A LEVEL CHEMISTRY

TOPIC 17 – CARBOXYLIC ACIDS, AMINES, ESTERS AND ACYLATION

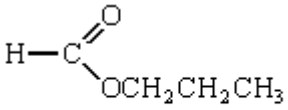
TEST

Answer all questions

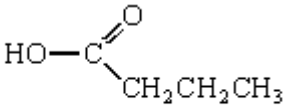
Max 50 marks

Name ……..
Mark ……../50 ……....% Grade ……

1. (a) Consider the following pair of isomers.



C



D

(i) Name compound **C**.

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(ii) Identify a reagent which could be used in a test-tube reaction to distinguish between **C** and **D**. In each case, state what you would observe.

Reagent .....

*Observation with **C*** .....

*Observation with **D***.....

(4)
(Total 4 marks)

2. (a) Write an equation for the formation of methyl propanoate, $CH_3CH_2COOCH_3$, from methanol and propanoic acid.

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(1)

(b) Name and outline a mechanism for the reaction between methanol and propanoyl chloride to form methyl propanoate.

Name of mechanism .....

Mechanism

(5)

(c) Propanoic anhydride could be used instead of propanoyl chloride in the preparation of methyl propanoate from methanol. Draw the structure of propanoic anhydride.

(1)

(d) (i) Give **one** advantage of the use of propanoyl chloride instead of propanoic acid in the laboratory preparation of methyl propanoate from methanol.

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(ii) Give **one** advantage of the use of propanoic anhydride instead of propanoyl chloride in the industrial manufacture of methyl propanoate from methanol.

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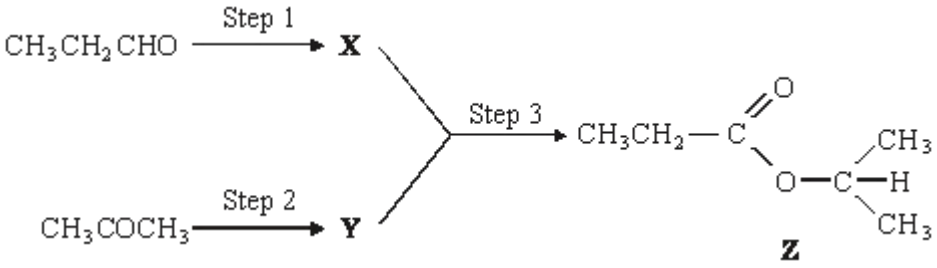
(2)
(Total 9 marks)

3. Compound **Z** can be produced by the reaction of compound **X** with compound **Y** as shown in the synthesis outlined below:



Identify compounds **X** and **Y**.
For each of the three steps in the synthesis, name the type of reaction involved and give reagents and conditions. Equations are **not** required.

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(10)
(Total 10 marks)

p

4. This question is about the primary amine $CH_3CH_2CH_2NH_2$

(a) The amine $CH_3CH_2CH_2NH_2$ reacts with CH_3COCl

Name and outline a mechanism for this reaction.

Give the IUPAC name of the organic product.

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(6)

(b) Isomers of $CH_3CH_2CH_2NH_2$ include another primary amine, a secondary amine and a tertiary amine.

(i) Draw the structures of these **three** isomers.
Label each structure as primary, secondary or tertiary.

(3)

(ii) Use **Table 1** on the Data Sheet to explain how you could use infrared spectra in the range outside the fingerprint region to distinguish between the secondary amine and the tertiary amine.

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(2)

(c) The amine $CH_3CH_2CH_2NH_2$ can be prepared by two different routes.

Route **A** is a two-stage process and starts from CH_3CH_2Br.

Route **B** is a one-stage process and starts from $CH_3CH_2CH_2Br$.

(i) Identify the intermediate compound in Route **A**.

Give the reagents and conditions for both stages in Route **A** and the single stage in Route **B**.

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(7)

(ii) Give **one** disadvantage of Route **A** and **one** disadvantage of Route **B**.

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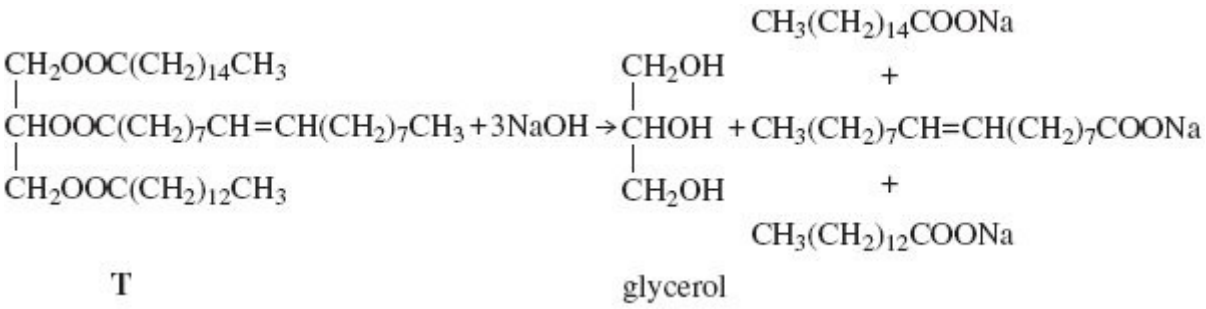
(2)

(Total 20 marks)

5. The triester, **T**, shown below is found in palm oil. When **T** is heated with an excess of sodium hydroxide solution, the alcohol glycerol is formed together with a mixture of three other products as shown in the following equation.



T glycerol

(a) (i) Give the IUPAC name for glycerol.

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(1)

(ii) Give a use for the mixture of sodium salts formed in this reaction.

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(1)

(b) When **T** is heated with an excess of methanol, glycerol is formed together with a mixture of methyl esters.

(i) Give a use for this mixture of methyl esters.

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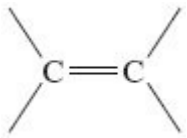
(1)

(ii) One of the methyl esters in the mixture has the IUPAC name methyl (*Z*)-octadec-9-enoate. Draw **two** hydrogen atoms on the diagram below to illustrate the meaning of the letter *Z* in the name of this ester.



(1)

(iii) One of the other methyl esters in the mixture has the formula $CH_3(CH_2)_{12}COOCH_3$
Write an equation for the complete combustion of one molecule of this ester.

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(1)
(Total 5 marks)

6. Describe briefly how you could measure the melting point of aspirin.

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(Total 2 marks)