Q:1 Write the electronic configaration of any atoms?

(i) Ca (ii) Cr (iii) Cu (iv) F

Calcium is a s-block element and its chemical symbol is 'Ca'. In general the outer electronic configuration of these block's is ns^{1-2}.

The atomic number of ~~these~~ this atom is 20 and the electronic configuration is given below:

$Ca(20) \longrightarrow 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$.

Florin is a p-block atom and its chemical symbol is 'F'. In general the outer electronic configuration of these block's is $ns^{2}\ np^{1-6}$.

The atomic number of this atom is 9 and the electron configuration is given below:

$F(9) \longrightarrow 1s^2\ 2s^2\ 2p^5$.

In the case of Copper and Chromium, here is an exeption. Because these atoms ~~are~~ ~~not obeying~~ don't follow (অনুসরণ করে) Auf bau principal for the reason of

gaining half-filled or full-filled stabilization of s, p, d, f orbitals. So, we can notice a different electronic configuration from another ~~electron~~ atoms.

Chromium is a d-block atom and its chemical symbol is "Cr". In general the outer electronic configuration of d-block's ~~atoms~~ is ~~ns²~~ ~~nd~~ $(n-1)d^{1-10}\ ns^{1-2}$. of d-block

But ~~$ and~~ in the case of exeptional atoms, the outer electronic configuration ~~of the~~ is $(n-1)\,d^5\,ns^1$, $(n-1)d^{10}\,ns^1$.

~~The general electronic configuration~~

~~In general~~, The electronic configuration of chromium is supposed to be,

$Cr\ (24) \longrightarrow 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^4\ 4s^2$

But, to get half-filled or full-filled stability the electronic configuration will be like this,

$Cr\ (24) \longrightarrow 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$.

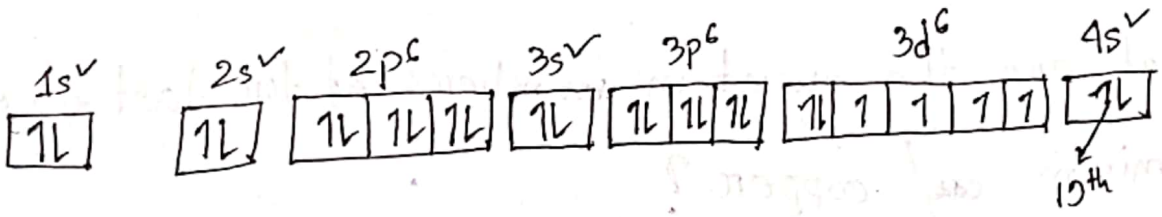
same for copper.

Q:2. What are the quantum numbers for 19th electron of iron (Fe)? 20th electron of calcium?

The electronic configuration of ~~zinc~~ iron (Fe) is,

$Fe(26) \longrightarrow 1s^{\checkmark} 2s^{\checkmark} 2p^{6} 3s^{\checkmark} 3p^{6} 3d^{6} 4s^{\checkmark}$.

For finding 19th electron's orbital, we use Hund's principle,



So, the orbital of 19th electron is 4s. Here the set of 4 quantum numbers of 19th electron of iron is,

$n = 4$

$l = 0$

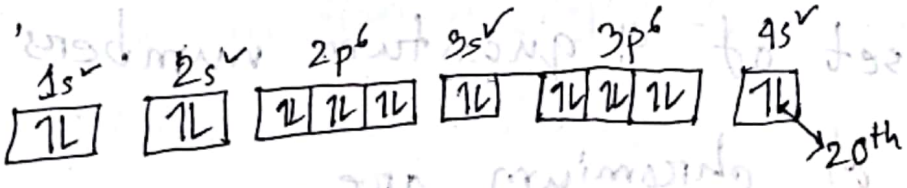
$m = 0$

$s = +\frac{1}{2}$

The electronic configuration of calcium (Ca) is,

$Ca(20) \longrightarrow 1s^{\checkmark} 2s^{\checkmark} 2p^{6} 3s^{\checkmark} 3p^{6} 4s^{\checkmark}$

For ~~finding~~ finding 20th electron's orbital ~~of calcium~~, we use Hund's principle,



So, the orbital of 20th electron of calcium is 4s. Now, the set of 4 quantum numbers of calcium is given below,

$n = 4$
$l = 0$
$m = 0$
$s = -\frac{1}{2}$.

Q: 3 What are the quantum numbers for last electron of chromium / copper?

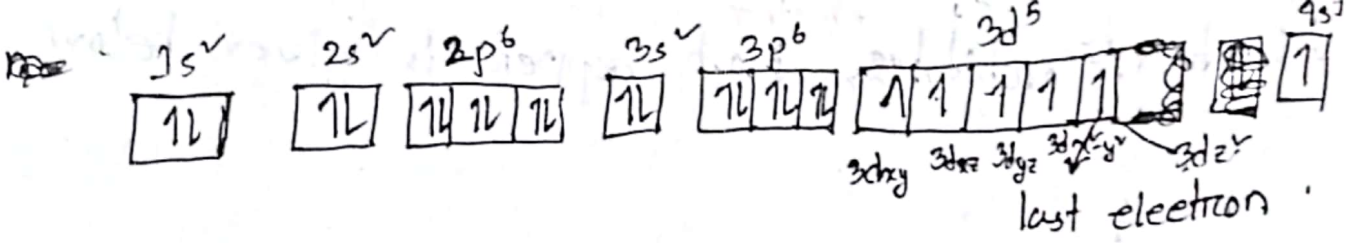
The electronic configuration of chromium (Cr) is,

$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5\ 4s^1$.

According to the Aufbau principal, electrons first occupy those orbitals whose energy is lowest, then electrons move to higher energy levels.

But in the case of chromium it looks different. The last electron enters the 3d orbital instead of the 4s orbital for gaining more stability.

So, that the set of 4 quantum numbers for last electron of chromium are,



∴ Value of n, l, m, s for the last electron,

$n = 3$

$l = 2$

$m = +2 \ (3dz^2)$

$s = +\frac{1}{2}$

Q:4. What are the quantum numbers of the ~~outer~~ external orbitals electron of cu(29) atom?

