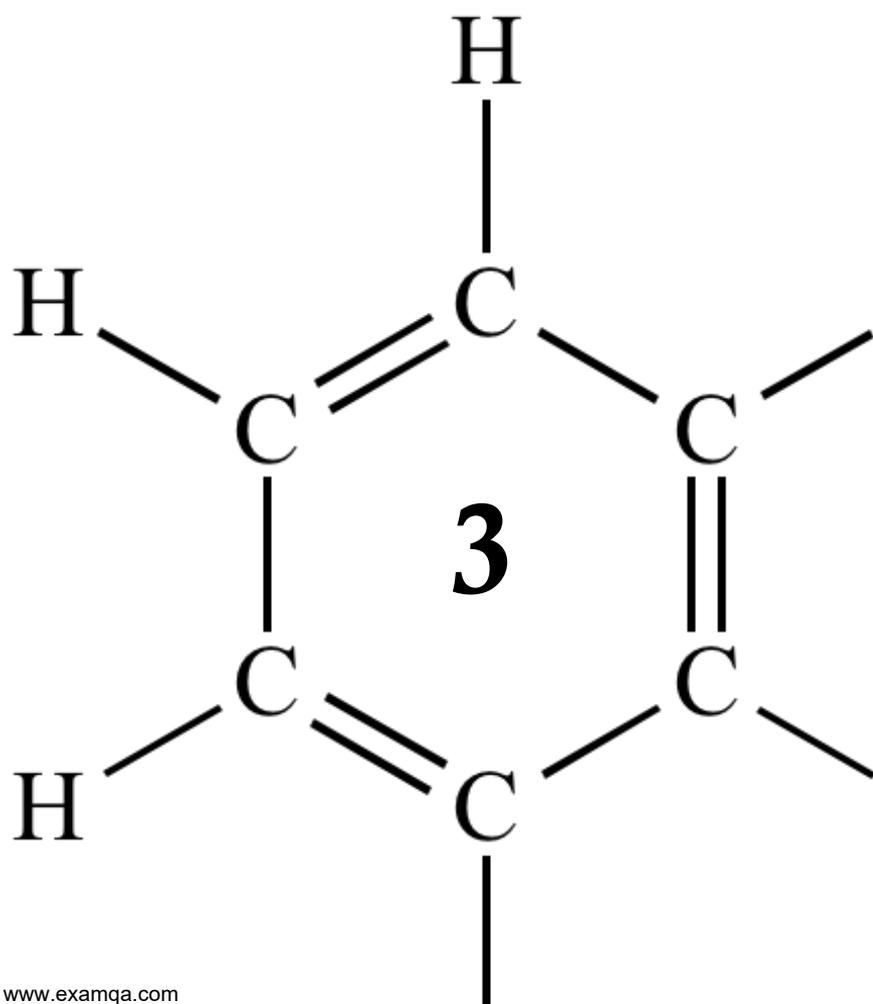


AQA A2 CHEMISTRY

ISOMERISM ~ CARBONYLS

CARBOXYLIC ACIDS + ESTERS



1

Butenedioic acid, $\text{HOOCCH}=\text{CHCOOH}$, occurs as two stereoisomers. One of the isomers readily forms the acid anhydride $\text{C}_4\text{H}_2\text{O}_3$ when warmed.

- (a) Draw the structures of the two isomers of butenedioic acid and name the type of isomerism shown.

Use the structures of the two isomeric acids to suggest why only one of them readily forms an acid anhydride when warmed. Draw the structure of the acid anhydride formed.

(6)

- (b) Identify one electrophile which will react with butenedioic acid and outline a mechanism for this reaction.

(4)

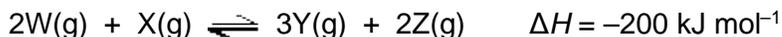
- (c) Write an equation for a reaction which occurs when butenedioic acid is treated with an excess of aqueous sodium hydroxide.

(2)

- (d) Describe and explain the appearance of the proton n.m.r. spectrum of butenedioic acid.

(3)**(Total 15 marks)****2**

- (a) The gaseous reactants **W** and **X** were sealed in a flask and the mixture left until the following equilibrium had been established.

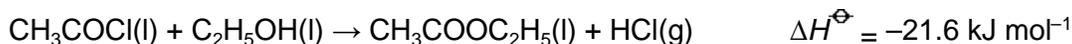


Write an expression for the equilibrium constant, K_p , for this reaction.

