

Alkenes

Mark Scheme 2

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

Time Allowed: 66 minutes

Score: /55

Percentage: /100

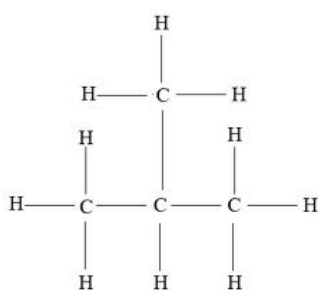
Grade Boundaries:

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

Question number	Answer	Notes	Marks
1 a i	C ₅ H ₁₂	Accept H ₁₂ C ₅ Ignore gap between C ₅ and H ₁₂ Ignore names Ignore C _n H _{2n+2}	1
	ii CH ₂ Br	Accept elements in any order Ignore molecular formula Ignore 2CH ₂ Br Penalise inappropriate use of upper or lower case letters or numbers(eg CH2Br / CH ₂ BR / CH ² Br)	1
b i	R <u>and</u> U	Accept in either order	1
	ii D (C _n H _{2n})		1
c	C (compound R → compound Q)		1

Question number	Answer	Notes	Marks
1 d	M1 $\begin{array}{c} \text{Br} \quad \text{Br} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array}$ M2 (1,2-)dibromoethane	Mark M1 and M2 independently Accept Br atoms in any positions so long as on different carbon atoms Ignore any numbers Accept ethylene dibromide	2
e i	$\begin{array}{c} \text{Br} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$	Ignore balancing in equation Ignore molecular formula	1
	ii bromomethane		1
	iii UV or ultraviolet (light/radiation)	Accept sunlight Ignore all references to heat and temperature Ignore references to pressure	1
	iv D (substitution)		1

Question number	Answer	Notes	Marks									
1 f i	<p>M1 setting out division of each % by A_r OR evaluation</p> <table style="margin-left: 40px;"> <tr> <td>C</td> <td>H</td> <td>F</td> </tr> <tr> <td>$\frac{36.4}{12}$</td> <td>$\frac{6.0}{1}$</td> <td>$\frac{57.6}{19}$</td> </tr> </table> <p>OR</p> <table style="margin-left: 40px;"> <tr> <td>3</td> <td>6</td> <td>3</td> </tr> </table> <p>M2 simplest whole number ratio (1:2:1 or ratio shown in notes for M1)</p> <p>M3 CH₂F</p>	C	H	F	$\frac{36.4}{12}$	$\frac{6.0}{1}$	$\frac{57.6}{19}$	3	6	3	<p>Award 0/3 if division by any atomic numbers / wrong way up / multiplication used</p> <p>Do not penalise roundings or minor misreads of % values (eg 56.7 for fluorine)</p> <p>Do not penalise use of FI in (i)</p> <p>If molecular masses used for H and/or F, lose M1 but M2 and M3 can be awarded: using 2 and 38 gives C₂H₂F using 2 and 19 gives CHF Using 1 and 38 gives C₂H₄F Working required for these answers</p> <p>M2 subsumes M1</p> <p>Accept elements in any order</p> <p>Award 3 marks for correct final answer with no working</p>	3
C	H	F										
$\frac{36.4}{12}$	$\frac{6.0}{1}$	$\frac{57.6}{19}$										
3	6	3										
ii	C ₂ H ₄ F ₂	<p>Accept elements in any order</p> <p>Do not accept C₂H₄FI₂</p>	1									
Total 15 marks												

Question number	Answer	Accept	Reject	Marks
2 (a) (i)	A	Methane		1
(ii)	C	Ethene		1
(iii)	C	Ethene		1
(b)	M1 – (molecular) C ₄ H ₁₀ M2 – (empirical) C ₂ H ₅ ECF from molecular formula	H ₁₀ C ₄ H ₅ C ₂	CH ₃ CH ₂ CH ₂ CH ₃	1 1
(c) (i)	M1 – (name) alkane(s) M2 – (general formula) C _n H _{2n+2}			1 1
(ii)	 <p>IGNORE bond angles</p>		missing Hs and bonds	1

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

(Total marks for Question 2 = 11 marks)

Question number	Answer	Notes	Marks
3 (a)	(i) CH_4 (ii) C_2H_6 (iii) $\text{CH}_3\text{CH}_2\text{CH}_3$ (iv) <pre> H H H H H-C-C-C-C-H H H H H </pre>	Accept H_4C Accept H_6C_2 Accept $\text{CH}_3\text{-CH}_2\text{-CH}_3$ / $\text{H}_3\text{C-CH}_2\text{-CH}_3$	1 1 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

3	(c)	(i)	$\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$	All formulae correct Ignore balanced nitrogen on both sides Balancing dep on M1 Ignore state symbols Accept fractions and multiples	1 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
3 (d)	<pre> H H H H H-C-C-C-C-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 CH_3Br 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

Question number			Answer	Notes	Marks
4	a	i	S	Accept diagram: $\begin{array}{c} \text{H} \\ \\ \text{H} - \text{C} - \text{Br} \\ \\ \text{H} \end{array}$	1
		ii	M1 T / U	Accept diagrams: $\begin{array}{c} \text{H} & & \text{H} \\ & \diagdown & / \\ & \text{C} = \text{C} & \\ & / & \diagdown \\ \text{H} & & \text{H} \end{array} \quad / \quad \begin{array}{c} \text{H} & & \text{H} \\ & \diagdown & / \\ & \text{C} = \text{C} & \\ & / & \diagdown \\ \text{H} & & \text{C} \\ & & / \quad \backslash \\ & & \text{H} \quad \text{H} \end{array}$	1
		iii	M1 T / U	Accept diagrams: $\begin{array}{c} \text{H} & & \text{H} \\ & \diagdown & / \\ & \text{C} = \text{C} & \\ & / & \diagdown \\ \text{H} & & \text{H} \end{array} \quad / \quad \begin{array}{c} \text{H} & & \text{H} \\ & \diagdown & / \\ & \text{C} = \text{C} & \\ & / & \diagdown \\ \text{H} & & \text{C} \\ & & / \quad \backslash \\ & & \text{H} \quad \text{H} \end{array}$ Do not penalise if both T and U are given Do not award the mark if either or both of T or U is given and any other letter is included	1

Question number		Answer	Notes	Marks		
4	b	M1	(add) bromine (water)	If bromide, then 0/2 Do not allow bromine in UV light, but M2 can be awarded	1	
		M2	decolourised / goes colourless	Ignore starting colour of bromine Ignore clear / discolours Reject bleached	1	
	c	M1	displayed formula of but-1-ene, but-2-ene or methylpropene	All atoms and bonds must be shown Allow dienes	1	
	d	i	M1	C_nH_{2n+2}	Accept x and other letters in place of n Accept answers like C_nH_{2n+2} Ignore brackets	1
		ii	M1	same/similar chemical properties / reactions / behaviour / characteristics	Ignore specific example such as react with oxygen Ignore similar (type of) reactivity	2
		M2	gradation / gradual change / trend / increase / decrease of physical properties	Accept reference to specific property, eg boiling point Reject same / similar physical properties		
		M3	(neighbouring members) differ by CH_2			
		M4	same functional group	Any two for 1 each Accept two answers on one answer line		

Question number		Answer	Notes	Marks
4	e	M1 (compounds / molecules with) same molecular formula / same number of each type of atom	Ignore same chemical formula Ignore hydrocarbons If atoms or elements instead of compounds or molecules, max 1 for Q	1
		M2 different structures / structural formulae / atoms arranged differently / different displayed formulae		1

Total 11 marks