~~The elect~~ The atomic number of copper is 29 and the electronic configuration of copper is,

$Cu(29) \rightarrow 1s^2 \ 2s^2 \ 2p^6 \ 3s^2 \ 3p^6 \ 3d^{10} \ 4s^1$.

we can easily notice that the external orbital ~~or external electron~~ is 4s. Because "n" represents the orbital number of any atoms. In the electronic configuration of copper, the highest value of n is 4.

Now, the quantum ~~nut~~ numbers of the external

electronic orbitals, electron of copper is given below,

$n = 4$

$l = 0$

$m = 0$

$s = +\frac{1}{2}$

Q:5 Isotopes, Isobars, Isotones, Iso-electronic. (defination with example).

Isotope: Isotope are the atoms in which the number of neutrons differs but the number of protons are same.

For example $^{12}_{6}C$ $^{13}_{6}C$ $^{14}_{6}C$.

Here the number of protons in carbon is 6 but the number of neutrons are different like 6, 7, 8. So, we can say that $^{12}_{6}C$ $^{13}_{6}C$ $^{14}_{6}C$ are the isotope with each other.

Isobar: Isobars are these atoms which have a different atomic number but same masses number.

For example $^{14}_{6}C$, $^{14}_{7}N$, $^{14}_{8}O$.

Here, the number of mass values are same but the proton numbers are different from each other. So that they are

the isobar with each other.

Isotone: If two or more atoms having an equal number of neutrons but different atomic numbers are called isotone.

For example $^{36}_{16}S$, $^{37}_{17}Cl$, $^{38}_{18}Ar$, $^{39}_{19}K$ and $^{40}_{20}Ca$.

Here, we can notice that all those atoms have different atomic numbers and mass numbers but their neutron numbers are equal to 20.

So, we can easily say that they are isotone with each other.

Isoelectronic: Atoms, ions or molecules which have an equal number of valence electrons and the same electronic structure is called iso-electronic.

For example, CO, N_2 and NO^+.

Here, all the compounds have different atoms and structures but they have an equal number of electrons.

Q:6 What is the defination of transtion elements?

Those d-block elements/~~atoms~~ that form an ion, whose electron ~~co~~ a configuration has partially filled (ns^{1-9}) d-orbitals, are called transition elements.

In ~~periodic table~~ d-block, the ~~elements of~~ group 3 to 12 are not contained ~~contained~~ transition elements.

Q:7 What is orbit and orbital?

Orbit: Orbit is a well-difined circular path around the nucleus in which electrons revolve around the nucleus. Orbits are represented by letters L, K, M, N etc.

Orbitals: The 3-dimensional space around the nucleus where the probability of finding an electron is maximum, is called an orbital. Orbitals are represented by letters like s, p, d and f.

Q:8 What are the properties of periodic table?

Properties which are directly or indirectly related to their electronic configuration and shows a regular ~~order~~ order when we move from left to right in a period or from top to bottom in a group are called ~~pre~~ periodic properties.

Some important periodic properties are given below:

1. Melting and Boiling points,
2. Atomic size,
3. Ionization energy,
4. Electron affinity,
5. Electronegativity,
6. valency,
7. metallic property of the elements.

Q:9: What is ionization energy?

The amount of energy required to remove one electron from an isolated atom of an element in the gaseous state and turn it into one mole of gaseous isolated positive ions is called the ionization energy or potential of that elements.

Q:10 Why ionization potential energy of Nitrogen is higher than that of Oxygen? (same for Berilium and Boron)

The ionization energy depends on the electron configuration of the element. That is, the more stable electronic configuration of an element, having a higher ionization energy of that element. By arranging the electrons of nitrogen and oxygen we find that, Nitrogen is more stable than oxygen because its p-orbital is half-filled ($2p^3$). So the ionization potential energy of nitrogen is higher than that of oxygen.

Q:11 Electron affinity of Florin is lower than that of Chlorine. Explain why? (What is electron affinity)

Electron affinity is the amount of energy released when an electron is added to a neutral atom to form a negatively charged ion in the gaseous state.

The electron affinity of fluorine is less than that of chlorine due to the small size of the fluorine atom. The addition of an extra electron to the valence shell of the fluorine atom

produce a strong electron-electron repulsion, as a result, low energy is released which is responsible for the low electron affinity of the fluorine atom.

** Electron affinity (defination) -

In periodic table, when we move from left ~~and~~ to right ~~the electron affinity~~ is in a period the electron affinity of the atoms are contineously increased and when we move in a group from top to bottom, the electron affinity is contineously decreased.

~~** Electronegativity~~

Q: 12. What is electronegativity?

~~Electronegativity is the measure of The tendency of an atom to attract~~

The tendency of an atom in a molecule to attract the shared pair of electrons towards itself is known as electronegativity.

In periodic table, when we move from left to right

in a period the electronegativity of electrons are continuously increased but we when we move from top to bottom in group, it is continuously decreased.

Na < Mg < Al < Si < P < S < Cl (across the period)

F > Cl > Br > I > At (in group)

Q:13 What is Aufbau principle?

A maximum of two electrons are put into orbitals in the order of increasing orbital energy: the lowest-energy orbitals are filled before electrons are placed in higher-energy orbitals.

* Orbitals are filled in orders of increasing $n+l$.
* If two orbitals have the same value of $n+l$, then we shall consider the lower value of n between them.

The increasing order of orbital energy level is,

1s < 2s < 2p < 3s < 3p < 4s < 3d < 4p < 5s. ——

Q:14 ~~Why are they called noble gases?~~

What is noble gas? Why are they called noble gases?

The noble gases are the elements that belong to group 18 of the modern periodic table. They are also known as the inert gases and aerogens.

They are called "noble" gases, because they rarely bond with lesser elements i.e. ones with unfilled outer electron shells. They have also a stable completely filled electronic shells and almost zero electron affinities. ~~Scotland~~ Therefore, they don't have any tendency to gain, lose or share electrons with other atoms.

Q:15 White the uses of noble gas?

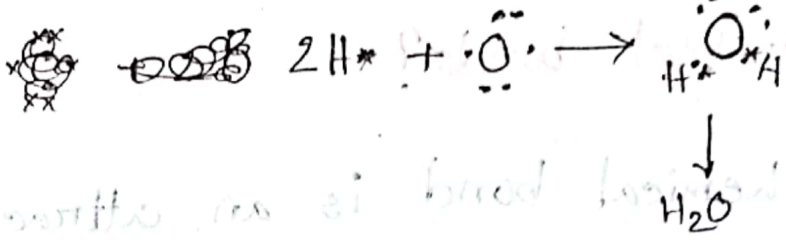
Q:16 What is chemical bond? How many types of chemical bonds?

