InkChemistry

QUESTION WORKBOOK

Reaction types, curly arrows and how a mechanism is written

Introduction to organic chemistry · Unit C16

AQA 3.3.1.2 · OCR A 4.1.1

20 questions · 63 marks

PRINT EDITION

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SECTION A · Short, 1 to 2 marks

A1 RTC-Q3
State what happens to the electrons in homolytic fission, and name the type of species formed. [2]

A2 RTC-Q4
Describe the heterolytic fission of the C–Br bond in 2-bromo-2-methylpropane, $(CH_3)_3CBr$. [2]

A3 RTC-Q6
Name the type of reaction in each change: propene and hydrogen bromide forming 2-bromopropane, and ethanol forming ethene and water. [2]

A4 RTC-Q14
Suggest why bromoethane is hydrolysed much more slowly by water than by aqueous hydroxide ions, although both are nucleophiles. [2]

SECTION B · Standard, 3 to 5 marks

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B1 RTC-Q1

State what is meant by a nucleophile and by an electrophile, and identify the species acting as each in two reactions: cyanide ions with bromoethane, and hydrogen bromide with ethene. [4]

B2 RTC-Q10

Draw the mechanism of the reaction between hydroxide ions and bromoethane, showing the dipole, the lone pair and both curly arrows. [4]

B3 RTC-Q11

Outline the mechanism for the reaction of cyanide ions with 1-bromopropane, $CH_3CH_2CH_2Br$, and name the organic product. [4]

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B4 RTC-Q17 Evaluate a student's mechanism for hydroxide ions reacting with bromoethane, in which the first arrow starts on the δ+ carbon and ends on the oxygen of OH^-, and the second starts on the bromine atom and ends on the carbon. [4]

B5 RTC-Q5 Identify each of the species $Cl•$, NH_3 and NO_2^+ as a radical, a nucleophile or an electrophile. [3]

B6 RTC-Q7 Explain why ammonia can act as a nucleophile although it has no charge. [3]

B7 RTC-Q8 Explain why the carbon atom of the C–Br bond in bromoethane is attacked by nucleophiles. [3]

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B8 RTC-Q9 Explain why bromine, Br_2, which is not polar, can act as an electrophile towards ethene, and name the product. [3]

B9 RTC-Q12 Calculate the percentage atom economy for making chloromethane by the reaction $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$. Use Ar values H 1.0, C 12.0, Cl 35.5. [3]

B10 RTC-Q13 Calculate the percentage atom economy for making ethanol by the reaction $CH_3CH_2Br + NaOH \rightarrow CH_3CH_2OH + NaBr$. Use Ar values H 1.0, C 12.0, O 16.0, Na 23.0, Br 79.9. [3]

B11 RTC-Q15 Suggest the mechanism for the reaction of ethene with iodine monochloride, ICl, given that chlorine is more electronegative than iodine. [3]

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B12 RTC-Q16 Compare the action of the hydroxide ion as a nucleophile with its action as a base. [3]

B13 RTC-Q19 Explain why the addition of bromine to ethene has a percentage atom economy of 100%, whereas a substitution reaction can never reach 100%. [3]

B14 RTC-Q20 Calculate the percentage atom economy for making propene by dehydrating propan-1-ol: $CH_3CH_2CH_2OH \rightarrow CH_3CH{=}CH_2 + H_2O$. Use Ar values H 1.0, C 12.0, O 16.0. [3]

B15 RTC-Q21 Suggest, in terms of atom economy, why ethanol is made industrially by adding steam to ethene, $CH_2{=}CH_2 + H_2O \rightarrow CH_3CH_2OH$, rather than by reacting bromoethane with sodium hydroxide. [3]

SECTION C · Long, 6 marks or more

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C1 RTC-Q18 Explain the difference between homolytic and heterolytic fission, giving an example of each and describing how the curly arrows used to show them differ. [6]

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