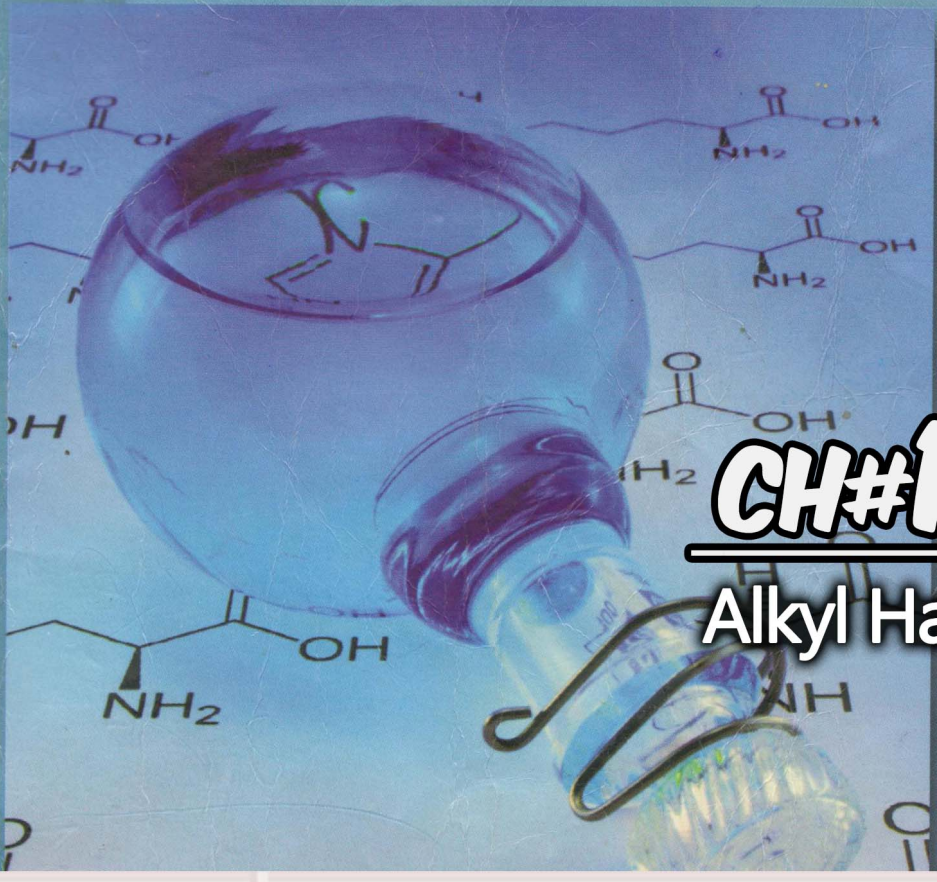
CHEMISTRY

12



CH#10

Alkyl Halides

These Notes Have been Prepared and Developed By

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CHAPTER 10
ALKYL HALIDES

Halogen derivatives of alkanes are called haloalkanes. The monohaloalkanes are called alkyl halides. e.g CH_3Cl (Methyl Chloride), C_2H_5Br (Ethyl bromide). Their general formula is R—X.

Types of Alkyl halides

There are three types of alkyl halides

(i) Primary alkyl halides:- An alkyl halide in which halogen atom is bonded with primary Carbon is called Primary alkyl halide.

e.g CH_3Cl , CH_3-CH_2-Br

Methyl Chloride Ethyl bromide

(ii) Secondary alkyl halide:- An alkyl halide in which halogen atom is bonded with secondary Carbon is called secondary alkyl halide. e.g $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}-Cl$ isopropyl Chloride

(iii) Tertiary alkyl halide:- An alkyl halide in which halogen atom is bonded with tertiary Carbon is called tertiary alkyl halide. e.g $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{\displaystyle |}{\underset{\displaystyle |}{C}}}}-Cl$ ter-butyl Chloride

Nomenclature of Alkyl Halides

Common System - In this system the name of alkyl group is written as prefix and halide group is written as suffix

CH_3Cl : CH_3-CH_2-Br CH_2Cl_2

Methyl Chloride Ethyl bromide Methylene Chloride

$CH_3-CH_2-CH_2-Br$ $CH_3-CH(CH_3)-CH_2-Cl$

n-Propyl bromide Isobutyl Chloride

I.U.P.A.C System

(i) Select the longest chain of Carbon atoms It is taken as parent chain

(ii) Numbering begins from that end which is nearer to the halogen atom.

(iii) The position of alk side groups is indicated.

(iv) The total number of similar groups is indicated by Prefix (di, tri and tetra) etc

(1) CH_3Cl (2) CH_3-CH_2-Cl

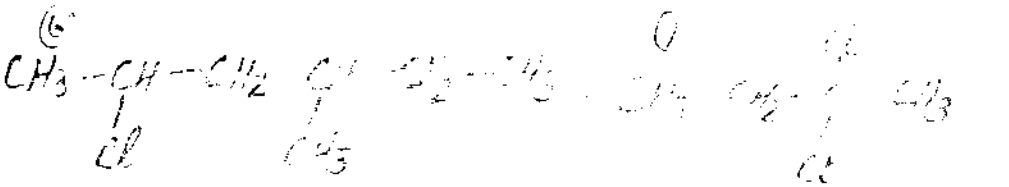
Chloromethane Chloroethane

(3) $CH_3-CH_2-CH_2-Cl$ (4) $CH_3-CH_2-CH(Cl)-CH_3$

1-chloropropane 2-Chlorobutane

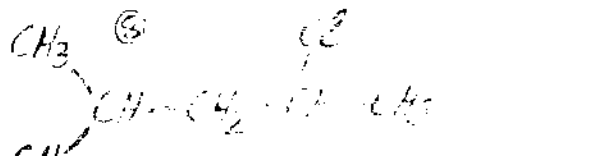
(5) $CH_3-CH(CH_3)-CH(Br)-CH_3$

2-Bromo-3-methyl butane

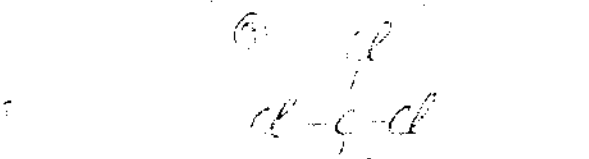


2-Chloro-4-methyl hexane

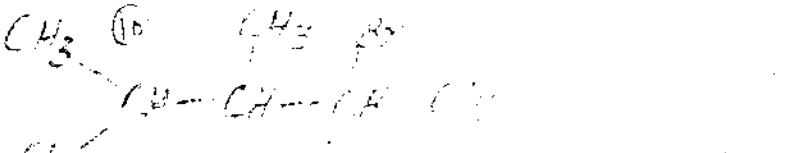
2,2-Dichlorobutane



2-Chloro-4-methyl Pentane



Trichloromethane



2-Bromo-3,4-dimethyl Pentane

Preparation of Alkyl Halides

Alkyl halides are prepared from alcohols.

