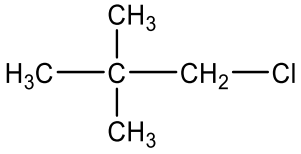
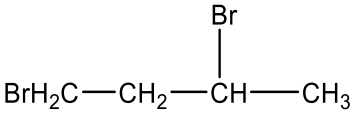
8. HALOALKANES (ALKYL HALIDES)

https://subarnam.com.np/

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)

4. Write short notes 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

3. **From alcohols**

a. Reaction with halogen acids

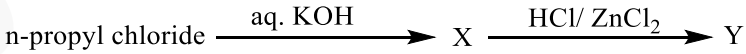
6. Write the action of Propan-2-ol with PCl_5. 1
7. Write three methods of preparation of Chloroethane. 3
   Write three methods of preparation of Iodomethane. 3
8. Write three methods of preparation of Iodoethane. 3

Physical Properties

Chemical Properties

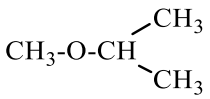
1. Formation of alcohols - Reaction with aqueous caustic alkali (substitution by -OH group)

9. Make the following conversions:



2. Formation of ether - Reaction 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. Convert Ethoxy ethane from a haloalkane C_2H_5Br by Williamson's reaction. 1
12. Use Williamson's synthesis method for the preparation of



    Give the correct chemical equation for the preparation of 2-methoxypropane.
13. Give Williamson's synthesis to prepare unsymmetrical ethers. 1
14. How would you prepare the unsymmetrical ether of C_3H_8O by Williamson's synthesis? 1
    Prepare CH_3-O-CH_2CH_3 by using Williamson's ether synthesis. 1
15. Write an example of Williamson's etherification reaction. What is its importance? 2

16. Give proper reason: Williamson's etherification is useful for the preparation of both symmetrical and unsymmetrical ether. 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

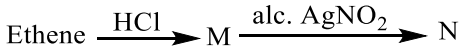
3. Formation of nitrile: Action of alcoholic potassium cyanide (substitution by -CN)

4. Formation of carbyl amine(isocyanide): Reaction with alcoholic AgCN

5. Formation of nitrites: action of alcoholic potassium nitrite

6. Formation of nitro compound: action of alcoholic silver nitrite

19. Make the following conversion:



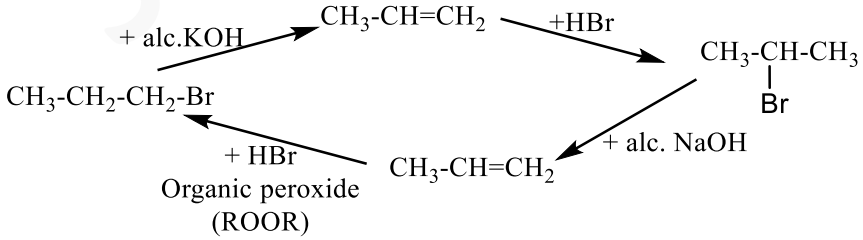
7. Formation of amines: Reaction with ammonia (Hoffmann's ammonolysis) - formation of different degrees of amines

8. **Formation of thioether**: (action of thioalcohol)

[B] Elimination Reaction

Dehydrohalogenation (reaction with alc. KOH)

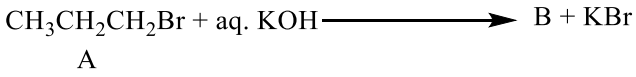
20. What happens when Chloroethane is heated with alcoholic KOH? 1
    What happens when Iodoethane is heated with alc. NaOH? 1
21. Give an example of an Elimination Reaction. 1
    Give an example of dehydrohalogenation. 1
22. Predict the major product when 2-chloro-3-methylbutane and 2-bromobutane are treated separately with an alcoholic solution of potassium hydroxide.
23. Convert 1-bromopropane to 2-bromopropane and vice versa. 2



(Practice names and side products yourself.)

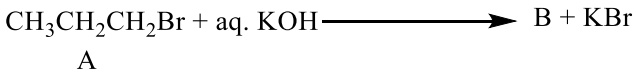
24. Convert 1-chloropropane to 2-chloropropane. 2

25. 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?

26. A chemical reaction occurs as follows:



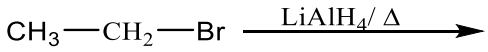
a) Identify the compound B in the above reaction. 1
b) Which substitution reaction mechanism occurs in the above reaction and why? 2
c) What product is formed when alc. KOH is used instead of aq. KOH in the above reaction? 1
d) How can you obtain nitropropane from above compound A? 1

[C] Reduction

[D] Reaction with metals

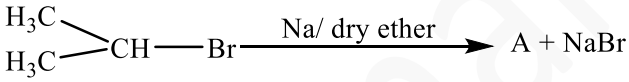
Wurtz reaction

27. Give the major products of the following equations



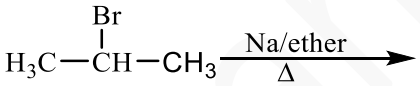
1

28. How would you obtain Ethane from Bromoethane? 1
29. Write short notes on a) Wurtz reaction 4
Write a correct example of the Wurtz reaction. 1
30. Starting from Iodomethane, how would you prepare Ethane? 1
What happens when Iodoethane is heated with sodium in the presence of dry ether? 1
31. Identify A with the IUPAC name in the following reaction.

