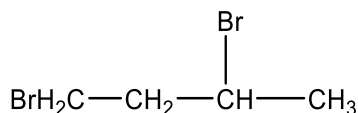
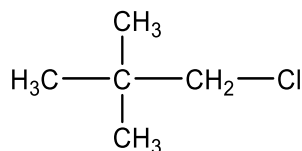


8. HALOALKANES (ALKYL HALIDES)

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Introduction

1. Write down the structure of the secondary haloalkane of C_3H_7X . 1
2. Write the possible isomers for the molecular formula C_4H_9Br . 2
3. Write the IUPAC names of the following compounds.



General Methods of Preparation of Monohaloalkanes (Alkyl halides)

1. From alkenes

4. Write a short note on Markovnikov's rule. 3
Write an example of Markovnikov's rule. 1
5. What product is obtained when 2-methylprop-1-ene is treated with HBr in the presence of organic peroxide? 1

2. From alcohols

6. Write the action of propan-2-ol with PCl_5 . 1
7. Write three methods of preparation of chloroethane. 3
Write three methods of preparation of iodomethane. 3
8. Write three methods of preparation of iodoethane. 3

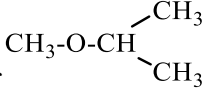
Chemical Properties

1. Formation of alcohols - Reaction with aqueous caustic alkali (substitution by -OH group)

9. Make the following conversions:



2. Formation of ether - $\text{R}_x\text{R}'$ with sodium alkoxide (substitution by -OR)(Williamson's etherification process)

10. What is Williamson's etherification reaction? 2
Write a reaction to illustrate Williamson's reaction. 1
11. Prepare ethoxyethane from a haloalkane, $\text{C}_2\text{H}_5\text{Br}$ by Williamson's ether synthesis. 1
12. Use Williamson's synthesis method for the preparation of  2
Give the correct chemical equation for the preparation of 2-methoxypropane. 1
13. Give Williamson's synthesis to prepare unsymmetrical ethers. 1
14. How would you prepare the unsymmetrical ether of $\text{C}_3\text{H}_8\text{O}$ by Williamson's synthesis? 1
Prepare $\text{CH}_3\text{-O-CH}_2\text{CH}_3$ by using Williamson's ether synthesis. 1
15. Write an example of Williamson's etherification reaction. State its importance. 2
16. Give a proper reason: Williamson's etherification is useful for the preparation of both symmetrical and unsymmetrical ethers. 2

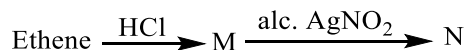
17. Write down the isomeric ether of isopropyl alcohol and use Williamson's synthesis process to prepare such an ether. 2

(Hint: isopropyl alcohol = propan-2-ol; isomer ether = methoxyethane.
Either chloromethane & sod. ethoxide or chloroethane & pot. methoxide.)

18. How would you obtain methoxyethane from ethanol? 1

6. Formation of nitroalkanes: action of alcoholic silver nitrite

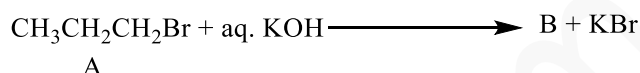
19. Make the following conversion:



[B] Elimination Reaction

Dehydrohalogenation (reaction with alc. KOH)

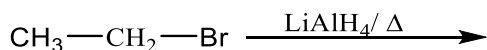
20. What happens when chloroethane is heated with alcoholic KOH? 1
What happens when iodoethane is heated with alc. NaOH? 1
21. Give an example of an Elimination Reaction. 1
Give an example of dehydrohalogenation. 1
22. Predict the major product when 2-chloro-3-methylbutane and 2-bromobutane are treated separately with an alcoholic solution of potassium hydroxide.
23. Convert 1-chloropropane to 2-chloropropane. 2
24. Consider the following equation: 5



