QB365 Question Bank Software Study Materials

Haloalkanes and Haloarenes Important 2 Marks Questions With Answers (Book Back and Creative)

11th Standard

Chemistry

Total Marks: 60

<u>2 Marks</u>

 $30 \ge 2 = 60$

1) Classify the following compounds in the form of alkyl, allylic, vinyl, benzylic halides

(i) $CH_3 - CH = CH - Cl$ (ii) $C_6H_5CH_2I$ (iii) $CH_3 - CH - CH_3$ B_r (iv) $CH_2 = CH - Cl$ **Answer :** (i) $CH_3 - CH = CH-Cl$ (ii) C_6H_5I - Benzyl iodide \rightarrow Benzylic Halides (iii) $CH_3 - CH - CH_3 - 2$ - bromo propane \rightarrow alkyl B_r (iv) $CH_2 = CH - Cl$ - Vinyl chloride \rightarrow Vinyl

2)

5)

Why chlorination of methane is not possible in dark?

Answer : The Chlorination of methane is carried out by free radical mechanism. The initiation step to form free radical needs high energy which is supplied by light energy.

 $\mathrm{Cl}-\mathrm{Cl} \xrightarrow{h
u} 2\mathrm{Cl}$ So this reaction is not possible in dark.

3) Give reasons for polarity of C-X bond in halo alkane.

Answer : Carbon halogen bond is a polar bond as halogens are more electro negative than carbon. The carbon atom exhibits a partial positive charge (δ +) and halogen atom a partial negative charge (δ -)

The C -X bond is formed by overlap of sp^3 orbital of carbon atom I with half filled p-orbitat of the halogen atom. The atomic size of halogen increases from fluorine to iodine, which increases the C - X bond length. Larger the size, greater is the bond length, and weaker is the bond formed. The bond strength of C - X decreases from C - F to C - I in CH_3X



4) Why is it necessary to avoid even traces of moisture during the use of Grignard reagent?

Answer : If moisture is present, the Grignard reagent will react with water to give alkanes.

 $R \underbrace{MgX + HO}_{H \to R - H + Mg} X$

So. moisture should not be present

Mention any three methods of preparation of haloalkanes from alcohols.

Answer : Alcoholscanbeconvertedintohaloalkenesbyreactingit withanyoneofthefollowingreagent 1.hydrogen halide

2. Phosphorous halides

3. Thionyl chloride

a) Reaction with hydrogen halide:

 $CH_{3}CH_{2}OH + HCl \stackrel{ZNCl_{2}}{\overset{ZNCl_{2}}{\frown}} CH_{3}CH_{2}Cl + H_{2}O \stackrel{CH_{3}CH_{2}Cl}{\overset{Chloroethane}{\frown}}$

Mixture of con.HCI and anhydrous $ZnCl_2$ is called Lucas reagent

b) Reaction with phosphorous halides :

Alcohols react with PX₅ or PX₃ to form haloalkane. PBr₃ and PI₃ are usually generated in situ (produced in the reaction mixture)

by the reaction of red phosphorus with bromine and iodine, respectively. $CH_3CH_2OH + PCl_5$

Ethanol

 $CH_3CH_2Cl + POCl_3 + HCl$

Chloro ethane

c)Reaction with thionyl chloride :

 $\begin{array}{c} CH_{3}CH_{2}OH + SOCl_{2} \\ Ethanol \\ CH_{3}CH_{2}Cl + SO_{2}^{+} + HCl^{+} \\ Chloroethane \end{array}$

This reaction is known as Darzen's halogenation

6)

Compare $S_N 1$ and $S_N 2$ reaction mechanisms.