A chemical bond is an attractive force that holds two or more atoms together in a molecule or an ion. Chemical bonds are following types;

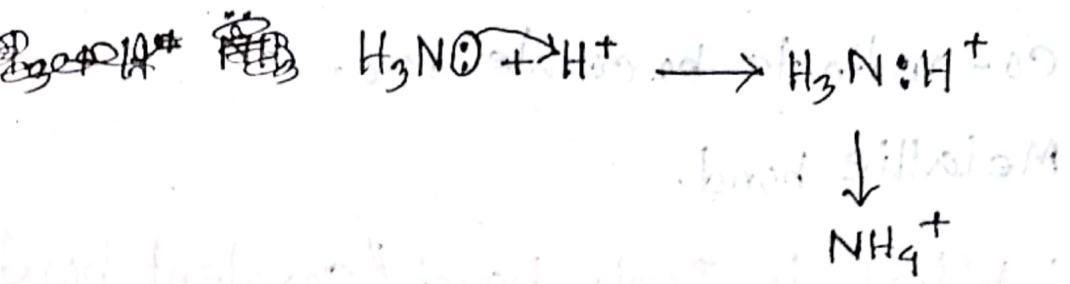
a. Ionic bond,
b. Covalent bond,
c. Co-ordinate ~~bo covater~~ bond.
d. Metallic bond.

Q:17 What is Ionic bond / Covalent bond / Co-ordinate bond ~~/ Metallic bond~~ Explain with an example.

Ionic bond: A connection between two ions with opposite charges. i.e. when a positive and a negative ion form a chemical bond, its called an ionic bond. For example $Na^+ + Cl^- \longrightarrow NaCl$

Covalent bond: A chemical bond between two atoms in which the electrons are shared by the both the participating atoms is called covalent bond. For example, 

Co-ordinate bond: A covalent bond which is formed by the mutual sharing of two electrons both which are provided entirely by one of the linked atoms is called co-ordinate bond.

For example, 

D. L.

Q:18 What is the Hybridization of CH_4, NH_3, H_2O?

The electronic configuration of carbon,

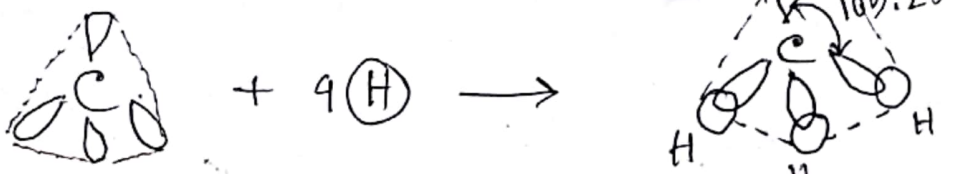
ground state : $_6C \longrightarrow 1s^2\ 2s^2\ 2p_x^1\ 2p_y^1\ 2p_z^0$

excited state; $_6C^* \longrightarrow 1s^2\ 2s^1\ 2p_x^1\ 2p_y^1\ 2p_z^1$

Hybrid state : $_6C \longrightarrow 1s^2\ 2\psi_1^1\ 2\psi_2^1\ 2\psi_3^1\ 2\psi_4^1$

Now coming to the Hybridization of methane, the central atom carbon is sp^3 hybridized. This is because of one 2s orbital and 3 2p orbitals in the valence shell of carbon combine to form four sp^3 hybrid orbitals which are of equal shape and energy. In four sp^3 hybrid orbitals of carbon to form C–H sigma bonds which ultimately leads to formation of this molecule.

The shape of CH_4 is tetragonal and the bond angle is 109.28°



Organic Chemistry

Reagent

- Substant
- Attacking
  - Carbanion
  - Carbocation
  - Electrophile (Attraction toward e^-)
  - Nucleophile (Attraction toward nucleus)

1: Aldol - Condensation Reaction: (অ্যালডলের ঘনীভবন বিক্রিয়া)

(i) CH_3CHO / $CH_3-\overset{O}{\overset{\|}{C}}-CH_3$ (substrate)

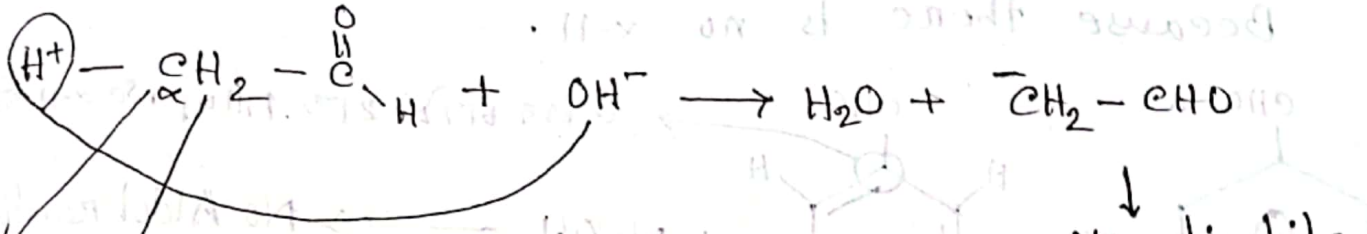
(ii) NaOH (50% solution) (attacking reagent)

$$CH_3CHO + CH_3CHO \xrightarrow[(50\% \text{ solution})]{NaOH} CH_3-\underset{OH}{\underset{|}{CH}}-CH_2-CHO$$

Ethanal → Aldol

Machanism of reaction:

