

# Alkanes

## Mark Scheme 2

<b>Level</b>	IGCSE(9-1)
<b>Subject</b>	Chemistry
<b>Exam Board</b>	Edexcel IGCSE
<b>Module</b>	Double Award (Paper 1C)
<b>Topic</b>	Organic Chemistry
<b>Sub-Topic</b>	Alkanes
<b>Booklet</b>	Mark Scheme 2

**Time Allowed:** 68 minutes

**Score:** /56

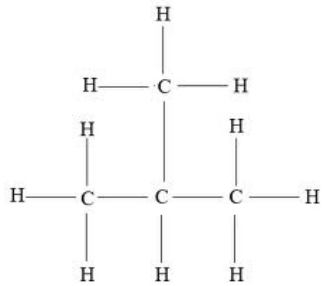
**Percentage:** /100

**Grade Boundaries:**

9	8	7	6	5	4	3	2	1
>90%	80%	70%	60%	50%	40%	30%	20%	10%



Question number	Answer	Notes	Marks
1 (c)	(provides an alternative pathway of) lower activation energy	Accept (molecules adsorb onto catalyst and covalent) bonds weakened	1
(i)			
(ii)	silica/silicon dioxide/alumina/aluminium oxide	accept correct formulae accept aluminosilicate(s) accept zeolite(s) ignore silica oxide and alumina oxide If both name and formula given, mark name only	1
(iii)	C <sub>2</sub> H <sub>4</sub>	Accept structural or displayed formula	1
(iv)	ethene	accept ethylene	1

Question number	Answer	Accept	Reject	Marks
2 (a) (i)	A	Methane		1
(ii)	C	Ethene		1
(iii)	C	Ethene		1
(b)	<b>M1</b> – (molecular) $C_4H_{10}$ <b>M2</b> – (empirical) $C_2H_5$ ECF from molecular formula	$H_{10}C_4$ $H_5C_2$	$CH_3CH_2CH_2CH_3$	1 1
(c) (i)	<b>M1</b> – (name) alkane(s) <b>M2</b> – (general formula) $C_nH_{2n+2}$			1 1
(ii)	 <p>IGNORE bond angles</p>		missing Hs and bonds	1

(d)	<p><b>M1</b> – incomplete combustion/insufficient oxygen</p> <p><b>M2</b> – toxic/poisonous/causes death IGNORE dangerous/harmful</p> <p><b>M3</b> – reduces the capacity of the blood to carry oxygen IGNORE references to suffocation/cannot breathe IGNORE blood carries no oxygen</p>	<p>lack of oxygen /less oxygen / <u>only</u> 1½ oxygen (in equation)</p> <p>correct references to haemoglobin /blood carries less oxygen/blood does not release oxygen as easily</p>		<p>1</p> <p>1</p> <p>1</p>
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(Total marks for Question 2 = 11 marks)

Question number	Answer	Accept	Reject	Marks
3 (a)	large hydrocarbons/alkanes/molecules become small ones IGNORE references to forming alkenes/ethene/more useful molecules	(large) hydrocarbons or alkanes or molecules become smaller ones long chains become short chains	references to polymers	1
(b)	<b>M1</b> – (add to) bromine (water)/Br <sub>2</sub> IGNORE Br  <b>M2</b> – (bromine) decolourised/turns colourless IGNORE starting colour and clear  <b>M2</b> dep on <b>M1</b> , but can be scored for a near miss in <b>M1</b> , eg Br or bromide (water)	(acidified) potassium manganate(VII)  decolourised/turns colourless		1  1
(c)	<b>M1</b> – (catalyst) silica / silicon dioxide / alumina / aluminium oxide  <b>N.B.</b> if both name and formula given, mark the name only  <b>M2</b> – 600-700 °C	correct formula aluminosilicate / zeolite  any value or range within this range equivalent temperatures in Kelvin		1  1

(Total marks for Question 3 = 5 marks)