State one change in the conditions which would both increase the rate of reaction and decrease the value of K_p . Explain your answers.

(7)

- (b) Ethyl ethanoate can be prepared by the reactions shown below.

Reaction 1**Reaction 2**

- (i) Give one advantage and one disadvantage of preparing ethyl ethanoate by **Reaction 1** rather than by **Reaction 2**.

- (ii) Use the information given above and the data below to calculate values for the standard entropy change, ΔS^\ominus , and the standard free-energy change, ΔG^\ominus , for **Reaction 2** at 298 K.

	$\text{CH}_3\text{COCl(l)}$	$\text{C}_2\text{H}_5\text{OH(l)}$	$\text{CH}_3\text{COOC}_2\text{H}_5\text{(l)}$	HCl(g)
$S^\ominus/\text{JK}^{-1}\text{mol}^{-1}$	201	161	259	187

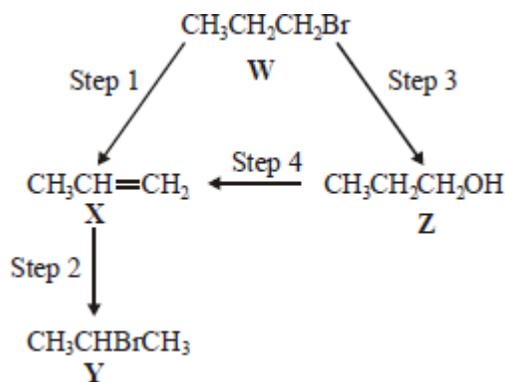
(8)
(Total 15 marks)

3 Which one of the following is **not** a correct general formula for the non-cyclic compounds listed?

- A alcohols $\text{C}_n\text{H}_{2n+2}\text{O}$
 B aldehydes $\text{C}_n\text{H}_{2n+1}\text{O}$
 C esters $\text{C}_n\text{H}_{2n}\text{O}_2$
 C primary amines $\text{C}_n\text{H}_{2n+3}\text{N}$

(Total 1 mark)

4 For this question refer to the reaction scheme below.



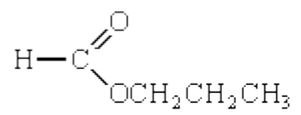
Which one of the following statements is **not** correct?

- A Reaction of **W** with sodium cyanide followed by hydrolysis of the resulting product gives propanoic acid.
 B Mild oxidation of **Z** produces a compound that reacts with Tollens' reagent, forming a silver mirror.
 C **Z** reacts with ethanoic acid to produce the ester propyl ethanoate.
 C **W** undergoes addition polymerisation to form poly(propene).

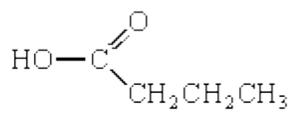
(Total 1 mark)

5

(a) Consider the following pair of isomers.



C



D

(i) Name compound **C**.

.....

(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.

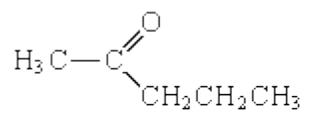
Reagent

Observation with **C**

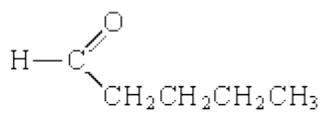
Observation with **D**.....

(4)

(b) Consider the following pair of isomers.



E



F

(i) Name compound **E**.

.....

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

Reagent

Observation with **E**

Observation with **F**.....

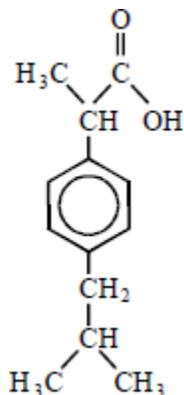
(4)

(c) Draw the structure of the chain isomer of **F** which shows optical isomerism.

(1)
(Total 9 marks)

6

Ibuprofen is a drug used as an alternative to aspirin for the relief of pain, fever and inflammation. The structure of ibuprofen is shown below.



Which one of the following statements is **not** correct?

- A It has optical isomers.
- B It liberates carbon dioxide with sodium carbonate solution.
- D It undergoes esterification with ethanol.
- D It undergoes oxidation with acidified potassium dichromate(VI).

(Total 1 mark)

7

Butan-1-ol was converted into butyl propanoate by reaction with an excess of propanoic acid. In the reaction, 6.0 g of the alcohol gave 7.4 g of the ester. The percentage yield of ester was

- A 57
- B 70
- C 75
- D 81

(Total 1 mark)