

Hydrocarbons

AS & A Level

Question Paper 3

Level	A Level
Subject	Chemistry
Exam Board	OCR
Module	Core Organic Chemistry
Topic	Hydrocarbons
Paper	AS & A Level
Booklet	Question Paper 3

Time allowed: 74 minutes

Score: /55

Percentage: /100

Grade Boundaries:

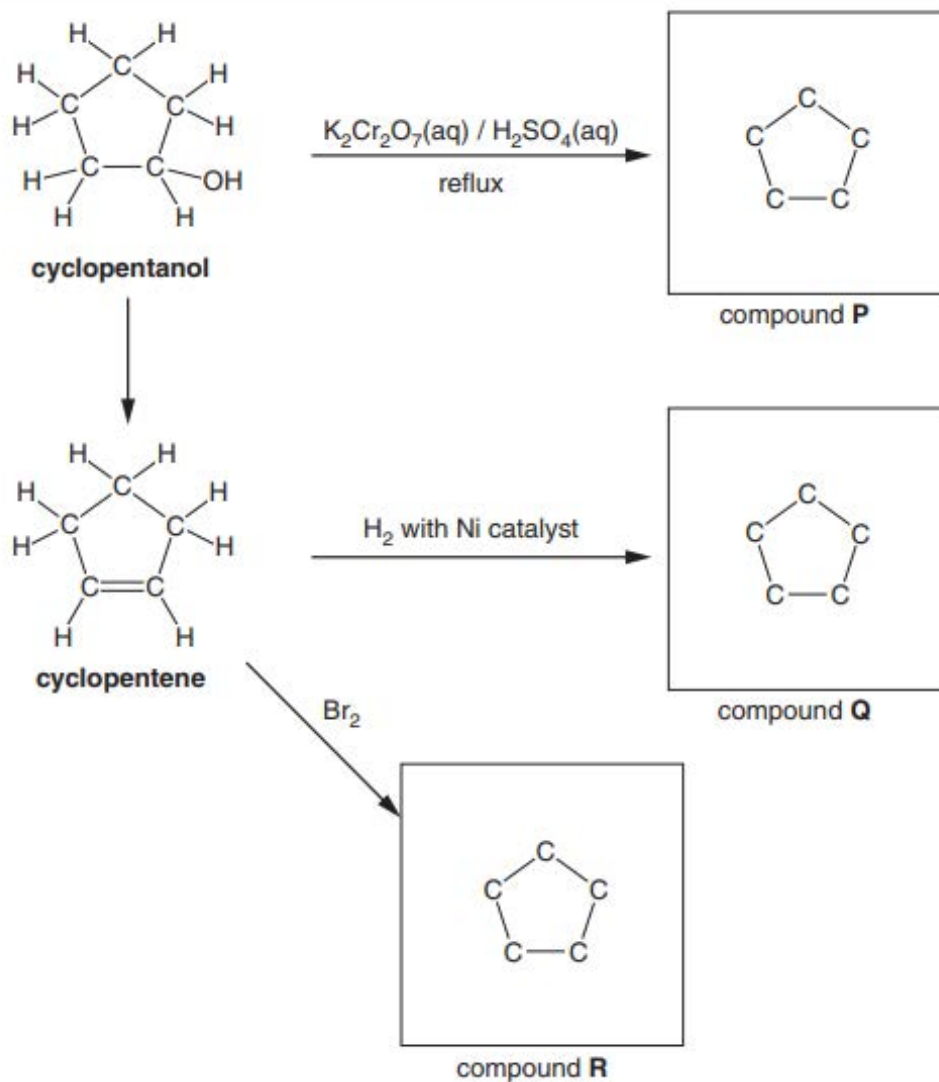
A*	A	B	C	D	E
>85%	73%	60%	47%	34%	21%

Question 1

Cyclopentene is a cyclic alkene.

(a) The flowchart shows some reactions involving cyclopentene and cyclopentanol.

Complete the partial structures in the boxes to show compounds **P**, **Q** and **R**, the main organic products of the reactions. [3]



(b) What would be the colour change in the reaction between cyclopentene and bromine? [1]

(c) Cyclopentene can be polymerised to give poly(cyclopentene).

