

“Too much alcohol”

Y13 UNIT 4 TEST 3

4.4 NOMENCLATURE AND ISOMERISM IN ORGANIC CHEMISTRY

4.5 COMPOUNDS CONTAINING THE CARBONYL GROUP

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Answer all questions

Total 53 marks

Name:.....


Mark for section A..... /38

Mark for section B..... /15

Total: /53

Grade.....

SECTION A

1. The two functional groups in compound **A**,  CHO, behave independently.

- (a) State what would be observed if a few drops of compound **A** were added to Fehling's solution and heated. Give the structure of the organic reaction product.

Observation

Structure

(2)

- (b) Using RCHO to represent compound A, write an equation for the reaction between RCHO and hydrogen cyanide. State the type of reaction taking place and outline a mechanism.

Equation

Type of reaction

Mechanism

(5)

- (c) State the type of isomerism shown by 2-hydroxypropanoic (*lactic*) acid, $\text{CH}_3\text{CH}(\text{OH})\text{COOH}$, and point out the structural feature of the molecule which causes the existence of two isomers. With the aid of diagrams, show the structural relationship between the two isomers and state how these isomers can be distinguished.

Type of isomerism

Structural feature

Isomer 1

Isomer 2

Method of distinguishing

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(5)

(Total 12 marks)

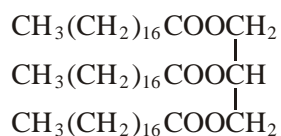
2. (a) Compound A, $\text{HCOOCH}_2\text{CH}_2\text{CH}_3$, is an ester. Name this ester and write an equation for its reaction with aqueous sodium hydroxide.

Name

Equation

(2)

- (d) A naturally-occurring triester, shown below, was heated under reflux with an excess of aqueous sodium hydroxide and the mixture produced was then distilled. One of the products distilled off and the other was left in the distillation flask.



- (i) Draw the structure of the product distilled off and give its name.

Structure

Name

- (ii) Give the formula of the product left in the distillation flask and give a use for it.

Formula

Use

(4)

(Total 6 marks)

3. (a) **P**, **Q** and **R** have the molecular formula C_6H_{12}

All three are branched-chain molecules and none is cyclic.

P can represent a pair of optical isomers.

Q can represent a pair of geometrical isomers.

R can represent another pair of geometrical isomers different from **Q**.

Draw one possible structure for one of the isomers of each of **P**, **Q** and **R**.

Structure of P

Structure of Q

Structure of R

(3)

- (b) Butanone reacts with reagent **S** to form compound **T** which exists as a racemic mixture. Dehydration of **T** forms **U**, C_5H_7N , which can represent a pair of geometrical isomers.

- (i) State the meaning of the term *racemic mixture* and suggest why such a mixture is formed in this reaction.

Racemic mixture

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Explanation.....

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- (ii) Identify reagent **S**, and draw a structural formula for each of **T** and **U**.

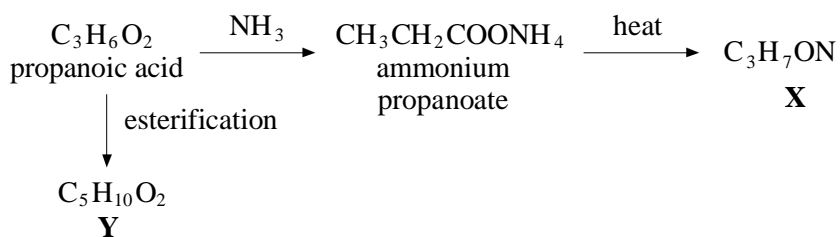
Reagent S

Compound T

Compound U

(6)
(Total 9 marks)

4. Consider the following reaction scheme and then answer the questions below.



- (a) Draw the graphical formula of propanoic acid.

(1)

- (b) Propanoic acid may be converted into compound **Y** by an esterification reaction.

- (i) Give the reagent(s) and condition(s) required for the formation of compound **Y** from propanoic acid.

Reagent(s)

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Condition(s)

.....

(3)

- (ii) Give the name of compound **Y**.

.....

(1)

- (iii) Write an equation for the esterification reaction.

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(2)

- (c) Propyl ethanoate is an ester that is structurally isomeric with compound **Y**. When propyl ethanoate is heated with aqueous sodium hydroxide, two products are formed.

(i) Explain what is meant by the term *structural isomerism*.

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(2)

(ii) Give the names or structures of the two products of this reaction.

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.....

(2)

(Total 11 marks)

SECTION B

5. There are several non-cyclic structural isomers with the molecular formula C_6H_{12} .
- (a) One of these isomers, 2-methylpent-2-ene, $(CH_3)_2C=CHCH_2CH_3$, reacts with hydrogen bromide. Name the major product and account for its formation by reference to the mechanism of the reaction. (7)
- (b) Identify one linear alkene of formula C_6H_{12} which can exist as a pair of stereoisomers. State the type of stereoisomerism shown, name the alkene and draw the structures of the two isomers. (4)
- (c) One of the branched, non-cyclic structural isomers of C_6H_{12} can exhibit a different type of stereoisomerism from that shown in part (b). State the type of stereoisomerism shown, name the alkene and draw the two structures. (4)
- (Total 15 marks)

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