(a) By reaction of alcohols with Halogen Acids

An alcohol reacts with halogen acid to give alkyl halide. It takes place in presence of $ZnCl_2$.

$$R-OH + HX \xrightarrow{ZnCl_2} R-X + H_2O$$

$$C_2H_5OH + HCl \xrightarrow{ZnCl_2} C_2H_5Cl + H_2O$$

(b) By reaction of alcohol with thionyl chloride

An alcohol reacts with thionyl chloride ($SOCl_2$) to give alkyl chloride

$$R-OH + SOCl_2 \xrightarrow{Pyridine} R-Cl + SO_2 + HCl$$

$$C_2H_5OH + SOCl_2 \xrightarrow{Pyridine} C_2H_5Cl + SO_2 + HCl$$

This method is very useful because the gases by-products ($HCl + SO_2$) escape easily and pure product is left behind.

(C) By reaction of alcohols with Phosphorous Trihalides or Phosphorous Pentahalide

An alcohol reacts with PX_3 or PX_5 to give alkyl halides. e.g

$$3\,C_2H_5OH + PBr_3 \longrightarrow 3\,C_2H_5Br + H_3PO_3$$

$$C_2H_5OH + PCl_5 \longrightarrow C_2H_5Cl + POCl_3 + HCl$$

Special method for Alkyl Iodide:-

An alkyl iodide can not be directly prepared. So reaction of any alkyl halide with NaI gives alkyl iodide

$$R-Cl + NaI \longrightarrow R-I + NaCl$$

$$R-Br + NaI \longrightarrow R-I + NaBr$$

e.g $C_2H_5Cl + NaI \longrightarrow C_2H_5I + NaCl$

Reactivity of Alkyl halides

The reactivity of an alkyl halide depends upon two factors

(i) Bond energy of R—X

(ii) Polarity of R—X

(i) **Bond Energy of R—X :-** Alkyl Fluorides have the strongest bonds and alkyl iodides have the weakest bonds. Therefore fluoro-Compounds are the least reactive and iodo-Compounds are the most reactive. The order of reactivity of alkyl halides is

$$R-I > R-Br > R-Cl > R-F$$

(ii) **Polarity of R—X :-** In halogens, Fluorine has maximum electronegativity and Iodine has minimum electronegativity. Greater the E.N difference of Carbon and halogen atoms, greater will be the Polarity of bond. Greater Polarity makes a bond more stronger. A Compound with stronger bond has less reactivity. Therefore overall order of reactivity of alkyl halides is

$$R-I > R-Br > R-Cl > R-F$$

Reactions of Alkyl Halides

(1) :- **Reduction :-** Alkyl halides show reduction with Nascent hydrogen

$$CH_3-CH_2-Cl + 2[H] \xrightarrow{Zn/HCl} CH_3-CH_3 + HCl$$

(2) **Wurtz Reaction :-** Alkyl halides react with Sodium metal to give higher symmetrical alkane.

$$CH_3-Cl + 2Na + Cl-CH_3 \xrightarrow{Ether} CH_3-CH_3 + 2NaCl$$

$$CH_3CH_2Cl + 2Na + ClCH_2CH_3 \xrightarrow{Ether} CH_3CH_2CH_2CH_3 + 2NaCl$$

(3) Reaction with Sodium Lead Alloy (Na_4Pb)

$$4CH_3Cl + Na_4Pb \longrightarrow (CH_3)_4Pb + 4NaCl$$

(Sodium lead alloy) Tetramethyl lead

$$4C_2H_5Cl + Na_4Pb \longrightarrow (C_2H_5)_4Pb + 4NaCl$$

Tetraethyl lead

Tetraethyl lead is used as anti-knock in gasoline (Petrol)

(4) Nucleophilic Substitution Reactions

The reaction in which one nucleophile replaces another nucleophile from a compound is called nucleophilic substitution reaction or S_N reactions

$$\bar{N}u + R^{+\delta}-X^{-\delta} \longrightarrow Nu-R + \bar{X}$$

$$CH_3-CH_2^{+\delta}-Br^{-\delta} + \bar{O}H \longrightarrow CH_3CH_2OH + \bar{B}r$$

$$CH_3CH_2Br + \bar{C}N \longrightarrow CH_3CH_2CN + \bar{B}r$$

$$CH_3CH_2Br + CH_3\bar{O} \longrightarrow CH_3CH_2-O-CH_3 + \bar{B}r$$

$$CH_3CH_2Br + \bar{S}H \longrightarrow CH_3CH_2SH + \bar{B}r$$

Ethyl thioalcohol

Nucleophile:- A chemical specie rich in electrons and donates electron pair for the formation of new covalent bond is called nucleophile. e.g $\bar{O}H$, $\bar{C}N$, $\bar{S}H$, $\ddot{N}H_3$ etc

The word nucleophile means "nucleous loving". It may be negatively charged or neutral

Electrophile:- A chemical specie deficit in electrons and accepts pair of electrons for the formation of new covalent bond is called electrophile. e.g $CH_3^{+\delta}-Br^{-\delta}$. $AlCl_3$ etc An electeophile may be neutral or positively charged. The word electrophile means "electron loving".

Substrate molecule:- An alkyl halide molecule on which a nucleophile attacks is called substrate molecule.