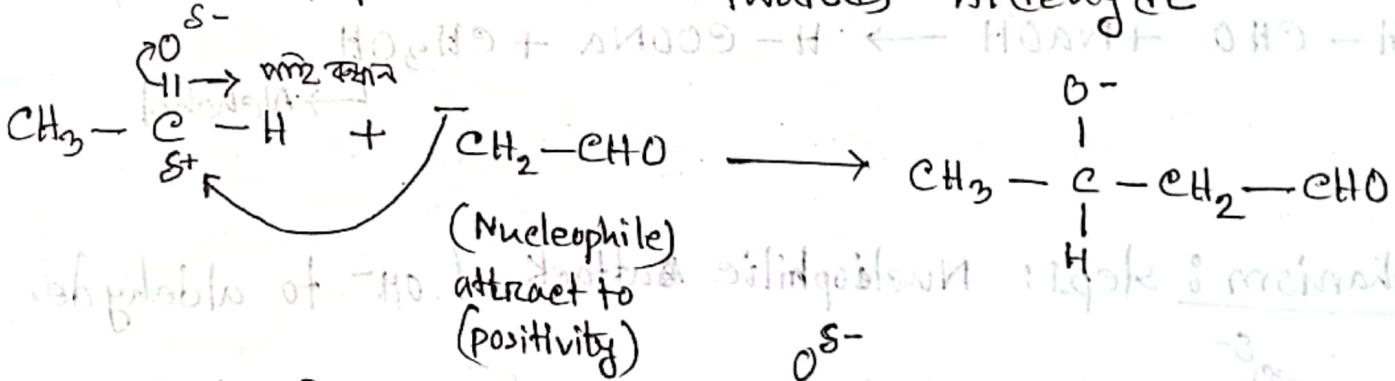
Step 1: preparation of carbanion



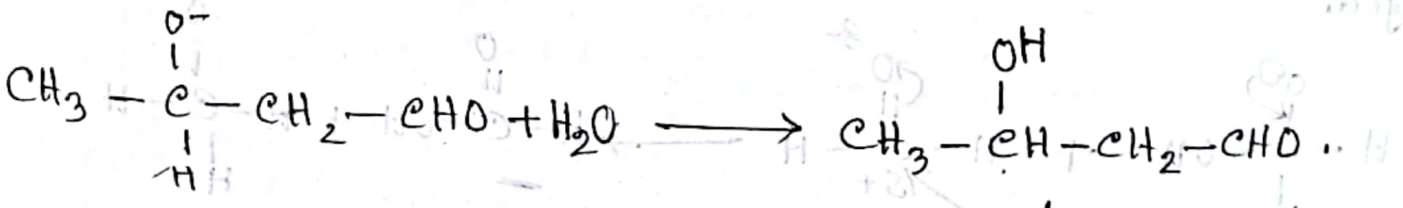
আলফা কার্বন কি? = কার্যকারী গ্রুপের সাথে যে কার্বন পরমাণু সংযুক্ত থাকে তাকে আলফা C বলে।

আলফা হাইড্রোজেন কি? = α–C এর সাথে যদি কোনো H থাকে তাবে তা α–H হয়।

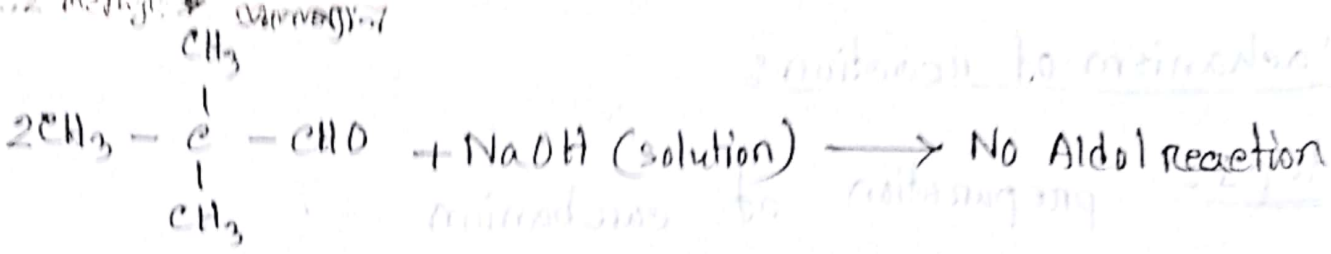
Step-2: Nucleophilic attack towards Aldehyde



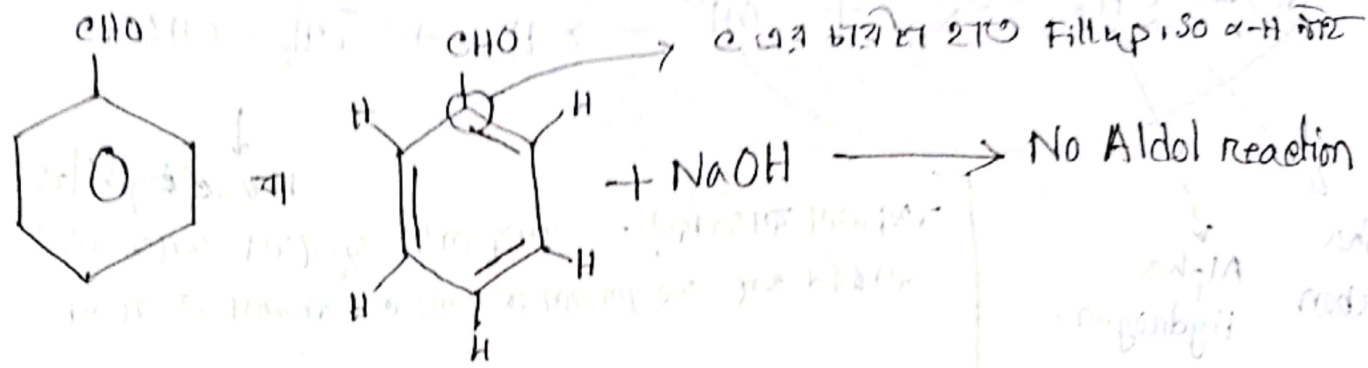
* পাই বন্ধন ভেঙে যাবে এবং $O^{\delta-}$ থেকে পুরোপুরি O^- এ পরিনত হবে। অর্থাৎ O Fully negative charge



