

3.7 Organic Mechanisms

Question Paper

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

Time allowed:

90

Score:

/71

Percentage:

/100

CHEMISTRY ONLINE
TUITION

Question 1a

- a) A cyanide ion can act as a nucleophile in nucleophilic substitution reactions. Nucleophilic substitution of a halogenoalkane with a cyanide ion is an effective way of increasing the length of a carbon chain.
- i) Draw the Lewis structure of the cyanide ion.
- ii) Refer to your diagram to explain why the cyanide ion can act as a nucleophile.

[3 marks]

Question 1b

- b) Suitable conditions for the nucleophilic substitution of a halogenoalkane are heating under reflux with a solution of sodium or potassium cyanide in ethanol.
- i) Outline the mechanism when 2-bromo-2-methylpropane is placed in these conditions.
- ii) State the name of the product.

[4 marks]

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Question 1c

- c) Aqueous conditions are used instead of alcoholic conditions for the reaction outlined in part (b). Draw the structure for the product of this reaction.

[1 mark]

Question 1d

- d) The product of the reaction outlined in part (c) is heated under reflux with concentrated sulfuric acid.
- i) Name and outline the mechanism of this reaction
- ii) Explain why this reaction does not require a high temperature.

[6 marks]



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Question 2a

- a) Name and outline the mechanism for the reaction between 1-methylcyclohex-1-ene and hydrogen bromide, HBr. In your answer, draw the major product of the reaction.

[6 marks]



Question 2b

- b) Explain why a major product and minor product are produced in the reaction outlined in part (a)

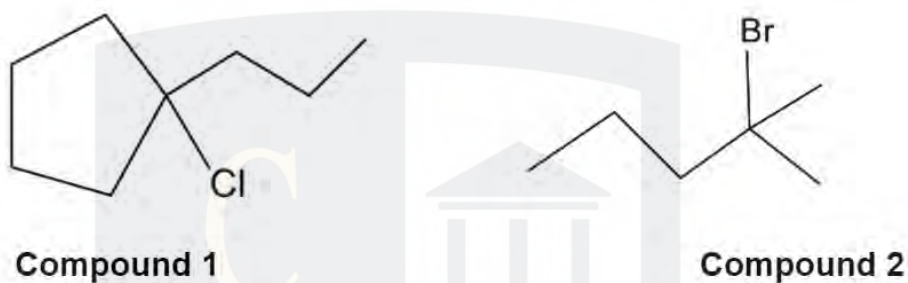
[3 marks]

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Question 2c

- c) Predict the skeletal structure of the alkenes that would react with a hydrogen halide to produce the following compounds in Figure 1.

Figure 1



[2 marks]

Question 2d

- d) Halogen molecules can react with alkenes to produce halogenoalkanes which contain two halogen atoms. The covalent bond in the halogen molecule is not polar. Explain why halogen molecules can react with alkenes.

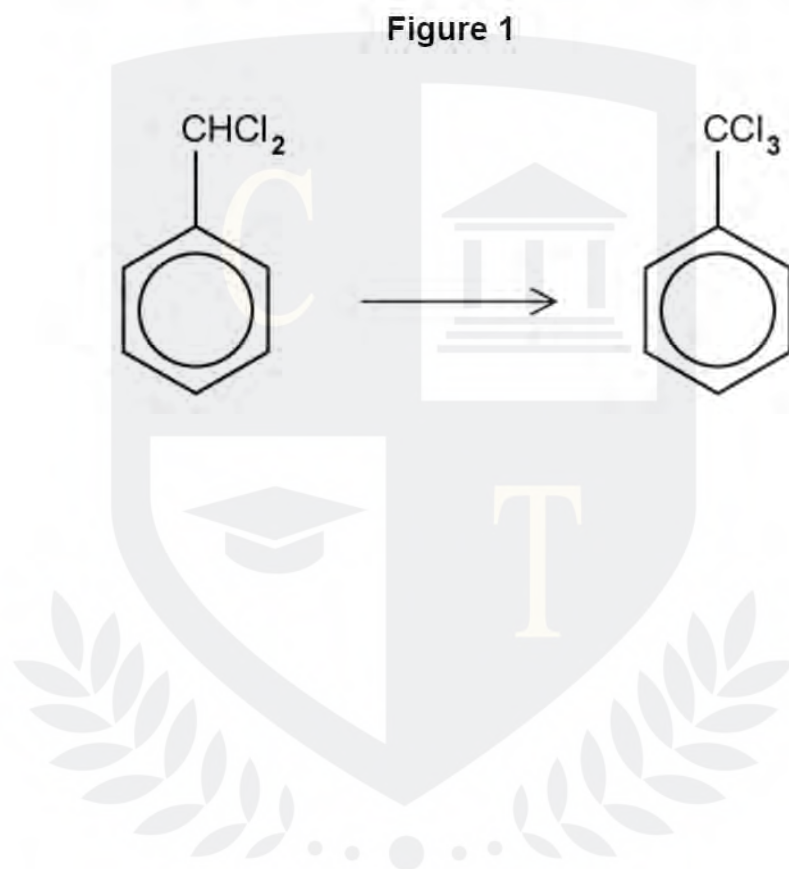
[2 marks]

