

Alcohols

Question Paper 1

Level	International A Level
Subject	Chemistry
Exam Board	CIE
Topic	Hydroxy Compounds
Sub-Topic	Alcohols
Paper Type	Theory
Booklet	Question Paper 1

Time Allowed: 72 minutes

Score: /60

Percentage: /100

Grade Boundaries:

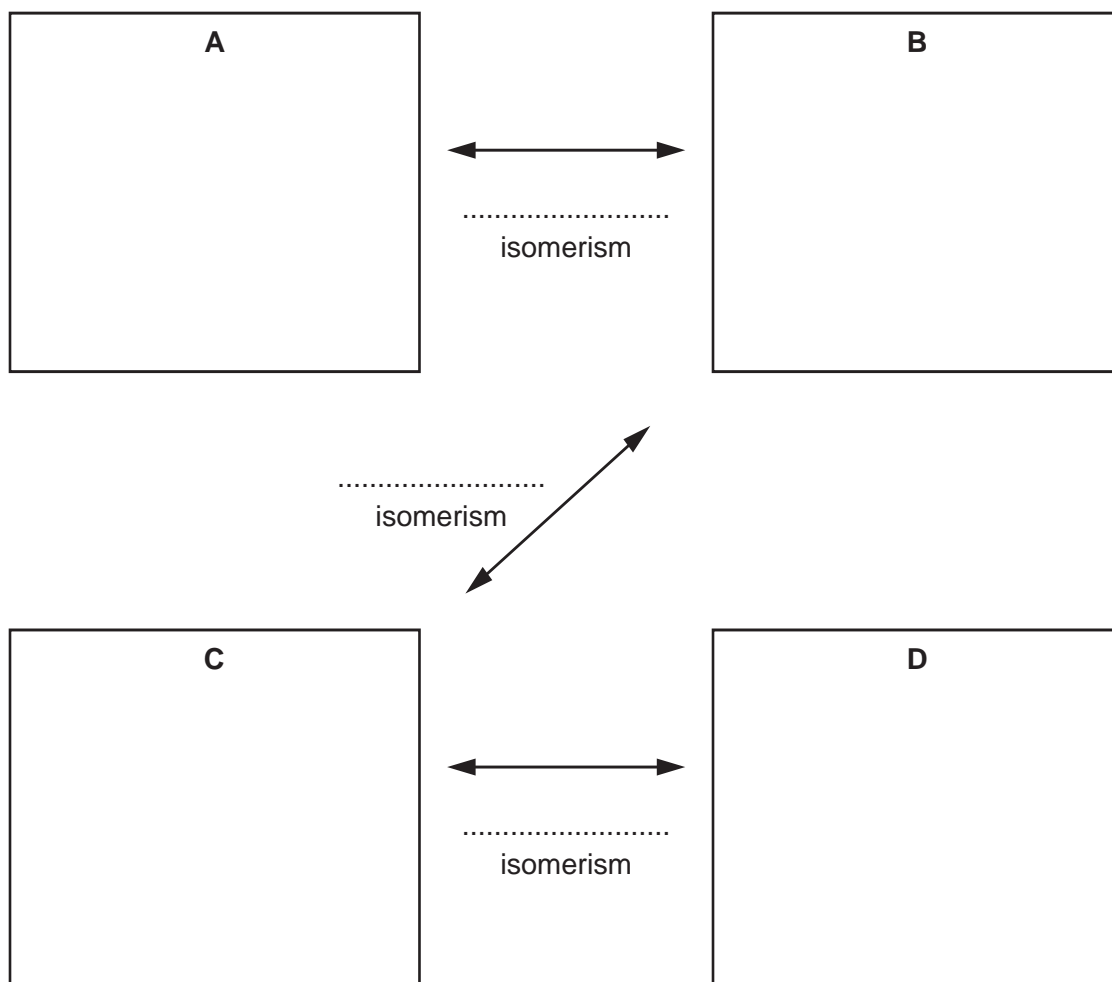
A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

- 1 There are four alcohols, **A**, **B**, **C** and **D**, which are structural isomers with the molecular formula $C_4H_{10}O$.

Alcohol **A** does not react with acidified potassium dichromate(VI) solution but **B**, **C** and **D** do.

All four alcohols react with hot, concentrated sulfuric acid to form products with the molecular formula C_4H_8 . **A**, **C** and **D** each give a single product in this reaction. **B** gives a mixture of two structural isomers, one of which shows stereoisomerism.

- (a) Give the **skeletal** formula for each of the four alcohols and complete the diagram with the names of the types of structural isomerism shown by each linked pair of compounds.