Leaving Group:- A weak nucleophile which leaves (departs) from alkyl halide when a strong nucleophile attacks on it is called leaving group. e.g

$$C\bar{N} + C_2H_5^{+\delta}-Br^{-\delta} \longrightarrow C_2H_5CN + Br^-$$

Mechanism of Nucleophilic Substitution Reactions

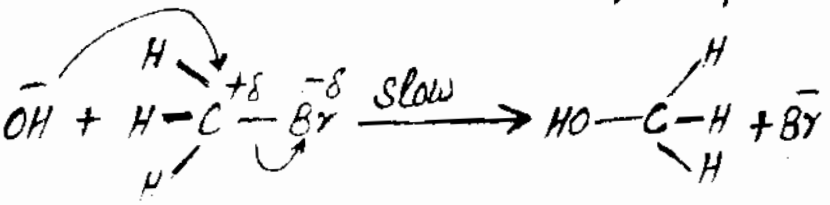
There are two types (mechanisms) of nucleophilic substitution reactions:

(i) Nucleophilic Substitution bimolecular (S_N2)

(ii) Nucleophilic Substitution unimolecular (S_N1)

Nucleophilic Substitution Bimolecular OR S_N2 reaction

(i) The S_N – reaction in which breaking and formation of bonds take place simultaneously (at a time) is called S_N2 reaction. It is a single step reaction In other words the extent of bond formation is equal to the extent of bond breakage. e.g



(ii) In S_N2 reaction the direction of attacking nucleophile is opposite to that of leaving group.

(iii) In S_N2 reaction the configuration of alkyl halide is 100% invested (الٹ جاتا ہے)

(iv) In S_N2 reaction there is only slow step. It is called rate determining step. Because two molecules take part in slow step. So it is called bimolecular reaction. It is the reason that mechanism is known as S_N2.

(V) Rate of S_N2 reaction depends upon both the concentration of alkyl halide and attacking nucleophile.

$$\text{Rate} = K[\text{Alkyl Halide}][\text{Nucleophile}]$$

(vi) In S_N2 reaction the molecularity and order of reaction [illegible]

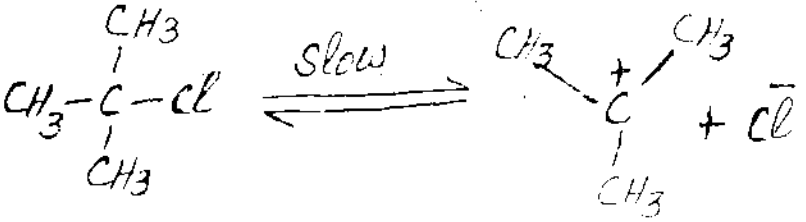
(vii) In S_N2 reaction Carbocation (Carboniumion) is not formed.

(viii) Primary alkyl halides show S_N2 reaction.

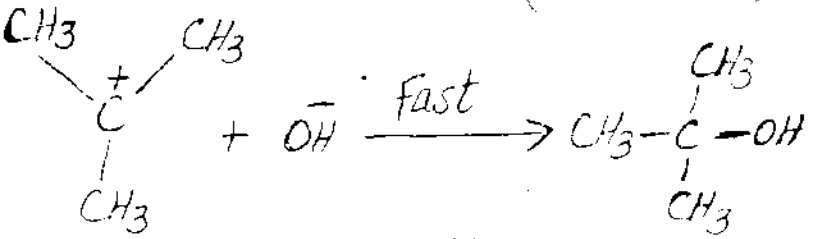
(ix) A secondary alkyl halide shows S_N2 reaction in non-Polar solvent.

Nucleophilic Substitution unimolecular (S_N1 reaction)

(i) The S_N-reaction in which breaking and formation of bonds do not take place at a time is called S_N1 reaction. It is a two steps reaction In other words the extent of bond formation is not equal to the extent of bond breakage.



(Carbocation)



(ii) In S_N1 reaction the attacking nucleophile can attack from both direction easily

(iii) In S_N1-reaction the configuration of alkyl halide is 50% inverted (ریسمی)

(iv) In S_N1 reaction first step is slow and

reversible and second step is fast. Because only one molecule take part in slow step So it is called unimolecular reaction. It is the reason that mechanism is known as S_N1

(v) Rate of S_N1 reaction depends upon the concentration of alkyl halide only, Rate = K[Alkyl halide]

(vi) In S_N1 reaction the molecularity and order of reaction is one

(vii) In S_N1 reaction the Carbocation (Carboniumion) is essentially formed

(viii) A tertiary alkyl halide show S_N1 - reaction

(ix) A secondary alkyl halide show S_N1 reaction in a Polar solvent

β- Elimination Reactions

The reactions in which two atoms or groups remove from two adjacent Carbons of a molecule with the formation of new double bond are called β-elimination reactions or simply elimination reactions.

$$\bar{O}H + CH_3-CH_2Br \longrightarrow CH_2=CH_2 + H_2O + \bar{B}r$$

In such reactions a nucleophile (base) removes a Proton from β-Carbon. The halogen atom is removed from α-Carbon. A double bond is formed between two Carbon atoms.

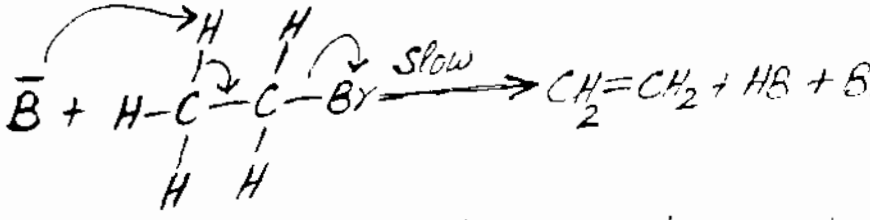
The elimination reactions are of two types.

(i) E_2 - reactions (ii) E_1 - reactions

E_2 - Reactions

(i) In E_2-reaction the attack of nucleophile (base) and removal of leaving group take place at a time. It is a single step reaction.

(ii) In E_2 - reaction there is only slow step. Because two molecules take Part in slow step. So it is Called bimolecular reaction.



(iii) Rate of E_2 - reaction depends upon both the Concentration of alkyl halide and base.

$$\text{Rate} = K[\text{Alkyl halide}][\text{Base}]$$

(iv) In E_2-reaction the molecularity and order of reaction is two.

(v) In E_2-reaction Carbocation (Carbonium ion) is not formed.

