

Extension

48 marks. Parts 1 and 2 are where the course goes next; parts 3 to 6 are Year 1 revision. Nothing here is beyond the specification. Answers are at the back of the mark scheme.

1

Naming benzene rings

Lesson 2. Read the box, then answer.

WHERE THE COURSE GOES NEXT

The rules

- The ring is usually the PARENT: everything else is a prefix in front of the word 'benzene'.
chlorobenzene · nitrobenzene · methylbenzene · 1,3-dimethylbenzene.
- Number the ring to give the LOWEST set of locants, and write the prefixes in alphabetical order. Only use numbers when you need them: chlorobenzene needs none.
- Five compounds have their own names, because the group takes over as the parent: phenol (OH), benzoic acid (COOH), phenylamine (NH₂), benzaldehyde (CHO), methylbenzene (CH₃).
- When the ring is the ADD-ON rather than the parent it is called phenyl: phenylethanone, C₆H₅COCH₃.

1. Name these: (a) C₆H₅Cl (b) C₆H₅NO₂ (c) 1,4-C₆H₄(CH₃)₂ (d) C₆H₅OH (e) C₆H₅COOH [5 marks]

2. Draw: (a) 1,2-dichlorobenzene (b) 4-nitromethylbenzene (c) 3-nitrophenol [3 marks]

(a)	(b)	(c)

- 3.** Explain why 'hydroxybenzene' and '2,4,6-trinitrotoluene' are not acceptable systematic names.
[2 marks]

2

Nitration of benzene

WHERE THE COURSE GOES NEXT

*Lesson 3, the first mechanism of the topic. Read the box, then answer.***The facts**

- Reagents: concentrated nitric acid with concentrated sulfuric acid as the catalyst. Temperature 50 °C (a water bath) — above about 55 °C a second NO₂ group goes on.
- The electrophile is the nitronium ion, NO₂⁺.
- Making it: $\text{HNO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{NO}_2^+ + \text{HSO}_4^- + \text{H}_2\text{O}$
- Getting the catalyst back: $\text{H}^+ + \text{HSO}_4^- \rightarrow \text{H}_2\text{SO}_4$
- The product is nitrobenzene, C₆H₅NO₂ — the starting point for dyes, explosives and many medicines.

1. State the reagents and conditions for the nitration of benzene, and explain why the temperature matters. [3 marks]

2. Write the equation that makes the electrophile, and the equation that regenerates the catalyst. [2 marks]

3. Benzene undergoes substitution, not addition. Use what you did in the main paper to explain why. [3 marks]

3**Alkanes and free-radical substitution**

REVISION — YEAR 1

Year 1, module 4.1.2.

- 1.** Methane reacts with chlorine in the presence of ultraviolet light. Write equations for the initiation step, both propagation steps, and one termination step. Label each one. **[5 marks]**

- 2.** Explain why this reaction gives a mixture of products, and why that makes it a poor way to make chloromethane in industry. **[2 marks]**

4**Alcohols***Year 1, module 4.2.1.***REVISION — YEAR 1**

1. Propan-1-ol is warmed with acidified potassium dichromate(VI). **[5 marks]**

(a) Name the reagent mixture in full.

(b) Give the product and the apparatus needed if you want the aldehyde.

(c) Give the product and the apparatus needed if you want the carboxylic acid.

2. Explain what happens when 2-methylpropan-2-ol is warmed with the same reagent, and why. **[2 marks]**

5
Haloalkanes

REVISION — YEAR 1

Year 1, module 4.2.2.

1. 1-bromobutane is warmed with aqueous sodium hydroxide. [4 marks]

- (a) Name the type of reaction and the mechanism.
(b) Give the organic product.
(c) Name the nucleophile and say what makes it one.

2. 1-chlorobutane, 1-bromobutane and 1-iodobutane are warmed separately with aqueous silver nitrate in ethanol. Put them in order of how quickly a precipitate appears, and explain the order. [3 marks]

6**Isomers and a calculation**

REVISION — YEAR 1

Year 1, modules 4.1.1 and 2.1.3.

1. Draw and name the three alkenes with the molecular formula C_4H_8 . There are also two cyclic isomers with the same formula — name them. [5 marks]

1	2	3	4	5

2. Ethene reacts with steam to make ethanol: $C_2H_4 + H_2O \rightarrow C_2H_5OH$. [4 marks]
- (a) Calculate the percentage atom economy for this reaction.
- (b) 28.0 g of ethene gives 34.5 g of ethanol. Calculate the percentage yield.
- (A_r : H 1.0, C 12.0, O 16.0)
