

**AQA – Amino acids, Proteins and DNA – A2 Chemistry P2**

1. June/ 2019/Paper\_2/No.11

1 1

This question is about esters including biodiesel.

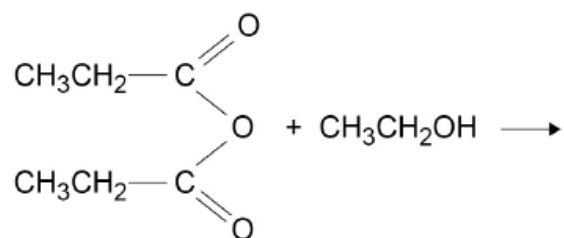
1 1 . 1

An ester is formed by the reaction of an acid anhydride with  $\text{CH}_3\text{CH}_2\text{OH}$ 

Complete the equation. In your answer show clearly the structure of the ester.  
Give the IUPAC name of the ester.

**[3 marks]**

Equation



Name of ester \_\_\_\_\_

1 1 . 2

In a reaction to form biodiesel, one mole of a vegetable oil reacts with an excess of methanol to form two moles of an ester with molecular formula  $\text{C}_{19}\text{H}_{34}\text{O}_2$  and one mole of an ester with molecular formula  $\text{C}_{19}\text{H}_{36}\text{O}_2$

Draw the structure of the vegetable oil showing clearly the ester links.

You should represent the hydrocarbon chains in the form  $\text{C}_x\text{H}_y$  where  $x$  and  $y$  are the actual numbers of carbon and hydrogen atoms.

**[2 marks]**

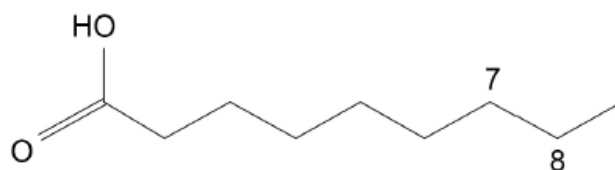
1 1 . 3 The compound  $C_{19}H_{34}O_2$  is the methyl ester of Z,Z-octadeca-9,12-dienoic acid.

Part of the structure of the acid is shown.

Complete the skeletal formula to show the next part of the hydrocarbon chain to carbon atom number 14.

In your answer, show the Z stereochemistry around both C=C double bonds.

[2 marks]



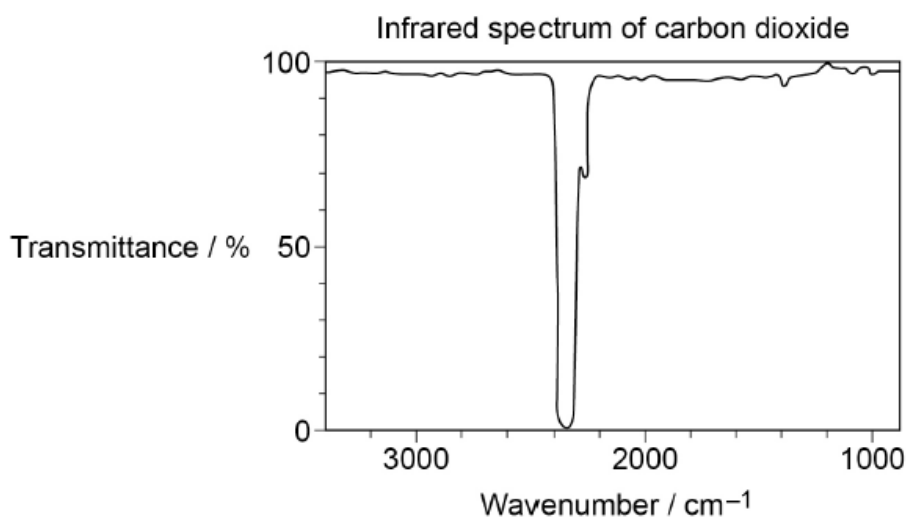
1 1 . 4 Give an equation for the complete combustion of the ester  $C_{19}H_{34}O_2$

[1 mark]

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- 1 1 . 5 Combustion of biodiesel produces greenhouse gases such as carbon dioxide that cause global warming.  
Part of the infrared spectrum of carbon dioxide is shown in **Figure 3**.

**Figure 3**



State how the infrared spectrum of carbon dioxide in **Figure 3** is **not** what you might predict from the data provided in **Table A** in the Data Booklet.

[1 mark]

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- 1 1 . 6 Explain how carbon dioxide causes global warming.

[2 marks]

