Oxford Cambridge and RSA

Monday 19 October 2020 – Morning

A Level Chemistry B (Salters)

H433/03 Practical skills in chemistry

Practical Insert

Time allowed: 1 hour 30 minutes

INSTRUCTIONS

- Do **not** send this Insert for marking. Keep it in the centre or recycle it.

INFORMATION

- This document has **4** pages.

© OCR 2020 [601/5371/4]
DC (ST) 193208/4

OCR is an exempt Charity

Mechanisms of hydrolysis reactions of haloalkanes

A group of students investigated whether the structure of a haloalkane affects the rate equation and mechanism for a substitution reaction.

They studied the rate of hydrolysis of the tertiary haloalkane, 2-bromo-2-methylpropane and the primary haloalkane, 1-bromobutane using hydroxide ions.

Method 1: The hydrolysis of 2-bromo-2-methylpropane, $CH_3C(CH_3)BrCH_3$

Equal moles of 2-bromo-2-methylpropane and sodium hydroxide in solution were mixed at room temperature. At the start of the reaction a sample was withdrawn and the reaction in the sample was quenched (slowed down or stopped). The concentration of hydroxide in the sample was determined by titration. The sampling and quenching procedure was repeated every 5 minutes as the reaction proceeded. The results are shown in **Table 4.1**.

Time / min	$[OH^-] \times 10^{-3}$ / mol dm^{-3}
0	50.0
5	30.0
10	19.5
15	12.0
20	9.0
25	5.0
30	4.5

Table 4.1

Method 2: The hydrolysis of 1-bromobutane, $CH_3CH_2CH_2CH_2Br$

The initial concentrations of 1-bromobutane and sodium hydroxide were changed as in **Table 4.2**. The initial rate of reaction was measured for each mixture.

Mixture number	$[C_4H_9Br] \times 10^{-1}$ / mol dm^{-3}	$[OH^-] \times 10^{-1}$ / mol dm^{-3}	Initial rate / mol dm^{-3} s^{-1}
1	0.25	0.10	3.2×10^{-6}
2	0.50	0.10	6.5×10^{-6}
3	0.50	0.50	3.3×10^{-5}

Table 4.2

Research by the students found there were two possible mechanisms for this type of substitution reaction.

Either: $C_4H_9Br + OH^- \rightarrow C_4H_9OH + Br^-$ (**mechanism A**)

Or: $C_4H_9Br \rightleftharpoons C_4H_9^+ + Br^-$ **followed by** $C_4H_9^+ + OH^- \rightarrow C_4H_9OH$ (**mechanism B**)

BLANK PAGE

OCR
Oxford Cambridge and RSA

Copyright Information

OCR is committed to seeking permission to reproduce all third-party content that it uses in its assessment materials. OCR has attempted to identify and contact all copyright holders whose work is used in this paper. To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced in the OCR Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download from our public website (www.ocr.org.uk) after the live examination series.

If OCR has unwittingly failed to correctly acknowledge or clear any third-party content in this assessment material, OCR will be happy to correct its mistake at the earliest possible opportunity.

For queries or further information please contact The OCR Copyright Team, The Triangle Building, Shaftesbury Road, Cambridge CB2 8EA.

OCR is part of the Cambridge Assessment Group; Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© OCR 2020