Answer:

S _N 1 Reaction	S _N 2 product
It is unimolecular reaction	It is a bimolecular reaction.
Its mechanism occurs in two steps	It is a one step process
It involves the formation of an intermediate (Carbocation)	It involves the formation of transition sate.
Rate = k[Alkyl halide]	Rate = k[Alkyl halide] [Nuclophile]
Products have both retained and inverted configuration	Products have inverted configuration.
Carbocation rearrangement occurs.	No carbocation rearrangement occurs.
Reactirity :	IReactirity :
Methyl < 1 ° < 2° < 3°	Methyl > 1° > 2° > 3°
Eg: CH_3 CH_3 - $C-Cl + KOH$ CH_3 CH_3 CH_3 CH_3 - $C-OH$ CH_3 CH_3 CH_3 + KCl	Eg: $CH_3Cl+KOH \stackrel{Aq}{ ightarrow} CH_3OH+KCl$

7) Discuss the aromatic nucleophilic substitutions reaction of chlorobenzene.

Answer : Halo arenes do not undergo nucleophilic substitution reaction readily is due to C-X bond in aryl halide is short and strong and also the aromatic ring is a centre of high electron density.

The halogen of haloarenes can be substituted by OH^- , NH_2^- , or CN^- with appropriate nucleophilic reagents at high temperature and pressure.

8) Account for the following

(i) t-butyl chloride reacts with aqueous KOH by S_N1 mechanism while n-butyl chloride reacts with S_N2 mechanism. (ii) p-dichloro benzene has higher melting point than those of o-and m-dichloro benzene.

Answer: (i) This is because rate of SN₂ reaction is directly proportional to delta inversely proportional to steric crowding. Terbuty & chloride has vast steric crowding and thus it is more stable. for SN₁ reaction rather then SN₂ reaction.
(ii) p-dichloro benzene is more symmetrical than 0 and m isomers and so fits perfectly in crystal lattice. Therefore more energy is required to break the crystal lattice of p-dichlorobenzens and so has higher melting point.

In an experiment ethyliodide in ether is allowed to stand over magnesium pieces. Magnesium dissolves and product is formed

9)

a) Name the product and write the equation for the reaction.

b) Why all the reagents used in the reaction should be dry? Explain

c) How is acetone prepared from the product obtained in the experiment.

Answer: a) The product formed is ethylmagnesium iodide (Grignard reagent)

 $C_2H_5+Mg \stackrel{dryether}{
ightarrow} C_2H_5Mgl$

Ethyl magnesium iodide

b) The Grignard carbon is highly basic and reacts with acidic protons of polar solvents like water to form an alkani so all reagents should be pure and dry.

 $\begin{array}{c} RMgX + H_2O \longrightarrow RH + Mg \\ \hline Grignard \\ Alkane \end{array} \begin{array}{c} OH \\ X \end{array}$

Write a chemical reaction useful to prepare the following:i) Freon-12 from Carbon tetrachloride

ii) Carbon tetrachloride from carbon disulphide

Answer: (i) Freon - 12 is prepared by the action of hydrogen fluoride on carbon tetrachloride in the presence "of catalylic

amount of antimony pentachloride. is is called swartz reaction.

$$CCl_4 + 2HF \stackrel{SoCl_5}{\longrightarrow} 2HCl + CCl_2F_2 \ Carbon tetrachloride$$

(ii) Carbon disulphide reacts with chlorine gas in the presence of anhydrous AICl₃ as catalyst giving carbon tetrachloride

$$CS_2 + 3Cl_2 \stackrel{anhydrous}{\overset{}{ imes}}_{AlCl_3} \stackrel{CCl_4}{\overset{}{ imes}}_{Carbontetrachloride} CCl_4 + S_2Cl_2 \ carbondisulphide$$

11) What are Freons? Discuss their uses and environmental effects

Answer : Freons (CFC): The chloro uoro derivatives of methane and ethane are called freons.

Uses:

(i) Freons are a used as refrigerants in refrigerators and air conditioners.

(ii) It is used as a propellant for aerosols and foams

(iii) It is used as propellant for foams to spray out deodorants, shaving creams, and insecticides

¹²⁾ Predict the products when bromoethane is treated with the following

i) KNO₂

ii) AgNO₂

Answer: i) KNO₂ : Haloaikanes react with alcoholic solution of NaNO₂ or KNO₂ to form alkyl nitrites.

