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70 Minutes

Time allowed

2002

CHEMISTRY

Topic Questions

AQA AS & A LEVEL

Percentage

%

3.3 Organic chemistry

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Score

/59



(a) Describe how propanal, CH₃CH₂CHO, and propanone, CH₃COCH₃, can be distinguished using

- (i) a chemical test and
- (ii) the number of peaks in their proton n.m.r. spectra.

(5)

(b) 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.

(10) (Total 15 marks)

2

Compound ${\bf Z}$ can be formed via compounds ${\bf X}$ and ${\bf Y}$ in the three step synthesis shown below.

Identify compounds X and Y and give reagents and conditions for Steps 1 and 2.

State the **type** of compound of which **Z** is an example.

Compound Z reacts with a large excess of bromomethane to form a solid product. Draw

the structure of this product and name the type of mechanism for this reaction.

(Total 9 marks)





(b) NaBH₄ is a possible reagent for Reaction 2. Name and outline the mechanism for the reaction with NaBH₄ in Reaction 2. Name the product of Reaction 2.

(6)

(c) Name the type of reaction involved in Reaction **3** and give a reagent for the reaction.

(2) (Total 14 marks)





Use the data given on the back of the Periodic Table (PT) to help you answer this question.

Compounds **A** to **G** are all isomers with the molecular formula $C_6H_{12}O_2$

(a) Isomer A, C₆H₁₂O₂, is a neutral compound and is formed by the reaction between compounds X and Y in the presence of a small amount of concentrated sulphuric acid.
X and Y can both be formed from propanal by different redox reactions.
X has an absorption in its infra-red spectrum at 1750 cm⁻¹.
Deduce the structural formulae of A, X and Y. Give suitable reagents, in each case, for the formation of X and Y from propanal and state the role of concentrated sulphuric acid in the formation of A.
(b) Isomers B, C, D and E all react with aqueous sodium carbonate to produce carbon

(7)

b) Isomers B, C, D and E all react with aqueous sodium carbonate to produce carbon dioxide.
 Deduce the structural formulae of the three isomers that contain an asymmetric carbon atom.

The fourth isomer has only three singlet peaks in its proton n.m.r. spectrum. Deduce



the structural formula of this isomer and label it E.

(c) Isomer **F**, C₆H₁₂O₂, has the structural formula shown below, on which some of the protons have been labelled.

$$a$$
 b \parallel
CH₃-CH₂-O-CH₂-CH₂-CH₃

A proton n.m.r. spectrum is obtained for **F**. Using Table 1 at the back of the Periodic Table (PT), predict a value of δ for the protons labelled *a* and also for those labelled *b*. State and account for the splitting patterns of the peaks assigned to the protons *a* and *b*.

(4)

(d) Isomer G, C₆H₁₂O₂, contains six carbon atoms in a ring. It has an absorption in its infra-red spectrum at 3270 cm⁻¹ and shows only three different proton environments in its proton n.m.r. spectrum. Deduce a structural formula for G.



This question concerns the preparation of the plastic poly(methyl 2-methylpropenoate) (*Perspex*), starting from propanone.



Which one of the following sets of reagents is not suitable for the step indicated?

- A Step 1 HCN (NaCN then dilute HCI)
- B Step 2 hot ethanolic KOH
- **C** Step 3 warm aqueous H₂SO₄
- **D** Step 4 CH₃OH with an acid catalyst

(Total 1 mark)