



2812 Chains and Rings

June 2003

Mark Scheme

The following annotations may be used when marking:

X	=	incorrect response (errors may also be underlined)
^	=	omission mark
bod	=	benefit of the doubt (where professional judgement has been used)
ecf	=	error carried forward (in consequential marking)
con	=	contradiction (in cases where candidates contradict themselves in the same response)
sf	=	error in the number of significant figures

Abbreviations, annotations and conventions used in the Mark Scheme:

/	=	alternative and acceptable answers for the same marking point
;	=	separates marking points
NOT	=	answers not worthy of credit
()	=	words which are not essential to gain credit
<u> </u> (underlining)	=	key words which <u>must</u> be used
ecf	=	allow error carried forward in consequential marking
AW	=	alternative wording
ora	=	or reverse argument

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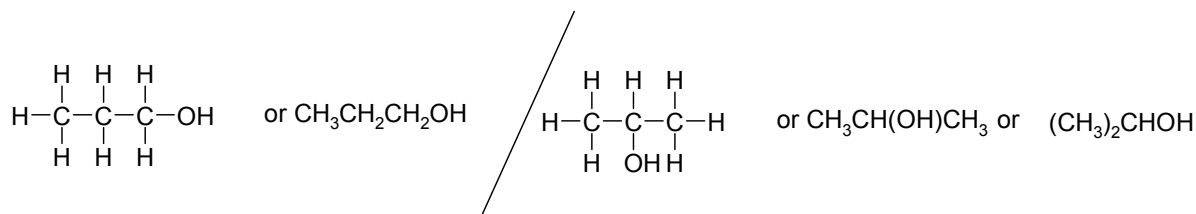
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1.

- (a)(i) \div each by its own A_r to give 5 : 13.3 : 1.67 ✓ [1]
 \div each by 1.67 to give 3 : 8 : 1 ✓ [1]

- (ii) Evidence of working e.g. $36 + 8 + 16 = 60$ / that C_3H_8O adds up to 60 ✓ [1]

- (b) unambiguous structure/formula of propan-1-ol & propan-2-ol to include:



✓✓ [2]

- (c)(i) dichromate/ $\text{Cr}_2\text{O}_7^{2-}$ / MnO_4^- ✓ [1]

- (ii) orange to green ✓✓ [2]
 purple to green/brown/black/pink/colourless

- (iii) continuous boiling/evaporation **and** condensation /
heating & return of liquid to reaction flask/
 simple sketch showing vertical condenser & heat ✓ [1]
 (any reference to a closed system negates the mark)

- (d)(i) OH/alcohol/hydroxy/hydroxyl – not hydroxide ✓ [1]

- (ii) C=O/carbonyl – not CO ✓ [1]

- (iii) carboxylic acid/ $-\text{CO}_2\text{H}/-\text{COOH}$ ✓ [1]

- (e) propan-1-ol (no marks)
 propan-1-ol oxidised to a carboxylic acid/ ✓ [1]

- (f) $\text{C}_3\text{H}_8\text{O} + 2[\text{O}] \rightarrow \text{CH}_3\text{CH}_2\text{COOH} / \text{C}_3\text{H}_6\text{O}_2 + \text{H}_2\text{O}$ ✓✓ [2]
 1 mark available if, $\text{CH}_3\text{CH}_2\text{COOH}$ & H_2O present in the equation

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2.

(a)(i) 1,1-dibromoethene ✓ [1]

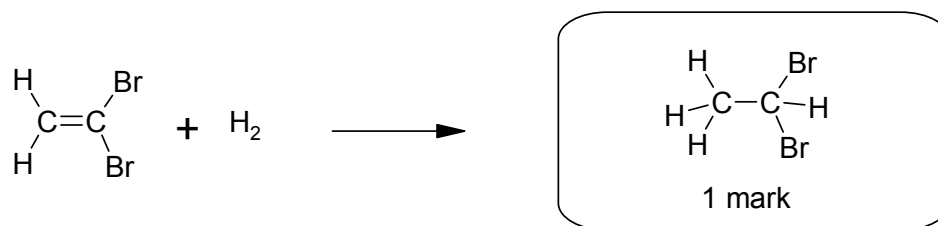
(ii) CHBr ✓ [1]

(b)(i) (Br₂ is) decolourised ✓ [1]

(ii) electrophilic addition ✓ [1]
✓ [1]

(c) allow names & unambiguous formulae throughout part (c)

(i) Isomer **C** reacts with H₂.



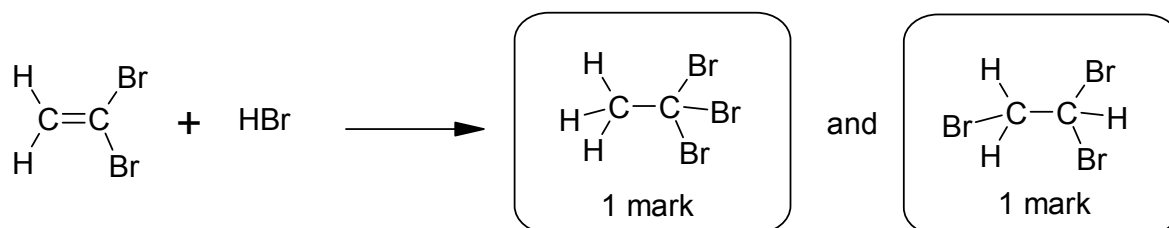
✓ [1]

conditions

suitable catalyst such as Ni/Pt/Pd

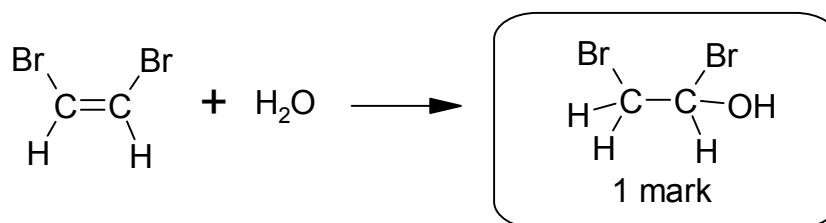
✓ [1]

(ii)



✓✓ [2]

(iii)



✓ [1]

conditions

phosphoric acid (catalyst)
temp ≥ 100 °C/ steam

✓ [1]
✓ [1]

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3.