 $egin{aligned} CH_3 & CH_2Br + KNO_2 \longrightarrow CH_3CH_2 - O - N = O + KBr \ Bromoethane & Ethylnitrite \end{aligned}$ ii) AgNO₂ : Haloalkanes react with alcoholic solution of AgNO₂ to form nitro alkanes $CH_3 & CH_2Br + AgNO_2 \longrightarrow CH_3CH_2NO_2 + AgBr \ Bromoethane & Ethylnitrite \end{aligned}$

13)

Explain the mechanism of $S_N 1$ reaction by highlighting the stereochemistry behind it

Answer : The rate of the following SN_1 reaction depends upon the concentration of alkyl halide (RX) and is independent of the concentration of the nucleophile (OH-).

Hence Rate of the reaction = k [alkyl halide]

SN₁ reaction mechanism by taking a reaction between tertiary butyl bromide with aqueous KOH.

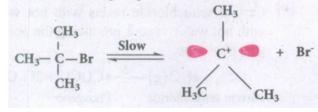
$$CH_3 - \stackrel{
m CH_3}{\mathop{C}\limits^{
m I}}_{CH_3} - Br \stackrel{OH^-(aq)}{ arrow}_{-Br} CH_3 - \stackrel{
m CH_3}{\mathop{C}\limits^{
m I}}_{CH_3} - OH$$

Tert-Butyl bromide Tert-Butyl alcohol

This reaction takes place in two steps as shown below

Step-1 Formation of carbocation :

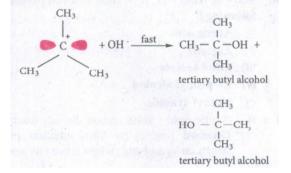
The polar C - Br bond breaks forming a carbocation and bromide ion. is step is slow and hence it is the rate determining step



The carbocation has 2 equivalent lobes of the vacant 2p orbital, so it can react equally rapidly from either face

Ste - 2

The nucleophile immediately reacts with the carbocation. This step is fast and hence does not affect the rate of the reactions.



As shown above, the nucleophilic reagent OH⁻ can attack carbocation from both the sides.

14) Write short notes on the the following

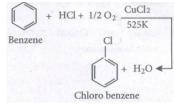
i) Raschig process

ii) Dows Process

iii) Darzens process

Answer: i) Raschig process Chloro benzene is commercially prepared by passing a mixture of benzene vapour, air and HCI

over heated cupric chlooride is reaction is called Raschig process.



ii) Dows Process :

$$C_6H_5Cl + NaOH \stackrel{350C}{\longrightarrow} C_6H_5OH + NaCl \ Chlorobenzne$$

This reaction is known as Dow's Process

iii) Darzens process : $CH_3CH_2OH + SOCl_2$ Ethanol Pyridine CH,CH,Cl+SO,1+HCl1 Chloroethane

This reaction is known as Dow's process

15)

Starting from CH₃MgI, How will you prepare the following?

i) Acetic acid

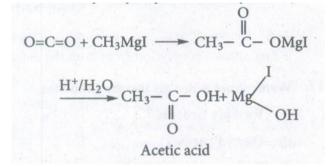
ii) Acetone

iii) Ethyl acetate

iv) Iso propyl alcohol

v) Methyl cyanide.

Answer: i) Acetic acid: Solid carbon dioxide reacts with Grignard reagent to form addition product which on hydrolysis yields carboxylic acids.



ii) Acetone :

 $CH_3 - I + Mg \stackrel{dryether}{\longrightarrow}$ CH_3MgI IodomethaneMethyl magnesium iodide

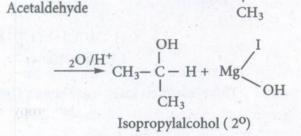
iii) Ethyl acetate: Ethylchloroformate reacts with Grignard reagent to form esters.

$$\begin{array}{c} O \\ \parallel \\ C_2H_5O - C - Cl + CH_3MgI \longrightarrow C_2H_5O & -C - Cl \\ I \\ Ethylchloroformate & CH_3 \\ \hline \\ \hline \\ CH_3 - C - OC_2H_5 + Mg \\ \hline \\ O \\ Ethylacet ate \end{array}$$

iv) Iso propyl alcohol : Aldehydes other than formaldehyde, react with Grignard reagent to give addition product which on

hydrolysis yields secondary alcohol.