Draw a section of poly(cyclopentene) to show **two** repeat units.

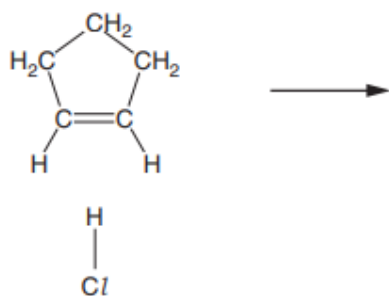
[1]

(d) Cyclopentene reacts with HCl by electrophilic addition.

Use the curly arrow model to complete the mechanism for this reaction.

In your answer include any relevant dipoles, the intermediate and the product.

[5]



intermediate



product

(e) Chlorocyclopentane can be hydrolysed by heating with aqueous sodium hydroxide.

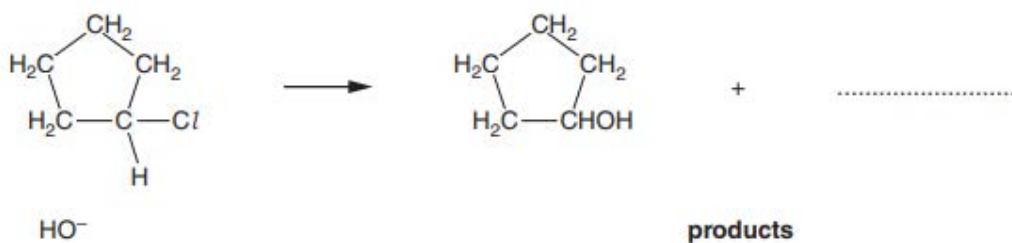


Use the curly arrow model to complete the mechanism for this hydrolysis reaction.

Include in your answer, relevant dipoles, the name of the mechanism and the type of bond fission.



In your answer you should use the correct technical terms, spelled correctly.



[5]

[Total: 15 Marks]

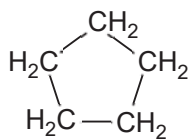
Question 2

Crude oil is a source of alkanes.

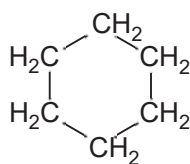
- (a) Fractional distillation is used to separate useful hydrocarbons found in crude oil.

Explain, in terms of intermolecular forces, how fractional distillation works. [2]

- (b) The petroleum industry processes straight-chained alkanes into cycloalkanes such as cyclopentane and cyclohexane.



