array}{ccccccc} & H & H & H & & H & H \\ &   &   &   & &   &   \\ H & -C & -C & -C & -C & -C & -H \\ &   &   &   & & &   \\ & H & H & H & & & H \\ & & & & & H-C-H & \\ & & & & &   & \\ & & & & & H-C-H & \\ & & & & &   & \\ & & & & & H & \end{array}$
A ☒	B ☒

$\begin{array}{ccccccc} & H & H & & H & & H & H & H \\ &   &   & &   & &   &   &   \\ H & -C & -C & -C & -C & -C & -C & -H \\ &   &   & &   & &   &   &   \\ & H & H & & H & & H & H & H \\ & & & & & & H-C-H & & \\ & & & & & &   & & \\ & & & & & & H & & \end{array}$	$\begin{array}{ccccccc} & H & H & H & & H & \\ &   &   &   & &   & \\ H & -C & -C & -C & -C & -H \\ &   &   &   & & &   \\ & H & H & H & & & H-C-H \\ & & & & & &   \\ & & & & & & H-C-H \\ & & & & & &   \\ & & & & & & H-C-H \\ & & & & & &   \\ & & & & & & H \end{array}$
C ☒	D ☒

(c) Heptane belongs to a homologous series of compounds called alkanes.

The general formula of the alkanes is  $C_nH_{2n+2}$

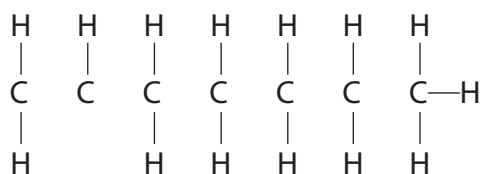
(i) Heptene belongs to a homologous series of compounds called alkenes.

Give the general formula of the alkenes.

(1)

(ii) Complete the following diagram to show the structural formula of heptene ( $C_7H_{14}$ ) by inserting lines to represent the covalent bonds between the carbon atoms.

(2)



(d) When heptene is added to bromine water, and the mixture is shaken, a reaction occurs.

State the type of reaction and give the colour of the bromine water before and after the reaction with heptene.

(3)

Type of reaction.....

Colour before.....

Colour after.....

(e) Explain, in terms of the bonds present, why heptane is described as saturated and heptene as unsaturated.

(2)

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**(Total for Question = 11 marks)**



- 3 The table gives some data about the first six members of a homologous series of compounds called the alkanes.

Alkane	Molecular formula	Relative formula mass	Boiling point in °C
methane	CH <sub>4</sub>	16	-164
ethane	C <sub>2</sub> H <sub>6</sub>	30	-87
propane	C <sub>3</sub> H <sub>8</sub>	44	-42
butane	C <sub>4</sub> H <sub>10</sub>		0
pentane	C <sub>5</sub> H <sub>12</sub>	72	
hexane		86	69

(a) Complete the table by

- giving the molecular formula of hexane
- giving the relative formula mass of butane
- suggesting the boiling point of pentane

(3)

(b) What does the data show about the relationship between boiling point and relative formula mass?

(1)

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.....

(c) The molecular formula of ethene is C<sub>2</sub>H<sub>4</sub>

Ethene and ethane are in different homologous series.

Explain how the formulae of these compounds show that they are in different series.

(1)

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.....

- (d) (i) In the table, draw displayed formulae for the two alkanes with the molecular formula  $C_4H_{10}$  (2)

Displayed formula 1	Displayed formula 2

- (ii) What is the name given to compounds that have the same molecular formula but different displayed formulae? (1)

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- (e) The reaction between ethane and bromine ( $Br_2$ ) is similar to the reaction between methane and bromine.

- (i) Write a chemical equation for the reaction between ethane and bromine. (2)

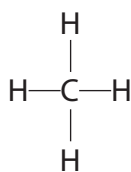
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- (ii) What is the name given to the type of reaction that occurs when ethane reacts with bromine? (1)

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- (iii) Suggest the condition necessary for this reaction to occur. (1)

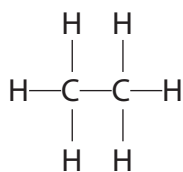
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**(Total for Question = 12 marks)**

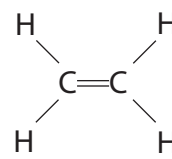
4 The diagram shows the displayed formulae of five hydrocarbons A, B, C, D and E.



