

Alkenes

Mark Scheme 3

Level	IGCSE(9-1)
Subject	Chemistry
Exam Board	Edexcel IGCSE
Module	Single Award (Paper 2C)
Topic	Organic Chemistry
Sub-Topic	Alkenes
Booklet	Mark Scheme 3

Time Allowed: 65 minutes

Score: /54

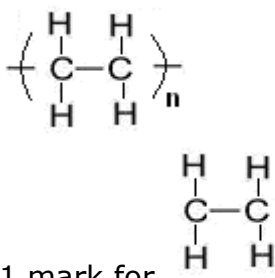
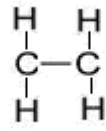
Percentage: /100

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)	Statement	Fractional distillation	Cracking	1 mark for each line correct	5
	Crude oil is heated	(✓)			
	A catalyst may be used		✓		
	Alkenes are formed		✓		
	Decomposition reactions occur		✓		
	Fuels are obtained	✓	✓		
	Separation is the main purpose	✓			
(b) i	C_5H_{12}			Accept $H_{12}C_5$	1
ii	<pre> H H H H H H—C—C—C—C—C— H H H H H H </pre>				1
ii	C_5H_{12}			Accept $H_{12}C_5$	1
iv	pentane				1
v	C_nH_{2n+2}			Accept x and other letters in place of n Accept answers like C_nH_{2n+2} Ignore $2(n+1)$	1

Question number	Answer	Notes	Marks
1 (c) i	(products) 2 2 (oxygen 3)	M1 and M2 independent	1 1
ii	4 electrons shared between 2 (carbon) atoms 4 electron pairs between 2C and 4H atoms	Ignore inner electrons even if wrong Ignore number of hydrogen atoms Accept all permutations of dots and crosses Ignore intersecting circles Accept H atoms at all angles At least one C or one H atom must be labeled if not Max 1 if more than 2 C Max 1 if wrong number of electrons in outer shell of any atom	1 1
(d) i	phosphoric acid / H_3PO_4 any value in range 250 – 350 °C	Ignore concentrated / dilute Accept value without unit Accept 523 – 623 K Marks independent	1 1
ii	20 (mol) M1 × 24 480 (dm ³)	Accept 480 000 cm ³ If M1 incorrect but 480 is final answer, then only M3 can be awarded If no answer to amount of ethene, then 20 x 24 = 480 scores M2 and M3	1 1 1
		Tota	19

2 (b) (i)	H ₂ O			1
	(ii) Dehydration	Elimination		1
(c)	 <p>1 mark for  i.e. double to single</p> <p>1 mark for rest of formula, including extension lines, brackets and the 'n'</p>	<p>CH₂ - CH₂</p> <p>n as superscript</p> <p>Max 1 for skeletal formula</p>	<p>Any double-bonded product scores 0/2</p> <p>n before the brackets</p>	2

Total 7 Marks

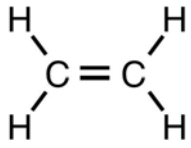
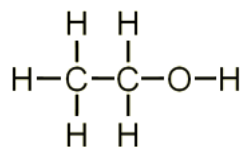
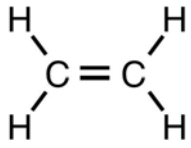
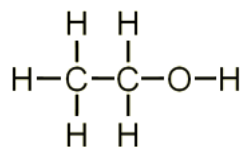
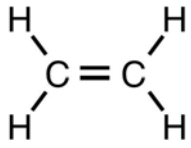
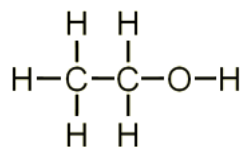
Question number	Answer	Notes	Marks
3 a i	C (C ₂ H ₄)		1
	ii B (colourless)		1
	iii A (dehydration)		1
b i	cracking		1
	ii (to act as a) catalyst OR to increase rate / speed up reaction	Accept (to provide an alternative route with) lower activation energy Accept decomposition / cracking in place of reaction	1
	iii cracking produces 2 or more products OR other products are formed OR identified possible product OR not all decane decomposed OR water vapour present (not just water)	Accept molecules / hydrocarbons / alkanes / alkenes in place of products Accept any hydrogen and any hydrocarbon with 8 or fewer carbon atoms (name or formula) Ignore decane decomposes / decane contains impurities Ignore references to air / oxygen / nitrogen / carbon dioxide Accept equation for cracking of decane showing two or more possible products (even if unbalanced)	1
		Total 6 marks	