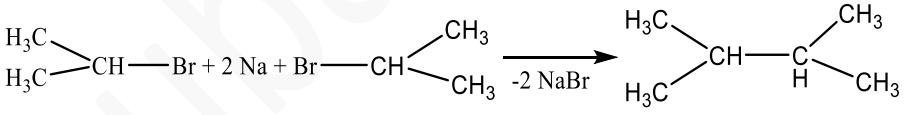


2

32. What happens when secondary Haloalkane C_3H_7X is heated with Na in the presence of dry ether? 1
33. Give the major products of the following equations 1



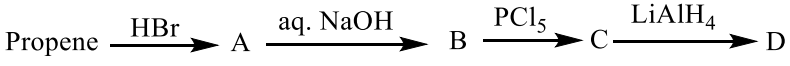
Solution:



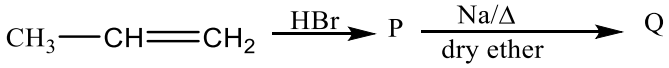
2,3-dimethylbutane

Conversions

34. You are given an organic compound having molecular formula C_3H_7X.
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

35. 

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



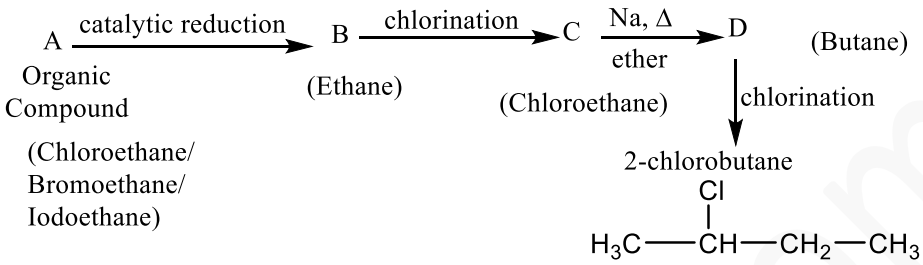
2

37. An alkene A undergoes addition with HBr to give B. When B is heated with sodium in the presence of dry ether gives 2,3-dimethylbutane. Identify A and B. 2
38. 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
39. Starting from Iodomethane, how would you prepare Ethene? *2*
40. A list of organic compounds is given as
C_2H_5Cl, C_2H_6O, C_2H_4, C_2H_5Br, C_3H_5N

    Write these compounds in an appropriate reaction sequence.

41. 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)



42. An unsaturated hydrocarbon (C_3H_6) undergoes Markovnikov's rule to give (A). Compound (A) is hydrolysed with aqueous alkali to yield (B). When (B) is treated with PBr_3, compound (C) is produced. (C) reacts with AgCN(alc.) to give another compound (D). Compound (D), if reduced with $LiAlH_4$, produces (E).
    i) Define Markovnikov's rule.
    ii) Identify (A), (B), (C), (D), and (E) with chemical reactions.
    iii) How does E react with nitrous acid?
    iv) How would you convert (B) into C_3H_8? 1+5+1+1

Preparation of Chloroform

43. Write the chemical reaction for the preparation of Trichloromethane from Ethanal. 2
44. 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

45. 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 air-tight bottle?
46. 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
47. Why is it discouraged to use Chloroform as an anaesthetic? 1

1) Reduction

48. Starting from Trichloromethane, how would you prepare Methane? 1

2) Reaction with silver powder

49. 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
50. What happens when Iodoform is heated with silver powder? 1

3) Reaction with aqueous Caustic alkali (Hydrolysis)

51. What happens when Chloroform is allowed to react with NaOH solution? 1
52. Give the action of Chloroform upon aq. KOH. 1
53. How would you convert Trichloromethane into formic acid? 1

4) Reaction with concentrated HNO_3

54. 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)

55. How does Chloroform react with acetone? 1
    How does Trichloromethane react with Propanone? 1
    Identify product A and write its IUPAC name.

    $CHCl_3 \xrightarrow[\text{alkali}]{\text{Acetone}} A$ 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

Conversions

56. The chlorinated compound 'A' reacts with acetone to give a sleep-inducing drug.
    a) How would you prepare compound 'A' by using one of the isomers of C_2H_6O? [2]
    b) What happens when compound 'A' is:
    i) Exposed to air? [1]
    ii) Heated with phenol in the presence of aq. NaOH? [2]
57. 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 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
58. 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?
59. 'A' + Propanol → aq.KOH → 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?
    iv) Why is compound 'A' stored in a dark-coloured airtight vessel? 1+2+1+1

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