

3.7 Organic Mechanisms

Question Paper

Course	AQA A Level Chemistry
Section	3. Organic Chemistry
Topic	3.7 Organic Mechanisms
Difficulty	Medium

Time allowed:

80

Score:

/65

Percentage:

/100

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TUITION

Question 1a

- a) The chemical reactions which organic compounds undergo can be shown using a step by step reaction mechanism.

In these mechanisms, curly arrows are used.

What does a curly arrow represent in these mechanisms?

[1 mark]

Question 1b

- b) The mechanism for the reaction between methane and chlorine is not represented using the curly arrow model, but rather a series of equations to represent what is happening at each stage of the reaction.
- (i) Name this reaction mechanism, when methane reacts with chlorine.
- (ii) Outline the mechanism, including all steps, stating the necessary reagents and the type of bond fission which is taking place.
Name the first two stages of the reaction.

[7 marks]

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Question 1c

- c) Write the overall equation for the reaction between chlorine and methane.

[1 mark]

Question 1d

- d) Chlorine will react with alkenes as well as alkanes, but the same conditions are not needed for this reaction to take place.

Explain why alkenes will readily react with chlorine.

[3 marks]

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Question 2a

- a) Alkenes will react readily with hydrogen halides, such as hydrogen bromide.

2-methylprop-1-ene will react with hydrogen bromide.

Suggest the mechanism for this reaction, showing the formation of the major product which is formed.

[4 marks]

Question 2b

- b) Draw the skeletal formula of the minor product that would be formed during this reaction and give its IUPAC name.

[2 marks]

Question 2c

- c) Name the type of mechanism taking place in part (a).

[1 mark]

Question 2d

- d) Explain why the major and minor products formed from the reaction in part (a) are not formed in equal amounts.

[2 marks]

Question 3a

- a) Halogenoalkanes are a very useful group of organic compounds, and are often used in organic synthesis.

The organic compound, $\text{CH}_3\text{CHClCH}_2\text{OH}$ reacts with potassium hydroxide to form a diol, if the reaction conditions are appropriate.

Draw the displayed formula of $\text{CH}_3\text{CHClCH}_2\text{OH}$ and give its IUPAC name.

[2 marks]

Question 3b

- b) Give the reagents and conditions necessary to convert $\text{CH}_3\text{CHClCH}_2\text{OH}$ into a diol and draw the skeletal formula of the diol that would be formed during the reaction.

[2 marks]

Question 3c

- c) In the reaction in part (b) where a diol is formed, the hydroxide ions behave as nucleophiles.