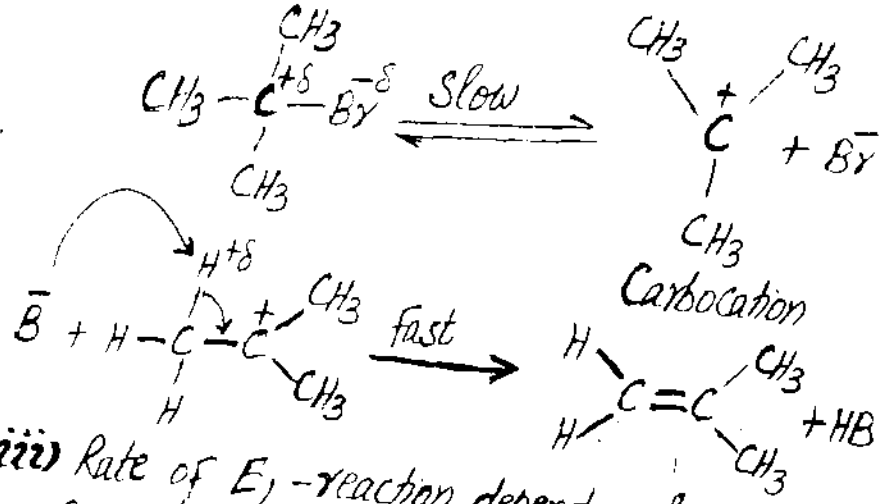
(vi) Primary alkyl halides generally show E_2 - reaction

(vii) A secondary alkyl halide can show E_2 - reaction in non-Polar solvent

E_1 – Reactions

(i) In E_1-reaction attack of base and removal of leaving group do not take place at a time. It is a two steps reaction.

(ii) In E_2-reaction the first step is slow and second step is fast. Because only one molecule takes part in slow step. So it is called uni-molecular reaction.



(iii) Rate of E_1-reaction depends only upon concentration of alkyl halide.

$$\text{Rate} = K[\text{Alkyl Halide}]$$

(iv) The molecularity and order of E_1-reaction is one.

(v) In E_1-reaction the carbocation is essentially formed.

(vi) Tertiary alkyl halides generally show E_1-reactions. A sec. alkyl halide can show in some solvents.

Grignard's Reagent (R–Mg–X)

When alkyl halide reacts with magnesium in presence of ether, then alkyl magnesium halide is formed. It is called Grignard reagent. Grignard reagent was first prepared by Victor Grignard in 1900 and was awarded nobel prize.

$$RX + Mg \xrightarrow{Ether} RMgX$$

$$CH_3I + Mg \xrightarrow{Ether} CH_3-Mg-I$$

$$C_2H_5Br + Mg \xrightarrow{Ether} C_2H_5-Mg-Br$$

Grignard reagent is an organo-metallic (ایسے مرکبات جن میں کاربن اور دھات ہو) Compound. The reactivity of alkyl halide with magnesium is in the order

$$RI > RBr > RCl \text{ and}$$

$$CH_3X > C_2H_5X > C_3H_7X$$

Structure and Reactivity

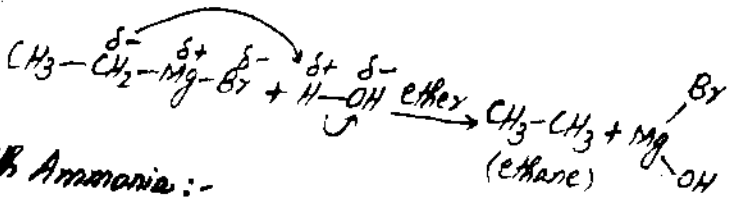
Grignard reagents are very reactive organic Compound. It is due to their Polar nature. Magnesium is more electropositive than Carbon. Thus Mg has Partial Positive Charge and Carbon has Partial negative Charge.

$$R^{-\delta}-Mg^{+\delta}-X^{-\delta}$$

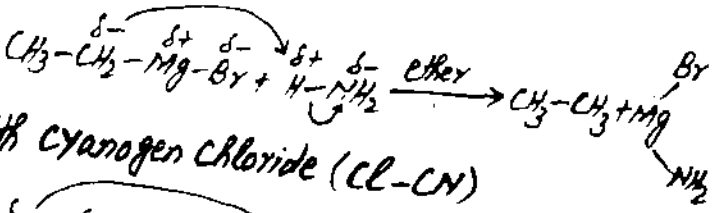
Therefore Grignard reagents are very reactive

Reactions of Grignard's Reagent

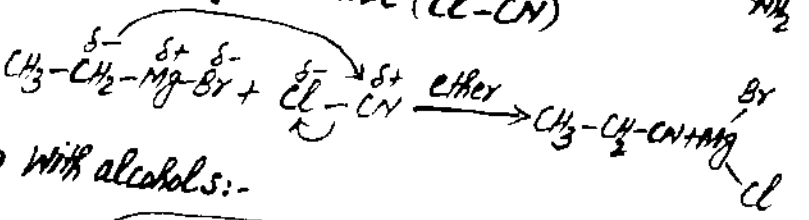
(i) With Water :-



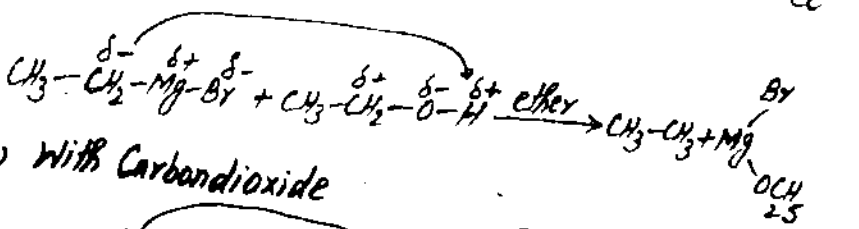
(ii) With Ammonia :-



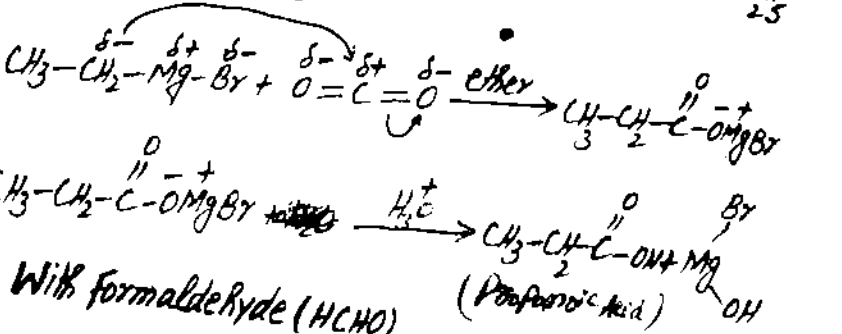
(iii) With Cyanogen Chloride (Cl-CN)



