CHEMISTRY ONLINE
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CHEMISTRY

ORGANIC CHEMISTRY II

Level & Board	AQA (A-LEVEL)
TOPIC:	OPTICAL ISOMERISM
PAPER TYPE:	SOLUTION - 3
TOTAL QUESTIONS	10
TOTAL MARKS	/33

Optical Isomerism – 3

1.

(a)

Name alcohol $(CH_3)_2C(OH)CH(CH_3)_2$

2, 3 – dimethylbutan – 2 – ol

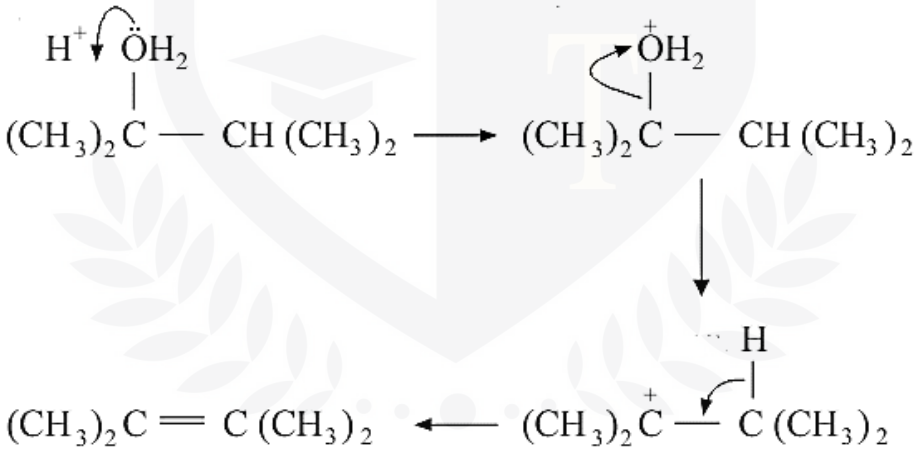
(1)

(b)

Name of the mechanism:

Elimination

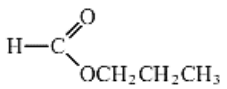
Mechanism:



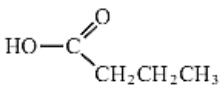
(3)

2.

(a)



C

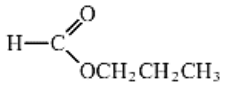


D

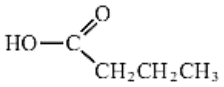
Name compound C: *Propyl methanoate*

(1)

(b)



C



D

Reagent:
Sodium bicarbonate ($NaHCO_3$)

Observation with C (Propyl methanoate):

No reaction or effervescence will be observed.

Observation with D (Carboxylic acid):

Effervescence (bubbling) will be observed when sodium bicarbonate is added to a carboxylic acid. This is due to the release of carbon dioxide gas (CO_2) when the carboxylic acid reacts with sodium bicarbonate.

Reagent: acidified $K_2Cr_2O_7$

Observation with C (Propyl methanoate):

Becomes green

Observation with D (Carboxylic acid):

no change

(3)

3.

The word Chirality / Chiral is used to describe optically active molecules.

(1)

I am Sorry !!!!!

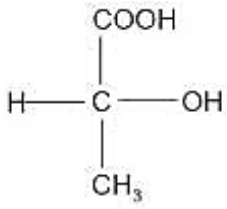
4.

Examples of Chiral Molecules:

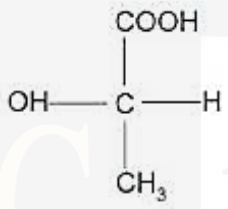
Lactic Acid: Lactic acid is a chiral molecule. It exists in two enantiomeric forms: L-lactic acid and D-lactic acid.

2-Amino-1-propanol: This is a chiral molecule due to the presence of a chiral carbon atom bonded to four different groups.

Lactic Acid:



L(+) Leavorotatory lactic acid



D(-) Dextrorotatory lactic acid

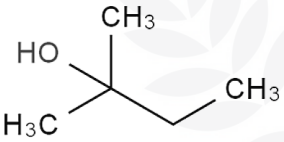
(3)

5.

