**A LEVEL CHEMISTRY**

**TOPIC 16 – ALDEHYDES, KETONES AND OPTICAL ISOMERISM**

**TEST**

Answer all questions

Max 50 marks

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

**SECTION A**

**1.**     (a)     (i)      Give a suitable reagent and state the necessary conditions for the conversion of propan-2-ol into propanone. Name the type of reaction.

*Reagent* ..............................................................................................

*Conditions* ...........................................................................................

*Type of reaction* ...................................................................................

(ii)     Propanone can be converted back into propan-2-ol. Give a suitable reagent and write an equation for this reaction.
(Use [H] to represent the reagent in your equation.)

*Reagent* ...............................................................................................

*Equation*

.............................................................................................................

**(5)**

(b)     Propanal is an isomer of propanone.

(i)      Draw the structure of propanal.

(ii)     A chemical test can be used to distinguish between separate samples of propanone and propanal. Give a suitable reagent for the test and describe what you would observe with propanone and with propanal.

*Test reagent* .........................................................................................

*Observation with propanone* ................................................................

*Observation with propanone* ................................................................

**(4)**

**(Total 9 marks)**

**2.**          Consider the sequence of reactions below.



(a)     Name and outline a mechanism for Reaction **1**.

*Name of mechanism* ....................................................................................................

*Mechanism*

**(5)**

(b)           Name compound **Q**

.............................................................................................................

**(1)**

(c)     Draw the structure of the main organic product formed in each case when **R** reacts separately with the following substances:

(ii)     acidified potassium dichromate(VI);

(iii)     concentrated sulphuric acid in an elimination reaction.

**(2)**

**(Total 8 marks)**

**3.**      The reducing agent in the following conversion is NaBH4



(i)      Name and outline a mechanism for the reaction.

Name of mechanism ............................................................................

Mechanism

**(5)**

(ii)     By considering the mechanism of this reaction, explain why the product formed is optically inactive.

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**(3)**

**(Total 8 marks)**

**4.**          (a)     **P**, **Q** and **R** have the molecular formula C6H12

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**, C5H7N, 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)**

**5.**          Compounds **C** and **D**, shown below, are isomers of C5H10O

 

**C                                          D**

(a)     Name compound **C**.

......................................................................................................................

**(1)**

(b)     Use **Table 2** on the Data Sheet to help you to answer this question.

(i)      Suggest the wavenumber of an absorption which is present in the infra-red spectrum of **C** but not in that of **D**.

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(ii)     Suggest the wavenumber of an absorption which is present in the infra-red spectrum of **D** but not in that of **C**.

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**(2)**

(c)     Identify a reagent that you could use to distinguish between **C** and **D**. For each of **C** and **D**, state what you would observe when the compound is treated with this reagent.

*Reagent* .......................................................................................................

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

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

**(3)**

(d)     Compound **E**, CH3CH2CH2CH2CHO, is also an isomer of C5H10O

Identify a reagent which will react with **E** but not with **C** or **D**. State what you would observe when **E** is treated with this reagent.

*Reagent* .......................................................................................................

*Observation with* **E** .......................................................................................

**(2)**

**(Total 8 marks)**

**SECTION B**

**6.** Which one of the following reactions involves nucleophilic addition?

**A**       CH3CH = CH2 + HBr → CH3CHBrCH3

**B**       CH3CH2CH3 + Cl2 → CH3CHClCH3 + HCl

**C**       CH3CH2CH2Br + NaOH → CH3CH2CH2OH + NaBr

**D**       CH3CH2CHO + HCN → CH3CH2CH(OH)CN

**(Total 1 mark)**

**7.** Which one of the following isomers is not oxidised under mild reaction conditions?

**A**       (CH3)2CHCH(OH)COCH3

**B**       (CH3)2C(OH)CH2COCH3

**C**       (CH3)2CHCH(OH)CH2CHO

**D**       (CH3)2C(OH)CH2CH2CHO

**(Total 1 mark)**

**8.** In which one of the following are the curly arrows **not** used correctly?

**A**        

**B**        

**C**        

**D**        

**(Total 1 mark)**

**9.** Which one of the following is **not** a suitable method for the preparation of ethanol?

**A**       oxidation of ethane

**B**       hydration of ethene

**C**       reduction of ethanal

**D**       hydrolysis of bromoethane

**(Total 1 mark)**

**10.** Which one of the following will undergo nucleophilic addition?

**A**       hex-3-ene

**B**       hexan-3-one

**C**       3-bromohexane

**D**       hexan-3-ol

**(Total 1 mark)**

**11.** How many structural isomers, which are aldehydes, have the molecular formula C5H10O?

**A**       2

**B**       3

**C**       4

**D**       5

**(Total 1 mark)**

**12.** On reduction, a racemate can be formed by

**A**       CH3CH2CH2CH2CHO

**B**       CH3CH2CH2COCH3

**C**       CH3CH2COCH2CH3

**D**       CH3CH=CHCH2CHO

**(Total 1 mark)**

**13.** The compound lithium tetrahydridoaluminate(III), LiAlH4, is a useful reducing agent. It behaves in a similar fashion to NaBH4. Carbonyl compounds and carboxylic acids are reduced to alcohols. However, LiAlH4 also reduces water in a violent reaction so that it must be used in an organic solvent.

Which one of the following can be reduced by LiAlH4 to a primary alcohol?

**A**        

**B**        

**C**        

**D**        

**(Total 1 mark)**