

Allow $\text{CH}_3\text{CO}_2\text{CH}(\text{CH}_3)_2$ and $\text{CH}_3\text{CO}_2\text{H}$

Ignore $(\text{CH}_3)_2-\text{C}$ in equation

1

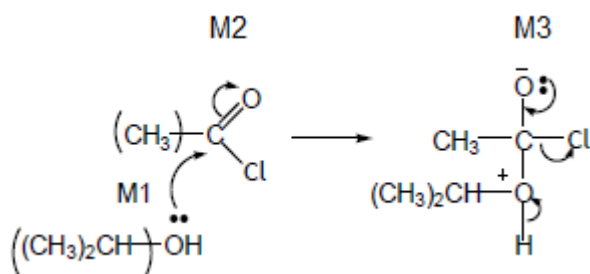
(1)-methylethyl ethanoate OR

Propan-2-yl ethanoate

Ignore extra or missing spaces, commas or hyphens

1

(ii)



M4 for 3 arrows and lp

NO Mark for name of mechanism

M1 for lone pair on O and arrow to C or to mid-point of space between O and C

M2 for arrow from C=O bond to O

- M2 not allowed independent of M1, but allow M1 for correct attack on C+
- + rather than $\delta+$ on C=O loses M2
- If Cl lost with C=O breaking, max1 for M1

M3 for correct structure with charges (penalise wrong alcohol here) but lone pair on O is part of M4

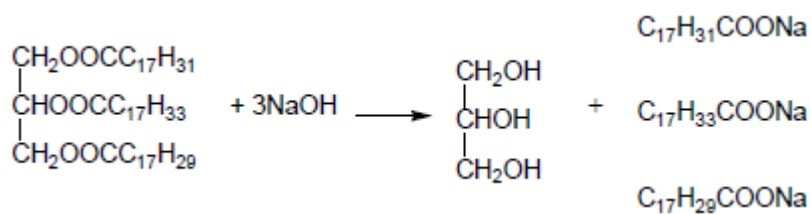
Penalise $(\text{CH}_3)_2-\text{C}$ in M3

M4 for lone pair on O and three arrows

- Only allow M4 after correct / very close M3
- M4 can be gained over more than one structure
- Ignore Cl^- removing H^+

4

(b) (i)



Penalise covalent Na e.g. -O-Na

LHS 1
RHS 1

(ii) $\text{C}_{17}\text{H}_{33}\text{COOCH}_3$
Allow $\text{C}_{19}\text{H}_{36}\text{O}_2$

1

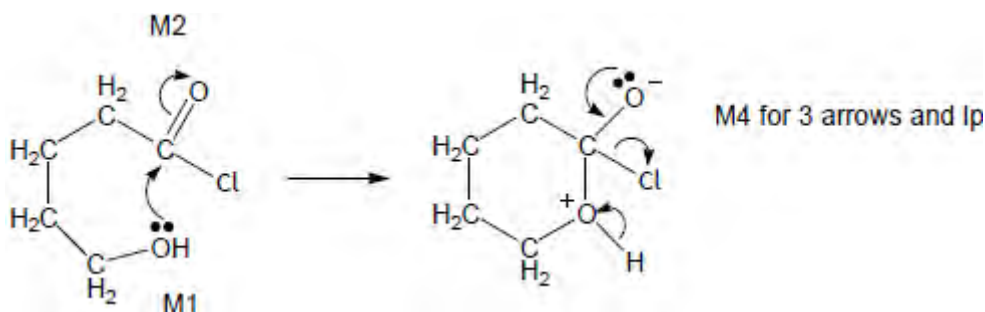
[9]

M2.(a) (i) (nucleophilic) addition-elimination

Not electrophilic addition-elimination

Ignore esterification

1



M3 for structure

- If wrong nucleophile used or O-H broken in first step, can only score M2.
- M2 not allowed independent of M1, but allow M1 for correct attack on C+
- + rather than $\delta+$ on C=O loses M2.
- If Cl lost with C=O breaking lose M2.
- M3 for correct structure with charges but lone pair on O is part of M4.
- Only allow M4 after correct / very close M3.
- Ignore HCl shown as a product.