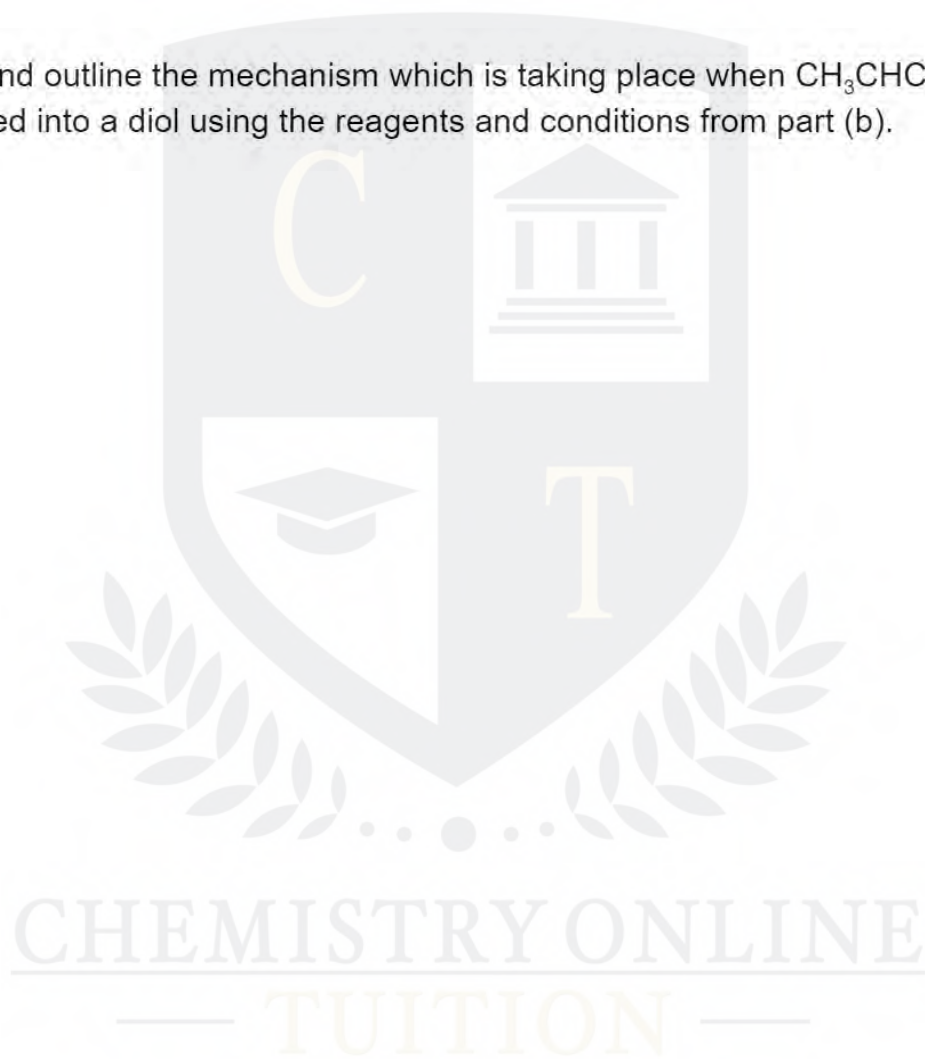
Explain why the hydroxide ions behave as nucleophiles in the reaction in part (b).

[3 marks]

Question 3d

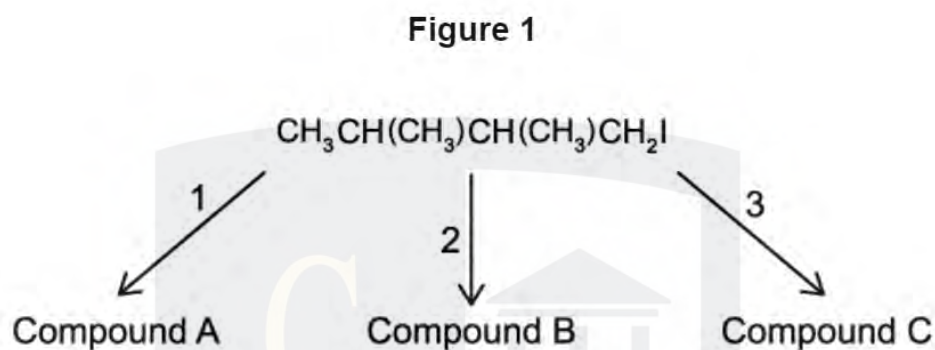
- d) Name and outline the mechanism which is taking place when $\text{CH}_3\text{CHClCH}_2\text{OH}$ is converted into a diol using the reagents and conditions from part (b).

[4 marks]



Question 4a

- a) **Figure 1** below shows possible products which can be formed from different reactions of a halogenoalkane.



Reaction **1** takes place with dilute sodium hydroxide solution.
Draw the displayed formula and give the IUPAC name of compound **A**.
Give the classification of the compound formed.

