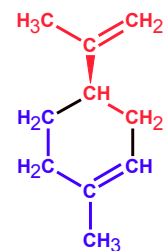
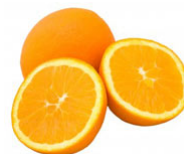
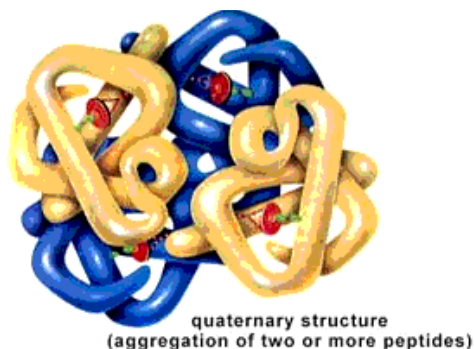


# Higher Chemistry



Limonene  
(skin of citrus fruits)

## Topic 6:

# Acids, Esters, Oils & Proteins

# Answer Book

6.1	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				

6.2	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				
9				

6.3	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				

6.4	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

6.4	A	B	C	D
11				
12				
13				
14				
15				
16				
17				
18				
19				

6.5	A	B	C	D
1				
2				
3				
4				
5				
6				
7				
8				

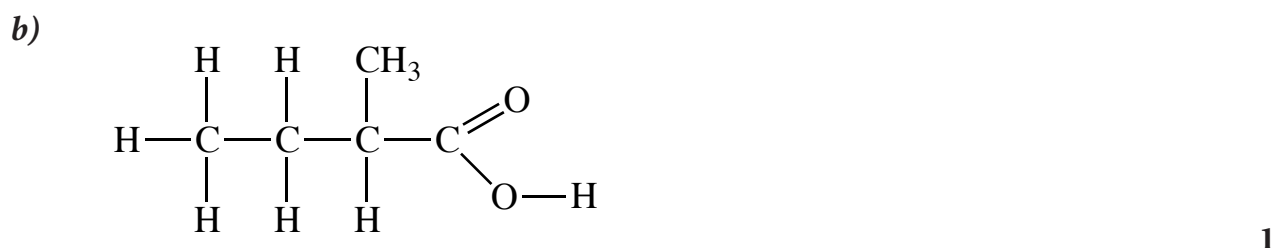
6.6	A	B	C	D
1				
2				
3				
4				
5				

6.7	A	B	C	D
1				
2				
3				
4				
5				
6				

## HOME PRACTICE ANSWERS

## 6.1

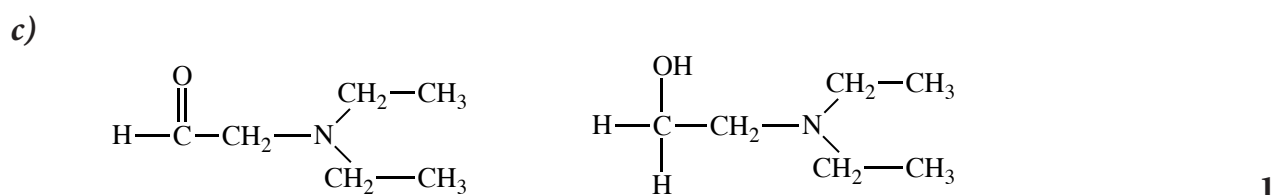
- Q1. a) propanoic acid 1  
 b) pentanoic acid 1



- Q3. a)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$  2  
 b)  $\text{CH}_3\text{CH}(\text{CH}_3)\text{CH}_2\text{CH}_2\text{COOH}$  1

- Q4. a) alkanoic acids 1  
 b) carboxylic acids 1  
 c) carboxyl 1  
 b) octanoic acid. All have the COOH group which can do (equal) hydrogen bonds so any difference should be due to the extra London dispersion forces that will increase as the length of the carbon chain increases. 1

- Q5. a) carboxyl 1  
 b)



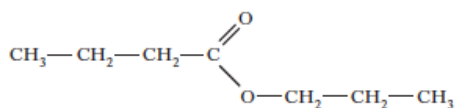
**Total (14)**



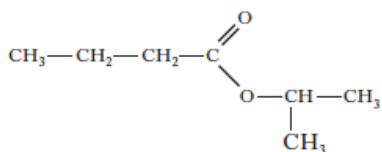
## HOME PRACTICE ANSWERS

## 6.3

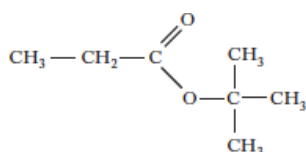
- Q1. a) to be a condenser - to prevent volatile chemicals (reactants and product) from escaping from the reaction mixture. 1
- b) butyl ethanoate + water  $\longrightarrow$  ethanoic acid + butanol 1
- c)  $\text{CH}_3\text{COOCH}_2\text{CH}_2\text{CH}_2\text{CH}_3 + \text{H}_2\text{O} \longrightarrow \text{CH}_3\text{COOH} + \text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$  2
- d) splitting apart using water 1
- e) it is the reverse reaction 1
- Q2. a) the products (alkanoic acid and alkanol) can react to form the original reactant under the same conditions (ester) 1
- b)  $\rightleftharpoons$  1
- c) methanoic acid 1
- d)  $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$  1
- Q3. a) butyl propanoate 1
- b) the more branches the lower the rating, so