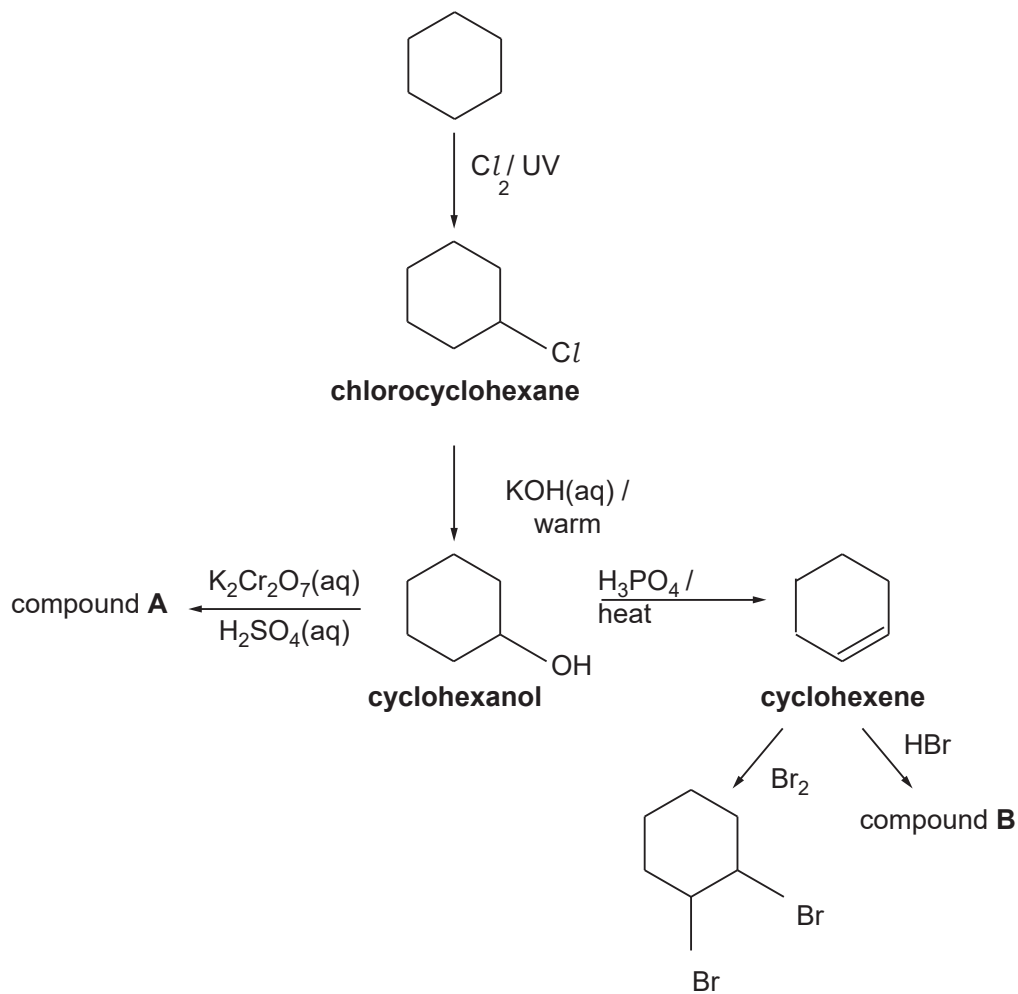
cyclopentane



cyclohexane

- (i) Deduce the general formula of a **cycloalkane**. [1]
- (ii) Construct the equation to show the formation of cyclohexane from hexane. [1]
- (iii) Suggest why the petroleum industry processes hexane into cyclohexane. [1]

(c) The flowchart below shows some of the organic compounds that could be made starting from cyclohexane.



(i) Explain why cyclohexene is described as *unsaturated* and as a *hydrocarbon*.

[2]

(i) The reaction between chlorine and cyclohexane is an example of radical substitution. State **one** problem of using this reaction to prepare a sample of chlorocyclohexane.

[1]

- (iii) The formation of cyclohexanol from chlorocyclohexane involves the reaction of a nucleophile, the hydroxide ion.

Suggest what feature of the hydroxide ion makes it able to act as a nucleophile. [1]

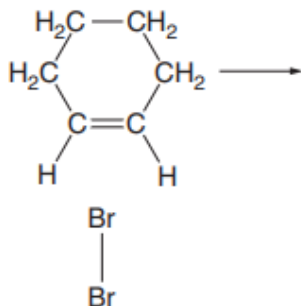
- (iv) Using the flowchart, draw the structures of compound **A** and compound **B**.

compound A	compound B
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[2]

- (v) Describe, using the 'curly arrow model', the mechanism for the reaction between Br_2 and cyclohexene.

Show relevant dipoles and charges. [4]



[Total: 15 Marks]

Question 3

Biofuels such as bioethanol and biodiesel are increasingly being used as an alternative to fossil fuels to provide energy.

(a) Describe, with the aid of an equation, how bioethanol is manufactured by fermentation. [3]

(a) Biodiesel is obtained from plant oils. The manufacture involves several stages, all of which have a high energy requirement.

Biodiesel is often described as being 'carbon-neutral' because:

- plants convert atmospheric carbon dioxide into carbon compounds
- on burning biodiesel this carbon dioxide is returned to the atmosphere.

(i) Construct an equation to show the complete combustion of biodiesel.

Assume that the molecular formula of the biodiesel is $C_{15}H_{30}O_2$. [2]

(ii) Suggest why biodiesel is **not** completely carbon-neutral. [1]

(c) Many scientists suggest that society should use more biofuels rather than fossil fuels to provide energy. Other scientists are worried that biofuels will need large areas of land to grow suitable crops.

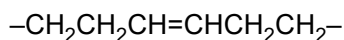
Suggest **disadvantages** or **advantages**, other than being carbon-neutral, of using more . [3]
biofuels.

(d) Unsaturated compounds in plant oils can also be used to make margarine.

Describe how.

