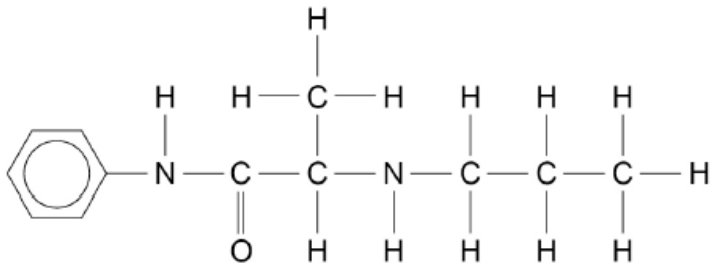
AQA – Aromatic chemistry – A2 Chemistry P2

1. June/ 2020/Paper_2/No.2

0 2 Prilocaine is used as an anaesthetic in dentistry.
Figure 3 shows the structure of prilocaine.

Figure 3



0 2 . 1 Draw a circle around any chiral centre(s) in **Figure 3**.

[1 mark]

0 2 . 2 Identify the functional group(s) in the prilocaine molecule.

[1 mark]

Tick (✓) the box(es) corresponding to the functional group(s).

Amide	Amine	Ester	Ketone

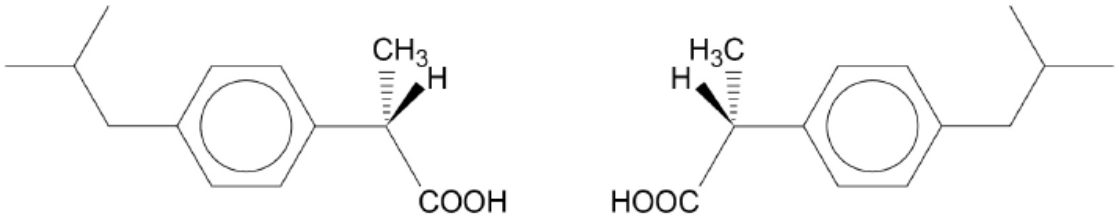
0 2 . 3 Prilocaine is completely hydrolysed in the human body to give a mixture of products.

Draw the structures of the two organic products formed in the complete hydrolysis of prilocaine in acidic conditions.

[3 marks]

0 2 . 4 **Figure 4** shows optical isomers **F** and **G**.

Figure 4



Isomer **F** Isomer **G**

Isomer **F** is the active compound in the medicine ibuprofen.

In the manufacture of ibuprofen both isomers **F** and **G** are formed. An enzyme is then used to bind to isomer **G** and catalyse its hydrolysis.

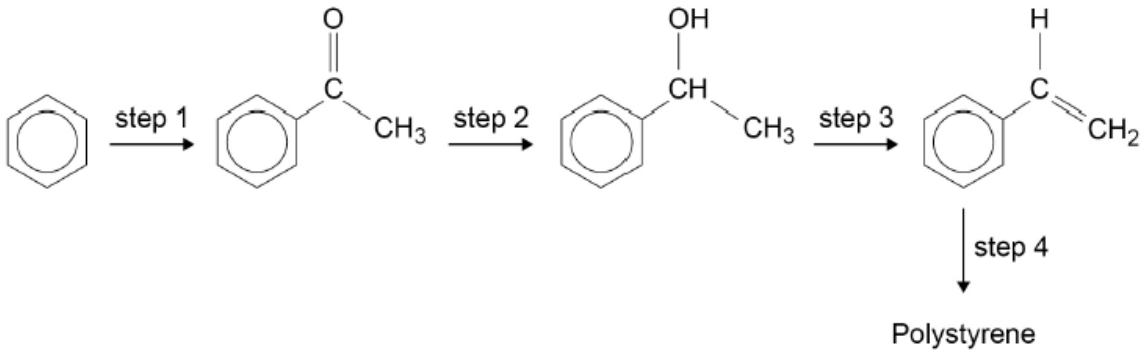
After the products of hydrolysis of **G** are removed, a pure sample of isomer **F** is collected.

Explain how a structural feature of this enzyme enables it to catalyse the hydrolysis of isomer **G** but not the hydrolysis of isomer **F**.

[2 marks]

2. June/ 2020/Paper_2/No.6

0 6 Polystyrene can be made from benzene in the series of steps shown.



0 6 . 1 State the type of reaction in step **1**.

Identify the reagent(s) and conditions needed for step **1**.

[3 marks]

Type of reaction _____

Reagent(s) _____

Conditions _____

0 6 . 2 State the name of the mechanism for the reaction in step **2**.

Identify the inorganic reagent needed for step **2**.

Name the organic product of step **2**.

[3 marks]

Name of mechanism _____

Inorganic reagent _____

Name of organic product _____

0 6 . 3 The organic product of step **2** is reacted with concentrated sulfuric acid in step **3**.

