SL Paper 2

Ethene belongs to the homologous series of the alkenes.

A bromoalkane, C_4H_9Br , reacts with a warm, aqueous sodium hydroxide solution, NaOH.

The time taken to produce a certain amount of product using different initial concentrations of C_4H_9Br and NaOH is measured. The results are shown in the following table.

Reaction	$[C_4H_9Br] / 10^{-2} mol dm^{-3}$	[NaOH] / 10 ⁻³ mol dm ⁻³	<i>t</i> / s
Α	1.0	2.0	46
В	2.0	2.0	23
С	2.0	4.0	23

a.i. Outline three features of a homologous series.[3]a.ii.Describe a test to distinguish ethene from ethane, including what is observed in each case.[2]a.iiiBromoethane can be produced either from ethene or from ethane. State an equation for each reaction.[2]b.i.State the equation for the reaction of C4H9Br with NaOH.[1]b.iiSuggest what would happen to the pH of the solution as the reaction proceeds.[1]c.i.Deduce the effect of the concentration of C4H9Br and NaOH on the rate of reaction.[2]

C₄H₉Br:

NaOH:

c.ii.Suggest why warm sodium hydroxide solution is used.	
c.iiiDeduce whether C_4H_9Br is a primary or tertiary halogenoalkane.	[2]
c.ivDetermine the structural formula of C_4H_9Br .	[1]
c.v.Describe, using an equation, how $ m C_4H_9Br$ can be converted into $ m C_4H_8Br_2$.	
d. Explain the mechanism for the reaction in (c) of $ m C_4H_9 m Br$ with NaOH, using curly arrows to represent the movement of electron pairs.	[4]

Electrolysis is an important industrial process used to obtain very reactive elements from their common ores.

Molten magnesium chloride can be electrolysed using inert graphite electrodes at 800 °C.

a.i. Describe, using a labelled diagram, the essential components of this electrolytic cell.	[2]
a.ii.Molten magnesium chloride can be electrolysed using inert graphite electrodes at 800 °C.	[3]
Deduce the half-equations, including state symbols, for the reactions occurring at each electrode. (The melting points of MgCl ₂ and Mg are 714 °C and 649 °C respectively.)	
Positive electrode (anode):	
Negative electrode (cathode):	
b. Outline why solid magnesium chloride does not conduct electricity.	[1]
c. Aluminium can also be obtained by electrolysis. Suggest one reason why aluminium is often used instead of iron by engineers.	[1]