Carbonyls and Optical Isomerism Practice Test

Mr Cole Chemistry

Name ..... Class: .....

Start Time ..... End Time ..... Time Taken .....

Time allowed: 44 minutes

INSTRUCTIONS TO CANDIDATES

- This document is designed to be used as a practice test.
- Complete the test under exam conditions in one sitting.
- Mark the test using the mark scheme make corrections on the paper.
- Complete the table on the front page.
- Use this as an opportunity to determine what you do and do not know in the topic.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets at the end of each question or part of a question.
- The marks allocated and the spaces provided for your answers are a good indication of the length of answers required.
- You may use a data book.

Success Criteria	**Questions in Paper**	**Mark**	**Out of**	**%**	**Rank Order**
Reduction of Carbonyls	1a, 3a		11		
Chemical Tests for Carbonyls	1b, 8, 9		4		
Carbonyls and Cyanide	2a, 7		6		
Oxidation of Alcohols	2bi		1		
EZ Isomerism	2bii		3		
Optical Activity	3b, 4bi, 5, 6		8		
Drawing Isomers from molecular formula	4a		3		
Elimination of Alcohols	4bii		3		
Total			39		

Q1.

Aqueous $NaBH_4$ reduces aldehydes but does not reduce alkenes.

(a) Show the first step of the mechanism of the reaction between $NaBH_4$ and 2-methylbutanal.
You should include two curly arrows.

Explain why $NaBH_4$ reduces 2-methylbutanal but has no reaction with 2-methylbut-1-ene.

First step of mechanism

Explanation _____

_____

_____

_____

_____

_____

_____

(5)

(b) A student attempted to reduce a sample of 2-methylbutanal but added insufficient $NaBH_4$
The student confirmed that the reduction was incomplete by using a chemical test.

Give the reagent and observation for the chemical test.

Reagent _____

_____

Observation _____

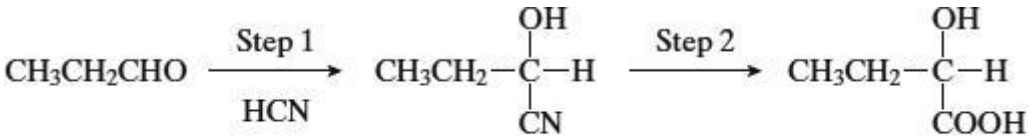
_____

(2)

(Total 7 marks)

Q2.

Consider the reaction sequence shown below.



propanal Q

(a) Name and outline a mechanism for the reaction in Step 1.

Name of mechanism _____

Mechanism

(5)

(b) (i) Name compound **Q** formed in Step 2.

_____

(ii) Two stereoisomers are formed by the dehydration of **Q**. Give the structures of these two isomers and name the type of stereoisomerism shown.

Structures of isomers

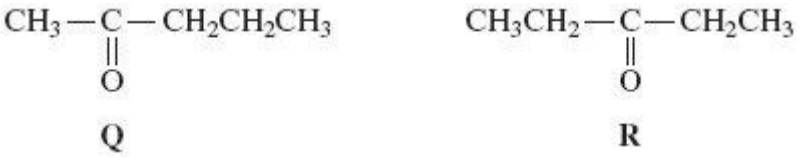
Type of stereoisomerism _____

(4)

(Total 9 marks)

Q3.

Two isomeric ketones are shown below.



Q **R**

(a) Name and outline a mechanism for the reaction of compound **Q** with HCN and name the product formed.

Name of mechanism _____

Mechanism

Name of product _____

(6)

(b) Some students were asked to suggest methods to distinguish between isomers **Q** and **R**.

One student suggested testing the optical activity of the products formed when **Q** and **R** were reacted separately with HCN.

By considering the optical activity of these products formed from **Q** and **R**, explain why this method would **not** distinguish between **Q** and **R**.

_____

_____

_____

_____

_____

(3)

(Total 9 marks)

Q4.

(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 _____

_____

Explanation _____

_____

_____

(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)

Q5.

Which one of the following reaction mixtures would give a product capable of exhibiting optical isomerism?

A $CH_3CH{=}CH_2$ + HBr

B $CH_3CH_2CH_2Br$ + NaOH

C $CH_3CH_2CH_2OH$ + H_2SO_4

D CH_3CH_2 CHO + HCN

(Total 1 mark)

Q6.

On reduction, a racemate can be formed by

A $CH_3CH_2CH_2CH_2CHO$

B $CH_3CH_2CH_2COCH_3$

C $CH_3CH_2COCH_2CH_3$

D $CH_3CH=CHCH_2CHO$

(Total 1 mark)

Q7.

Which one of the following reactions involves nucleophilic addition?

A $CH_3CH = CH_2 + HBr \rightarrow CH_3CHBrCH_3$

B $CH_3CH_2CH_3 + Cl_2 \rightarrow CH_3CHClCH_3 + HCl$

C $CH_3CH_2CH_2Br + NaOH \rightarrow CH_3CH_2CH_2OH + NaBr$

D $CH_3CH_2CHO + HCN \rightarrow CH_3CH_2CH(OH)CN$

(Total 1 mark)

Q8.

In which one of the following mixtures does a redox reaction occur?

A ethanal and Tollens' reagent

B ethanoyl chloride and ethanol

C ethanal and hydrogen cyanide

D ethanoic acid and sodium hydroxide

(Total 1 mark)

Q9.

How many structural isomers with the molecular formula $C_5H_{10}O$ react with Tollens' reagent?

A 3 ⬭

B 4 ⬭

C 5 ⬭

D 6 ⬭

(Total 1 mark)