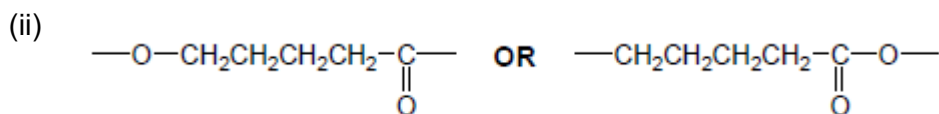
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a 20-50 (ppm) or single value or range entirely within this range
If values not specified as a or b then assume first is a.

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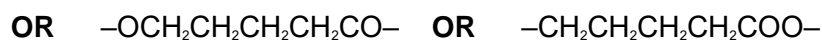
b 50-90 (ppm) or single value or range entirely within this range

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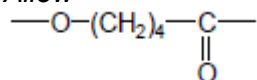


Must have trailing bonds, but ignore n.

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Allow



but not $\text{—C}_4\text{H}_8\text{—}$

one unit only

Condensation

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(b)

	Tollens'	Fehling's / Benedict's	Acidified potassium dichromate
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Penalise wrong formula for Tollens or missing acid with potassium dichromate but mark on.

1

J	No reaction / no (visible) change / no silver mirror	No reaction / no (visible) change / stays blue / no red ppt	No reaction / no (visible) change / stays orange / does not turn green
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Ignore 'clear', 'nothing'.

Penalise wrong starting colour for dichromate.

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K	Silver <u>mirror</u> / grey <u>ppt</u>	Red <u>ppt</u> (allow brick red or red-orange)	(orange) turns green
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J Two (peaks)
Allow trough, peak, spike.

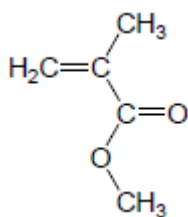
1

K Four (peaks)
Ignore details of splitting.
If values not specified as J or K then assume first is J.

1

(c) If all the structures are unlabelled, assume that the first drawn ester is L, the second ester is M; the first drawn acid is N, the second P. The cyclic compound should be obvious.

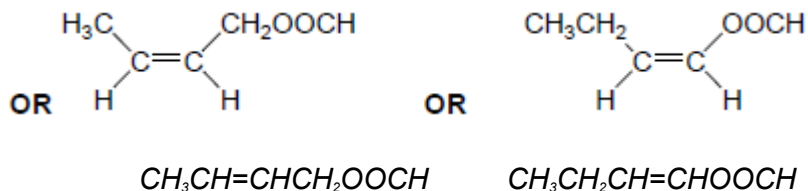
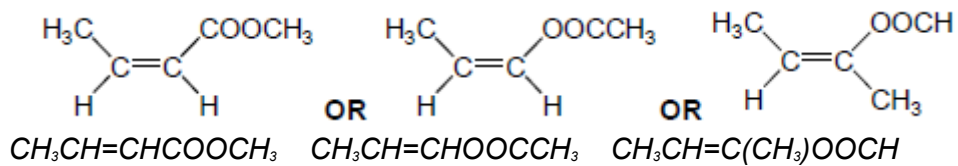
L
ester



OR $H_2C=C(CH_3)COOCH_3$
All $C_5H_8O_2$ L to P must have $C=C$.
Allow CH_3- .
Allow $-CO_2CH_3$ etc.
Allow $CH_2C(CH_3)COOCH_3$.

1

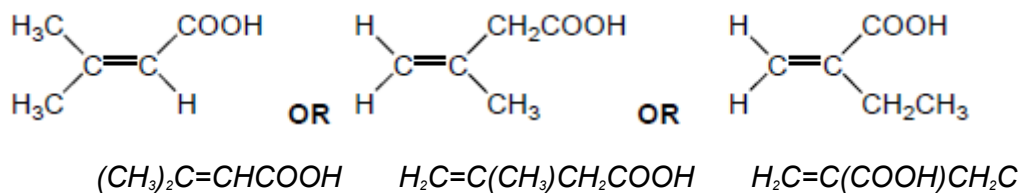
M
ester



Allow either *E-Z* isomer.
 Allow CH_3 - or C_2H_5 - but not CH_2CH_3 -.
 Allow $\text{CH}_3\text{CHCHCOOCH}_3$ etc.