$$\begin{array}{c} O \\ \parallel \\ CH_3 - C - H + CH_3MgI \longrightarrow CH_3 - \begin{bmatrix} OMgI \\ I \\ CH_3 - H \end{bmatrix} H$$



v) Methyl cyanide : Grignard reagent reacts with cyanogen chloride to from alkyl cyanide

 $\begin{array}{c} CH_3 Mg I + CNCl \longrightarrow CH_3 CN + Mg' \\ Cyanogen chloride & Methyl cyanide I \end{array}$

16) Complete the following reactions i) CH₃ - CH = CH₂ + HBr $\xrightarrow{Peroxide}$ ii) CH₃ - CH₂ - Br + NaSH $\xrightarrow[H_2O]{alcohol}$

iii) $C_6H_5Cl + Mg \longrightarrow$ v) CCl₄ + H₂O $\xrightarrow{\Delta}$

Answer : i) The addition of HBr to an alkene in the presence of organic peroxide, gives the anti Markovniko's product is effect is called peroxide effect.

$$CH_3 - CH = CH_2 + HBr \xrightarrow{peroside}_{(C_6H_5Co)_2O_2} CH_3 - CH_2 - CH_2 - Br$$

Bromoethane

ii) Haloalkanes react with sodium or potassium hydrogen sulphide to form thio alcohols.

$$CH_{3}CH_{2}Br + NaSH \stackrel{alcohol/H_{2}O}{\longrightarrow} CH_{3}CH_{2}SH + NaBr \ Bromoethane$$

iii) Chloroform reacts with nitric acid to form chloropicrin.(Trichloro nitro methane)

$$CH_{3}Cl_{3} + HNO_{3} \stackrel{ riangle}{\longrightarrow} CCl_{3}NO_{2} + H_{2}O \stackrel{ riangle}{Chloropicrin}$$

iv) Carbon tetrachloride reacts with hot water or with hot water vapour producing the poisonous gas, phosgene.

$$CCl_3 + H_2O(g) \stackrel{ riangle}{\longrightarrow} COCl_2 + 2H_2O \ _{Phosgene}$$

17) Explain the preparation of the following compounds

i) DDT

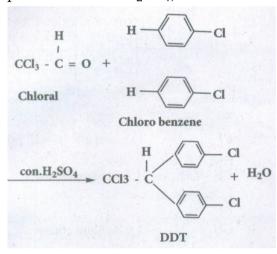
ii) Chloroform

iii) Biphenyl

iv) Chloropicrin

v) Freon-12

Answer: i) DDT: DDT can be prepared by heating a mixture of chlorobenzene with chloral (Trichloro acetaldehyde) in the presence of con. H_2SO_4 ,



ii) Chloroform :The reaction of methane with excess of chlorine in the presence of sunlight will give carbon tetrachloride as the

major product.

$$CH_4 \mathop{+}\limits_{Methane} 4Cl_2 \stackrel{h\gamma}{\longrightarrow} + \mathop{4HCl}\limits_{Carbon\ tetrachloride}$$

iii) Bipheenyl :

$$rac{C_{6}H_{5}Cl}{Chlorobenzene}+2Na+Cl-C_{6}H_{5}\stackrel{Ether}{\longrightarrow}C_{6}H_{5}-rac{C_{6}H_{5}}{Biphenyl}+2NaCl$$

iv) Chloropicrin : Chloroform reacts with nitric acid to form chloropicrin.(Trichloro nitro methane)

$$CH_3 + HNO_3 \stackrel{ riangle}{\longrightarrow} CCl_3NO_2 + H_2O \ Chloropicrin$$

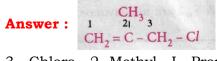
v) Freon-12 :Freon - 12 is prepared by the action of hydrogen fluoride on carbon tetrachloride in . the presence of catalylic

amount of antimony pentachloride. is is called swartz reaction

$$CCl_3 + 2HF \xrightarrow{SbCl_5} 2HCl + CCl_2F_2 \ Carbon tetrachloridew$$

18) Write the IUPAC name of the following

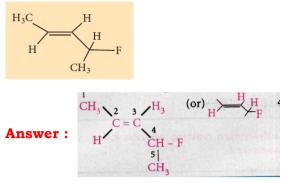
> CH_3 $CH_2 = C - CH_2 - Cl$



- 3 Chloro 2- Methyl I Propene
- 19) Chloroform is kept with a little ethyl alcohol in a dark coloured bottle why?

