Halogen compounds – 2022 June AS Chemistry 9701

1. June/2022/Paper_11/No.31

Structural isomerism and stereoisomerism should be taken into account when answering this question.

How many isomeric alkenes with formula C_5H_8 are present in the mixture produced when 1,4-dibromopentane is reacted with NaOH in ethanol?

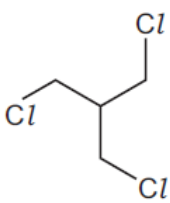
A 1 **B** 2 **C** 3 **D** 4

2. June/2022/Paper_11/No.32

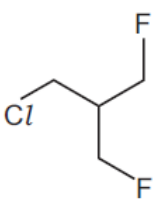
The presence of a halogen in an organic compound may be detected by warming the organic compound with aqueous silver nitrate.

Which compound would be the quickest to produce a precipitate?

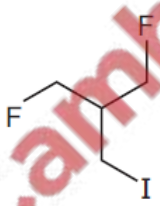
A



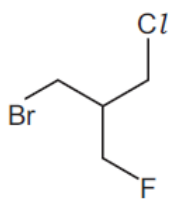
B



C

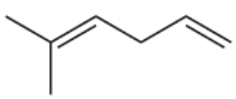


D



3. June/2022/Paper_12/No.30

The alkene shown reacts with an excess of HBr via an electrophilic addition reaction.



What is the **major** product formed?

A 3,5-dibromo-2-methylhexane

B 2,5-dibromo-2-methylhexane

C 2,6-dibromo-2-methylhexane

D 3,6-dibromo-2-methylhexane

4. June/2022/Paper_13/No.31

Which statement concerning the hydrolysis of 1-bromopropane with water is correct?

A The hydrolysis reaction between water and 1-iodopropane is faster because the C–Br bond is less polar than the C–I bond.

B The hydrolysis reaction with water is very slow because water is a weak electrophile.

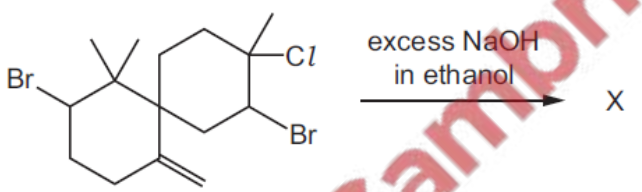
C The mechanism of the reaction involves the formation of a stable carbocation.

D The reaction is slower with 1-chloropropane because the C–C*l* bond is stronger than the C–Br bond.

5. June/2022/Paper_13/No.32

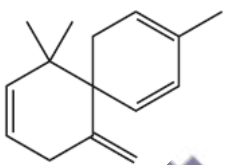
Compound J, $C_{15}H_{23}Br_2Cl$, is reacted with an excess of a hot concentrated solution of sodium hydroxide in ethanol. One of the products is X.

compound J

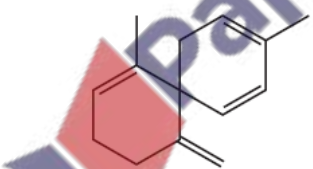


What could be the skeletal formula of X?

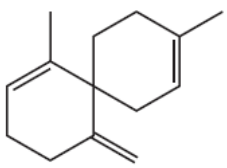
A



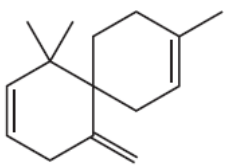
B



C



D



6. June/2022/Paper_13/No.35

Which reaction has a nucleophilic addition mechanism and gives a good yield of product under the stated conditions?

A 1-bromopropane reacting with hot ethanolic sodium hydroxide

B 2-iodopropane reacting with hot aqueous sodium hydroxide

C propanal reacting with hydrogen cyanide under alkaline conditions

D propanal reacting with hydrogen cyanide under acidic conditions

7. June/2022/Paper_22/No.4(b)

(b) Halothane is an anaesthetic.

halothane

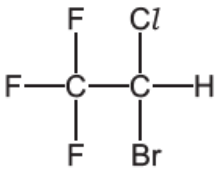


Fig. 4.1

(i) Identify the chiral centre in halothane and mark it with an asterisk (*). [1]

When halothane reacts in ultraviolet light, homolytic fission occurs and the C–Br bond is broken.

(ii) Construct an equation to show the homolytic fission of halothane, $CF_3CHBrCl$.

..... [1]

(iii) Complete Fig. 4.2 to show the arrangement of electrons in a bromine atom using the electrons in boxes notation.

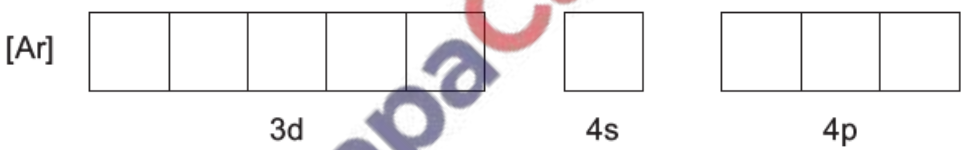


Fig. 4.2

[1]

8. June/2022/Paper_22/No.5

Fig. 5.1 shows three reactions of 2-bromopropane, $CH_3CH(Br)CH_3$.