[3 marks]

Question 4b

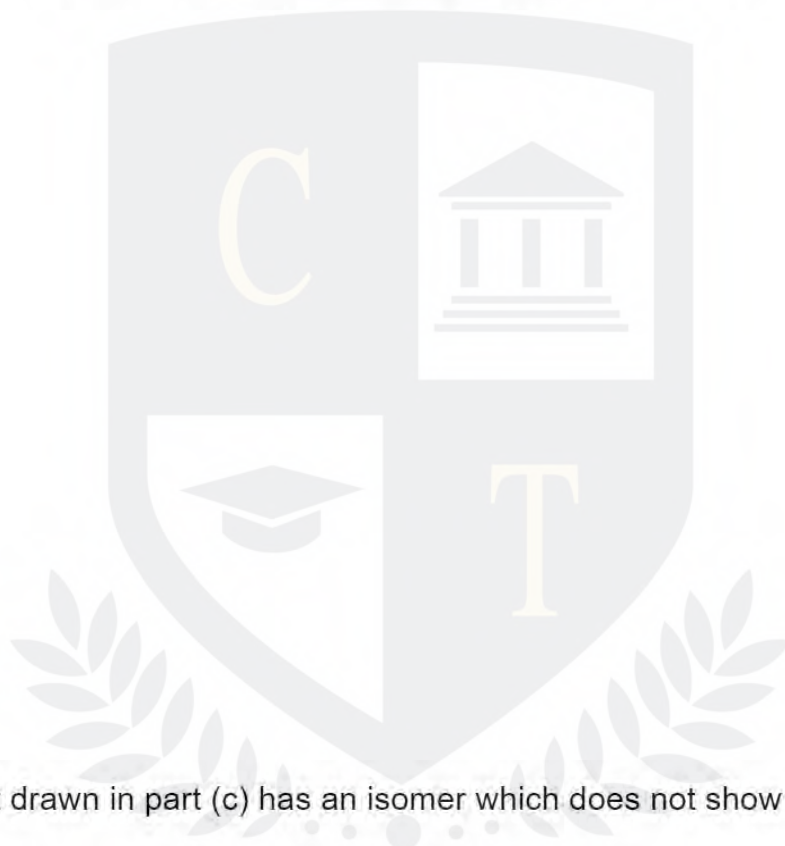
- b) Compound **B** is part of the homologous series which has the general formula C_nH_{2n} .
Give the reagents and conditions necessary to produce compound **B**.

[3 marks]

Question 4c

- c) Name and outline the reaction mechanism for the reaction stated in part (b), to show how a product which has the key functional group on the first carbon atom is formed.

[5 marks]



Question 4d

- d) The product drawn in part (c) has an isomer which does not show stereoisomerism.

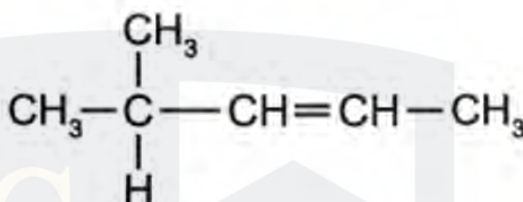
Draw the displayed and skeletal formula of this isomer and explain why stereoisomerism does not arise in this product.

[3 marks]

Question 5a

- a) The following alkene in **Figure 1** will undergo a number of different chemical reactions, depending on the reagents and conditions which are used.

Figure 1



Name and outline a mechanism which would convert the alkene shown in Figure 1 to 2-bromo-4-methylpentane.

[6 marks]

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Question 5b

- b) Name and outline the mechanism, including necessary reagents, used to convert the product formed from the reaction in part (a) into an amine.

[6 marks]

Question 5c

- c) The halogenoalkane produced from the reaction in part (a) can be converted back into the alkene shown in **Figure 1**.

Name the reagent and a key condition which would be necessary to ensure that the yield of the alkene formed during this reaction is high.

[2 marks]

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Question 5d

- d) The alkene in **Figure 1** in part (a) can also be reacted with concentrated sulfuric acid.

Draw the mechanism to show the product formed when this reaction takes place.

[4 marks]

Question 6

What statement is true about the mechanism of the reaction between aqueous sodium hydroxide and 1-bromobutane

- A** attack by a nucleophile on a carbon atom with a partial positive charge
- B** heterolytic bond fission and attack by a nucleophile on a carbocation
- C** homolytic bond fission and attack by an electrophile on a carbanion
- D** homolytic bond fission and attack by a nucleophile on a carbocation

[1 mark]

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