CHEMISTRY (CODE – 043)

Chapter-wise Test: Haloalkanes and Haloarenes

(NCERT Class XII Chemistry, Unit 6: Haloalkanes and Haloarenes)

PRACTICE QUESTION PAPER

CLASS XII (2026-27)

Time: 1½ hours **Max. Marks: 35**

GENERAL INSTRUCTIONS: Read the following instructions carefully.

1. There are 17 questions in this question paper with internal choice. All questions are based on Unit 6: Haloalkanes and Haloarenes.
2. SECTION A consists of 8 multiple-choice questions carrying 1 mark each.
3. SECTION B consists of 3 very short answer questions carrying 2 marks each.
4. SECTION C consists of 4 short answer questions carrying 3 marks each.
5. SECTION D consists of 1 case-based question carrying 4 marks.
6. SECTION E consists of 1 long answer question carrying 5 marks.
7. All questions are compulsory. Internal choice is provided in Questions 9 to 15, 16(iii) and 17.
8. Questions 2, 3, 9, 12, 13, 14 and 16 are based on figures, structures or data tables given in the paper.
9. Use of log tables and calculators is not allowed.

SECTION A

Questions 1 to 8 are multiple choice questions. Only one of the choices is correct. Select and write the correct choice as well as the answer to these questions. Each question carries 1 mark.

1 The IUPAC name of neo-pentyl bromide, $(CH_3)_3CCH_2Br$, is: 1

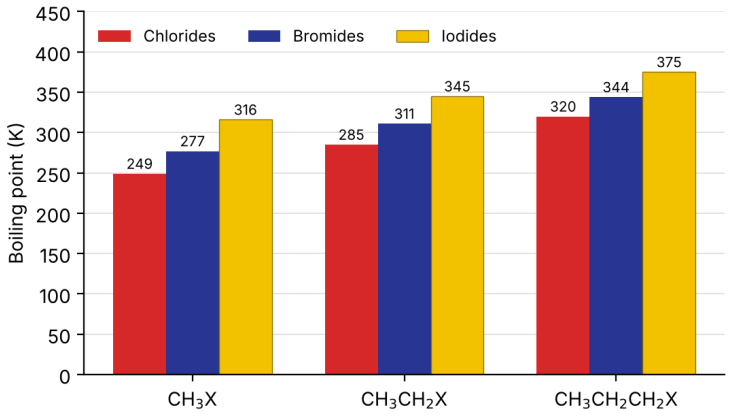
A. 2-Bromo-2,2-dimethylpropane
B. 1-Bromo-3-methylbutane
C. 1-Bromo-2,2-dimethylpropane
D. 2-Bromo-2-methylbutane

2 The table gives the carbon–halogen bond data for the methyl halides. 1

Bond	Bond length (pm)	Bond enthalpy (kJ mol^{-1})	Dipole moment (D)
CH_3–F	139	452	1.847
CH_3–Cl	178	351	1.860
CH_3–Br	193	293	1.830
CH_3–I	214	234	1.636

Which conclusion drawn from the table is correct?

A. The C–X bond enthalpy increases from C–F to C–I.
B. The C–I bond is the longest and weakest, so alkyl iodides are the most reactive towards nucleophilic substitution.
C. CH_3F has the highest dipole moment because fluorine is the most electronegative.
D. The C–X bond length decreases down the group.

3	Fig. 1 compares the boiling points of some alkyl halides.  **Fig. 1** Which conclusion from Fig. 1 is correct? A. For the same halogen, the boiling point decreases as the length of the alkyl group increases. B. For the same alkyl group, the order of boiling points is RCl > RBr > RI. C. The boiling point depends only on the polarity of the C–X bond. D. For the same alkyl group, the boiling points increase from chloride to bromide to iodide because the van der Waals forces increase with the size and mass of the halogen atom.	1
4	Ethyl bromide reacts with silver cyanide (AgCN) to give mainly: A. ethyl isocyanide, CH_3CH_2NC B. ethyl cyanide, CH_3CH_2CN C. ethanol D. ethene	1
5	Which of the following alkyl halides undergoes S_N1 hydrolysis at the fastest rate? A. $CH_3CH_2CH_2Br$ B. CH_3CH_2Br C. $(CH_3)_3CBr$ D. CH_3Br	1
6	Thionyl chloride is the preferred reagent for converting an alcohol to an alkyl chloride because: A. it is the cheapest chlorinating agent B. the by-products, SO_2 and HCl, are gases and escape, leaving a pure alkyl chloride C. it works equally well for phenols D. it needs anhydrous $ZnCl_2$ as a catalyst	1
7	Ethyl iodide is prepared from ethyl bromide by treating it with NaI in dry acetone (Finkelstein reaction). The reaction goes to completion because: A. NaI is more soluble in water than NaBr B. iodine is a stronger oxidising agent than bromine C. ethyl iodide is insoluble in acetone D. NaBr is insoluble in dry acetone and is precipitated, which drives the equilibrium forward	1
8	**Assertion (A):** The S_N2 reaction of optically active 2-bromooctane with NaOH gives octan-2-ol with inversion of configuration. **Reason (R):** The nucleophile attacks the carbon from the side opposite to the leaving group. A. Both A and R are true and R is the correct explanation of A. B. Both A and R are true but R is not the correct explanation of A. C. A is true but R is false. D. A is false but R is true.	1

