

Subject: Chains and Rings

Code: 2812

Session: January

Year: 2004

Public Mark Scheme

Post Standardisation

Post QPEC

MAXIMUM MARK	60
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ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme.
You are advised to destroy all draft versions.
2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks ($\frac{1}{2}$) should never be used.
3. The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.

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
4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.
5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.
6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)
7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.
8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

1

- (i) *unsaturated* contains a double/multiple/ π bond
✓[1]

hydrocarbon contains hydrogen and carbon **only**. ✓[1]

- (ii) angle a 109–110° ✓[1] angle b 117–120° ✓[1]

(iii)

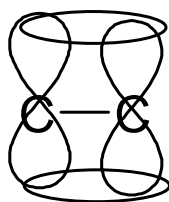


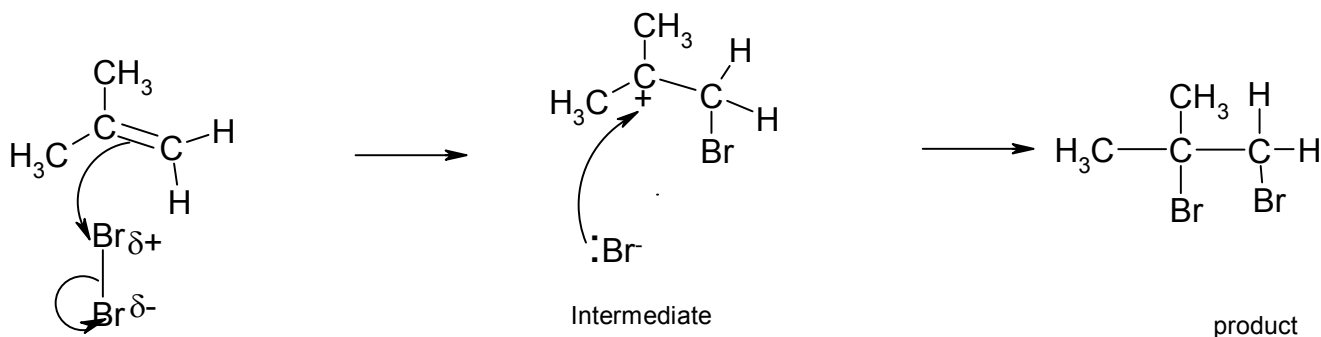
Diagram to show a minimum of 2 carbons, each with a σ -bonds and a p-orbitals ✓

Overlap of adjacent p-orbitals (in words or in diagram) ✓ [2]

(b)

- (i) *electrophile*: lone pair (of electrons) acceptor. ✓[1]

(ii)



essential mark
essential mark

intermediate carbocation/carbonium ion, accept primary/"triangular"/
product ✓

✓

curly arrow from double bond to Br_2

curly arrow showing movement of electrons in the $\text{Br}-\text{Br}$ bond **or** the dipole in the $\text{Br}-\text{Br}$

curly arrow from lone pair of electrons in Br^- to intermediate

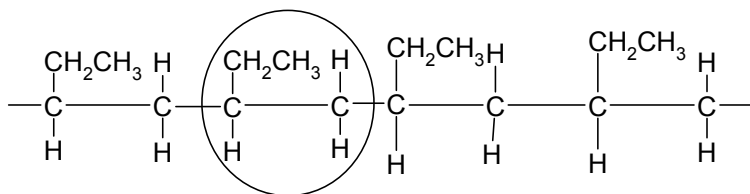
mark any errors first

(c)

(i) Addition (not additional)

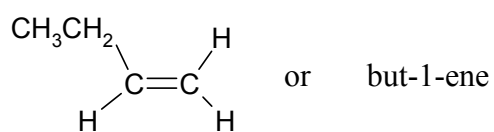
✓ [1]

(ii)



✓ [1]

(iii)



✓ [1]

(iv) Poly(but-1-ene)

✓ [1]

[Total : 15]

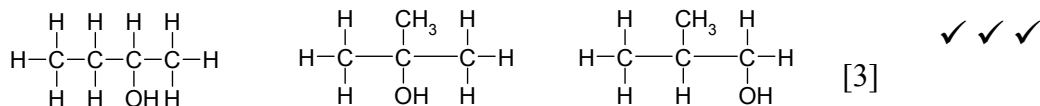
2

(a) (i) bubbles/ effervescence ✓ [1]

(ii) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{O}^-\text{Na}^+/\text{C}_4\text{H}_9\text{O}^-\text{Na}^+$ need **not** be shown as ionic ✓ [1]

Must clearly show that the Na is bonded to the O, penalise if the Na—O is a covalent bond