Question number	Answer	Notes	Marks
4 a i	sugar(s)	Accept carbohydrate(s)	1
	ii fermentation		1
	iii zymase	Accept enzyme(s) / yeast	1
	iv hydration	Accept addition	1
b i	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{O}-\text{H} \\ \\ \text{H} \end{array}$	Accept O–H in any position All atoms and bonds must be shown	1
	ii propanol/propan-2-ol/2-propanol	Reject propan-1-ol / 1-propanol	1
c	phosphoric acid / phosphoric(V) acid / H_3PO_4	Accept sulfuric acid / H_2SO_4 Ignore references to dilute Reject phosphoric(III) acid/phosphorous acid If both name and formula given, both must be correct	1
	300 (°C)	Accept a value, or any range, within the range 250-350 (°C) Accept equivalent value in other units, but unit must be given	1

4 d i		needs more oxygen (to react)	Accept needs 3 instead of 2.5 O ₂ Accept reverse argument Ignore references to flammability	1
ii	M1	carbon monoxide / CO	If both name and formula given, both must be correct	1
	M2	poisonous / toxic / causes death IGNORE dangerous/harmful		1
	M3	reduces capacity of blood to carry oxygen	Accept correct reference to haemoglobin IGNORE references to suffocation/cannot breathe IGNORE blood carries no oxygen M2 & M3 can be awarded if M1 is missing or is a near miss (eg carbon dioxide)	1

4 e i		may explode / gas may leak / cylinder might break / pipe might burst / may catch fire (if gas leaks)		1
	ii	$C_2H_5OH \rightarrow C_2H_4 + H_2O$	Accept CH_3CH_2OH or displayed formula Ignore state symbols Reject C_2H_6O	1

(Total for Question 4 = 14 marks)

Question number		Answer	Notes	Marks						
5	(a)	B (a pressure of 65 atm)		1						
	(b)	<table border="1"><thead><tr><th></th><th>Displayed formula</th></tr></thead><tbody><tr><td>ethene</td><td></td></tr><tr><td>ethanol</td><td></td></tr></tbody></table>		Displayed formula	ethene		ethanol		All atoms and bonds must be shown Ignore bond angles	2
	Displayed formula									
ethene										
ethanol										

Question number		Answer	Notes	Marks
5	(c)	<p>M1 (saturated because) there are only single bonds / all the bonds are single</p> <p>M2 (not a hydrocarbon) because it contains oxygen/another element</p>	<p>Accept no double bonds / no multiple bonds</p> <p>Accept contains an OH group / an alcohol group</p> <p>Accept does not contain only hydrogen and carbon</p>	2
	(d)	<p>Any three of the following:</p> <p>M1 correct statement about connection between crude oil and ethene, eg: crude oil is converted /fractionally distilled /cracked to obtain ethene</p> <p>M2 correct statement about connection between sugar cane or glucose and ethanol, eg: sugar/glucose is converted into ethanol / sugar/glucose fermented to make ethanol</p> <p>M3 correct statement about effect of crude oil being less available, eg: less ethene available /ethene more expensive / ethene production (more) difficult OR process 1 used less / less favoured / (more) expensive</p>	<p>Ignore references to time taken to obtain ethene or ethanol</p> <p>Ignore references to purity of ethene or ethanol</p> <p>Ignore references to global warming / finite and renewable resources</p>	3

		M4 correct statement about effect of climate change, eg: more sugar can be fermented / more ethanol can be produced / ethanol cheaper / ethanol production easier/easy OR process 2 used more / more favoured / less expensive		
			Total for Question 4	8