Outline the mechanism for step **3**.

[3 marks]

0 6 . 4 Draw the repeating unit of polystyrene.

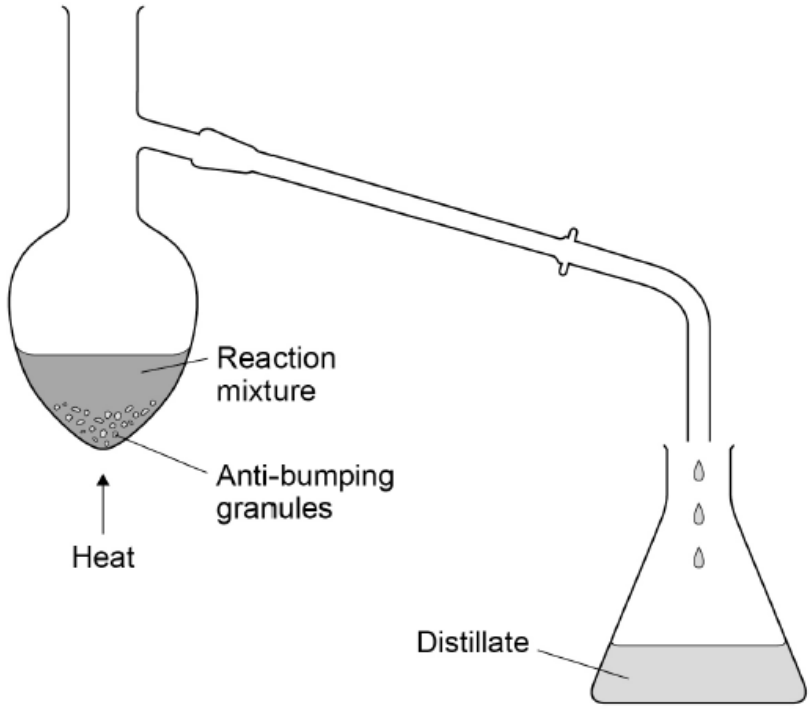
[1 mark]

3. June/ 2019/Paper_2/No.2

0 2 A student prepared cyclohexene by heating cyclohexanol with concentrated phosphoric acid. The cyclohexene produced was distilled off from the reaction mixture.

0 2 . 1 Complete the diagram of the apparatus used to distil the cyclohexene from the reaction mixture at 83 °C.

[2 marks]



0 2 . 2 The distillate was shaken with saturated sodium chloride solution. The cyclohexene was separated from the aqueous solution using a separating funnel.

State why cyclohexene can be separated from the aqueous solution using the separating funnel.

[1 mark]

0 2 . 3 The cyclohexene separated in Question **02.2** was obtained as a cloudy liquid.
The student dried this cyclohexene by adding a few lumps of anhydrous calcium chloride and allowing the mixture to stand.

Give **one** observation that the student made to confirm that the cyclohexene was dry.

[1 mark]

_____

_____

0 2 . 4 In this preparation, the student added an excess of concentrated phosphoric acid to 14.4 g of cyclohexanol (M_r = 100.0).
The student obtained 4.15 cm^3 of cyclohexene (M_r = 82.0).
Density of cyclohexene = 0.810 g cm^{-3}

Calculate the percentage yield of cyclohexene obtained.
Give your answer to the appropriate number of significant figures.

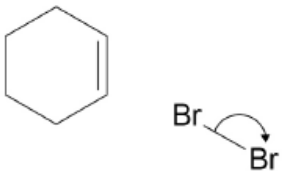
[5 marks]

% yield _____

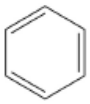
0 2 . 5 Cyclohexene reacts with bromine.

Complete the mechanism for this reaction.

[3 marks]



4. June/2021/Paper_2/No.4

0 4 Kekulé suggested this structure for benzene. 

Benzene is now represented by this structure. 