- a) Identify compound B in the above reaction.
- b) Which substitution reaction occurs in the above reaction and why?
- c) What product is formed when alc. KOH is used instead of aq. KOH in the above reaction?
- d) How can you obtain 1-methoxypropane from the above compound A?
25. A chemical reaction occurs as follows:
- $$\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} + \text{aq. KOH} \longrightarrow \text{B} + \text{KBr}$$
- A
- a) Identify the compound B in the above reaction. 1
- b) Which substitution reaction mechanism occurs in the above reaction and why? 2
- c) What product is formed when alc. KOH is used instead of aq. KOH in the above reaction? 1
- d) How can you obtain nitropropane from the above compound A? 1
26. A haloalkane X has molecular formula $\text{C}_4\text{H}_9\text{Cl}$. On treatment with aqueous KOH, it gives **butan-2-ol**. When X is heated with alcoholic KOH, **but-2-ene** is obtained as the major product.
- a) Identify X.
- b) Write the equations for both reactions.
- c) Why is the second reaction classified as an elimination reaction?
27. A student wants to convert **1-chloropropane into 2-chloropropane** but proposes:
- $$\text{1-chloropropane} \xrightarrow{\text{aq. KOH}} \text{propene} \xrightarrow{\text{HCl}} \text{2-chloropropane}$$
- a) Identify the mistake in the proposed route.
- b) Design a suitable reaction sequence to achieve the required conversion.
- c) State the rule involved in the addition step.

[C] Reduction

28. Give the major products of the following reactions.



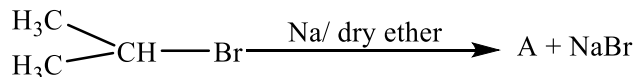
1

[D] Reaction with metals

Wurtz reaction

29. Identify A with the IUPAC name in the following reaction.

2



2

What product do you expect when 2-bromopropane is heated with Na/dry ether?

1

30. What happens when secondary haloalkane $\text{C}_3\text{H}_7\text{X}$ is heated with Na in the presence of dry ether?

1

31. A haloalkane X, if heated with sodium metal in the presence of dry ether, produces 2,3-dimethylbutane as the major product. Identify X and write the chemical reaction.

2

A Haloalkane 'X' undergoes a Wurtz reaction to give 2,3-dimethylbutane as the major product. Identify 'X' and write the chemical reaction.

2

Conversions

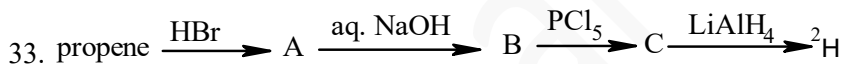
32. You are given an organic compound having molecular formula $\text{C}_3\text{H}_7\text{X}$.

I) Write down primary and secondary haloalkanes, giving their IUPAC names.

II) Give a proper reaction sequence to convert the primary haloalkane into a secondary haloalkane.

III) What product is obtained when the secondary haloalkane is subjected to the Wurtz reaction?

1+2+1



34. Write down the IUPAC name of the major products P and Q in the following reaction sequence:



2

35. An alkene A undergoes addition with HBr to give B. When B is heated with sodium in the presence of dry ether, it gives 2,3-dimethylbutane. Identify A and B.

2

36. A Haloalkane M reacts with aq. NaOH to give isopropyl alcohol. What major product would you get when M is heated with Na in the presence of dry ether?

2

37. Starting from iodomethane, how would you prepare ethene?

2

38. A list of organic compounds is given as



Write these compounds in an appropriate reaction sequence.

5

39. A list of organic compounds is given as:

ethene, ethanol, chloroethane, ethoxyethane and bromoethane

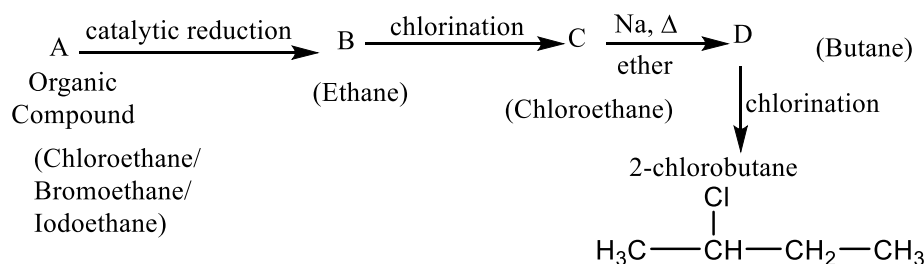
Write these compounds in an appropriate reaction sequence.