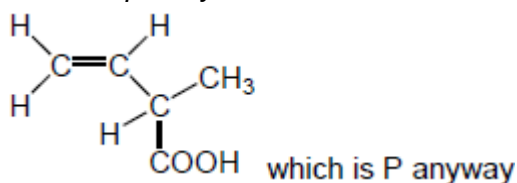
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N
acid



H_3

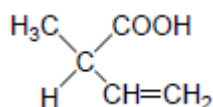
Allow CH_3 - or C_2H_5 - but not CH_2CH_3 -.
 Allow $-\text{CO}_2\text{H}$.
 Not cyclic isomers.
 Not the optically active isomer.



Allow $(\text{CH}_3)_2\text{CCHCOOH}$ etc.

1

P
acid

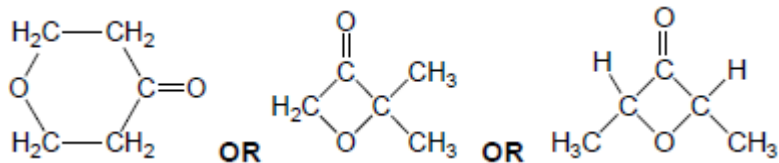


Allow $-\text{CO}_2\text{H}$.

$\text{CH}_3\text{CH}(\text{COOH})\text{CH}=\text{CH}_2$
 Allow $\text{CH}_3\text{CH}(\text{CO}_2\text{H})\text{CHCH}_2$ or
 $\text{CH}_3\text{CH}(\text{CO}_2\text{H})\text{C}_2\text{H}_5$.

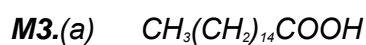
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Q



Not cyclic esters.

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[19]



Allow molecular formulae.

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Allow one mark only if formulae are swapped in position.

1

(b) *Keeping the foodstuff dry*

Allow an answer which refers to removal of water from the environment.

Do not allow dehydration / removal of water from the fat.

1

(c) *They (antioxidants) react with free radicals*

1

And they are used up in the reaction / do not remain behind after reaction

Lose one mark for any reference to 'catalysts can't slow down a reaction'.

1

(d) *Mol of fat = $(2.78 / 806 =) 3.45 \times 10^{-3}$*

Mol of NaOH = 3.68×10^{-3} = mol of fatty acid

1

Mol of NaOH = 3.68×10^{-3}

Mol of fat hydrolysed = 1.23×10^{-3}

1

Mol of fat hydrolysed = $(3.68 \times 10^{-3} / 3 =) 1.23 \times 10^{-3}$

Mass of fat hydrolysed = 0.987 g

1

Percentage hydrolysed = 35.5 – 35.7

Percentage hydrolysed = 35.5 – 35.7

Do not penalise precision at any point.

Since there are a variety of approaches to this calculation, award four marks for a correct answer but it must be clear that there is some relevant working.

The answer alone gets M4 only.

Any incorrect use of the 3:1 ratio is CE – lose M3 and M4.

1

[9]



Accept multiples, including fractions.

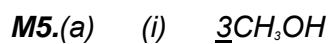
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(b) *Gas syringe / inverted burette over water / measuring cylinder over water*

Collection apparatus must show graduations or be clearly labelled (eg syringe, burette, measuring cylinder).

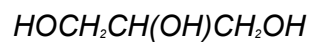
1

[2]



Not molecular formula

1

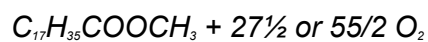


1



Or doubled

1



Consequential on correct right-hand side

1

(b) (i) A0.7

1

Ethanol 6.4

1

Water 3.6

1

(ii) No effect

If wrong, CE= 0

1

Equal moles on each side of equation **OR** V cancels

Ignore moles of gas

1

$$(iii) \quad M1 \quad K_c = \frac{[\text{DEM}][\text{H}_2\text{O}]^2}{[\text{A}][\text{C}_2\text{H}_5\text{OH}]^2}$$

Must have all brackets but allow ()

1

(iv) M2 $\frac{2.1 \times (3.4)^2}{0.85 \times (7.2)^2}$

If K_c wrong can only score M4 for units consequential to their K_c working in (b)(iv)

1

M3 0.55 (min 2dp)

1

M4 No units

1

[13]