Q1. Which one of the following **cannot** be produced by oxidation of propan-l-ol?

A carbon dioxide

B propanone

C propanal

D propanoic acid

(Total 1 mark)

Q2. Which one of the following isomers is not oxidised under mild reaction conditions?

A $(CH_3)_2CHCH(OH)COCH_3$

B $(CH_3)_2C(OH)CH_2COCH_3$

C $(CH_3)_2CHCH(OH)CH_2CHO$

D $(CH_3)_2C(OH)CH_2CH_2CHO$

(Total 1 mark)

Q3. Which one of the following does **not** represent an oxidation?

A propene → propane

B propan-l-ol → propanal

C propan-l-ol → propanoic acid

D propanal → propanoic acid

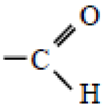
(Total 1 mark)

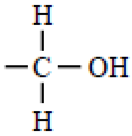
Q4. Certain chemical tests were performed on the pain-relief drug ibuprofen. The results of these tests are given in the table below.

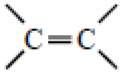
Test	**Result**
Aqueous sodium carbonate	Effervescence

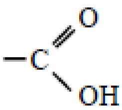
Bromine water	Remained orange
Acidified potassium dichromate(VI) and heat	Remained orange
Fehling's solution and heat	Remained blue

Which one of the following functional groups do these results suggest that ibuprofen contains?

A 

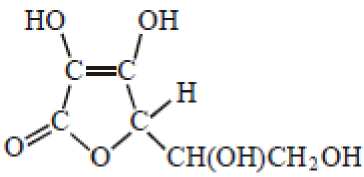
B 

C 

D 

(Total 1 mark)

Q5. Which one of the following is **not** a correct statement about vitamin C, shown below?



A It is a cyclic ester.

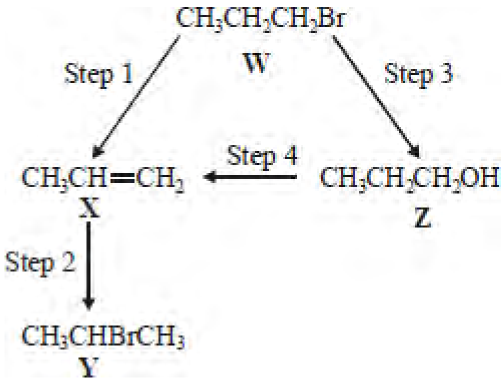
B It can form a carboxylic acid on oxidation.

C It decolourises a solution of bromine in water.

D It is a planar molecule.

(Total 1 mark)

Q6. 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)

Q7. (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)

Q8. Some alcohols can be oxidised to form aldehydes, which can then be oxidised further to form carboxylic acids.
Some alcohols can be oxidised to form ketones, which resist further oxidation.
Other alcohols are resistant to oxidation.

(a) Draw the structures of the **two** straight-chain isomeric alcohols with molecular formula, $C_4H_{10}O$

(2)

(b) Draw the structures of the oxidation products obtained when the two alcohols from part (a) are oxidised separately by acidified potassium dichromate(VI). Write equations for any reactions which occur, using [O] to represent the oxidising agent.

(6)

(c) Draw the structure and give the name of the alcohol with molecular formula $C_4H_{10}O$ which is resistant to oxidation by acidified potassium dichromate(VI).

(2)
(Total 10 marks)

Q9. Consider the following reaction schemes involving two alcohols, **A** and **B**, which are position isomers of each other.

$$\underset{\textbf{A}}{CH_3CH_2CH_2CH_2OH} \rightarrow \underset{\text{butanal}}{CH_3CH_2CH_2CHO} \rightarrow \underset{\text{butanoic acid}}{CH_3CH_2CH_2COOH}$$

$$\underset{\textbf{B}}{CH_3CH_2CH(OH)CH_3} \rightarrow \underset{\textbf{C}}{CH_3CH_2COCH_3}$$

(a) State what is meant by the term *position isomers*.

....

....

....

(2)

(b) Name compound **A** and compound **C**.

*Compound **A*** ....

*Compound **C*** ....

(2)

(c) Each of the reactions shown in the schemes above is of the same type and uses the same combination of reagents.

(i) State the type of reaction.

....

(ii) Identify a suitable combination of reagents.

....

(iii) State how you would ensure that compound **A** is converted into butanoic acid rather than into butanal.

....

....

(iv) Draw the structure of an isomer of compound **A** which does not react with this combination of reagents.

(v) Draw the structure of the carboxylic acid formed by the reaction of methanol with this combination of reagents.

(6)

(d) (i) State a reagent which could be used to distinguish between butanal and compound **C**.

....

(ii) Draw the structure of another aldehyde which is an isomer of butanal.

(2)
(Total 12 marks)

Q10. This question concerns four isomers, **W**, **X**, **Y** and **Z**, with the molecular formula $C_5H_{10}O_2$

(a) The proton n.m.r. spectrum of **W** shows 4 peaks.
The table below gives the chemical shifts, δ values, for each of these peaks, together with their splitting patterns and integration values.

δ/ppm	2.18	2.59	3.33	3.64
Splitting pattern	singlet	triplet	singlet	triplet
Integration value	3	2	3	2

State what can be deduced about the structure of **W** from the presence of the following in its n.m.r. spectrum.