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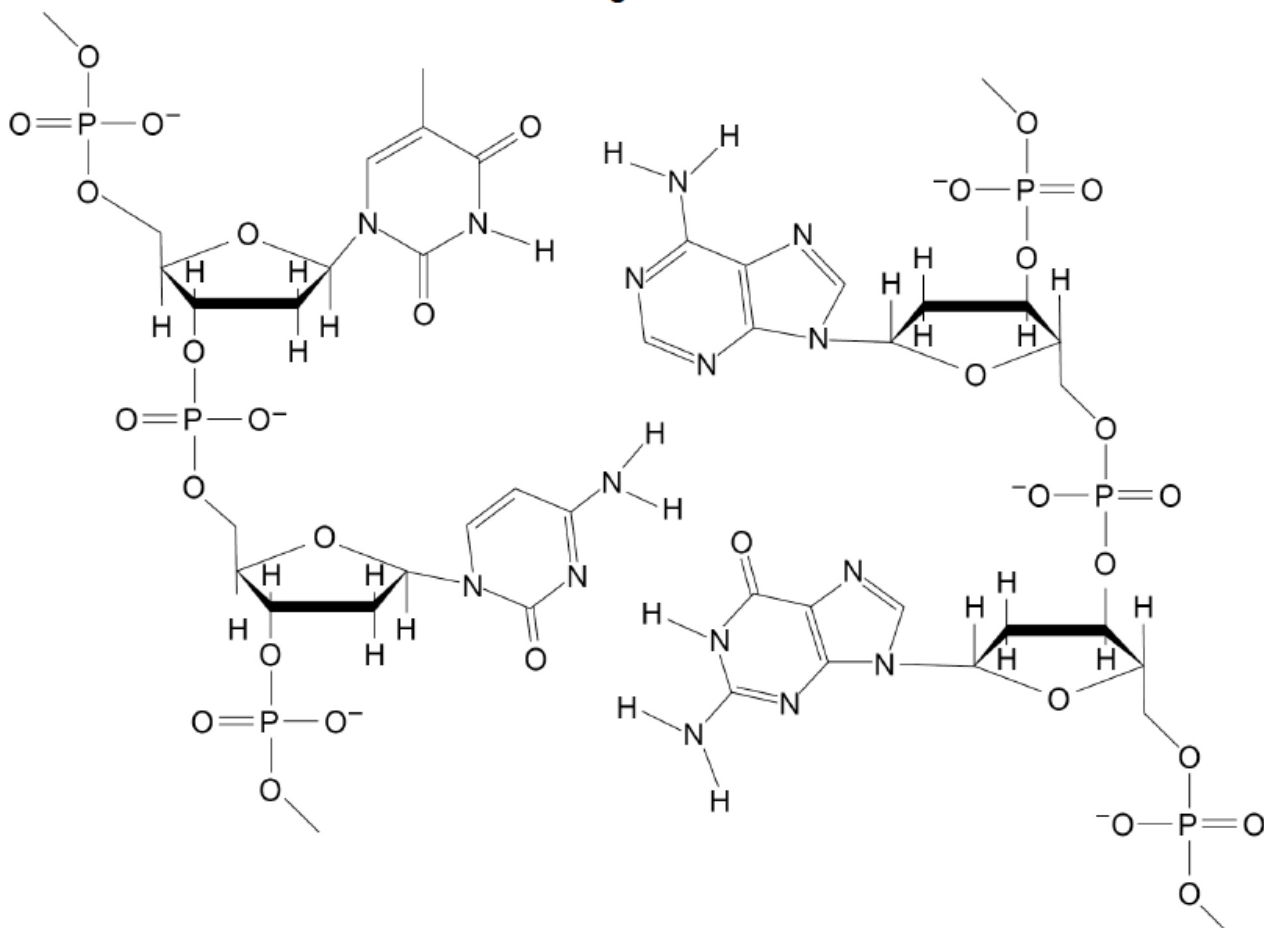
2. June/ 2019/Paper\_2/No.12

32

1 2

Figure 4 shows two complementary strands in part of a DNA double helix structure.

Figure 4



1 2 . 1

Draw all the hydrogen bonds between the complementary strands shown in Figure 4.

Use dashed lines to show the hydrogen bonds.  
You do **not** need to show lone pairs of electrons or partial charges.

[2 marks]

1 2 . 2

Draw a ring around each of the component parts that make up the cytosine nucleotide in the section of DNA shown in Figure 4.

[2 marks]

1 2 . 3

State the meaning of the term complementary when it is used to refer to DNA strands.

[1 mark]

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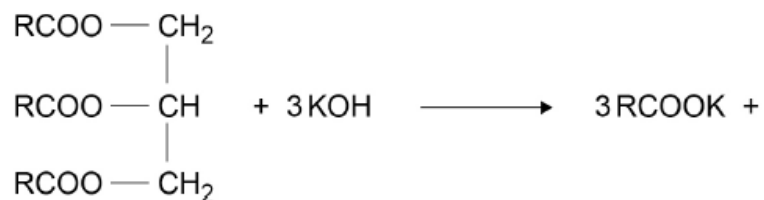


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## 3. June/2021/Paper\_2/No.1

0 1

Coconut oil contains a triester with three identical R groups.  
This triester reacts with potassium hydroxide.



0 1 . 1

Complete the equation by drawing the structure of the other product of this reaction in the box.

Name the type of compound shown by the formula RCOOK

Give one use for this type of compound.

[3 marks]

Type of compound \_\_\_\_\_

Use \_\_\_\_\_

0 1 . 2

The triester in coconut oil has a relative molecular mass,  $M_r = 638.0$   
In the equation shown at the start of Question 01, R represents an alkyl group that can be written as  $\text{CH}_3(\text{CH}_2)_n$

Deduce the value of n in  $\text{CH}_3(\text{CH}_2)_n$   
Show your working.

[3 marks]

n \_\_\_\_\_

0 1 . 3

A 1.450 g sample of coconut oil is heated with 0.421 g of KOH in aqueous ethanol until all of the triester is hydrolysed.

The mixture is cooled.

The remaining KOH is neutralised by exactly 15.65 cm<sup>3</sup> of 0.100 mol dm<sup>-3</sup> HCl

Calculate the percentage by mass of the triester ( $M_r = 638.0$ ) in the coconut oil.

**[6 marks]**

Percentage by mass \_\_\_\_\_

0 1 . 4

Suggest why aqueous ethanol is a suitable solvent when heating the coconut oil with KOH.

Give a safety precaution used when heating the mixture.  
Justify your choice.

**[3 marks]**

Reason \_\_\_\_\_

\_\_\_\_\_

Safety precaution \_\_\_\_\_

\_\_\_\_\_

Justification \_\_\_\_\_

\_\_\_\_\_