Carbonyl Compounds, Carboxylic Acids, Esters & Polyesters AS & A Level

Question Paper 1

Level	A Level
Subject	Chemistry
Exam Board	OCR
Module	Organic Chemistry & Analysis
Topic	Carbonyl Compounds, Carboxylic Acids, Esters & Polyesters
Paper	AS & A Level
Booklet	Question Paper 1

Time allowed: **49 minutes**

Score: **/36**

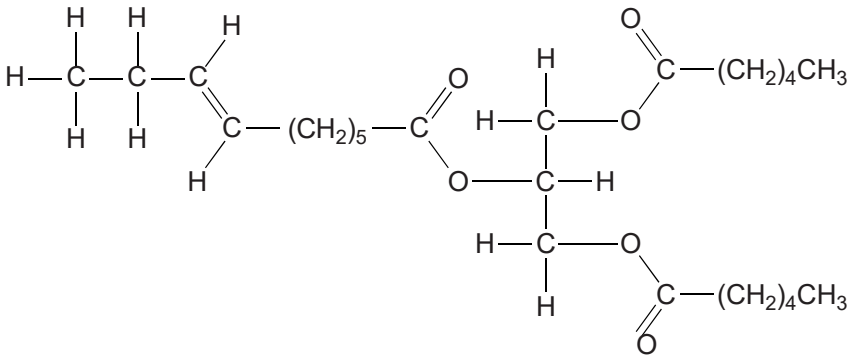
Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E
>85%	73%	60%	47%	34%	21%

Triglycerides are triesters and are found in fats and oils.

The structure of a triglyceride found in some goats' milk is shown below.



(a) This triglyceride is hydrolysed with hot aqueous sodium hydroxide.

(i) Give the systematic name of the alcohol that is formed by this hydrolysis. [1]

(ii) Draw the structures of the other organic products of this hydrolysis. [3]

(b) Suggest why people who consume a large quantity of this type of goats' milk might be more at risk of suffering from coronary heart disease.

In your answer, you should use appropriate technical terms, spelled correctly. [2]

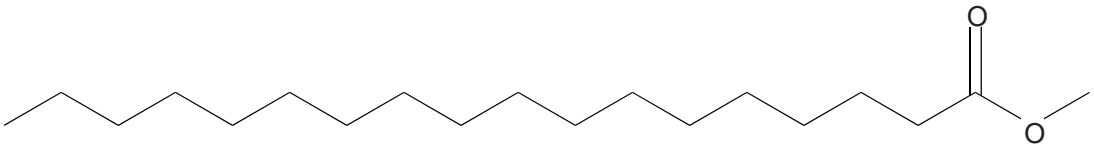
[Total 6 Marks]

Fats and oils are mixtures of organic compounds. Some fats contain glycerides and steroids.

(a) Some processed foods contain *trans* oils which have been linked to health risks.

(i) The incomplete structure below shows an octadeca-12-enoate section of a *trans* oil.

- Add the double bond to the structure
- State how the *trans*-isomer is different from the *cis*-isomer.

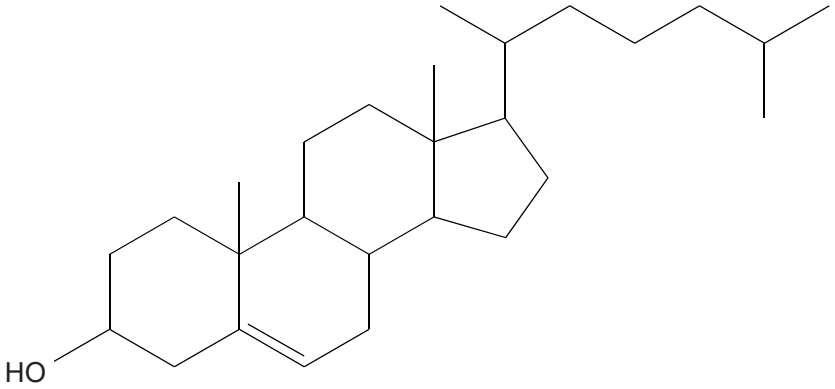


[2]

(ii) State **one** possible health risk of a diet that is high in *trans* oils. [1]

(b) Cholesterol is part of a family of compounds called steroids.

The structure of cholesterol is shown below.

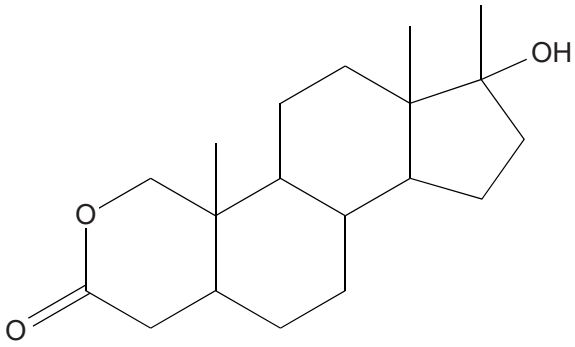


(i) How many carbon atoms are there in a molecule of cholesterol? [1]

(ii) How many chiral centres are there in a molecule of cholesterol? [1]

(c) Oxandrolone is a type of synthetic drug called an 'anabolic steroid', prescribed to promote muscle growth.