(iii)



(b) (i) orange to green/dark green/brown/black ✓ [1]

(ii) $\text{C}_4\text{H}_9\text{OH}/\text{C}_4\text{H}_{10}\text{O} + 2[\text{O}] \rightarrow \text{C}_3\text{H}_7\text{COOH} + \text{H}_2\text{O}$ ✓ ✓ [2]
 1 mark available for correct formula of the carboxylic acid

(iii) Identify isomer 2-methylpropan-1-ol by appropriate number/name/formula ✓ [1]

(c)

(i) CH_2 has mass = 14, $14 \times 4 = 56$ ✓ [1]

$\therefore \text{C}_4\text{H}_8$ ✓ [1]

(ii) $\text{C}_4\text{H}_9\text{OH} \rightarrow \text{C}_4\text{H}_8 + \text{H}_2\text{O}$ ✓ [1]

(iii) Identify butan-2-ol by appropriate number/name/formula ✓ [1]

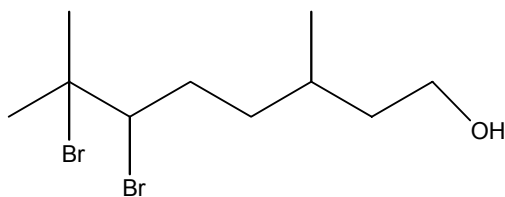
(d) (i) H_2SO_4 ✓ [1]

(ii) 0.06 ✓ [1]

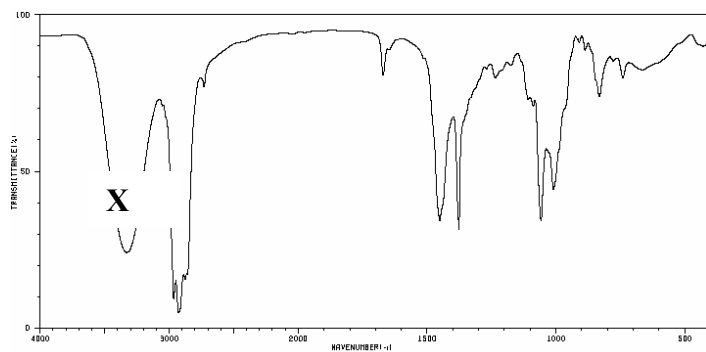
(iii) 60% ✓ [1]

[Total : 16]

- 3 (a) (i) alkene ✓ [1]
 alcohol/hydroxy/hydroxyl ✓ [1]
- (b)(i) I = alkene & II = alcohol... both are needed ✓ [1]
- (ii) decolourised / colourless ✓ [1]
- (iii) ✓ [1]



- (iv) **X** as shown below ✓ [1]

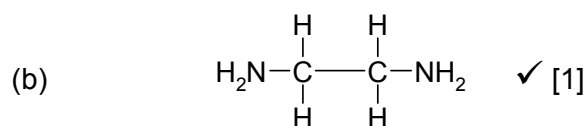


- (c) (i) Ni/Pt/Rh/Pd ✓ [1]
- (ii) compound **B** is C₁₀H₂₂O ✓ [1]
- (iii) C₁₀H₂₀O + H₂ → C₁₀H₂₂O ✓ [1]

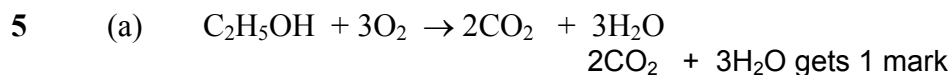
[Total : 9]

4.

- (i) sodium hydroxide/potassium hydroxide/NaOH/KOH ✓ [1]
- (ii) heat to reflux ✓ [1]
- (iii) water/aqueous accept NaOH(aq) ✓ [1]
- (iv) ethanol/ethanolic/alcohol accept NaOH(alc) ✓ [1]
- (v) (nucleophilic) substitution/hydrolysis ✓ [1]
- (vi) elimination ✓ [1]



[Total :8



(b) **Fermentation** ✓



Yeast /enzyme/ temperature about 30 °C/ batch process ✓

Hydration of ethene. ✓



Temp > 100 °C/ Press 370 –100 atm/ 6 –20 MPa/phosphoric acid catalyst/ continuous process ✓

Glucose is obtained from plants ✓

Ethene is obtained from crude oil/cracking/fossil fuel ✓

glucose is renewable/ethene isn't ✓

1 mark available for *Quality of written communication*..... base the award of the mark on the ability to communicate the essential chemistry by correct use of at least two from:
 fermentation/hydration/catalyst/renewable/sustainable/biofuel/enzymes/finite/cracking ✓

[Total : 12]