(a)

Name of this is: alcohol 2-methylbutan-2-ol

Graphical formula:



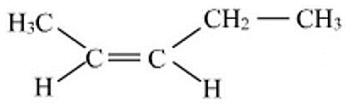
(2)

(b)

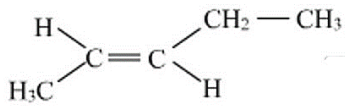
pent-1-ene:

$CH_3CH_2CH_2CH{=}CH_2$

pent-2-ene:



cis pent-2-ene



trans pent-2-ene

(2)

(c)

Type of reaction: *Dehydration / elimination*

(1)

(d)

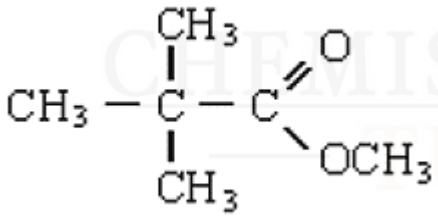
When 2,2-dimethylpropan-1-ol is heated with concentrated sulfuric acid, it does not undergo dehydration because:

No Hydrogen Atoms: *There are no hydrogen atoms on the carbon atom adjacent to the C–OH group.*
Steric Hindrance: *The carbon atom next to the C–OH group is bonded to three bulky methyl groups, preventing the necessary steps for dehydration.*

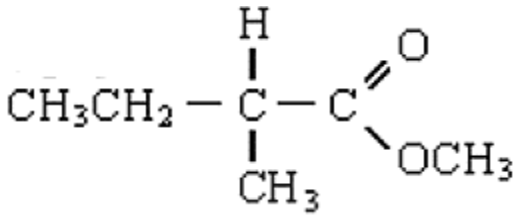
(1)

6.

Isomer E:



Isomer F:



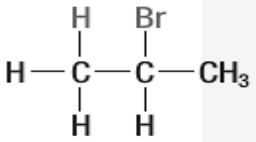
(2)

7.

Structures of Isomers

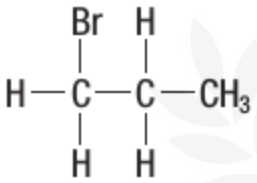
When 2-butene reacts with HBr, it forms two structural isomers:

2-Bromobutane



2-bromobutane

1-Bromobutan



1-bromobutane

Mechanism for Formation of the Major Product:

Protonation of the Alkene:

- *The double bond in 2-butene attacks a proton (H^+) from HBr, leading to the formation of a carbocation intermediate.*
- *The more stable carbocation forms at the more substituted carbon.*

$$CH_3\text{-}CH{=}CH\text{-}CH_3 + HBr \rightarrow CH_3\text{-}CH^+\text{-}CH_2\text{-}CH_3 + Br^-$$

Nucleophilic Attack:

- *The bromide ion (Br^-) then attacks the carbocation, resulting in the formation of 2-bromobutane.*

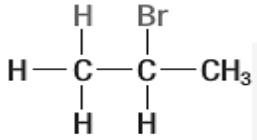
$CH_3–CH^+–CH_2–CH_3 + Br^-$ → $CH_3–CH(Br)–CH_2–CH_3$ or

$CH_2(Br)–CH_2–CH_2–CH_3$

Structures:

2-Bromobutane (Major Product):

Structure:

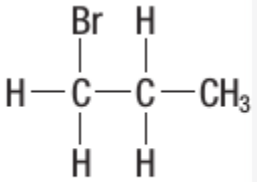


2-bromobutane

$CH_3–CH(Br)–CH_2–CH_3$

1-Bromobutane (Minor Product):

Structure:



1-bromobutane

$CH_2(Br)–CH_2–CH_2–CH_3$

(6)

8.

The racemic mixture has no effect on plane-polarized light.

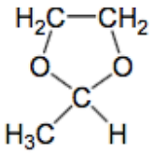
This is because in a racemic mixture, there are equal amounts of both enantiomers present.
Each enantiomer rotates plane-polarized light in opposite directions, but to the same extent.

As a result, the rotations caused by the two enantiomers cancel each other out, resulting in no net rotation of plane-polarized light.

Therefore, when a racemic mixture is passed through a polarimeter, no overall rotation is observed.

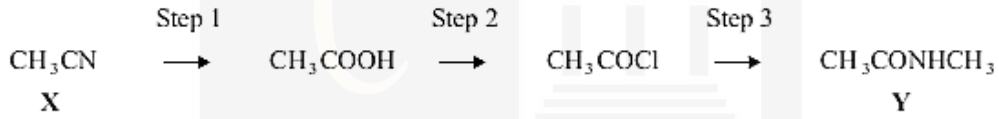
(2)

9.



(2)

10.



(a)

Name of compound X:

ethanenitrile or methyl cyanide / cyanomethane

(1)

(b)

Type of reaction: *Acid hydrolysis*

(1)

(c)

Equation for the reaction taking place in Step 3:

$CH_3COCl + CH_3NH_2 \rightarrow CH_3CONHCH_3 + HCl$

(2)

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