

# Aromatic Compounds

## A Level only

### Question Paper 1

Level	A Level
Subject	Chemistry
Exam Board	OCR
Module	Organic Chemistry & Analysis
Topic	Aromatic Compounds
Paper	A Level only
Booklet	Question Paper 1

**Time allowed:** 36 minutes

**Score:** /27

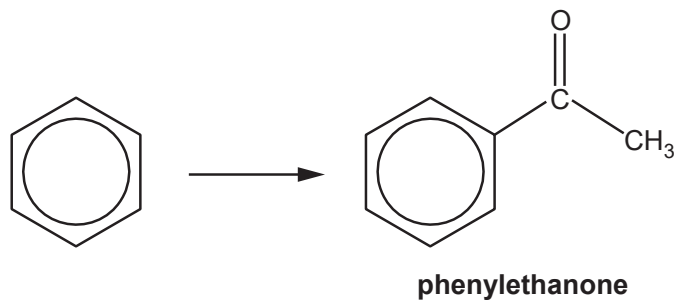
**Percentage:** /100

**Grade Boundaries:**

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

## Question 1

Benzene reacts with an organic reagent in the presence of a halogen carrier to form phenylethanone.



Which organic reagent is required?

- A.  $\text{CH}_3\text{CH}_2\text{OH}$
- B.  $\text{CH}_3\text{CHO}$
- C.  $\text{CH}_3\text{COCl}$
- D.  $\text{CH}_3\text{COOH}$

[1]

## Question 2

Which statement(s) support(s) the delocalised model for the structure of benzene?

- 1 All carbon–carbon bonds have the same length.
  - 2 The enthalpy change of hydrogenation of benzene is less exothermic than expected.
  - 3 Bromine reacts with benzene less readily than with cyclohexene.
- A. 1, 2 and 3
- B. Only 1 and 2
- C. Only 2 and 3
- D. Only 1

[1]

### Question 3

Two chemical tests are carried out on an aqueous solution of an aromatic organic compound **Y**.

The results of the tests are shown below.

Test	Br <sub>2</sub> (aq)	Na <sub>2</sub> CO <sub>3</sub> (aq)
Observation	decolourised	effervescence

What is the minimum number of C atoms in **Y**?

- A 6
- B 7
- C 8
- D 9

[1]

## Question 4

Bromine is reacted separately with nitrobenzene and phenylamine.

Which organic products are likely to form?

	Product from nitrobenzene	Product from phenylamine
<b>A</b>	2-bromonitrobenzene	2-bromophenylamine
<b>B</b>	2-bromonitrobenzene	3-bromophenylamine
<b>C</b>	3-bromonitrobenzene	2-bromophenylamine
<b>D</b>	3-bromonitrobenzene	3-bromophenylamine

[1]

## Question 5

Which of the following support(s) the delocalised model for benzene rather than the Kekulé model?

- 1: Benzene is less reactive than cyclohexene
- 2: A benzene molecule has a planar, hexagonal structure
- 3: The enthalpy change of hydrogenation of benzene is more exothermic than predicted from the Kekulé structure

- A 1, 2 and 3
- B Only 1 and 2
- C Only 2 and 3
- D Only 1

[1]

## Question 6

Alkenes and benzene both react with bromine but alkenes are much more reactive.

- (a) Explain the relative resistance to bromination of benzene compared with alkenes.



*In your answer, you should use appropriate technical terms, spelled correctly.*

[4]

- (b) A student investigates two reactions of bromine with phenylethene,  $C_6H_5CH=CH_2$ .

### Reaction 1

The student first mixes phenylethene with excess bromine at room temperature. An organic compound forms with the molecular formula  $C_8H_8Br_2$ .

### Reaction 2

The student then adds a halogen carrier to the mixture obtained from **reaction 1**. A mixture of isomers forms. Each isomer has the molecular formula  $C_8H_7Br_3$ .

- (i) Draw the structure of the organic compound formed in **reaction 1**.

[1]

- (ii) Predict the number of peaks in the carbon-13 NMR spectrum of the organic compound formed in **reaction 1**.

[1]

- (iii) Draw the structures of two of the isomers of  $C_8H_7Br_3$  formed in **reaction 2**.

<p style="text-align: center;"><b>isomer 1</b></p>	<p style="text-align: center;"><b>isomer 2</b></p>
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[2]

- (iv) State the types of mechanism that take place in **reaction 1** and **reaction 2**.