(a) non-polar ✓ [1]

hence particles not attracted to methane ✓ [1]

(b)

• (free radical) substitution ✓ [1]

• $\text{CH}_4 + \text{Br}_2 \rightarrow \text{CH}_3\text{Br} + \text{HBr}$ ✓ [1]

• ultra violet/UV light ✓ [1]

• $\text{Br}_2 \rightarrow 2 \text{Br}\cdot$ ✓ [1]

• homolysis/ homolytic fission ✓ [1]

• $\text{Br}\cdot + \text{CH}_4 \rightarrow \cdot\text{CH}_3 + \text{HBr}$ ✓ [1]

• $\cdot\text{CH}_3 + \text{Br}_2 \rightarrow \text{CH}_3\text{Br} + \text{Br}\cdot$ ✓ [1]

• any two free radicals $2 \text{Br}\cdot \rightarrow \text{Br}_2$ ✓ [1]

free rads are difficult to control/react with anything/very reactive ✓ [1]

identifies one of CH_2Br_2 / CHBr_3 / CBr_4 or can be polysubstituted ✓ [1]

[10 max = 9]

1 QWC mark is available for using specific chemical terms.

chemical terms: initiation, propagation, termination, free radical substitution,
homolysis/ homolytic fission, photochemical

any **two** terms used correctly ✓ [1]

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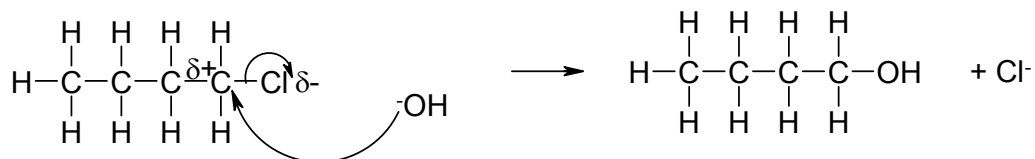
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4.



(ii)



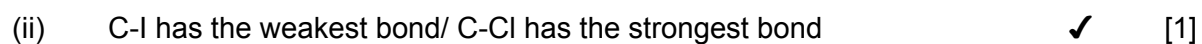
marking points:

dipoles

curly arrow from OH^- to $C^{\delta+}$

curly arrow from C-Cl bond to Cl

✓✓✓ [3]



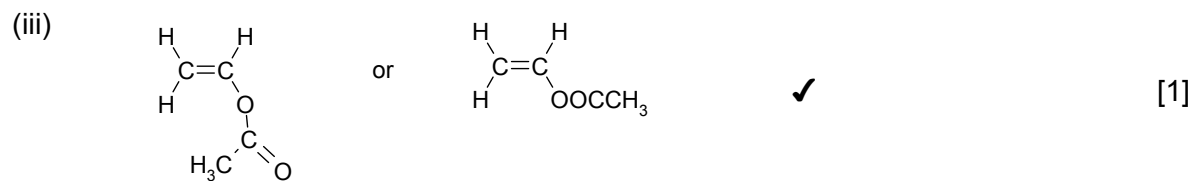
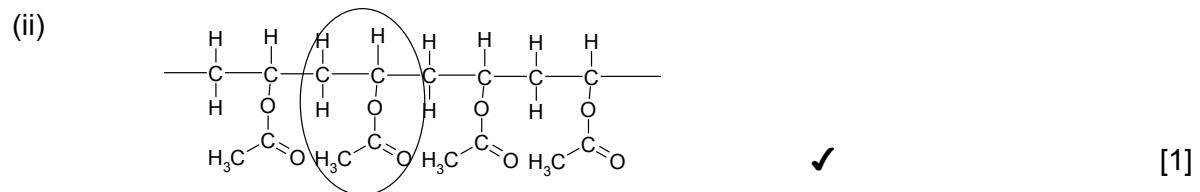
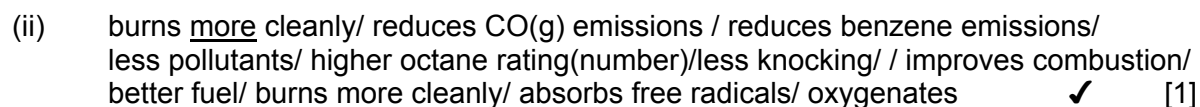
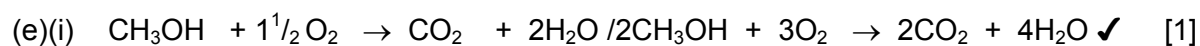
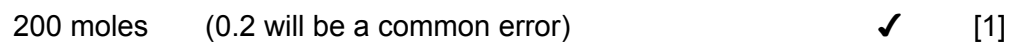
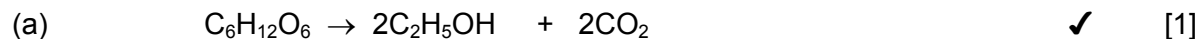
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5.



[Total : 15]