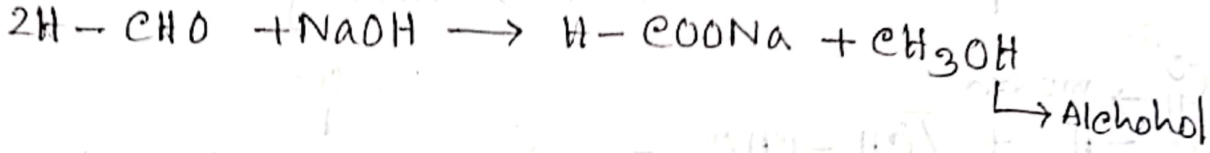
* α–H যুক্ত যৌগে অ্যালডল বিক্রিয়া হয়।



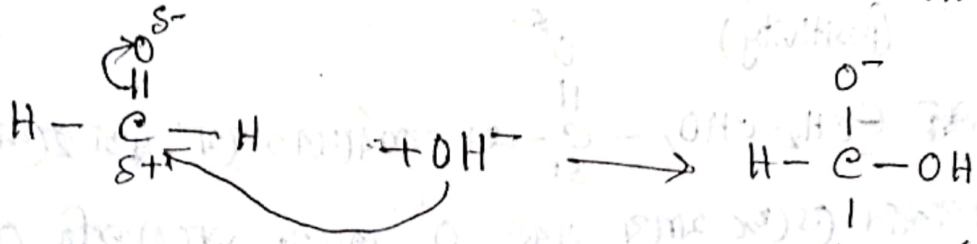
Because there is no α-H.



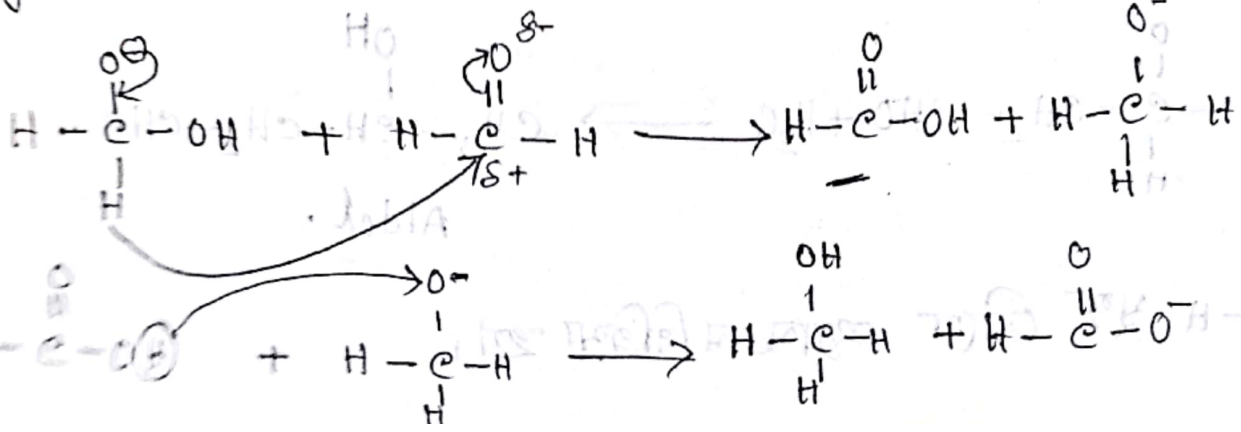
⊕ Cannizzaro Reaction:

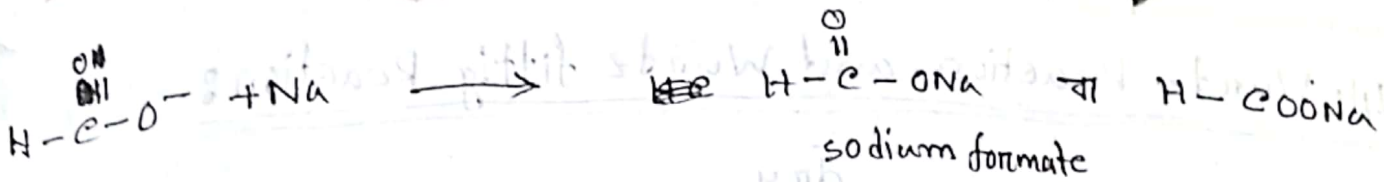


Machanism: step1: Nucleophilic attack of OH^- to aldehyde.



* এই বন্ধনীর O Fully negative charged.

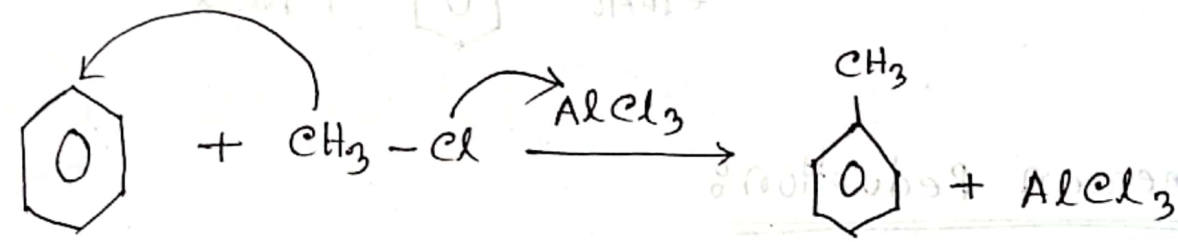




Friedel craft Alkylation and Acylation:

* Substrate → Alkyl halide
* Attacking reagent → Acyl group / Alkyl group.

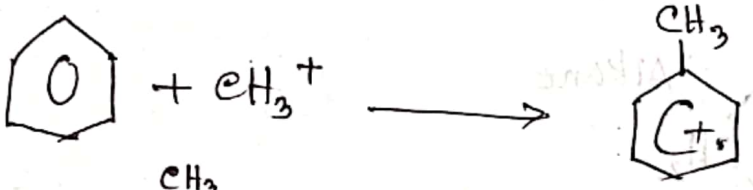
$CH_3-\overset{O}{\overset{\|}{C}}-$ CH_3-



