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Practice questions created by actual examiners and assessment experts

Detailed mark scheme

Suitable for all boards

Designed to test your ability and thoroughly prepare you

2002

XVIII

1583

Time allowed
67 Minutes

Score

/56

Percentage

%

CHEMISTRY

**OCR
AS & A LEVEL**

Mark Scheme

Module 6: Organic chemistry and analysis

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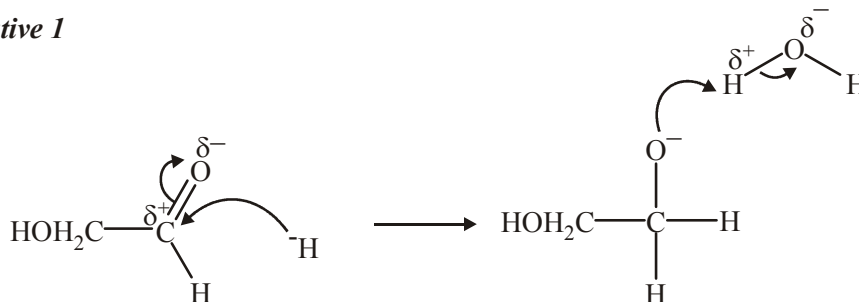
F324: Rings, Polymers and Analysis

4.1.2 Carbonyl Compounds /56

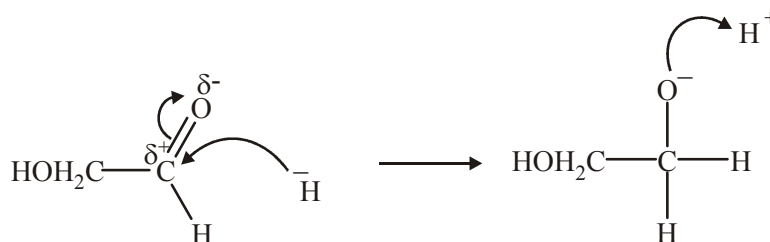
1. (a) (i) silver mirror ✓
*ALLOW Ag(s) OR Ag mirror OR precipitate OR ppt OR solid
ALLOW brown OR black OR grey* 1
- (ii) HOCH₂COOH ✓
*ALLOW CH₂OHCOOH OR CH₂OHCO₂H OR HOCH₂CO₂H
OR displayed OR skeletal formula OR HOCH₂COO⁻
DO NOT ALLOW C₂H₄O OR 2-hydroxyethanoic acid* 1
- (b) HOCH₂CHO + 3[O] → HOCCOOH + H₂O
reagents ✓ both products ✓
*ALLOW displayed/skeletal formula/COOHCOOH ✓✓
if molecular formula used C₂H₄O₂ + 3[O] → C₂H₂O₄ + H₂O
max = 1 ✓
Any correctly balanced equation for partial oxidation can
score 1 mark ✓
HOCH₂CHO + [O] → HOCH₂COOH
OR
HOCH₂CHO + 2[O] → OHCCOOH + H₂O
OR
HOCH₂CHO + [O] → OHCCHO + H₂O
OR
HOCH₂CHO + 2[O] → HOOCCHO + H₂O* 2
- (c) (i) HOCH₂CH₂OH ✓
*ALLOW HO(CH₂)₂OH OR (CH₂OH)₂ OR skeletal formula OR
displayed formula
DO NOT ALLOW molecular formula (C₂H₆O₂)* 1

- (ii) curly arrow from H^- to $\text{C}^{\delta+}$ ✓
 dipoles and curly arrow from $\text{C}=\text{O}$ bond to O ✓
ALLOW curly arrow to C even if dipole missing or incorrect
 intermediate ✓
- curly arrow from intermediate to $\text{H}^{\delta+}$ in $\text{H}_2\text{O}/\text{H}^+$ and if H_2O
 is used it must show the curly arrow from the $\text{O}-\text{H}$ bond to the O ✓
lone pairs are not essential
ALLOW maximum of 3 marks if incorrect starting material is used

Alternative 1

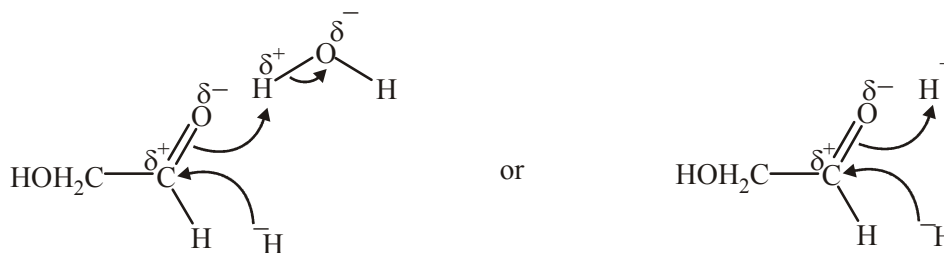


Alternative 2



products
are not
required

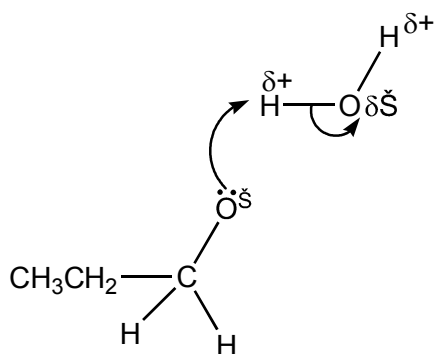
Alternative 3



Alternative 3 scores all 4 marks even though the intermediate is not shown



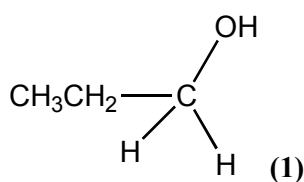
2. (i)