Answer : Chloroform undergoes oxidation in presence of light and air to form phosgene (a poisonous chemical) which makes chloroform unfit for use as anaesthetic. So it is kept in dark Coloured bottles filled upto the brim. lo/o ethanol is added to retard oxidation. It converts, phosgene if formed, into harmless lethyl carbonate.

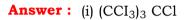
20) Write the IUPAC name of the following



4-fluoro -2- pentene

21) Write the IUPAC names of the following compounds.

(i) (CCI₃)₃ CCl
(ii) (CH₃)₃ CCH = C(CI) C₆H₄I- p



(ii) $(CH_3)_3 CCH = C(CI) C_6H_4I - p$ $CH_3 - C - CH = C - CI$

1-Chloro -1-(4-iodophenyl)-3,3-dimethylbut-l-ene.

22) Explain-Finkelstein reaction.

CH₃

Answer : Chloro (or) bromoalkane on heating with sodium iodide in dry acetone gives iodo alkane. This reaction is called

Finkelstein reaction.

 $\begin{array}{c} \mathrm{CH}_3 - \mathrm{CH}_2\mathrm{Br} + \mathrm{NaI} \longrightarrow \mathrm{CH}_3 - \mathrm{CH}_2\mathrm{I} + \mathrm{NaBr} \\ \\ \text{Bromoethane} \end{array}$

23)

³⁾ What happens when bromoethane is treated with moist silver oxide?

Answer : When bromoethane is treated with moist silver oxide, ethanol will be formed as product:

 $CH_3 - CH_2Br + AgoH \underset{silveroxide}{Moist} AgoH \xrightarrow{BoilCH_3 - CH_2OH + AgBr} Ethoanol$

24) State-Saytzeff's rule.

by Saytzeff's rule which states that in a dehydrohalogenation reaction, the preferred product is that alkene which has more number of alkyl group attached to the doubly bonded carbon atom.

25) How will you convert l-chloropropane to propene?

26) What is Grignard reagent? How is it prepared from ethyl bromide?

Answer: When a solution of haloalkane in either is treated with magnesium, we will get alkyl magnesium halide known as

Grignard reagent, ethyl magnesium bromide is prepared from ethyl bromide as:

 $CH_3 - CH_2Br + Mg \stackrel{dry ether}{\longrightarrow} CH_3CH_2MgBr \stackrel{orm}{\longrightarrow} Ethyl magnesium bromide (or) Grignard reagent$

27) How will you prepare ethyl lithium?

Answer : When bromoethane is treated with an active metal like lithium in the presence of dry ether, then ethyl lithium will be formed.

$$CH_3 - CH_2Br$$
+ 2Li $dry \ ether \ CH_3 - CH_2Li$ + LiBr $Bromo \ ethane$ \longrightarrow $Ethyl \ lithium$

28) How will you prepare ethylidene dichloride from acetylene?

Answer:
$$HC = CH + HCl \rightarrow CH_2 = CH \xrightarrow{HCl} CH_3 - CHCl_2$$

 $Acetylene \qquad \qquad | \qquad Ethylidene \\ Cl \qquad dichloride$

29) Convert methane to methylene chloride.

30) Explain: Carbylamine reaction (or) How is a primary amine tested?

Answer : Chlorofgrm reacts with aliphatic or aromatic primary amine and alcoholic caustic potash, to give foul smelling alkyl

isocyanide (carbylamines)

	CH ₃ NH ₂ + CHCl ₃ + 3KOH Methylamine Chloroform	CH ₃ NC+3KCl+3H ₂ O Methylisocyanide

This reaction is used to test primary amine.