Question number	Answer	Accept	Reject	Marks
4 (a)	<p><b>M1</b> (molecules/compounds/substances) with the same <u>molecular</u> formula/number of each type of atoms</p> <p><b>IGNORE</b> chemical formula/same compound</p> <p><b>M2</b> (but) different structural formulae/different displayed formulae/different structures</p>	<p>hydrocarbons</p> <p>atoms arranged differently</p>	<p>elements/atoms general formula/empirical formula for <b>M1</b> only</p>	<p>1</p> <p>1</p>
(b)	D			1
(c) (i)	<b>M1</b> C <sub>n</sub> H <sub>2n</sub>	<p>letters other than n, e.g.</p>	C <sub>n</sub> H <sub>2n</sub>	1
(ii)	<p><b>M1</b> double bond between two left hand end carbon atoms</p> <p><b>M2</b> single bond between each pair of rest of carbon atoms</p> <p>Penalise max 1 mark for any extra bond shown</p>			1
				1
(d)	<p><b>M1</b> addition</p> <p><b>M2</b> orange</p> <p><b>M3</b> colourless</p> <p><b>IGNORE</b> clear/transparent/looks like water</p>	<p>additional</p> <p>yellow/brown</p>	<p>red, either on its own or in combination with any other colour</p>	<p>1</p> <p>1</p> <p>1</p>
(e)	<p><b>M1</b> saturated – <u>all</u> (carbon to carbon) bonds are single</p> <p>/contains <u>only</u> (carbon to carbon)</p>	does not contain any multiple/double bonds		1

	single bonds			1
	<b>M2</b> unsaturated - contains (carbon to carbon) double/multiple bond(s)			
			<b>Total</b>	<b>11</b>



Question number	Answer	Notes	Marks
5 (a) (i)	CH <sub>4</sub>	Accept H <sub>4</sub> C	
(ii)	C <sub>2</sub> H <sub>6</sub>	Accept H <sub>6</sub> C <sub>2</sub>	1
(iii)	CH <sub>3</sub> CH <sub>2</sub> CH <sub>3</sub>	Accept CH <sub>3</sub> -CH <sub>2</sub> -CH <sub>3</sub> / H <sub>3</sub> C-CH <sub>2</sub> -CH <sub>3</sub>	1
(iv)	<pre>  H H H H           H-C-C-C-C-H             H H H H</pre>		1

(b)	(i)	alkane(s)		1
	(ii)	$C_nH_{2n+2}$	Accept x and other letters in place of n Accept answers like $C_nH_{2n+2}$ Ignore brackets that still give same answer	1
	(iii)	similar chemical properties / characteristics / reactions / behaviour  same functional group  (neighbouring members) differ by $CH_2$ gradation/gradual change/trend in physical properties	Accept 'same chemical properties' but ignore a specific example, eg all react with oxygen  Accept 'methylene group'  Accept gradation/gradual change/increase/decrease in specified property, eg boiling point Reject same / similar physical properties  Accept any two for 1 mark each Accept two answers in lines 1 or 2	2

5	(c)	(i)	$C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$	All formulae correct Ignore balanced nitrogen on both sides Balancing dep on M1 Ignore state symbols Accept fractions and multiples	1
		(ii)	carbon / C  carbon monoxide / CO	Accept soot Ignore graphite Reject coke  Award 1 for both correct answers in wrong order	1  1

Question number	Answer	Notes	Marks
5 (d)	<pre>       H H H H                   H-C-C-C-C-H                       H       H H                     H-C-H                       H            H                     H-C-H                   H-C   C   C-H                       H       H                         H-C-H                       H </pre>	<p>Accept in either order</p> <p>Award 1 mark for two correct isomers as structural formulae</p> <p>Award 1 mark for two correct isomers as skeletal formulae</p> <p>Ignore names</p>	<p>1</p> <p>1</p>

(e)	(i)	UV (light) / ultraviolet (light)	Accept sunlight Ignore ref to temperature	1
	(ii)	bromomethane	Accept 1-bromomethane / methyl bromide / monobromomethane Ignore hyphens / spaces	1
	(iii)	$\text{CH}_4 + \text{Br}_2 \rightarrow \text{CH}_3\text{Br} + \text{HBr}$	Award M1 for $\text{CH}_3\text{Br}$ Award M2 for other formulae and correct balancing Max 1 for error in symbol e.g. BR, br Ignore state symbols  Accept further bromination in (ii) and (iii)	1 1

**Total 18 marks**