[2]

(e) Part of the structure of an unsaturated compound in plant oils is shown below:



(i) Draw the displayed formula of the *Z* isomer of this part of the structure. [1]

(ii) Explain why this part of the structure can have an *E* and a *Z* isomer.

[2]

Question 4

This question is about two compounds used in medicine.

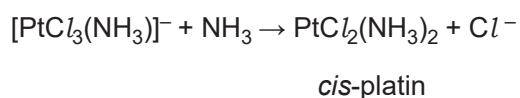
(a) *Cis*-platin, $\text{PtCl}_2(\text{NH}_3)_2$, is a complex of platinum which is used in cancer treatment.

(i) What is the oxidation number of platinum in *cis*-platin?

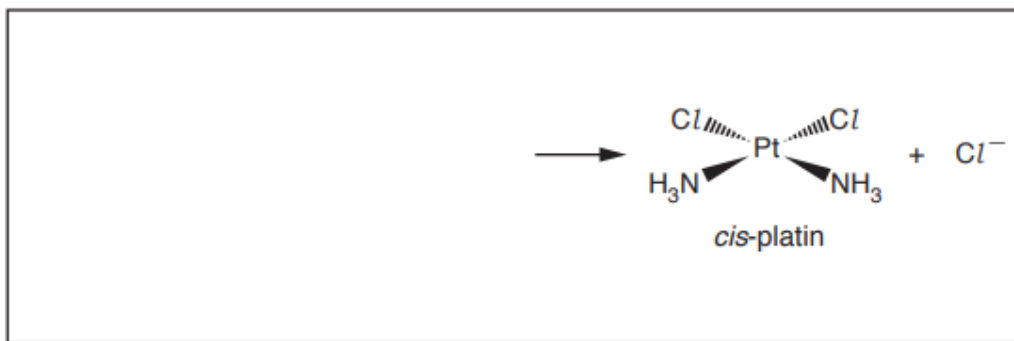
[1]

(ii) *Cis*-platin is prepared in a ligand substitution reaction which takes place in multiple steps.

The equation for the final step forming *cis*-platin is shown below.

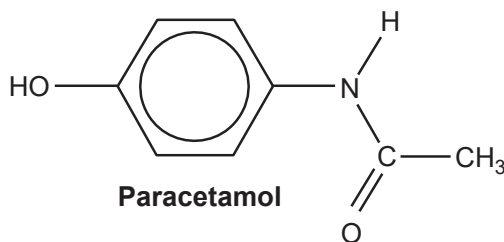


In the box, outline the mechanism for the formation of *cis*-platin from $[\text{PtCl}_3(\text{NH}_3)]^-$. Use curly arrows and lone pairs where appropriate.



[2]

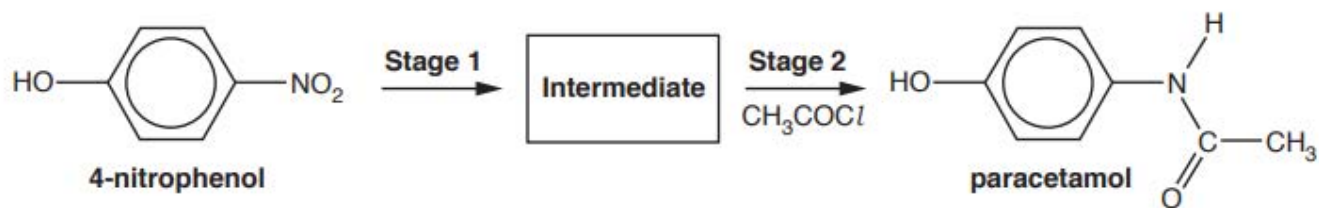
(b) Paracetamol is a solid organic compound used in tablets as a painkiller.



(i) Name the functional groups present in paracetamol.

[2]

(ii)* A chemist prepares a pure solid sample of paracetamol from 4-nitrophenol in two stages:



Describe a two-stage synthesis of 5.00 g of pure paracetamol from 4-nitrophenol. The overall percentage yield of paracetamol from 4-nitrophenol is 40.0%.

In your answer, include the mass of 4-nitrophenol required, the reagents and intermediate, and details of the purification of paracetamol.

[6]

(Total 11 marks)