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Question 3a

- a) Outline the mechanism and give the reagents and conditions for the reaction shown in **Figure 1**.

In your answer include the name and conditions required for the mechanism.



[6 marks]

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Question 3b

- b) Explain how the conditions of this mechanism could be altered to produce a high yield of trichloromethyl benzene.

[2 marks]

Question 3c

- c) In a separate reaction involving similar conditions as part (a) tetrachloromethane was produced from trichloromethane. Outline both propagation steps for this reaction.

[2 marks]

Question 3d

- d) Draw **all possible** products of mono-substituted halogenoalkanes when 2-methylbutane undergoes reaction with bromine in the same conditions asked for in part (a).

[3 marks]

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Question 4a

- a) For the reaction profile outlined in **Figure 1**, state the mechanism or type of reaction for each step

Figure 1



[3 marks]

Question 4b

- b) Outline the mechanism for the conversion of 1-bromopropane to Compound **G**. In your answer give the reagents and conditions for the reaction.

[4 marks]

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Question 4c

- c) 2-bromobutane undergoes a reaction to produce an unsymmetrical alkene. Name and outline the mechanism for this reaction and give the reagents and conditions required.

[5 marks]

Question 4d

- d) An alternative pathway to form butylamine is to react 1-bromobutane with ammonia.
- i) Outline the full mechanism for this reaction
- ii) Explain why an excess of ammonia would be required.

[5 marks]

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Question 5a

- a) During the conversion of 2-methylbutan-2-ol to an alkene, the reaction requires sodium or potassium hydroxide

Explain the role of the hydroxide ion in this reaction

[2 marks]

Question 5b

- b) 2-methylbutan-2-ol can be produced from the reaction of 2-iodo-2-methylbutane. Explain why this reaction would be quicker than using 2-chloro-2-methylbutane.

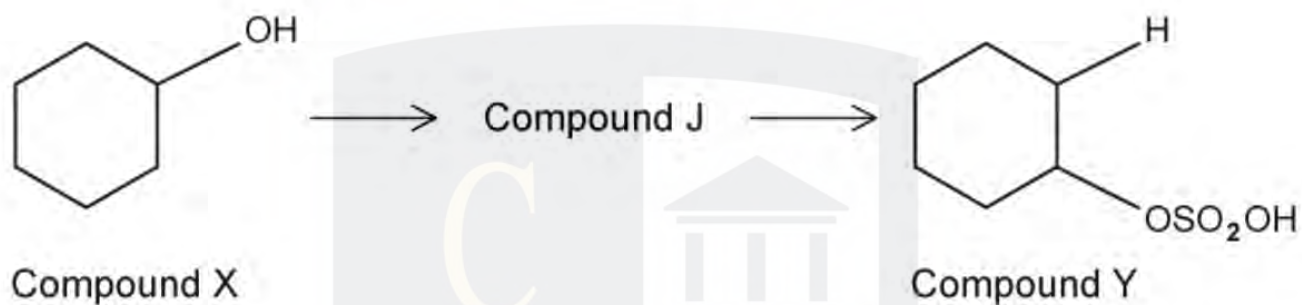
[3 marks]

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Question 5c

- c) A reaction pathway is shown in **Figure 1**. Compound J reacts with bromine water to form a colourless solution.

Figure 1



- i) Name compound **J**.
- ii) Outline the reaction mechanism for the conversion of compound **J** to compound **Y**.

[4 marks]

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Question 5d

- d) Outline the mechanism for the conversion of compound **X** to compound **J** and give the reagents and conditions required.

[5 marks]



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