4

40. An organic compound A, on catalytic reduction, gives B; B on chlorination gives C; C on heating with sodium metal in the presence of ether gives D, and D on chlorination gives 2-chlorobutane as a major product. Give names for A, B, C and D.

5

Hint: (explanation of the question)



Preparation of Chloroform

41. Write the chemical reaction for the preparation of trichloromethane from ethanal. 2
42. Write down the chemical reaction for the preparation of trichloromethane from acetone. 2
- Give a suitable chemical reaction for the laboratory preparation of trichloromethane. 1
- Give the reactions for the laboratory preparation of trichloromethane.

Properties of Trichloromethane

1) Oxidation

43. Why is chloroform stored in a dark room, in an airtight bottle containing a little ethyl alcohol? 1
- Why is trichloromethane (chloroform) stored in a dark-brown airtight bottle?
44. What happens when chloroform is exposed to atmospheric air? 1
- Write the reaction of trichloromethane with oxygen. 1
- What happens when trichloromethane reacts with atmospheric air? 1
- Starting from trichloromethane, how would you prepare carbonyl chloride? 1
45. Why is it discouraged to use chloroform as an anaesthetic? 1

1) Reduction

46. Starting from trichloromethane, how would you prepare methane? 1

2) Reaction with silver powder

47. What happens when trichloromethane is heated with silver powder? 1
- Give the action of chloroform upon heated silver. 1
- How would you obtain ethyne from trichloromethane? 1
- Give an equation for the conversion of chloroform into ethyne. 1
- Starting from trichloromethane, how would you prepare ethyne? 1
48. What happens when iodoform is heated with silver powder? 1

3) Reaction with aqueous Caustic alkali (Hydrolysis)

49. What happens when chloroform is allowed to react with NaOH solution? 1
50. Give the action of chloroform upon aq. KOH. 1
51. How would you convert trichloromethane into formic acid? 1

4) Reaction with concentrated HNO₃

52. What happens when chloroform is treated with conc. nitric acid? 1
- What happens when trichloromethane reacts with nitric acid? 1
- Starting from trichloromethane, how would you prepare chloropicrin?

5) Reaction with Propanone (acetone)

53. How does chloroform react with acetone? 1
How does trichloromethane react with Propanone? 1
Identify product A and write its IUPAC name.
$$\text{CHCl}_3 \xrightarrow[\text{alkali}]{\text{Acetone}} \text{A}$$
 2
Starting from trichloromethane, how would you prepare chloretone?
What product would you expect when trichloromethane is condensed with acetone? Write the IUPAC name of the product. 1
What happens when chloroform is treated with acetone in the presence of aq. KOH? 1

Conversions

54. An organic compound (A), when heated with Ag powder, gives C_2H_2 and carbonyl chloride when exposed to air.
i) Identify the compound (A).
ii) Write the reaction for the laboratory preparation of (A).
iii) What happens when compound (A) is treated with conc. nitric acid
iv) Convert (A) into methanoic acid. 1+2+1+1
55. A sweet-smelling organic compound (A) is slowly oxidised by air in the presence of sunlight to give a highly poisonous gas, carbonyl chloride.
i) Why is the above compound (A) stored in a dark and brown bottle?
ii) Give the principal reaction involved in the preparation of compound (A) from ethanol.
iii) How would you convert compound (A) into a) chloretone, b) chloropicrin, c) ethyne?
iv) Why can compound (A) not give a white ppt with AgNO_3 solution?
56. 'A' + Propanol $\rightarrow$ aq.KOH $\rightarrow$ chloretone.
i) Identify compound 'A' with IUPAC name.
ii) Write the chemical equations for the laboratory preparation of 'A' from acetone.
iii) How does compound A react with aniline in the presence of alc. KOH?
Why is compound 'A' stored in a dark-coloured airtight vessel? 1+2+1+1
57. 'A' + Propanone (aq.KOH/ Δ) $\rightarrow$ chloretone.
i) Identify compound 'A' with IUPAC name. [1]
ii) Write the chemical equations for the laboratory preparation of 'A' from acetone. [2]
iii) How does compound A react with aniline in the presence of alc. KOH? [1]
iv) Why is compound 'A' stored in a dark-coloured airtight vessel? [1]

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