Ester B



Ester A



Ester C

1

**Total (12)**

## HOME PRACTICE ANSWERS

## 6.4

- Q1. a) fats and oils (can also be called triglycerides and are, of course, also esters) 1
- b) olive oil 1
- c) olive oil 1
- d) bromine water, olive oil would be able to decolourise a larger volume of bromine water than the bacon fat 1
- Q2. a) olive oil would contain more energy 1
- b) fatty foods can have more vitamins (fat soluble vitamins) 1
- c) less risk of heart disease (higher cholesterol) 1
- d) obesity is caused by eating too many calories - taking in more energy than you need  
fats & oils contain large amounts of energy (high calorific values) 1
- Q3. a) 3 ester links 1
- b) glycerol or propane-1,2,3-triol 1
- c)
- $$\begin{array}{c}
 \text{H} \\
 | \\
 \text{H}-\text{C}-\text{O}-\text{H} \\
 | \\
 \text{H}-\text{O}-\text{C}-\text{H} \\
 | \\
 \text{H}-\text{C}-\text{O}-\text{H} \\
 | \\
 \text{H}
 \end{array}$$
- 1
- Q4. a)  $\text{C}_{17}\text{H}_{33}\text{COOH}$  1
- b) unsaturated - there are 2 H atoms fewer than the  $2n + 1$  maximum possible 1
- c) 3 acid molecules to 1 alcohol molecule 3:1 1
- d) hydrogenation (addition of hydrogen) 1
- d) i) becomes *more* saturated / *less* unsaturated 1
- ii) the melting point increases 1

**Total (19)**



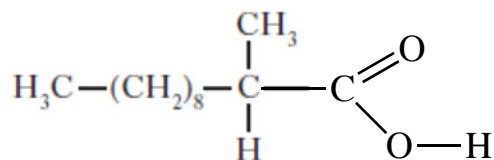
## HOME PRACTICE ANSWERS

## 6.6

Q1. a) limonene only has london dispersion forces whereas geraniol has hydrogen bonding so more energy required for evaporation 1

b) alkanal (aldehyde may not be enough) 1

c)



1

d) it would change the fragrance (sourer smell due to acid group) 1

Q2. a) 1.11 (71 seconds) 1

b) compound A 1

c) compound A 1

d) run a sample of octane through the column under the same conditions and compare retention times 1

Q3. Could mention (including equations):

ethanol: could be oxidised to ethanal or ethanoic acid - smell of vinegar

ethanol: could react with ethanoic acid produced to form ester - ethyl ethanoate - smell

water: could cause original ester to be hydrolysed - lose those smells

water: could cause edible oil to be hydrolysed to glycerol & fatty acids - new smells

radical oxidation: terpenes and unsaturated chains in edible oils are vulnerable to radical oxidation

volatile molecules (london dispersion forces only) may have evaporated and escaped.

3

**Total (11)**

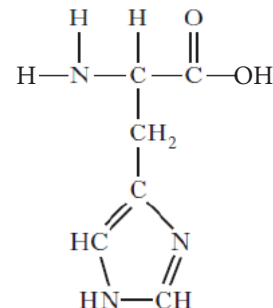
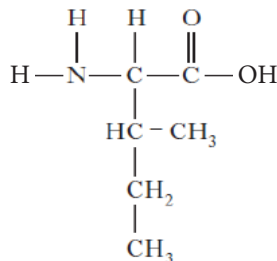
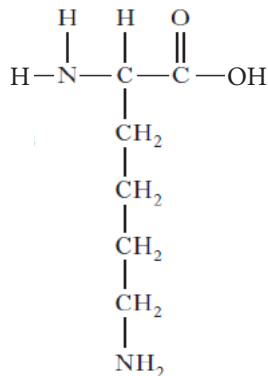
## HOME PRACTICE ANSWERS

## 6.7

Q1. a) denatured 1

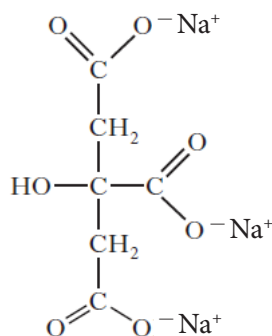
b) more even transfer of heat (less chance of accidentally denaturing protein) 1

c)



1

d)

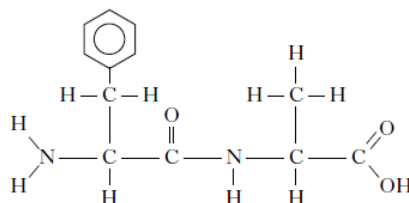


1

Q2. a) An amino acid that can't be made by the body so it has to be part of the diet (state symbols not required) 1

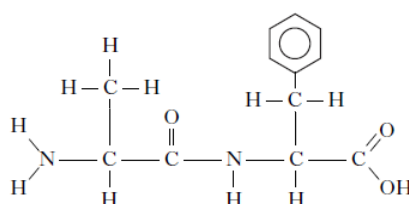
b) 11 hydrogens 1

c)



1

d)



1

**Total (8)**