Unit 8 · Haloalkanes

WORKSHEET

Full marks 33

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 33

1 Key words [4]

Write True or False in the box beside each sentence. Correct each false sentence. Each carries 0.5 mark.

i. In a haloalkane, the carbon bonded to the halogen carries a partial positive charge. ☐

ii. In a geminal dihalide, the two halogen atoms are on neighboring carbons. ☐

iii. Haloalkanes boil at higher temperatures than the alkanes they come from. ☐

iv. Of the C–X bonds, C–F is the easiest to break. ☐

v. An SN2 reaction takes place in one step, with the nucleophile attacking from the side opposite the halogen. ☐

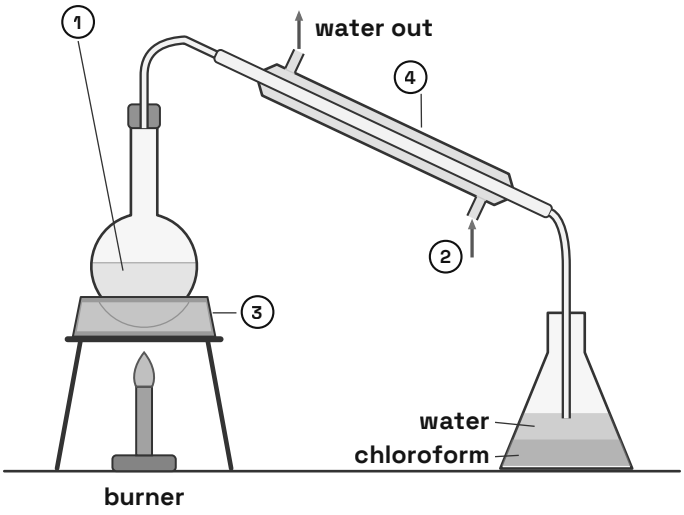
vi. Haloalkanes react with alcoholic KOH to give alcohols. ☐

vii. A Grignard reagent is made by the reaction of a haloalkane with magnesium in dry ether. ☐

viii. Chloroform is lighter than water and floats on it. ☐

2 Label the diagram [2]

The diagram shows chloroform being prepared in the laboratory. Write what belongs in place of 1 to 4. Each carries 0.5 mark.



1. _____ **2.** _____

3. _____ **4.** _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. The IUPAC name of $CH_3–CHBr–CH_2–CH_3$ is: [1]

a. 3-bromobutane
b. 2-bromobutane
c. 1-bromo-1-methylpropane
d. sec-butyl bromide

ii. Bromoethane is heated with silver cyanide. The main product is: [1]

a. ethanenitrile, $CH_3CH_2–C\equiv N$
b. ethyl isocyanide, $CH_3CH_2–N\equiv C$
c. ethanamine
d. ethanol

iii. Which of these reacts fastest with hydroxide ions by the SN2 mechanism? [1]

a. CH_3Br
b. CH_3CH_2Br
c. $(CH_3)_2CHBr$
d. $(CH_3)_3CBr$

iv. 2-bromobutane is heated with alcoholic KOH. The main product is: [1]

a. but-1-ene
b. but-2-ene
c. butan-2-ol
d. butane

v. The carbylamine test, warming with chloroform and alcoholic KOH to give a foul-smelling isocyanide, is given by: [1]

a. primary amines
b. secondary amines
c. tertiary amines
d. all amines

4 Short answers [7]

Write short answers to the following questions.

a. Write the equation for preparing chloroethane from ethanol with thionyl chloride. Why does this method give the purest product? [2]

b. What are vicinal and geminal dihalides? Give one example of each. [2]

c. Write the main organic product, with a balanced equation, when bromoethane reacts with: a. aqueous KOH; b. alcoholic KCN; c. silver nitrite, $AgNO_2$. [3]

5 Long answer [4]

Write a long answer to the following question.

How is chloroform prepared in the laboratory from acetone (propanone) and bleaching powder? Write the equations for each step. Why is chloroform stored in dark brown bottles filled to the brim?

6 Numerical problems [8]

Solve the following problems. Show your working. Take H = 1, C = 12, Br = 80; one mole of a gas at STP fills 22.4 L.

a. A haloalkane contains 29.3% carbon, 5.7% hydrogen and 65.0% bromine by mass. Its vapor density is 61.5. **[4]**

i. Find its empirical formula.
ii. Find its molecular formula.
iii. Draw and name (IUPAC) its two isomers, and say whether each is primary or secondary.
iv. Both isomers give the same product when heated with alcoholic KOH. Name it, and write the equation for one isomer.

Answer:

b. 10.9 g of bromoethane, C_2H_5Br, is used. **[4]**

i. How many moles is it?

ii. All of it is heated with sodium in dry ether (Wurtz reaction). Write the equation and find the mass of butane formed, if the reaction were complete.

iii. In practice the yield is 60%. What mass of butane is obtained?

iv. If the same mass of bromoethane were instead reduced completely with zinc and hydrochloric acid, what volume of ethane would form at STP?

Answer: _____

7 Think **[3]**

In bromoethane the carbon bonded to bromine is $\delta+$, and it is attacked by nucleophiles. After it reacts with magnesium in dry ether, the same carbon in $CH_3CH_2–MgBr$ attacks the $\delta+$ carbon of a C=O group. Explain this change, and use it to say what alcohol forms when CH_3CH_2MgBr reacts with ethanal and the product is treated with water.

8 Activity: Which halide comes off fastest? (not marked)

Your teacher adds a few drops each of 1-chlorobutane, 1-bromobutane and 1-iodobutane to three test tubes of warm silver nitrate solution in ethanol. Note how long each takes to turn cloudy, and the color of each precipitate.

Haloalkane	Time to turn cloudy	Color of the precipitate
1-chlorobutane		
1-bromobutane		
1-iodobutane		

Arrange them in order of reactivity, and explain the order from the C–X bond.