1 mark for each curly arrow (1)(1)

2

(ii)



(1)

1

(iii) electron pair donor (1)

1

(iv) electron pair on H^- attracted to δ^+ carbon forming a dative covalent bond (1)
the double/ π electron pair breaks (1)
electron pair now on O^- (1)

3

[7]

3. (a) (i) Tollens' reagent / ammoniacal silver nitrate (1)

silver mirror / precipitate (1)

butanoate / butanoic acid / unambiguous formula or structure (1)

3

(ii) **Any of:** Br_2 – decolourises – (electrophilic) addition

Na – fizzes – redox

 SOCl_2 / PCl_5 / acid chloride – white fumes –

substitution/chlorination

carboxylic acid + conc H_2SO_4 / acid chloride – sweet smell –

esterification/ condensation

test (1) - observation (1) - type of reaction (1)

3

*NOT**2-4DNPH to give no precipitate*

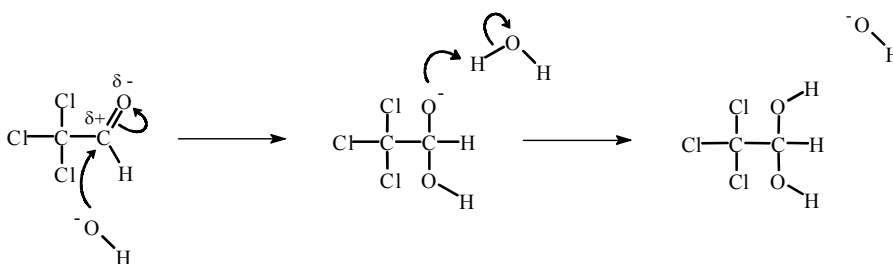
- (b) recrystallise /purify (the precipitate) (1)
 measure melting point (1)
 compare with known values (1) 3

[9]

4. (a) (i) heat with:
 Tollens' reagent / ammoniacal silver nitrate (1)
 to give: silver mirror / precipitate (1) 2
- (ii) aldehydes can be oxidised to a carboxylic acid **ora**
 / aldehydes can reduce Ag^+ to Ag (1) 1
- (b) (i) $\text{CH}_3\text{CH}=\text{CHCH}_2\text{OH}$ (1)
(either stereoisomer) 1
- (ii) reduction / redox / addition (1)
(NOT hydrogenation) 1
- (c) $\text{C}_4\text{H}_6\text{O} + 5\text{O}_2 \rightarrow 4\text{CO}_2 + 3\text{H}_2\text{O}$ (1) 1

[6]

5. (a)



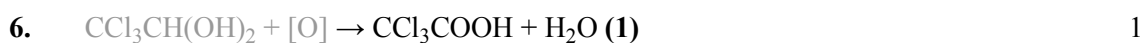
- curly arrow from O of OH to C (1)
 dipole on C=O and curly arrow breaking C=O (1)
 structure of the intermediate (1)
 curly arrow from O (of the correct intermediate)
 ... to H of H_2O (1) (allow O to H^+ ion here)
 curly arrow breaking the H-O bond in H_2O (1) 5



- (b) one mark for the correct answer to each step below with ecf throughout
steps may come in any order

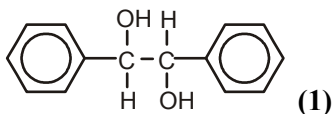
one week's supply = $21 \times \text{dose}$ (1) 5.25 g / 0.0317 mol
mass of trichloroethanal = 4.68 g (223mg if done first)
 $0.891 \times \text{mass of chloral hydrate}$ (1)
60% yield = $\text{mass/moles} \times 100/60$ (1) 7.8(0 g) 3
common errors for two marks are: 9.82 g (mass ratio upside down)
8.75 g (mass ratio not done)
2.60 g ($3 \times$ not done), 1.11 g ($7 \times$ not done), 0.371g ($21 \times$ not done)
7798 g (mg to g not done) *etc.*

[8]



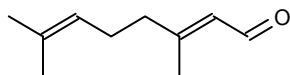
[1]

7. (i)

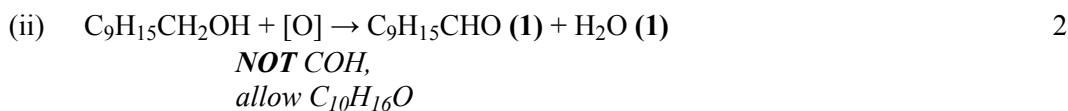


[2]

8. (i)

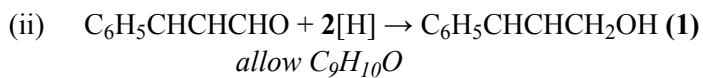


a correct skeletal aldehyde is shown on C1 (1)
rest of the skeletal structure ($\text{C}_2\text{-C}_{10}$) correct (1) 2



[4]





1

[2]

10. method

silver nitrate (1)

ammonia / ammoniacal (1)

warm / heat (1)

silver (mirror) / brown ppt forms (1)

explanation

silver ions reduced / $Ag^+ + e^- \rightarrow Ag$ (1)

aldehyde oxidised to a carboxylic acid (1)

correct structure – eg $C_6H_5CHCHCOO^-/COOH$ (1)

quality of written communication

mark for correct spelling, punctuation and grammar in at least two sentences (1)

8

[8]