

Alkanes

Mark Scheme 1

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

Time Allowed: 56 minutes

Score: /46

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
2 a	<p>M1 (they/all) contain hydrogen and carbon (atoms)</p> <p>M2 only</p>	<p>Accept H and C Accept particles/elements in place of atoms Reject ions/molecules/compounds in place of atoms Reject element instead of they/all Reject H₂ Reject mixture</p> <p>Accept words with other meaning (eg solely/exclusively) M2 DEP on reference to hydrogen and carbon even if M1 not awarded</p>	2
b	double bond	<p>Accept multiple in place of double Accept contain C=C Ignore references to single bonds</p>	1
c	A		1
d	B and E and F	<p>All three correct scores 2 marks Two correct scores 1 mark</p> <p>If more than three answers given lose one mark for each error eg BCEF scores 1 mark</p>	2
e	because it has no double bond(s) / has only single bonds / is saturated	<p>Accept because only unsaturated compounds decolourise bromine water Accept because only alkenes decolourise bromine water Accept because it's not an alkene Accept because it's not unsaturated Accept because it's a (cyclo)alkane</p>	1

Question number	Answer	Notes	Marks																	
2 f i	<p>M1 for setting out calculation</p> <table style="margin-left: 40px;"> <tr> <td style="text-align: center;">C</td> <td style="text-align: center;">H</td> <td style="text-align: center;">Br</td> </tr> <tr> <td style="text-align: center;"><u>22.2</u></td> <td style="text-align: center;"><u>3.7</u></td> <td style="text-align: center;"><u>74.1</u></td> </tr> <tr> <td style="text-align: center;">12</td> <td style="text-align: center;">1</td> <td style="text-align: center;">80</td> </tr> </table> <p>If division upside down or division by one or more atomic numbers, then 0/3</p> <p>M2 for obtaining ratio</p> <table style="margin-left: 40px;"> <tr> <td style="text-align: center;">1.85</td> <td style="text-align: center;">3.7</td> <td style="text-align: center;">0.93</td> </tr> </table> <p>Accept any number of sig figs except one Allow 0.92</p> <p>M3 for whole number ratio</p> <table style="margin-left: 40px;"> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">:</td> <td style="text-align: center;">4</td> <td style="text-align: center;">:</td> <td style="text-align: center;">1</td> </tr> </table> <p>M3 DEP on M2</p> <p>allow alternative method:</p> <p>M1 calculation of $M_r \text{C}_2\text{H}_4\text{Br} = 108$</p> <p>M2 expression for % of <u>each</u> element eg C: $24/108 \times 100$</p> <p>M3 evaluation to show these equal 22.2%, 3.7%, 74.1%</p>	C	H	Br	<u>22.2</u>	<u>3.7</u>	<u>74.1</u>	12	1	80	1.85	3.7	0.93	2	:	4	:	1		3
C	H	Br																		
<u>22.2</u>	<u>3.7</u>	<u>74.1</u>																		
12	1	80																		
1.85	3.7	0.93																		
2	:	4	:	1																
ii	<p>M1 $((2 \times 12) + (4 \times 1) + (1 \times 80) =) 108$</p> <p>M2 $(216 \div 108 = 2)$ (so molecular formula is) $\text{C}_4\text{H}_8\text{Br}_2$</p>	correct answer with no working scores 2	2																	

Question number	Answer	Notes	Marks
3 a	i fuel oil		1
	ii fuel oil		1
	iii gasoline		1
b	i alumina / silica	Accept aluminosilicates/zeolites Accept aluminium oxide/silicon dioxide/silicon oxide/silicon (IV) oxide Accept correct formulae	1
	ii M1 for correct formula - C ₄ H ₈ M2 for correct coefficient - 2	Accept C ₄ H ₈ + C ₄ H ₈ for 2 marks Award 1 mark for 4C ₂ H ₄ Award 1 mark for C ₈ H ₁₆ Award 1 mark for two alkenes which have a total of 8C and 16H eg C ₃ H ₆ + C ₅ H ₁₀	2

iii	M1	over/greater supply of long-chain hydrocarbons/molecules/ heavy/heavier fractions / OWTTE	Accept long chain hydrocarbons/molecules heavy/heavier fractions are of less use (as fuels)	3
	M2	high demand/more use for short-chain/small hydrocarbons/ light/lighter fractions / OWTTE	Accept answers in terms of petrol / fuel (for cars) Short chain hydrocarbon molecules are more useful/in greater demand than long chain hydrocarbons/molecules scores M1 and M2	
	M3	Alkenes used to make polymers	Accept specific alkene and product eg ethene to make poly(ethene)/ethanol/alcohol	
c	M1	forms sulfur dioxide (when burned)	eg acid rain / damages trees / kills fish eg toxic / respiratory irritant / triggers asthma attacks Ignore harmful gas	2
	M2	which causes specified problem for environment OR specified problem for humans		

Question number	Answer	Notes	Marks
3 d	$ \begin{array}{cccc} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ \text{---C} & \text{---C} & \text{---C} & \text{---C} \text{---} \\ & & & \\ \text{H} & \text{CH}_3 & \text{H} & \text{CH}_3 \end{array} $	<p>M1 for only <u>two</u> (of the four) carbon atoms both with two H eg -CH₂-CH₂-CH₂-CH₂- scores 0</p> <p>M2 for (the other) <u>two</u> carbon atoms each with one H and one CH₃ No M2 if methyl groups on 1st + 2nd, or on 3rd + 4th carbons in chain</p> <p>Do not penalise bonds to H of CH₃</p> <p>Max 1 if chain extended correctly</p> <p>Ignore brackets and n</p> <p>each carbon must have four bonds eg -CH₂-CH-CH-CH₂- scores 0</p> <p>if terminal Hs added max 1</p> <p>0/2 if any double bonds shown</p>	2

Question number	Answer	Notes	Marks
4 a i	C_5H_{12}	Accept $H_{12}C_5$ Ignore gap between C_5 and H_{12} Ignore names Ignore C_nH_{2n+2}	1
ii	CH_2Br	Accept elements in any order Ignore molecular formula Ignore $2CH_2Br$ Penalise inappropriate use of upper or lower case letters or numbers(eg CH_2Br / CH_2BR / CH^2Br)	1
b i	R <u>and</u> U	Accept in either order	1
ii	D (C_nH_{2n})		1
c	C (compound R → compound Q)		1

Question number	Answer	Notes	Marks
4 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									
4 f i	<p>M1 setting out division of each % by A_r OR evaluation</p> <table style="margin-left: 40px;"> <tr> <td style="padding-right: 20px;">C</td> <td style="padding-right: 20px;">H</td> <td>F</td> </tr> <tr> <td style="padding-right: 20px;">$\frac{36.4}{12}$</td> <td style="padding-right: 20px;">$\frac{6.0}{1}$</td> <td>$\frac{57.6}{19}$</td> </tr> </table> <p>OR</p> <table style="margin-left: 40px;"> <tr> <td style="padding-right: 20px;">3</td> <td style="padding-right: 20px;">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 CH_2F</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 $\text{C}_2\text{H}_2\text{F}$ using 2 and 19 gives CHF Using 1 and 38 gives $\text{C}_2\text{H}_4\text{F}$ 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	$\text{C}_2\text{H}_4\text{F}_2$	<p>Accept elements in any order</p> <p>Do not accept $\text{C}_2\text{H}_4\text{F}_2$</p>	1									
Total 15 marks												