The structure of oxandrolone is shown below.

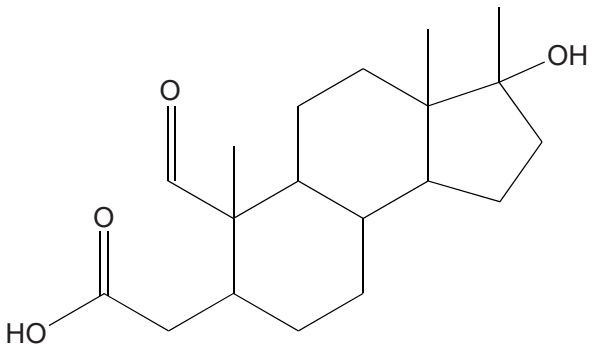


(i) What are the functional groups in oxandrolone? [2]

(ii) Oxandrolone is synthesised from naturally occurring steroids.

Suggest an advantage of developing a synthetic route to oxandrolone starting from a natural steroid. [1]

(iii) Compound **C** below is an intermediate formed during the synthesis of oxandrolone.



compound C

Suggest a two-step synthesis of oxandrolone from compound **C**.

For each step of the synthesis,

- state the reagents and any conditions
- state the functional groups that would react and those that would form. [4]

[Total 12 Marks]

Mandelic acid (2-phenyl-2-hydroxyethanoic acid), $C_6H_5CH(OH)COOH$, is used in some skin creams and can be converted into a condensation polymer.

The addition polymer of ethyl methacrylate (ethyl 2-methyl-2-propenoate), $CH_2C(CH_3)COOC_2H_5$, is used to make some artificial fingernails.

(a) Explain what is meant by the term *condensation polymerisation*.

Your answer should use appropriate technical terms, spelled correctly. [1]

(b) Draw **two** repeat units of a polymer that is formed when,

(i) mandelic acid, $C_6H_5CH(OH)COOH$, polymerises [2]

(ii) ethyl methacrylate, $CH_2C(CH_3)COOC_2H_5$, polymerises. [1]

(c) When ethyl methacrylate, $CH_2C(CH_3)COOC_2H_5$, is heated under reflux with aqueous dilute acid, a hydrolysis reaction takes place forming compound **C** and ethanol.

When compound **C** is heated with steam in the presence of an acid catalyst, an addition reaction takes place forming two organic products **D** and **E**.

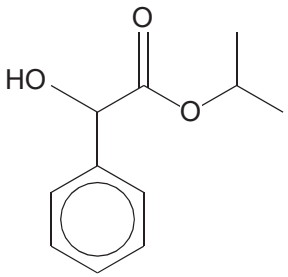
Compounds **D** and **E** are structural isomers with the molecular formula $C_4H_8O_3$.

Draw the structures of compounds **C**, **D** and **E**.

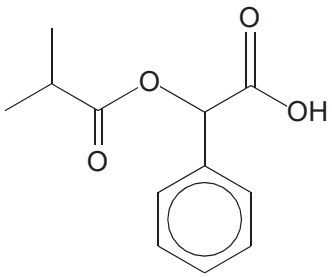
compound **C**
compound **D**
compound **E**

[3]

(d) Mandelic acid has anti-bacterial properties and is used in some skin creams. A cosmetic chemist used mandelic acid to prepare two different esters that might be suitable for new skin creams. The structures of the two esters are shown below.



ester 1



ester 2

(i) Draw the structure of an organic compound that could react with mandelic acid, $C_6H_5CH(OH)COOH$, to produce **ester 1**. [1]

(ii) Identify an organic compound that could react with mandelic acid to produce **ester 2.**

[1]

(iii) **Ester 1** is less soluble in water than mandelic acid, $C_6H_5CH(OH)COOH$.

Explain the difference in water solubility of mandelic acid and **ester 1**.

You may use a labelled diagram in your answer. [3]

(iv) Before any skin cream can be sold to the public, it must be tested to ensure it is safe to use.

Suggest why. [1]

[Total 13 Marks]

'Methylglyoxal', CH_3COCHO, is formed in the body during metabolism.

Describe **one** reduction reaction and **one** oxidation reaction of methylglyoxal that could be carried out in the laboratory.

Your answer should include reagents, equations and observations, if any. [5]

[Total 5 Marks]