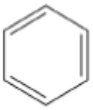
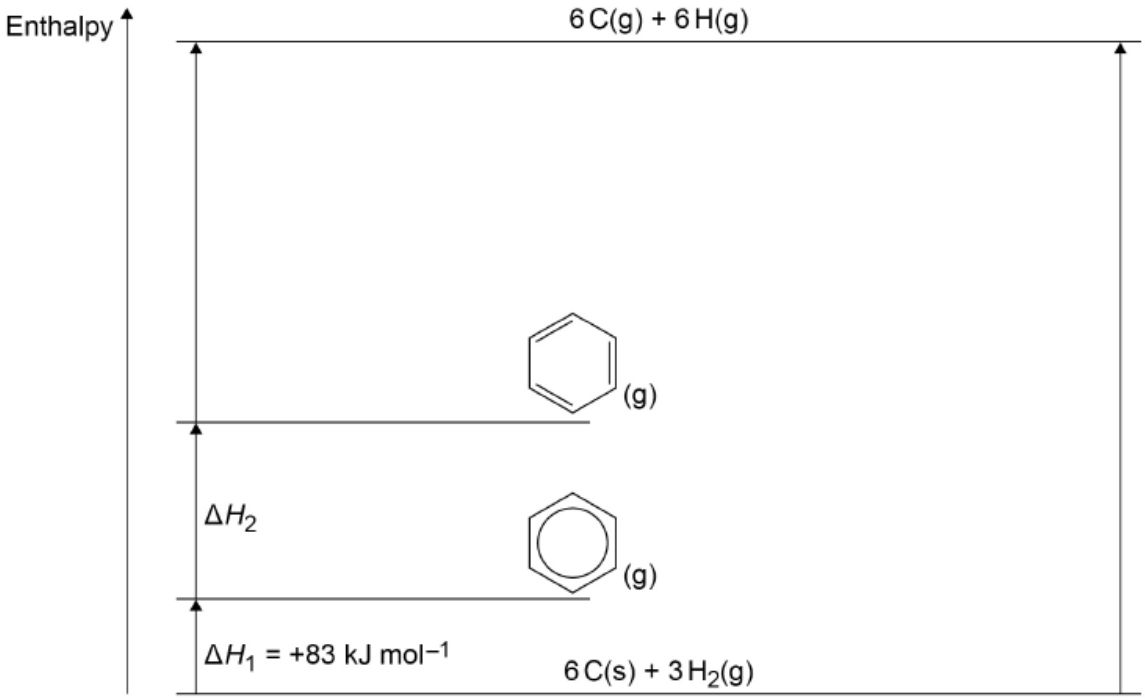
Figure 3 shows the relative stability of  compared to  .

Figure 3



0 4 . 1 Use **Figure 3** and the data shown in **Table 1** to calculate ΔH_2

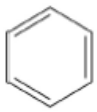
[3 marks]

Table 1

	ΔH / kJ mol^{-1}
Enthalpy of atomisation for carbon	+715
Enthalpy of atomisation for hydrogen	+218
Bond enthalpy (C–C)	+348
Bond enthalpy (C=C)	+612
Bond enthalpy (C–H)	+412

ΔH_2 _____ kJ mol^{-1}

0 4 . 2 Explain, in terms of structure and bonding, why 

is more thermodynamically stable than 

[1 mark]

_____

_____

_____

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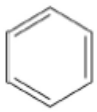
is more thermodynamically stable than 

[1 mark]

0 4 . 3 A mixture of concentrated nitric acid and concentrated sulfuric acid reacts with benzene.

Figure 4 shows the incomplete mechanism for this reaction.

Name the mechanism.

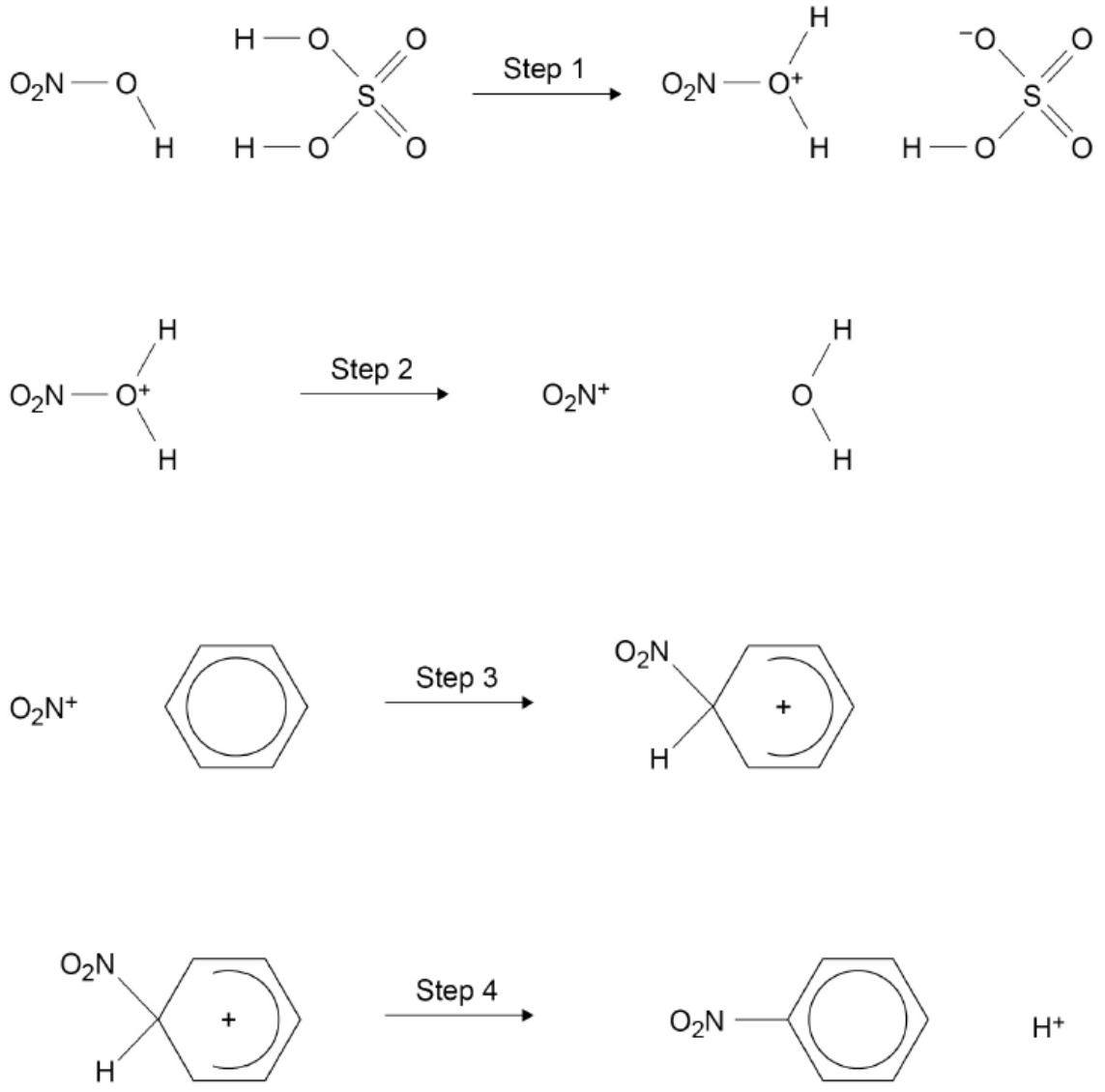
Complete the mechanism in **Figure 4** by adding

