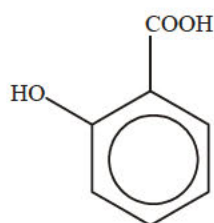


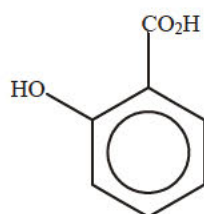
F324: Rings, Polymers and Analysis

4.1.3 Carboxylic Acids and Esters /46

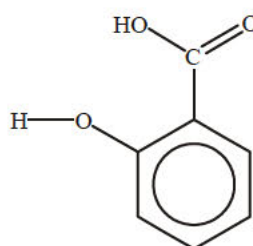
1.



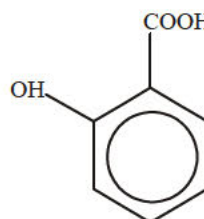
✓
ALLOW



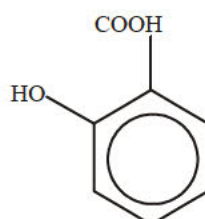
or



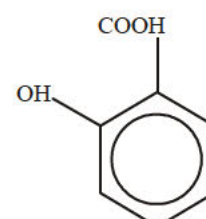
DO NOT ALLOW incorrect bond linkage



or



or



[1]

2. (i) hydrolysis (1)

(sorbitan monolaurate is an) ester (1)

broken down to form an alcohol and carboxylic acid/salt (1) **AW**
/ equation to show the reaction

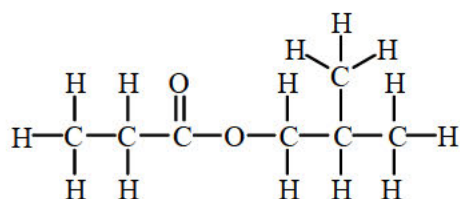
3

(ii) sorbitan monolaurate is made from a renewable resource
/ not based on crude oil (1) **AW**

1

[4]

3. (a)



propanoate and ester group (1)

2-methyl propyl (1)

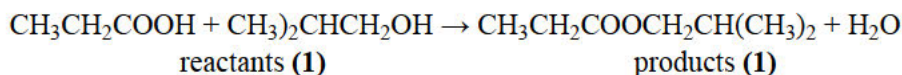
2

- (b) propanoic acid (1)
(2-)methylpropan-1-ol (1)

heat (1)

conc. H_2SO_4 (1)

(allow ecf from part (a) for the equation)



6

- (c) mass spectrum / spectrometry (1)

molecular ion peak /

m/e or mass of the peak furthest right (1) AW

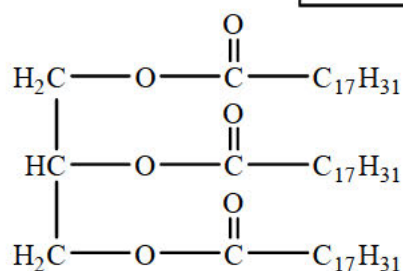
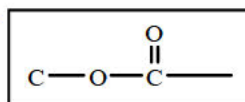
2

[10]

4. (i)

(1) for a correct ester

(1) for rest



Accept correct skeletal form (even if only for acyl groups)
but must have 17C and two double bonds/one triple bond

2

- (ii) 6. Ecf from (i). (1)

1

[3]

5. Three of following points: (1)(1)(1)

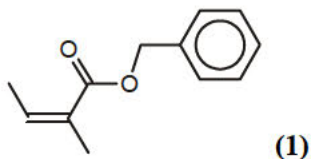
- 1. There is van der Waals (IDID) between triglycerides.
- 2. There is van der Waals between triglycerides and (non-polar) solvent.
- 3. Triglycerides cannot hydrogen bond (to water)(enough).
- Because there are not enough suitable sites/oxygen atoms
Or long hydrocarbon chains do not hydrogen
bond/would interfere with hydrogen bonding in water
AW

3

[3]

6. (a) (i) alkene (1)
 ester (1)
allow "C=C double bond" 2

i.

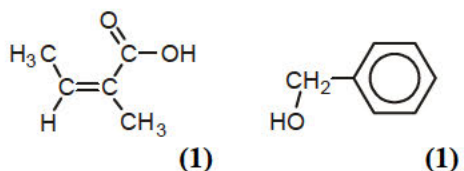


1

- ii. $C_{12}H_{14}O_2$ (1) 1

- (b) same structural formula/order of bonds,
 different spacial arrangement **AW** (1)
 description or diagram showing **B** and how it is different from **A** (1) □ 2

(c)



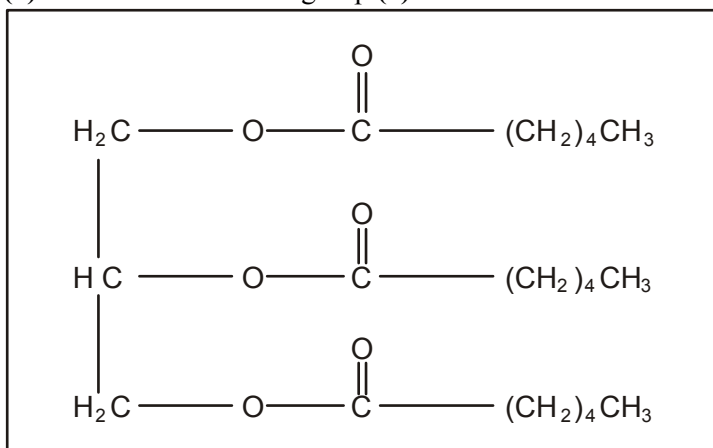
2

- (d) (i) peak at $1680-1750\text{ cm}^{-1}$ due to C=O (1)
 peak at $1000-1300\text{ cm}^{-1}$ due to C-O / (1) 2

- (ii) $2500-3300 / 3230-3550\text{ cm}^{-1}$ □ (1)
 O-H / carboxylic acid/alcohol is **not** present in **A** (1)
 allow 1 mark for $\sim 500-1500\text{ cm}^{-1}$ which is a unique
 fingerprint region etc 2

[12]

7. (1) for correct functional group (1) for the rest

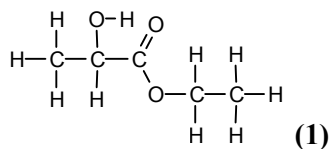


C₅H₁₁ acceptable

2

[2]

8. (i)



1

- (ii) any sensible change in flavour linked to the presence of the ester or loss of the acid (1) – e.g.
 ‘more fruity due to the ester’
 ‘less sour as acids get used up’

1

[2]

9. (i) flavouring / fruity smell etc
NOT perfume or sweetener

1

- (ii) conc H₂SO₄ (1)
 reflux/ distil (1)

2

- (iii) $\text{CH}_3\text{COOH} + \text{C}_9\text{H}_{15}\text{CH}_2\text{OH} \rightarrow \text{CH}_3\text{COOCH}_2\text{C}_9\text{H}_{15} + \text{H}_2\text{O}$
 (1) (1) (1)
allow C₂H₄O₂ and C₁₂H₂₀O₂
but NOT wrong structures
allow ecf on the wrong acid

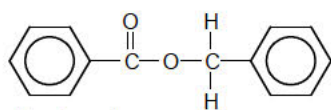
3

[6]

10. (i) H^+ / acid / named strong acid eg H_2SO_4 / HCl

1

(ii)



displayed ester group (1)

rest of the ester (1)

2

[3]