SECTION B

Question Nos. 9 to 11 are very short answer questions carrying 2 marks each.

9 **Attempt either A or B.** 2

(A) The table gives the densities of some haloalkanes.

Compound	Density (g mL^{-1})	Compound	Density (g mL^{-1})
n-C_3H_7Cl	0.89	CH_2Cl_2	1.336
n-C_3H_7Br	1.335	$CHCl_3$	1.489
n-C_3H_7I	1.747	CCl_4	1.595

(i) Which compound in the table will float on water? (Density of water = 1.0 g mL^{-1})
(ii) State the two trends in density shown by the table.

OR

(B) Arrange the following sets in order of increasing boiling points: (i) bromomethane, bromoform, chloromethane, dibromomethane; (ii) 1-chloropropane, isopropyl chloride, 1-chlorobutane.

10 **Attempt either A or B.** 2

(A) What are ambident nucleophiles? Explain with the help of the reactions of ethyl bromide with KCN and with AgCN.

OR

(B) Name and write the equation for the reaction used to prepare (i) ethyl iodide from ethyl bromide and (ii) methyl fluoride from methyl bromide.

11 **Attempt either A or B.** 2

(A) Write the major product(s) in each case and name the rule or reaction involved:
(i) 2-bromopentane heated with alcoholic KOH
(ii) chlorobenzene treated with Cl_2 in the presence of anhydrous $FeCl_3$

OR

(B) Why must Grignard reagents be prepared in dry ether? Write the equation for the reaction of CH_3MgBr with water.

SECTION C

Question Nos. 12 to 15 are short answer questions carrying 3 marks each.

12 **Attempt either A or B.** 1+1+1

(A) The table shows the relative rates of the S_N2 reaction of some alkyl bromides with the same nucleophile.

Alkyl bromide	CH_3Br	CH_3CH_2Br	$(CH_3)_2CHBr$	$(CH_3)_3CBr$
Relative rate	30	1	0.02	≈ 0

(i) State the trend in reactivity and give the reason.
(ii) How will the order of reactivity of the same four bromides change in S_N1 reactions? Why?
(iii) Which of these bromides reacts by a two-step mechanism? Name the intermediate.

OR

(B) Which compound in each pair reacts faster in an S_N2 reaction with OH^-? Give a reason for each.
(i) CH_3Br or CH_3I
(ii) $(CH_3)_3CCl$ or CH_3Cl
(iii) 1-bromobutane or 2-bromobutane

13 **Attempt either A or B.** 1+1+1

(A) Fig. 2 shows the potential energy diagrams for two nucleophilic substitution reactions, I and II, of an alkyl halide R–X with a nucleophile.

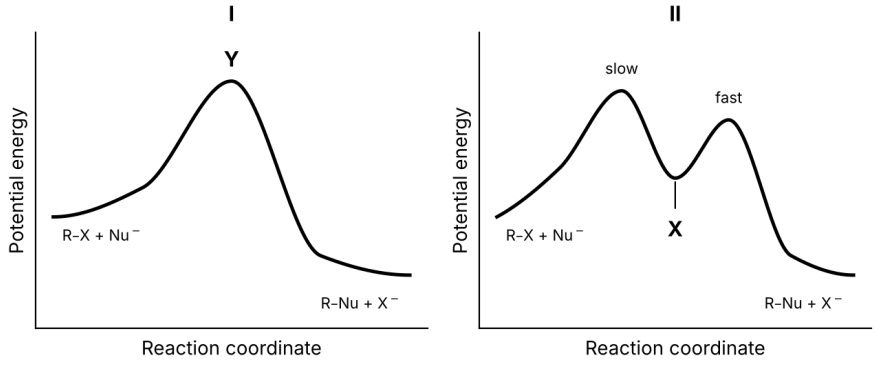
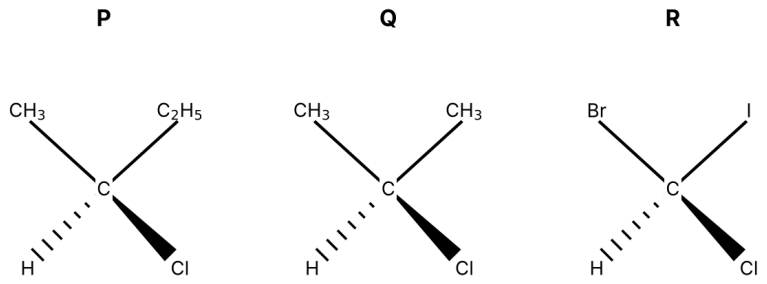