(i) The singlet peak at δ = 2.18

....

(ii) The singlet peak at δ = 3.33

....

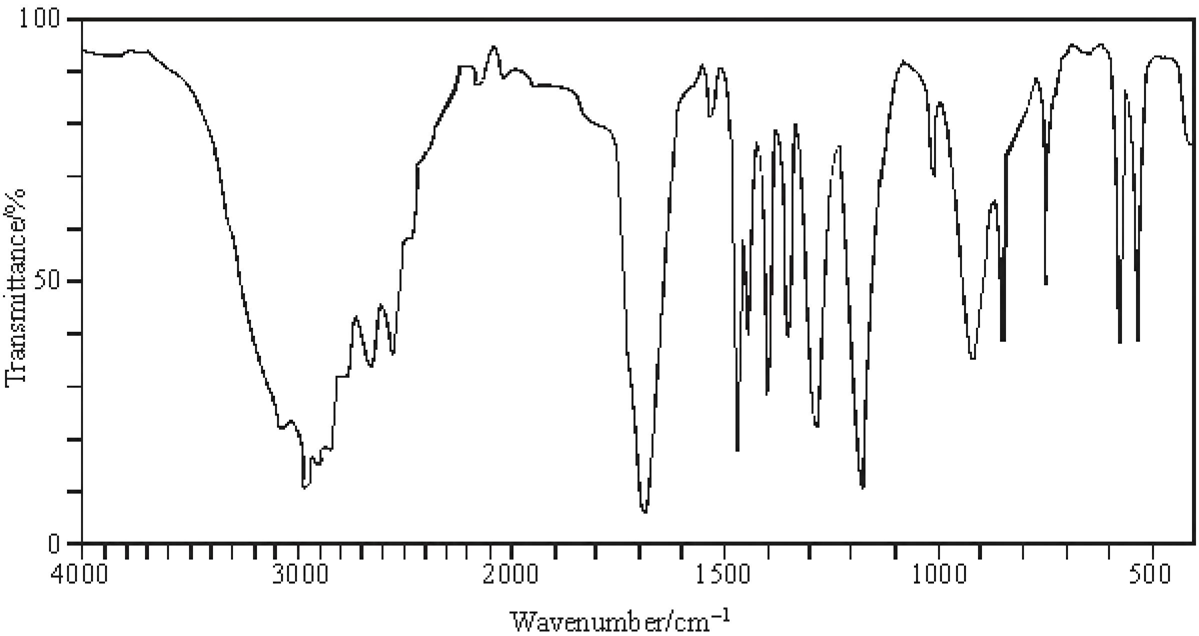
(iii) Two triplet peaks.

....

(iv) Hence, deduce the structure of **W**.

(4)

(b) The infra-red spectrum of **X** is shown below.



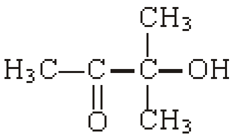
(i) What can be deduced from the broad absorption centred on 3000 cm^{-1} in the infra-red spectrum of **X**?

....

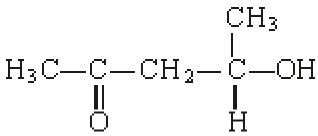
(ii) Given that the proton n.m.r. spectrum of **X** contains only two peaks with the integration ratio 9:1, deduce the structure of **X**.

(2)

(c) Isomers **Y** and **Z** have the structures shown below.



Y



Z

Identify the two reagents you could use in a simple chemical test to distinguish between **Y** and **Z**. State what you would observe when each of **Y** and **Z** is tested with a mixture of these two reagents.

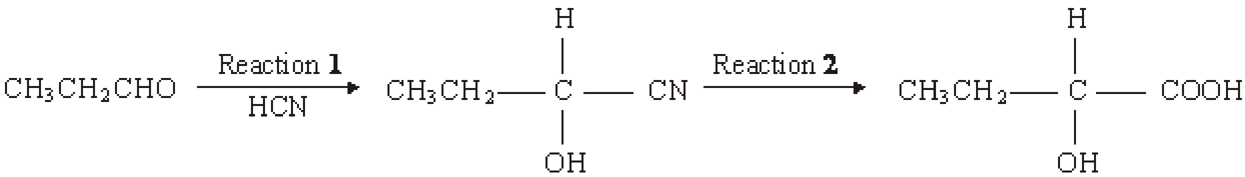
Reagents ....

*Observation with **Y*** ....

*Observation with **Z*** ....

(3)
(Total 9 marks)

Q11. Consider the sequence of reactions below.



P **Q** **R**

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

Name of mechanism ....

Mechanism

(5)

(b) (i) Name compound **Q**

....

(ii) The molecular formula of **Q** is C_4H_7NO. Draw the structure of the isomer of **Q** which shows geometrical isomerism and is formed by the reaction of ammonia with an acyl chloride.

(3)

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

(i) methanol in the presence of a few drops of concentrated sulphuric acid;

(ii) acidified potassium dichromate(VI);

(iii) concentrated sulphuric acid in an elimination reaction.

(3)
(Total 11 marks)