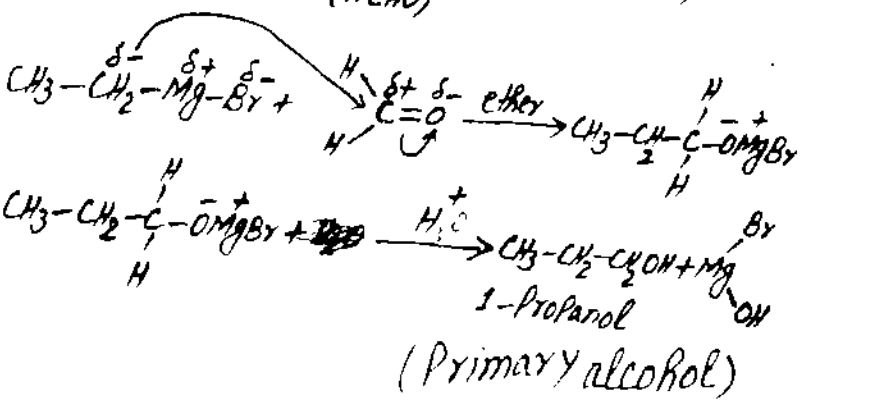
(iv) With alcohols :-



(v) With Carbondioxide

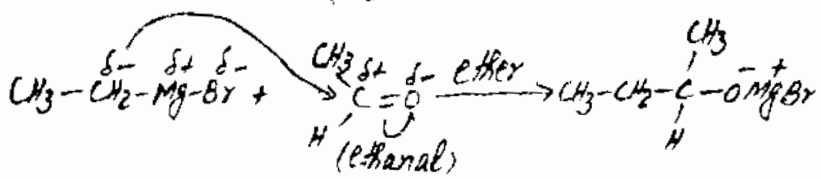


(vi) With Formaldehyde (HCHO)

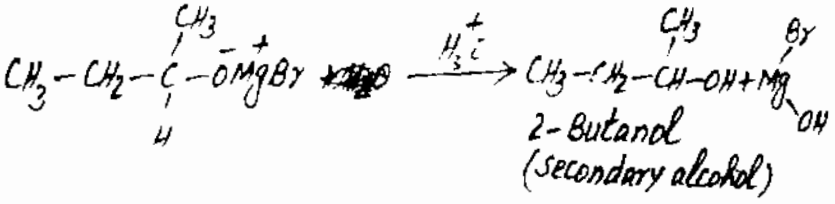


(Primary alcohol)

(vii) With acetaldehyde (CH_3CHO)

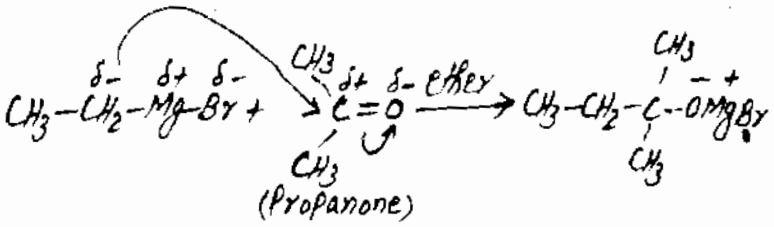


(ethanal)

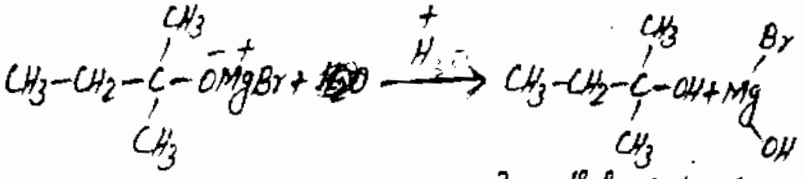


2-Butanol
(secondary alcohol)

(viii) With Acetone (CH_3COCH_3)

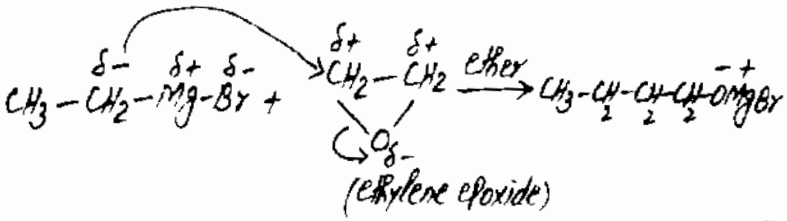


(Propanone)

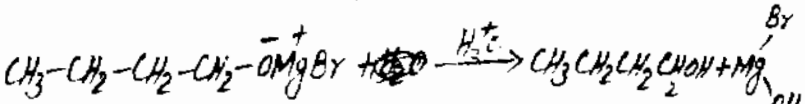


2-methyl 2-butanol
(Tertiary alcohol)

(ix) With Epoxide :-



(ethylene epoxide)



(1-butanol)

EXERCISE

Q1. *Fill in the Blanks.*

(i) In tertiary alkyl halides the halogen atom is attached to a carbon which is further attached to _____carbon atoms directly.
(ii) The best method for the preparation of alkyl halides is the reaction of _____ with inorganic reagents.
(iii) An alkyl group with a partial positive charge on the carbon atom is called _____centre.
(iv) The mechanism is called_____if it involves one molecule in the rate-determining step.
(v) Molecularity of reaction is defined as the number of molecules taking part in the _____.
(vi) The Molecularity of E2 reactions is always two and the reactions show _____ order kinetics.
(vii) Wurtz synthesis is useful for the preparation of_____alkanes.
(viii) Grignard reagents are prepared by the reaction of magnesium metal with alkyl halides in the presence of _____.