[2]

[Total 10 Marks]



## Question 7

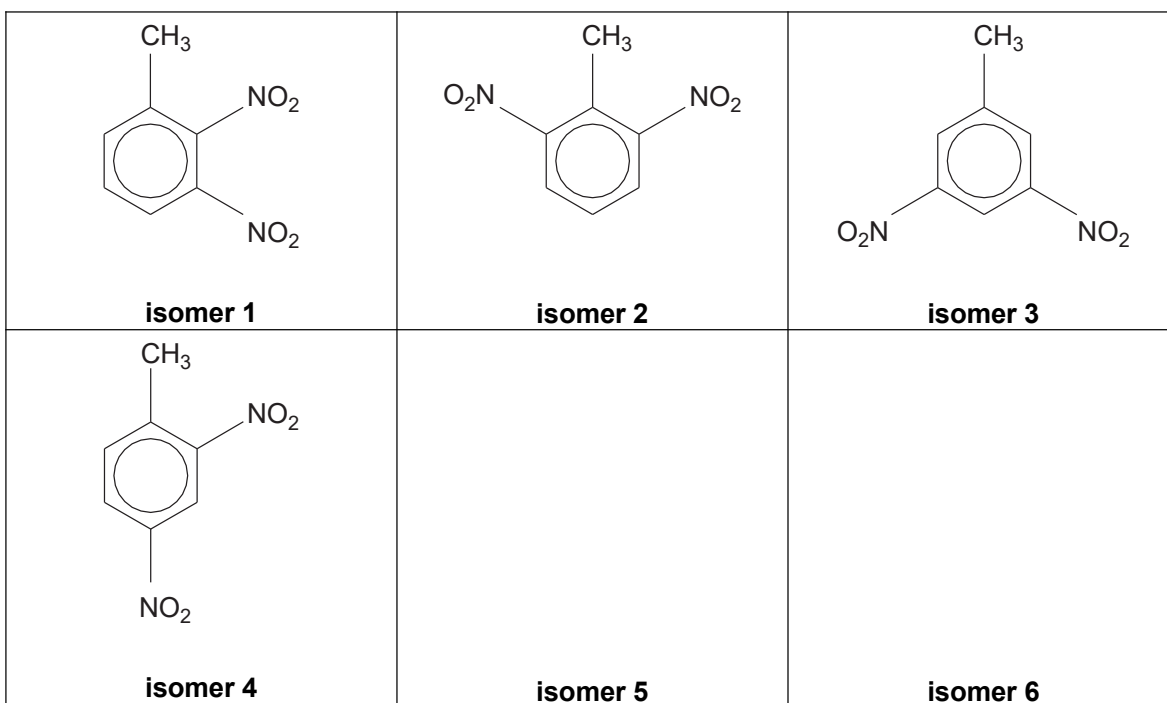
Methylbenzene,  $C_6H_5CH_3$ , is an aromatic hydrocarbon and is used widely as a solvent. It is readily nitrated and it can form mono-, di-, or tri-nitromethylbenzenes.

(a) 4-Nitromethylbenzene can be formed by the nitration of methylbenzene.

Outline the mechanism for the formation of 4-nitromethylbenzene from methylbenzene using  $NO_2^+$  as the electrophile. [4]

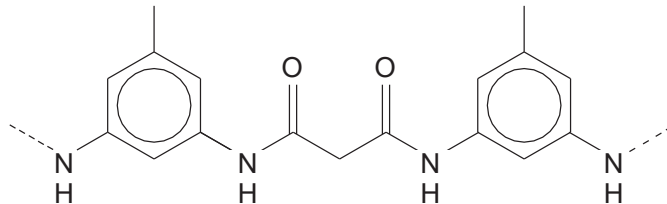
(b) There are six possible structural isomers of  $CH_3C_6H_3(NO_2)_2$  that are dinitromethylbenzenes. Four of the isomers are shown below.

Draw the structures of the other two isomers in the boxes provided.



[2]

- (c) A research chemist investigated whether dinitromethylbenzenes could be used in the manufacture of fibres.  
The chemist devised a **two**-stage synthesis of the condensation polymer below, starting from one of the isomers in part (b).



For the **first** stage of the synthesis,

- Which of the isomers **1**, **2**, **3** or **4** could be used?
- Identify the product formed and state suitable reagents.
- Write an equation.

For the **second** stage of the synthesis,

- Suggest an organic compound that could react with the organic product from the **first** stage to form the polymer.
- State the type of condensation polymer formed. [6]

[Total 12 Marks]