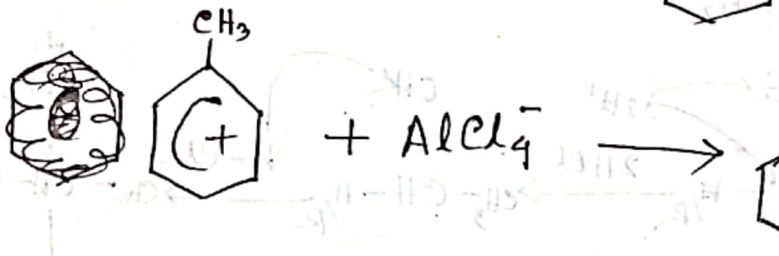
বেনজিন. toluene

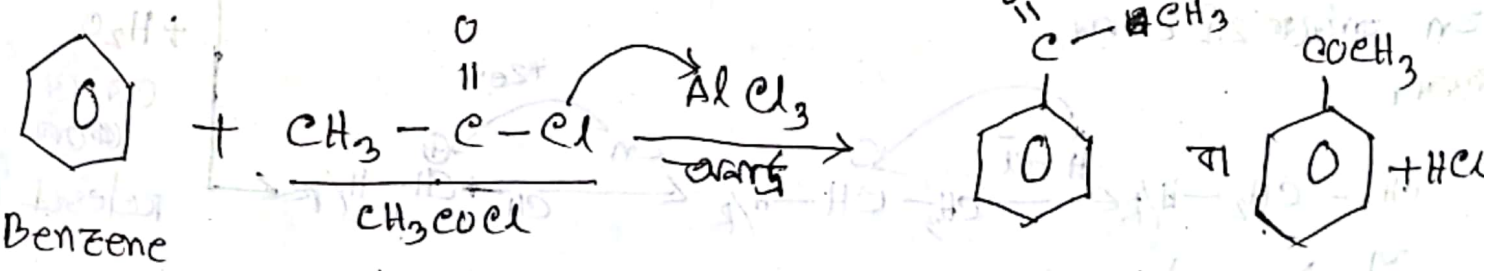
1st: $CH_3-Cl + AlCl_3 \longrightarrow CH_3^+ + AlCl_4^-$

2nd:



3rd:





Benzene CH_3COCl Acetyl choloride

Methyl Phenyl keton

[11] Wurtz Reaction and Wurtz fitting Reaction:

① $R-X + Na + R-X \xrightarrow[\text{ether}]{\text{dry}} \underset{\text{Alkane}}{R-R} + NaX$

$CH_3-Cl + Na + CH_3-Cl \xrightarrow[\text{ether}]{\text{dry}} CH_3-CH_3 + NaCl$

① $R-X + Na + Ar-X \xrightarrow[\text{ether}]{\text{dry}} Ar-R + NaX$

$CH_3-Cl + Na + C_6H_5-Cl \xrightarrow[\text{ether}]{\text{dry}} C_6H_5-CH_3 + NaCl$

[12] Clemmensen Reduction:

$$CH_3-\overset{O}{\overset{\|}{C}}-H/R + [H] \xrightarrow[+\text{ conc. HCl}]{Zn\cdot Hg} CH_3-CH_2-H/R$$

Machanism:

Aldihyde/Keton → Alkane

$>C=O \xrightarrow[HCl]{Zn\cdot Hg} >CH_2$

$CH_3-\overset{\overset{O^{\delta-}}{|}}{\underset{\delta+}{C}}-H/R \xrightarrow{+2e^-,\ Zn} CH_3-\overset{O^{\ominus}}{\underset{\ominus}{C}}-H/R \xrightarrow{2H^+} CH_3-\underset{OH}{\underset{|}{CH}}-H/R \xrightarrow{2HCl} CH_3-\underset{\overset{\oplus}{OH_2}}{\underset{|}{CH}}-H/R$

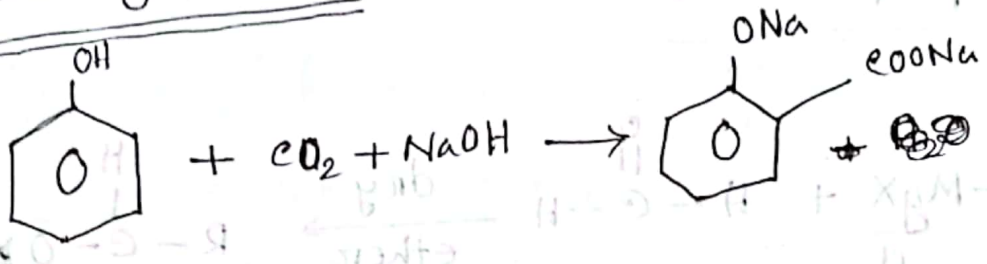
Zn কার্বনকে 2টি e দান করল।

$\xrightarrow{+H_2O}$ ... released

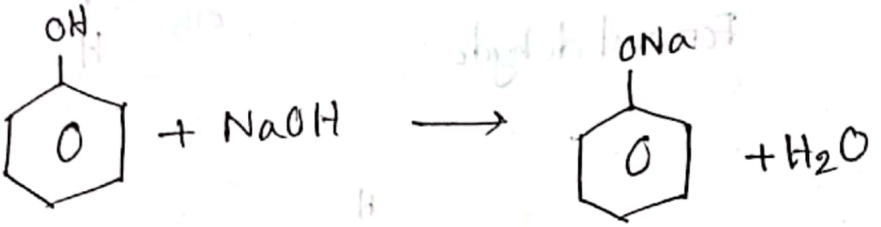
$CH_3-CH_2-H/R \xleftarrow{H^+-Cl^-} CH_3-\underset{\ominus}{CH}-H/R \xleftarrow[Zn]{+2e^-} CH_3-\underset{\oplus}{CH}-H/R$

বা $>CH_2$ হয়ে গেল।

Kolbe synthesis:

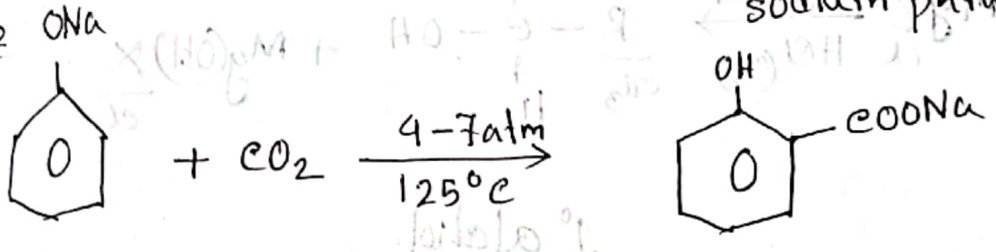


step1

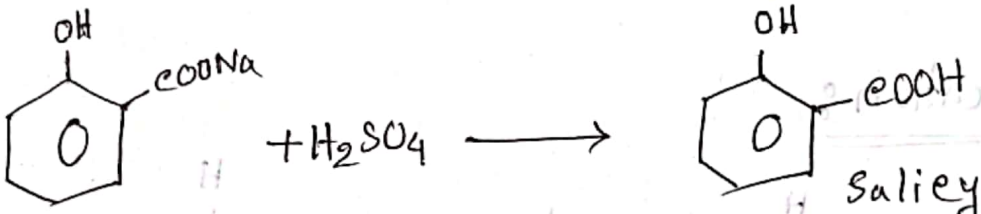


sodium phenet

step2



step3



Salicylic Acid.