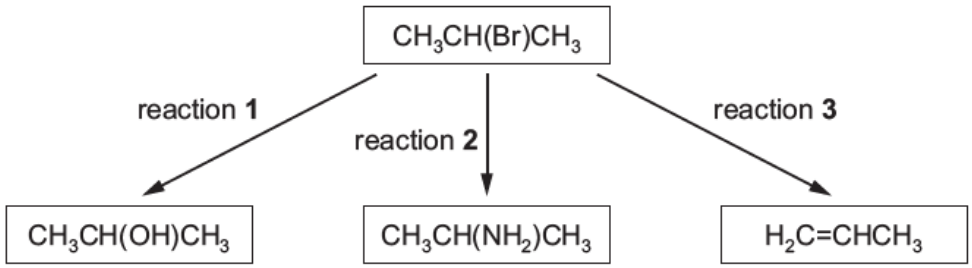


Fig. 5.1

(a) Complete Table 5.1 for each reaction, by:

- stating the reagent and conditions used
- identifying the type of reaction that occurs.

Table 5.1

reaction	reagent and conditions	type of reaction
1		
2		
3		

[6]

(b) A sample of 2-iodopropane, $CH_3CH(I)CH_3$, reacts under the same conditions as reaction **1** to produce $CH_3CH(OH)CH_3$.

Explain why 2-iodopropane reacts at a faster rate than 2-bromopropane.

.....

.....

..... [2]

(c) Fig. 5.2 shows how butan-1-ol can be made from 1-bromopropane in three steps.

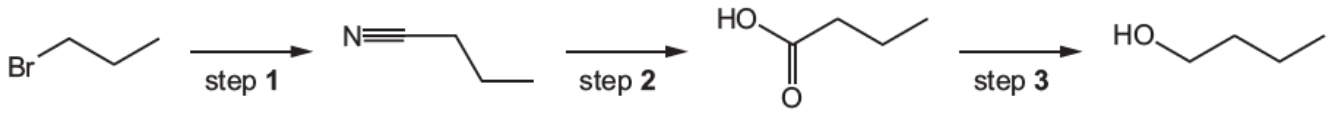


Fig. 5.2

(i) In step **1**, 1-bromopropane reacts with CN^- to form butanenitrile.

Complete Fig. 5.3 to show the mechanism for step **1**. Include charges, dipoles, lone pairs of electrons and curly arrows as appropriate.

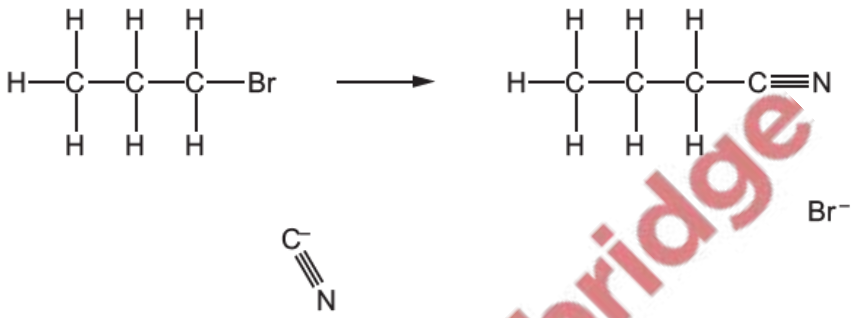


Fig. 5.3

[2]

(ii) In step **2**, butanenitrile is heated with HC*l*(aq). A hydrolysis reaction occurs.

Construct an equation for the reaction in step **2**.

..... [1]

(iii) Step **3** is a reduction reaction.

Construct an equation for the reduction reaction in step **3**. Use [H] to represent one atom of hydrogen from the reducing agent.

..... [1]

(iv) State the identity of a suitable reducing agent in step **3**.

..... [1]

[Total: 13]

9. June/2022/Paper_23/No.4

(a) 2-methylpropene reacts with HCl(g) at room temperature. The major organic product is 2-chloro-2-methylpropane.

(i) Complete Fig. 4.1 to show the structure of the intermediate and mechanism for this reaction. Include charges, dipoles, lone pairs of electrons and curly arrows as appropriate.

Fig. 4.1

[3]

(ii) Explain why, in this reaction, 2-chloro-2-methylpropane is produced at a higher yield than 1-chloro-2-methylpropane.

.....

.....

..... [2]

(b) Two bottles labelled **Q** and **M** each contain a straight-chain halogenoalkane with molecular formula C_4H_9X, where **X** represents Cl, Br or I.
A sample from each bottle is added to separate samples of equal amounts of aqueous silver nitrate in ethanol. In each reaction, the same organic product, **T**, and a precipitate are made, as shown in Fig. 4.2.

Fig. 4.2

Table 4.1 describes the colour of each of the precipitates made.

Table 4.1

halogenoalkane added to $AgNO_3$(aq) in ethanol	colour of precipitate
Q	white
M	yellow

(i) Identify the functional group present in **T** and name the type of reaction that occurs using the information in Fig. 4.2 and Table 4.1.

functional group in **T** .....

type of reaction .....

[2]

(ii) Construct an ionic equation to describe the formation of the yellow precipitate produced when **M** reacts with $AgNO_3(aq)$ in ethanol.

..... [1]

(iii) Describe which reagent, **Q** or **M**, will produce a precipitate more quickly when each is added to $AgNO_3(aq)$ in ethanol. Explain your answer.

reagent .....

.....

.....

[1]

(iv) When pure **T** is added to alkaline $I_2(aq)$, a yellow precipitate and an anion, **L**, are made.

Identify the anion **L**.

..... [1]

(v) Deduce the structure of the straight-chain halogenoalkane **M**.

[2]

[Total: 12]