Answer:- (i) three (ii) alcohol (iii) electro philic(iv) uni molecular (v) rate determining step(vi) second (vii) higher (viii) dry-ether

Q2. *Indicate True or False*

(i) In secondary alkyl halides, the halogen atom is attached to a carbon which is further attached to two carbon atoms directly.
(ii) Alcohol's react with thionyl chloride in ether as solvent to give alkyl halides.
(iii) Order of reactivity of alkyl halides for a particular alkyl group is: Iodide > Bromide > Chloride > Fluoride
(iv) In S_N2 reactions the attacking nucleophile always attacks from the side in which the leaving groups is attached.
(v) Methyl magnesium iodide on hydrolysis yields ethyl alcohol.
(vi) Primary, secondary and tertiary amines react with Grignard reagents in the same way.
(vii) The reactions of secondary alkyl halides may follow both S_N1 and S_N2 mechanisms.
(viii) S_N1 mechanism is a one stage process involving a simultaneous bond breakage and bond formation.
(ix) In β-elimination reactions, the two atoms or groups attached to two adjacent carbon atoms are lost under the influence of an electrophile.
(x) The reactivity order of alkyl halides is determined by the strength of carbon – halogen bond.

Answer:- (i) true (ii) false(iii) true (iv) false (v) false (vi) false(vii) true (viii) false (ix) false (x) true

Q3. Multiple Choice Questions. Encircle the correct answer.

(i) In primary alkyl halides, the halogen atom is attached to a carbon which is further attached to how many carbon atoms.
(a) Two (b) Three (c) One (d) Four

(ii) The reactivity order of alkyl halides for a particular alkyl group is.
(a) Fluoride > Chloride > Bromide > Iodide
(b) Chloride > Bromide > Fluoride > Iodide
(c) Iodide > Bromide > Chloride > Fluoride
(d) Bromide > Iodide > Chloride > Fluoride

(iii) When CO_2 is made to react with ethyl magnesium iodide, followed by acid hydrolysis, the product formed is.
(a) Propane (b) Propanoic acid (c) Propanal (d) Propanol

(iv) Gringnard regent is reactive due to.
(a) The presence of halogen atom (b) The presence of Mg atom
(c) The polarity of C – Mg bond (d) None of the above

(v) S_N2 reactions can be best carried out with.
(a) Primary alkyl halides (b) Secondary alkyl halides
(c) Tertiary alkyl halides (d) All the three

(vi) Elimination bimolecular reactions involve.
(a) First order kinetics (b) Second order kinetics
(c) Third order kinetics (d) Zero order kinetics

(vii) For which mechanisms, the first step involved is the same.
(a) E1 and E2 (b) E1 and S_N2
(c) S_N1 and S_N2 (d) E1 and S_N1

(viii) Alkyl halides are considered to be very reactive compounds towards nucleophiles, because.
(a) They have an electrophilic carbon.
(b) They have an electrophilic carbon and a good leaving group.
(c) They have an electrophilic carbon and a bad leaving group.
(d) They have a nucleophilic carbon and a good leaving group.

(ix) The rate of E_1 reaction depends upon.
(a) The concentration of substrate.
(b) The concentration of nucleophile.
(c) The concentration of substrate as well as nucleophile
(d) None of the above .

(x) Which one of the following is not a nucleophile.
(a) H_2O (b) H_2S (c) BF_3 (d) NH_3

Answer:- (i) c (ii) c (iii) b (iv) c (v) a
(vi) b (vii) d (viii) b (ix) a (x) c

Q4. Define alkyl halide. Which is the best method o preparing alkyl halides?

Answer:- see page No. 121, 123

Q5. Write down a method for the preparation of ethyl magnesium bromide in the laboratory?

Answer:- see page No. 133

Q6. Give IUPAC names to the following compounds.

(i) $CH_3 - CH(CH_3) - CH_2 - CH - CH_3$
Cl

(ii) $C_2H_5 - CH - CH - C_2H_5$
CH_3 Br

(iii) $(C_2H_5)_2CH - CH_2 - CH - CH_3$
Cl

(iv) $(CH_3)_3 C - CH_2 - Cl$

(v) $(CH_3)_2CHBr$

(vi) $(CH_3)_2CH - CH_2 - CH(C_2H_5)CH_2Cl$
Br Br

(vii) CBr_4

(viii) $H_2C - CH_2$

(ix) CH_2Cl_2

(x) $(CH_3)_3C - CH_2 - CH_2 - Br$

(xi) $(CH_3)_2CH - CH_2 - C(CH_3)_2$
Cl

(xii) $(CH_3)_2C - C(CH_3)_2$
Cl Cl

(xiii) $(CH_3CH_2)_3CBr$

Answer:- (i) $CH_3 - \underset{CH_3}{CH} - CH_2 - \underset{Cl}{CH} - CH_3$

2-Chloro-4-methyl Pentane

(ii) $CH_3 - CH_2 - \underset{CH_3}{CH} - \underset{Br}{CH} - CH_2 - CH_3$

3-Bromo-4 methyl hexane

(iii) $CH_3 - CH_2$
$CH_3 - CH_2 - CH - CH_2 - CH - CH_3$
CH_3 Cl

2-Chloro-4 ethyl hexane

(iv) $CH_3 - \underset{CH_3}{C} - CH_2 - Cl$

1-Chloro 2,2 dimethyl Propane

(v) $CH_3-\underset{\underset{CH_3}{|}}{CH}-Br$ 2-Bromo Propane

(vi) $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-\underset{\underset{CH_2-CH_3}{|}}{CH}-CH_2-Cl$

1-Chloro-2-ethyl, 4-methyl Pentane

(vii) CBr_4 or $Br-\underset{\underset{Br}{|}}{\overset{\overset{Br}{|}}{C}}-Br$ Tetra bromo methane

(viii) $\overset{Br}{\overset{|}{CH_2}}-\overset{Br}{\overset{|}{CH_2}}$ 1,2 dibromo ethane (ix) CH_2Cl_2 Dichloromethane

(x) $CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_2-CH_2Br$, 1-Bromo-3,3 dimethyl butane

(xi) $CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2-\underset{\underset{Cl}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_3$

2-Chloro, 2,4 dimethyl Pentane

(xii) $CH_3-\underset{\underset{Cl}{|}}{\overset{\overset{CH_3}{|}}{C}}-\underset{\underset{Cl}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_3$ 2,3 dichloro,2,3 dimethyl butane

(xiii) $(CH_3-CH_2)_3CBr$ or $CH_3-CH_2-\underset{\underset{CH_2-CH_3}{|}}{\overset{\overset{Br}{|}}{C}}-CH_2-CH_3$

3-Bromo, 3-ethyl Pentane

Q7. Draw all possible structures that have the molecular formula $C_6H_{13}Cl$. Classify each as primary, secondary or tertiary chloride. Give their names according to IUPAC system.