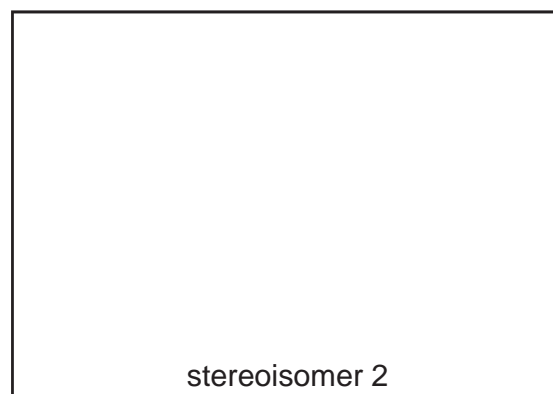
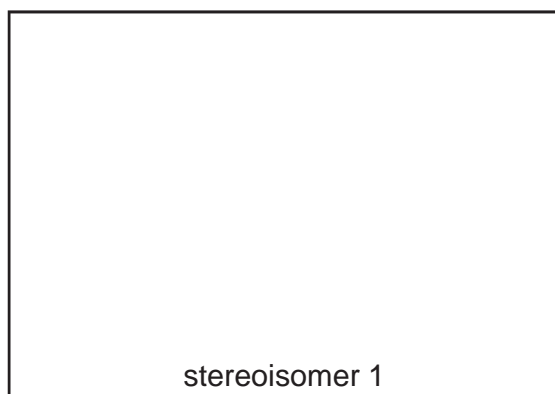
- (b) Give the names of the two structural isomers produced by the reaction of **B** with hot, concentrated sulfuric acid

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- (ii) State which of these two isomers shows stereoisomerism. Explain why this molecule is capable of showing stereoisomerism.

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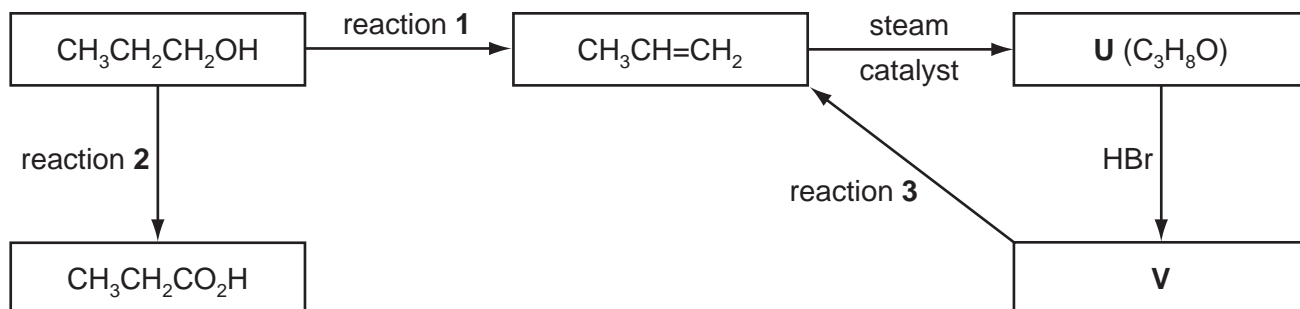
- (iii) Draw **displayed** formulae to show the two stereoisomers.



[2]

[Total: 13]

2 A series of reactions based on propan-1-ol is shown.



(a) Suggest a suitable reagent and conditions for reaction 1.

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(b) Write an equation for reaction 2, using [O] to represent the oxidising agent.

..... [1]

(ii) Suggest a suitable reagent and conditions for reaction 2.

..... [2]

(c) Give the structural formulae of **U** and **V**.

U

V

[2]

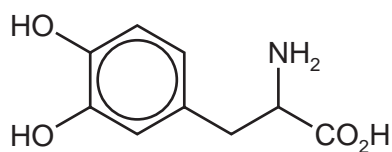
(d) Suggest a suitable reagent and conditions for reaction 3.

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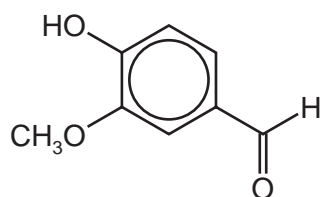
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[Total: 9]

- 3 L-DOPA is used in the treatment of Parkinson's disease. It can be prepared from vanillin.



L-DOPA



vanillin

- (a) L-DOPA and vanillin each contain an aromatic benzene ring.
Describe, with the aid of a diagram, the bonding and shape of a molecule of benzene, C₆H₆.

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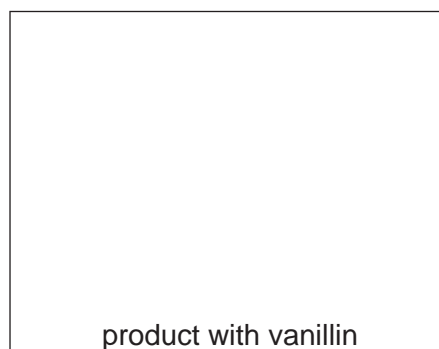
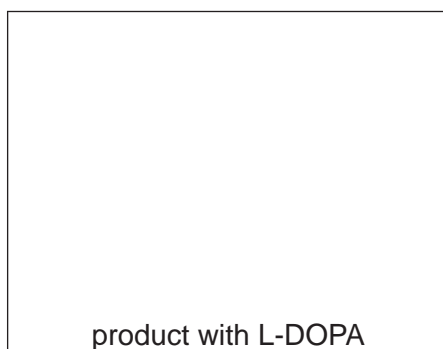
(b) A student carried out some reactions with samples of L-DOPA and vanillin using reagents **X**, **Y** and **Z**.