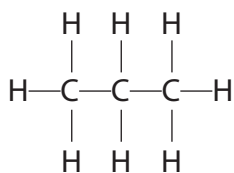
**A**



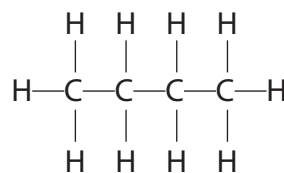
**B**



**C**



**D**



**E**

(a) Give the letter of a hydrocarbon to answer these questions.

You may use each letter once, more than once or not at all.

(i) Which hydrocarbon is the main component of natural gas?

(1)

(ii) Which other hydrocarbon is produced, together with D, when pentane ( $\text{C}_5\text{H}_{12}$ ) is cracked?

(1)

(iii) Which hydrocarbon can undergo an addition reaction with hydrogen to form B?

(1)

(b) Give the molecular formula and the empirical formula of E.

(2)

molecular formula.....

empirical formula.....



(c) Hydrocarbons A, B, D and E all belong to the same homologous series.

(i) Give the name and the general formula of this homologous series.

(2)

name.....

general formula.....

(ii) Draw the displayed formula of an isomer of E.

(1)

(d) Two reactions that can occur when hydrocarbon A is burned in air are represented by these equations.



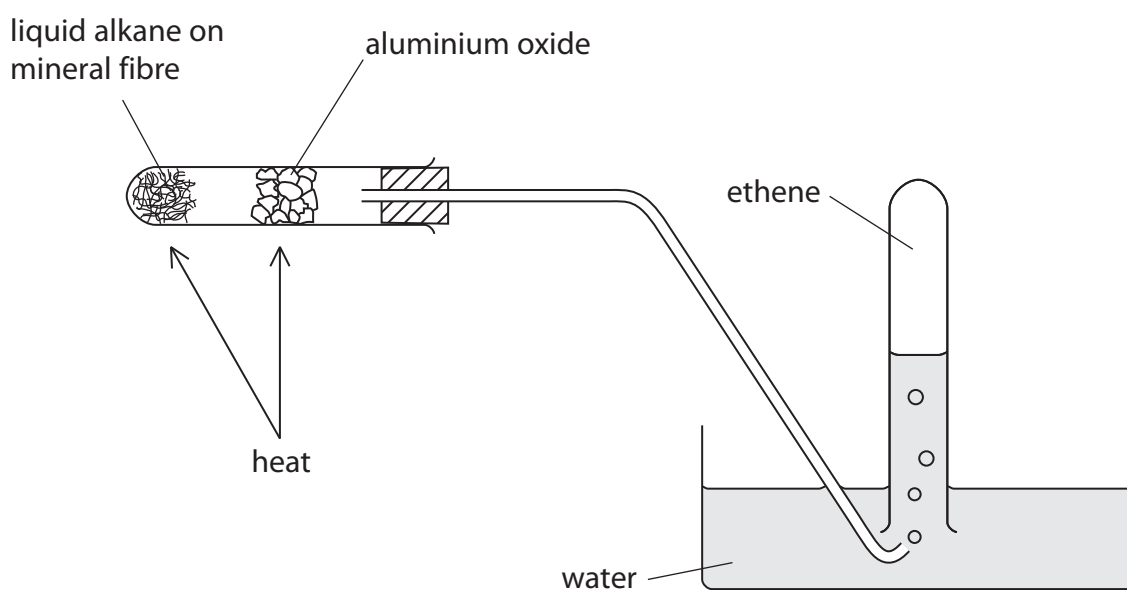
Explain why a different product is formed in reaction 2 and why this product is dangerous.

(3)

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**(Total for Question = 11 marks)**

5 This apparatus can be used to obtain ethene by cracking a liquid alkane.



(a) What is meant by the term **cracking**?

(1)

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(b) Give a chemical test to show that the gas collected is unsaturated.

(2)

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(c) Cracking is also carried out in industry.

Give the name of the catalyst and the temperature used in the catalytic cracking of hydrocarbons.

(2)

catalyst.....

temperature.....

**(Total for Question = 5 marks)**

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