Answer:-

(i) $CH_3-CH_2-CH_2-CH_2-CH_2-CH_2-Cl$

1-chlorohexane (Primary)

(ii) $CH_3-CH_2-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2Cl$ 1-chloro,2-methyl pentane (Primary)

(iii) $CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-CH_2Cl$ 1-chloro,3-methyl pentane (Primary)

(iv) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2-CH_2-CH_2Cl$ 1-chloro, 4-methyl pentane (Primary)

(V) $CH_3-CH_2-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH_2Cl$ 1-chloro 2,2 dimethyl butane (Primary).

(VI) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_2Cl$ 1-chloro 2,3 dimethyl butane (Primary)

(Vii) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH_2-CH_2Cl$ 1-chloro, 3,3 dimethyl butane (Primary)

(Viii) $CH_3-CH_2-CH_2-CH_2-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_3$ 2-chlorohexane (Secondary)

(ix) $CH_3-CH_2-CH_2-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_2-CH_2$ 3-chlorohexane (Secondary)

(X) $CH_3-CH_2-\underset{\displaystyle CH_3}{\underset{|}{CH}}-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_3$ 2-chloro,3-methyl pentane (Secondary)

(Xi) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH-\underset{\displaystyle Cl}{\underset{|}{CH}}-CH_3$ 2-chloro, 4-methyl pen...

(xii) $CH_3-\underset{CH_3}{\overset{CH_3}{CH}}-\underset{Cl}{CH}-CH_3$ 2-Chloro-3-dimethyl butane (Secondary)

(xiii) $CH_3-CH_2-\underset{Cl}{\overset{CH_3}{C}}-CH_3$ 2-Chloro-2-methyl butane (Tertiary)

(XIV) $CH_3-CH_2-\underset{CH_3}{\overset{Cl}{C}}-CH_2-CH_3$ 3-Chloro 3 methyl pentane (Tertiary)

(XV) $CH_3-\underset{CH_3}{CH}-\underset{CH_3}{\overset{Cl}{C}}-CH_3$ 2-Chloro 2,3 dimethyl butane (Tertiary)

Q8. Using ethyl bromide as a starting material how would you prepare the following compounds. Give also the inorganic reagents and conditions necessary to carry out these reactions

(a) n-Butane (b) Ethyl alcohol (c) Ethyl cyanide
(d) Ethane (e) Ethene (f) Propanoic acid
(g) Propane

Answer:

(a) $2CH_3-CH_2Br + 2Na \longrightarrow CH_3-CH_2-CH_2-H_2 + 2NaBr$ (n-butane)

(b) $CH_3-CH_2Br + KOH \xrightarrow{\Delta} CH_3-CH_2-OH + KBr$ (Ethyl alcohol)

(C) $C_2H_5Br + KCN \longrightarrow C_2H_5CN + KBr$ (Ethyl cyanide)

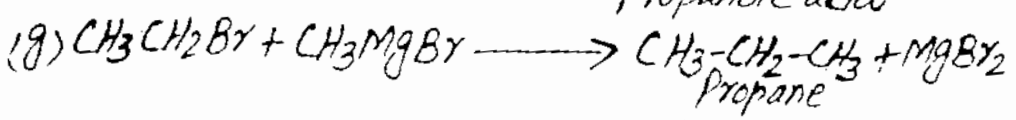
(d) $C_2H_5Br + (H) \xrightarrow{Zn-Cu} C_2H_6 + HBr$ (Ethane)

(e) $CH_3-CH_2Br + KOH \xrightarrow{alc.} CH_2=CH_2 + KBr + H_2O$ (Ethene)

(f) $CH_3-CH_2-Br + Mg \longrightarrow CH_3-CH_2-MgBr$

$CH_3-CH_2MgBr + O=C=O \longrightarrow CH_3-CH_2-C(=O)-OMgBr$

Propanoic acid



Propane

Q9. Write a detailed note on the mechanism of nucleophilic substitution reactions.

Answer:- see page No. 128, 129

Q10. What do you understand by the term β-elimination reaction. Explain briefly the two possible mechanisms of β-elimination reactions.

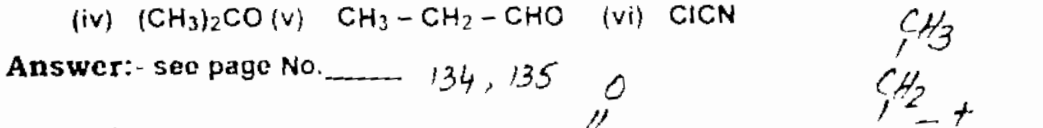
Answer:- see page No. 130, 131, 132

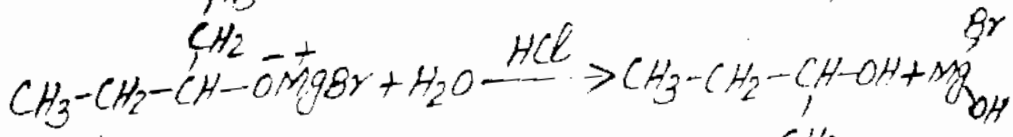
Q11. What products are formed when the following compounds are treated with ethylmagnesium bromide, followed by hydrolysis in the presence of an acid.

(i) HCHO (ii) CH_3CHO (iii) CO_2

(iv) $(CH_3)_2CO$ (v) $CH_3 - CH_2 - CHO$ (vi) ClCN

Answer:- see page No. 134, 135





(3-Pentanol)

Q12. How will carry out the following conversions.