- Reagent **X** reacted with L-DOPA **and** with vanillin.
- Reagent **Y** reacted with L-DOPA but **not** with vanillin.
- Reagent **Z** reacted with vanillin but **not** with L-DOPA.

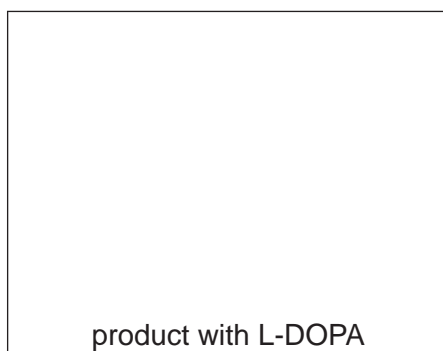
Assume that the $\text{CH}_3\text{O}-$ group in vanillin does not react.

Suggest possible identities of reagents **X**, **Y** and **Z** and give the structures of the organic products that were formed.

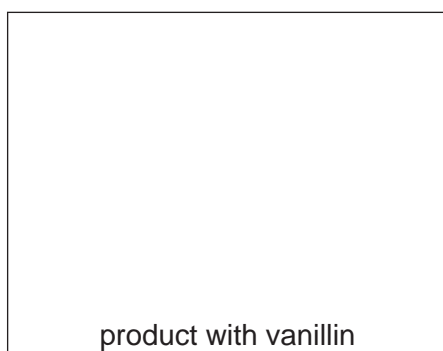
Reagent **X**



Reagent **Y**



Reagent **Z**



[7]

[Total: 12]

4 Crotyl alcohol, $\text{CH}_3\text{CH}=\text{CHCH}_2\text{OH}$, is a colourless liquid which is used as a solvent.

- (a) In the boxes below, write the **structural formula** of the organic compound formed when crotyl alcohol is reacted separately with each reagent under suitable conditions. If you think no reaction occurs, write 'NO REACTION' in the box.

A	Br_2 in an inert organic solvent	
B	PCl_5	
C	H_2 and Ni catalyst	
D	NaBH_4	
E	$\text{K}_2\text{Cr}_2\text{O}_7/\text{H}^+$ heat under reflux	

[5]

- (b) Draw the **displayed formula** of the organic compound formed when crotyl alcohol is reacted with cold, dilute acidified potassium manganate(VII).

[1]

- (c) Draw the **skeletal formula** of the compound formed in reaction E.

[2]

(d) Crotyl alcohol is obtained from crotonaldehyde, $\text{CH}_3\text{CH}=\text{CHCHO}$.

- (i) Describe one test that would confirm the presence of a small amount of unreacted crotonaldehyde in the crotyl alcohol.
Give the name of the reagent used and state what you would see.

reagent

observation

- (ii) What *type of reaction* is the conversion of crotonaldehyde into crotyl alcohol?

.....

[3]

- (e) Compound **P**, another unsaturated compound, is found in some blue cheeses.
The percentage composition by mass of compound **P** is C: 73.7%; H: 12.3%; O: 14.0%.

Calculate the empirical formula of compound **P**.

[2]

[Total: 13]

5 Compounds containing the allyl group, $\text{CH}_2=\text{CHCH}_2-$, have pungent smells and are found in onions and garlic.

Allyl alcohol, $\text{CH}_2=\text{CHCH}_2\text{OH}$, is a colourless liquid which is soluble in water.

(a) Allyl alcohol behaves as a primary alcohol and as an alkene.

Give the structural formula of the organic compound formed when allyl alcohol is reacted separately with each of the following reagents.

(i) acidified potassium dichromate(VI), heating under reflux

(ii) bromine in an inert organic solvent

(iii) cold, dilute, acidified potassium manganate(VII)

(iv) hot, concentrated, acidified potassium manganate(VII)

[5]

(b) Allyl alcohol undergoes the following reactions.

(i) When reacted with concentrated HCl at 100°C , $\text{CH}_2=\text{CHCH}_2\text{Cl}$ is formed.

State as fully as you can what *type of reaction* this is.

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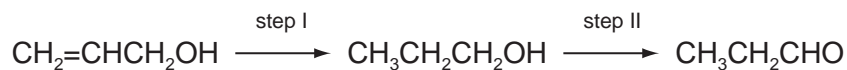
(ii) When reacted with MnO_2 at room temperature, $\text{CH}_2=\text{CHCHO}$ is formed.

What *type of reaction* is this?

.....

[2]

(c) Allyl alcohol can be converted into propanal in two steps.



(i) What reagents and conditions would be used for **each** step?

step I

reagent(s)

condition(s)

step II

reagent(s)

condition(s)

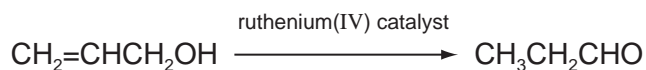
(ii) Allyl alcohol and propanal are isomers.

What form of isomerism do they display?

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[5]

(d) Allyl alcohol may also be converted into propanal by using a ruthenium(IV) catalyst in water.



Suggest what is unusual about this single step reaction.

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..... [1]

[Total: 13]