- any lone pairs of electrons involved in each step
- **two** curly arrows in step **1**
- a curly arrow in step **2**
- a curly arrow in step **3**
- a curly arrow in step **4**.

[5 marks]

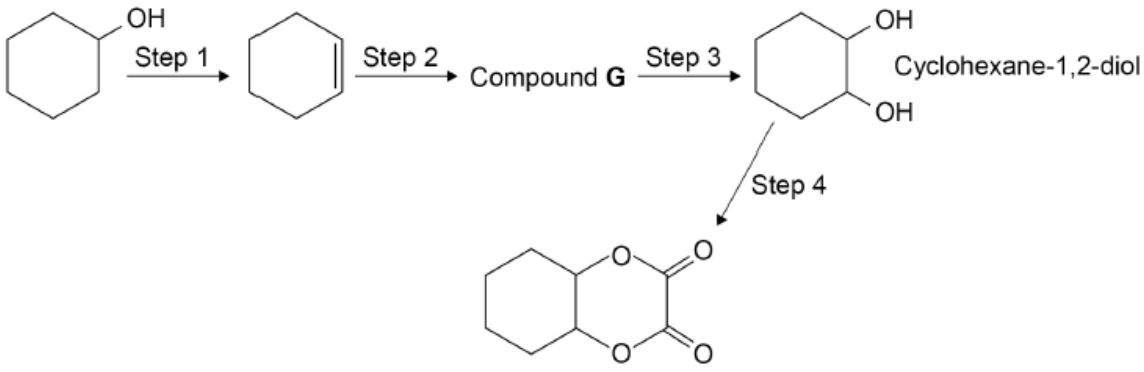
Name of mechanism _____

Figure 4



5. June/2021/Paper_2/No.8

0 8 This question is about making a diester from cyclohexanol.



0 8 . 1 State the type of reaction in step **1**.

Give the name of the reagent needed for step **1**.

[2 marks]

Type of reaction _____

Reagent _____

0 8 . 2 State the reagents needed and give equations for step **2** and step **3**.

Show the structure of Compound **G** in your equations.

[4 marks]

Step 2 reagent _____

Step 2 equation

_____

Step 3 reagent _____

Step 3 equation

_____

0 8 . 3 Cyclohexane-1,2-diol reacts with ethanedioyl dichloride.

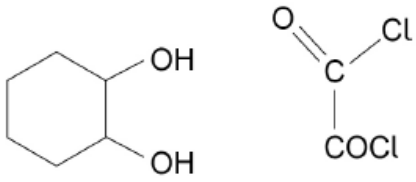
Give the name of the mechanism for this reaction.

Complete the mechanism to show the formation of **one** ester link in the first step of this reaction.

[5 marks]

Mechanism name _____

Mechanism



0 8 . 4 Suggest why chemists usually aim to design production methods

- with fewer steps
- with a high percentage atom economy.

[2 marks]

Fewer steps _____

_____

_____

High percentage atom economy _____

_____

_____