(i) CH_4 ⟶ CH_3CH_2COOH

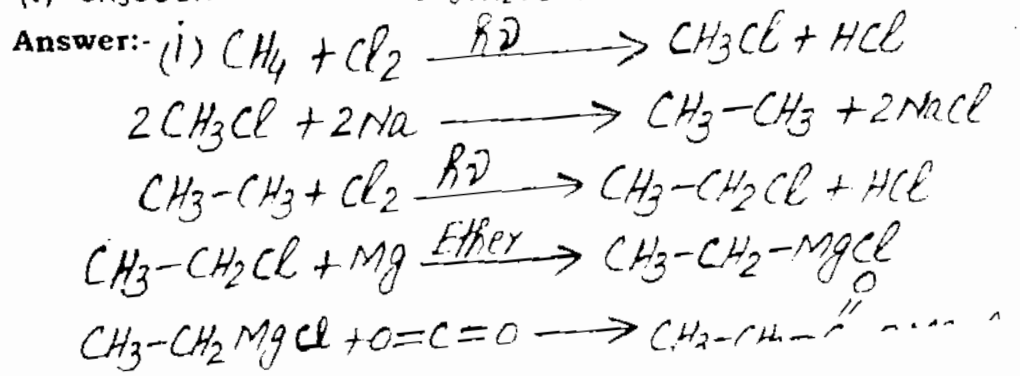
(ii) $CH_3 - CH_3$ ⟶ $(CH_3 - CH_2)_4\ N^+Br^-$

(iii) $CH_2 = CH_2$ ⟶ $CH_3 - CH_2 - CH_2 - CH_2 - OH$

(iv) $CH_3CH_2CH_2Cl$ ⟶ $CH_3 - CH = CH_2$

(v) CH_3COOH ⟶ CH_3CH_2COOH

Answer:-



$CH_3-CH_2-\overset{O}{\overset{\|}{C}}-O^{-}Mg^{+}Cl + H_2O \xrightarrow{HCl} CH_3CH_2COOH + Mg\begin{matrix}Cl\\OH\end{matrix}$

(Propanoic acid)

(ii) $CH_3-CH_3 + Br_2 \xrightarrow{h\nu} CH_3CH_2Br + HBr$

$C_2H_5Br + NH_3 \longrightarrow C_2H_5NH_2 + HBr$

$C_2H_5Br + C_2H_5NH_2 \longrightarrow (C_2H_5)_2NH + HBr$

Ethylamine — $(C_2H_5)_2$ (Diethyl amine)

$C_2H_5Br + (C_2H_5)_2NH \longrightarrow (C_2H_5)_3N + HBr$

$C_2H_5Br + (C_2H_5)_3N \longrightarrow (C_2H_5)_4N^{+}Br^{-}$

Triethyl amine — Quaternaryethyl Ammonium Bromide

(iii) $CH_2=CH_2 + HCl \longrightarrow CH_3-CH_2Cl$

$2CH_3CH_2Cl + 2Na \longrightarrow CH_3CH_2CH_2CH_3 + 2NaCl$

$CH_3-CH_2-CH_2-CH_3 + Cl_2 \xrightarrow{h\nu} CH_3-CH_2-CH_2-CH_2Cl + HCl$

$CH_3CH_2CH_2CH_2Cl + KOH \xrightarrow{Aq} CH_3CH_2CH_2CH_2OH + KCl$

(iv) $CH_3-CH_2-CH_2Cl + KOH \xrightarrow{Alc} CH_3-CH=CH_2 + KCl + H_2O$

(v) $CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O$

$2CH_3COONa + 2H_2O \xrightarrow[Current]{Electric} CH_3-CH_3 + 2CO_2 + 2NaOH + H_2$

$CH_3-CH_3 + Cl_2 \xrightarrow{sunlight} CH_3-CH_2Cl + HCl$

$CH_3-CH_2-Cl + Mg \longrightarrow CH_3-CH_2MgCl$

$CH_3CH_2MgCl + CO_2 + H_2O \xrightarrow{HCl} CH_3CH_2COOH + Mg\begin{matrix}Cl\\OH\end{matrix}$

(Propanoic acid)

گلدستہ ڈاٹ پی کے کی جانب سے خوش آمدید

السلام علیکم ورحمتہ اللہ وبرکاتہ

مختصر تعارف

کافی عرصہ سے خواہش تھی کہ ایک ایسی ویب سائٹ بناؤں جس پر طالب العلموں کیلئے کچھ تعلیمی مواد جمع کر سکوں۔ اللہ تعالیٰ نے توفیق دی اور میں نے ایک سال کی محنت کے بعد ایک سائٹ "گلدستہ ڈاٹ پی کے" کے نام سے بنائی جو کہ قرآن و حدیث، اصلاحی، دلچسپ، تاریخی قصے واقعات، اُردو انگلش تحریریں، شاعری و اقوال زریں، F.Sc اور B.Sc کے مضامین کے آن لائن نوٹس، اسلامک، تفریحی، معلوماتی وال پیپرز، حمد و نعت، فرقہ واریت سے پاک اسلامی بیانات، پنجابی نظمیں و ترانے اور کمپیوٹر و انٹرنیٹ کی دنیا کے بارے میں ٹپس، آن لائن کمائی کرنے کے مستند طریقہ کار۔ کے ساتھ ساتھ اور بھی بہت سی چیزوں پر مشتمل ہے۔ اور انشاء اللہ میں مزید وقت کے ساتھ ساتھ اضافہ کرتا جاؤں گا۔ آپ کی قیمتی رائے کی ضرورت ہے۔ عرنان شفیق

اہم نوٹ

ذیل میں جو نوٹس مہیا کیے گئے ہیں وہ کئی گھنٹوں کی لگاتار محنت کے مرتب ہوئے ہیں۔ اور آپ کو بالکل مفت مہیا کر رہے کیے جارہے ہیں۔ آپ سے ان کی قیمت صرف اتنی سی متوقع ہے کہ ایک بار **درودّ ابراھیمی** اپنی زبان سے ادا کر دیں۔

بِسْمِ اللّٰهِ الرَّحْمٰنِ الرَّحِيْمِ

اَللّٰهُمَّ صَلِّ عَلٰى مُحَمَّدٍ

وَّعَلٰى اٰلِ مُحَمَّدٍ كَمَا صَلَّيْتَ

عَلٰى اِبْرَاهِيْمَ وَعَلٰى اٰلِ اِبْرَاهِيْمَ

اِنَّكَ حَمِيْدٌ مَّجِيْدٌ ۝

اَللّٰهُمَّ بَارِكْ عَلٰى مُحَمَّدٍ وَّعَلٰى

اٰلِ مُحَمَّدٍ كَمَا بَارَكْتَ عَلٰى

اِبْرَاهِيْمَ وَعَلٰى اٰلِ اِبْرَاهِيْمَ

اِنَّكَ حَمِيْدٌ مَّجِيْدٌ ۝