Preparation of grignard reagent:

* $R - Mg - X$

Alkyle group — Halide group

* $Ar - Mg - X$

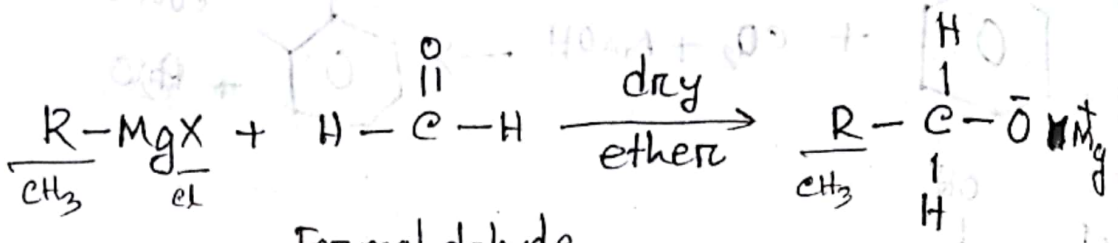
Aralyl group

$R-X + Mg \xrightarrow[ether]{dry} R-Mg-X$

$CH_3-CH_2-Cl + Mg \xrightarrow[ether]{dry} CH_3-CH_2-Mg-C$

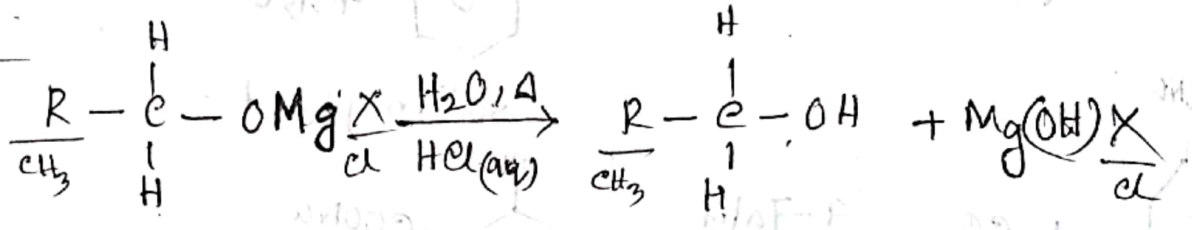
1° alcohol preparation:

step-1



Formal dehyde

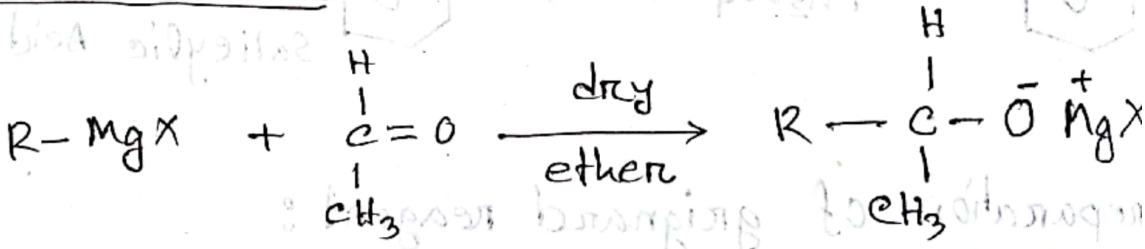
step-2



1° alcohol.

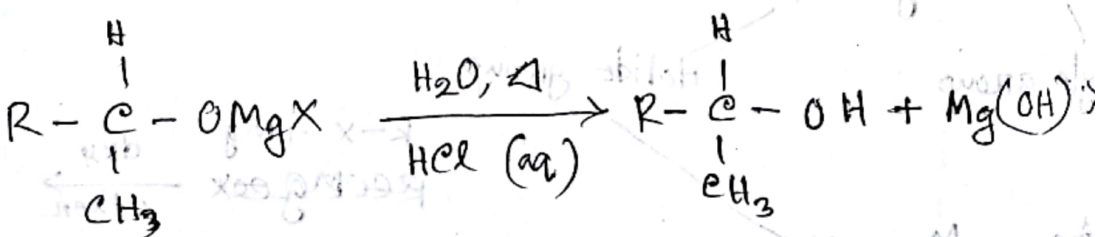
2° alcohol preparation:

step 1:

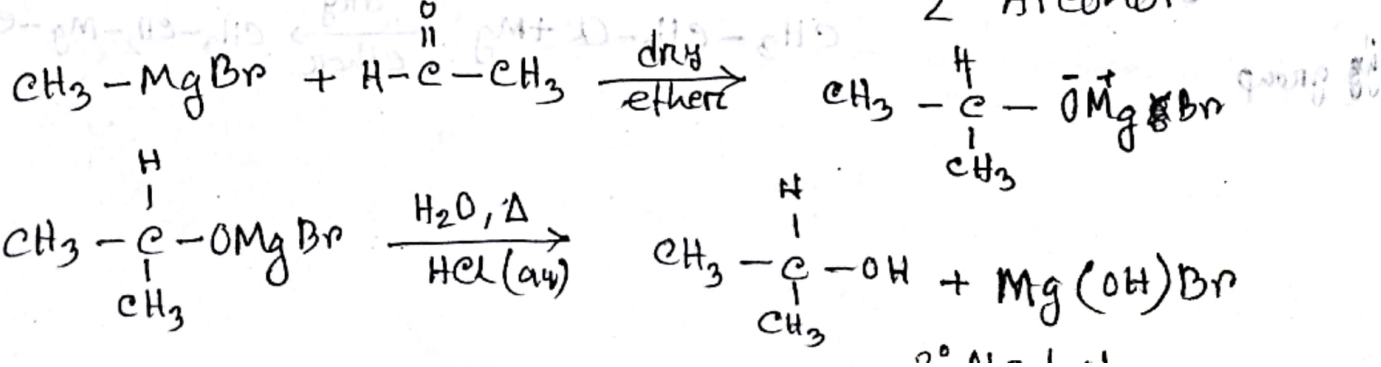


~~ethanol~~
ethanel

step 2:



2° Alcohol



3° alcohol preparation:

step 1:

$$R-MgX + CH_3-\overset{\overset{O}{\|}}{C}-H_3C \xrightarrow[\text{ether}]{\text{dry}} R-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-\bar{O}\,\overset{+}{Mg}X$$

(Aceton)

step 2:

$$R-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-OMgX \xrightarrow[HCl(aq)]{H_2O,\Delta} R-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-OH + Mg(OH)X$$

$$CH_3-MgI + CH_3-\overset{\overset{O}{\|}}{C}-H_3C \xrightarrow[\text{ether}]{\text{dry}} CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-\bar{O}\,\overset{+}{Mg}I$$

$$CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-OMgI \xrightarrow[HCl(aq)]{H_2O,\Delta} CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-OH + Mg(OH)I$$

3° Alcohol.

[1] Substitution Reaction: (প্রতিস্থাপন বিক্রিয়া)

1. Nucleophilic substitution:

The organic reaction in which substitution of a saturated carbon atom by a nucleophile is called nucleophilic substitution or S_N reaction.

There are two type of S_N reaction:

(i) S_{N_1} or Unimolecular Nucleophilic Substitution Reaction

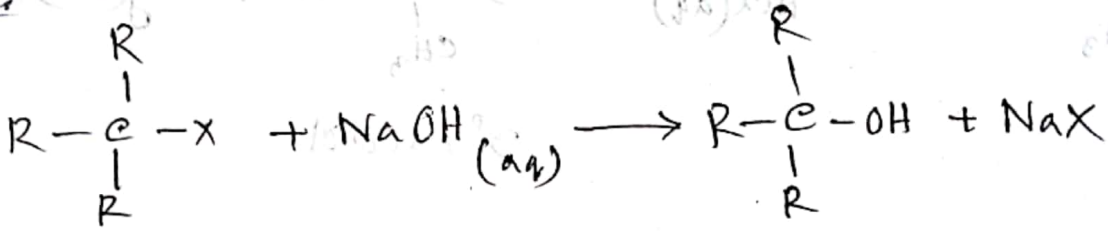
(ii) S_{N_2} or Bi-molecular " "

S_N1 → The rate of S_N reaction depends only on the concentration of alkyl halide rather than the concentration of nucleophile is called S_N1 reaction.

properties of S_N1 reaction:

1. The S_N1 Reaction occurs in 3° alkyl halid.
2. It's first order reaction
3. This reaction occurs in two steps.

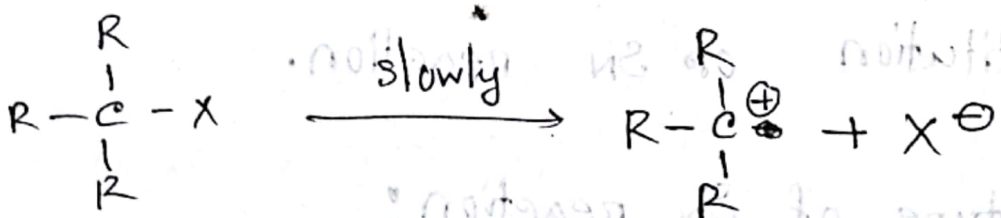
Example:



3° Alkyl halid → 3° Alcohal.

Mechanism:

step 1: The 3°-alkyl halide slowly dissociates to from the more stable – 3° carbonim ion and halid ion



3° alkyl halid → 3° carbonim ion

Step2: The nucleophilic is rapidly added to the carbonim ion and create alchol.

The order of activition in S_{N_1} reaction:

3° Alkyl halid > 2° Alkyl halid > 1° Alkyl halid

SN_2 → The rate of S_N reaction depends on concentration of alkyl-halid and nucleophilic is called S_{N_2} reaction

Properties of S_{N_2} reaction:

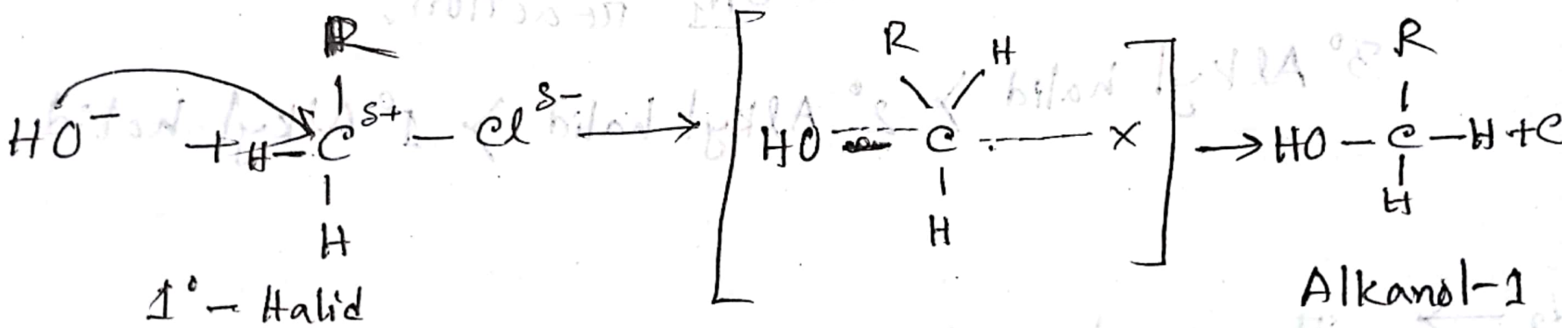
1. The S_{N_2} reaction occurs in 1° alkyl halid.
2. This reaction occurs in one steps.
3. It's 2nd ~~orth~~ order reaction. The order of activition S_{N_2} reaction is 1° > 2° > 3° alkyl halid.
4. The concentration of nuclephile is more.

$$R-CH_2-Cl + NaOH_{(aq)} \longrightarrow R-CH_2-OH + NaCl.$$

1°-halide — alkanol-1

Machanism :

Nucleophile attacks the partially positive carbon atom from ~~the~~ ~~side~~ opposite side of halid atom $R-CH_2-X$.



~~Electrophilic Attraction~~

Example: 1 (pre-increment use in e

```
#include<stdio.h>
```