Fig. 2

(i) Identify the mechanism represented by I and by II.
(ii) What are Y and X? Which of the two cannot be isolated?
(iii) What is the stereochemical outcome if the reactant R–X is optically active, for I and for II?

OR

(B) Define (i) enantiomers, (ii) racemic mixture, (iii) retention of configuration. Why does a racemic mixture show no optical activity?

14	**Attempt either A or B.** **(A)** Fig. 3 shows the three-dimensional structures of three molecules, P, Q and R. (A solid wedge shows a bond above the plane of the paper, a dashed wedge a bond below it.)  **Fig. 3** (i) Identify the chiral and the achiral molecules among P, Q and R. Give a reason. (ii) Name molecule P and identify its asymmetric carbon. (iii) What will be the optical rotation of an equimolar mixture of the two mirror-image forms of P? What is such a mixture called? **OR** **(B)** Write the equations for (i) the Wurtz reaction of bromoethane, (ii) the Fittig reaction of chlorobenzene, and (iii) the Wurtz–Fittig reaction of chlorobenzene with bromomethane.	1+1+1
15	**Attempt either A or B.** **(A)** Write the chemical equation, with conditions, for the conversion of: (i) ethanol to chloroethane using thionyl chloride (ii) aniline to chlorobenzene (iii) propene to 2-bromopropane **OR** **(B)** (i) Why is chloroform stored in dark coloured bottles that are completely filled? Write the equation for the reaction involved. (ii) Why is the use of DDT banned in many countries? (iii) Why are freons harmful to the environment?	1+1+1

SECTION D

Question No. 16 is a case-based/data-based question carrying 4 marks.

16 **Why is chlorobenzene so unreactive?** 1+1+2

Haloarenes are much less reactive than haloalkanes towards nucleophilic substitution. The reactivity is increased by the presence of an electron withdrawing group such as $-NO_2$ at the ortho and para positions. The table gives the conditions needed for the hydrolysis of some chloroarenes.

Compound	Substituents	Conditions for replacement of Cl by OH
Chlorobenzene	None	NaOH, 623 K, 300 atm
4-Nitrochlorobenzene	One $-NO_2$ (para)	NaOH, 443 K
2,4-Dinitrochlorobenzene	Two $-NO_2$ (ortho, para)	NaOH, 368 K
2,4,6-Trinitrochlorobenzene	Three $-NO_2$ (ortho, para, ortho)	Warm water

Answer the following questions:

(i) What is the effect of the number of nitro groups at the ortho and para positions on the reactivity? Give a reason.
(ii) What effect will a nitro group at the meta position have on the reactivity? Explain.
(iii) **Attempt either A or B.**
(A) Give two reasons why chlorobenzene is less reactive than chloroethane towards nucleophilic substitution.
OR
(B) Chlorine is an electron withdrawing group, yet it is ortho, para-directing in electrophilic substitution of chlorobenzene. Explain.

SECTION E

Question No. 17 is a long answer question carrying 5 marks.

17 **Attempt either A or B.** 5

(A) (i) Write the order of reactivity of the primary, secondary and tertiary alkyl halides in S_N1 and in S_N2 reactions.
(ii) Write the mechanism of the hydrolysis of 2-bromo-2-methylpropane with aqueous KOH. Which step is the slowest, and what is the order of the reaction?
(iii) Hydrolysis of optically active 2-bromobutane with aqueous KOH gives (±)-butan-2-ol. Explain.
(iv) (−)-2-Bromooctane reacts with NaOH to give (+)-octan-2-ol. Name the mechanism and the stereochemical change.

OR

(B) An organic compound A, 1-chloropropane ($CH_3CH_2CH_2Cl$), is prepared from propan-1-ol. Write the equations for the reactions in which A is converted into:
(i) propan-1-ol, using a suitable reagent
(ii) propene
(iii) butanenitrile
(iv) hexane
(v) propane via a Grignard reagent

— End of Question Paper —