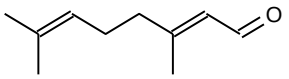
Carbonyls and carboxylic acids

1. (i)



a correct skeletal aldehyde is shown on C1 **(1)**
rest of the skeletal structure (C_2-C_{10}) correct **(1)** 2

(ii) $C_9H_{15}CH_2OH + [O] \rightarrow C_9H_{15}CHO$ **(1)** + H_2O **(1)** 2
NOT *COH,*
allow $C_{10}H_{16}O$

[4]

2. $CCl_3CH(OH)_2 + [O] \rightarrow CCl_3COOH + H_2O$ **(1)** 1

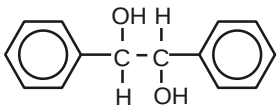
[1]

3. (i) aldehyde / C=O / carbonyl **(1)** 1

(ii) $C_6H_5CHCHCHO + \mathbf{2}[H] \rightarrow C_6H_5CHCHCH_2OH$ **(1)** 1
allow $C_9H_{10}O$

[2]

4. (i)



(1) 1

(ii) $C_{14}H_{10}O_2 + 4[H] \rightarrow C_{14}H_{14}O_2$ **(1)** 1
allow ecf from (i)

[2]

5. (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

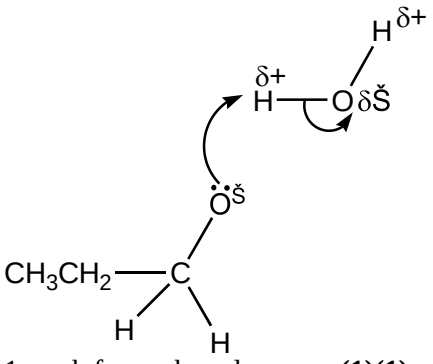
(b) (i) $CH_3CH=CHCH_2OH$ **(1)**
(either stereoisomer) 1

(ii) reduction / redox / addition **(1)**
*(**NOT** hydrogenation)* 1

(c) $C_4H_6O + \mathbf{5}O_2 \rightarrow \mathbf{4}CO_2 + \mathbf{3}H_2O$ **(1)** 1

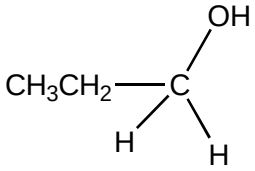
[6]

6. (i)



1 mark for each curly arrow **(1)(1)** 2

(ii)



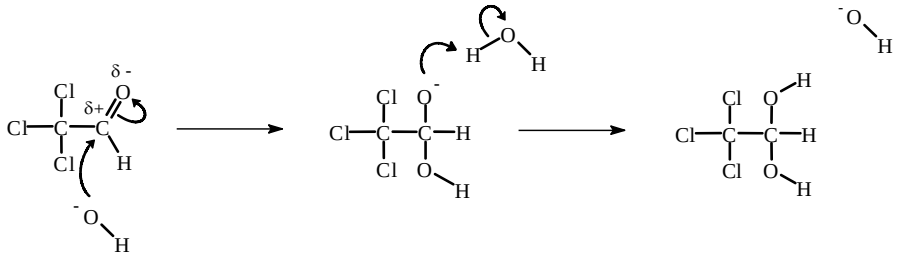
(1) 1

(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]

7. (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× dose **(1)** 5.25 g / 0.0317mol

mass of trichloroethanal =
0.891 × mass of chloral hydrate **(1)** 4.68 g (223mg if done first)

60% yield = mass/moles x 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× not done), 1.11 g (7× not done), 0.371g (21× not done)
7798 g (mg to g not done) *etc.*

[8]

8. **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]