

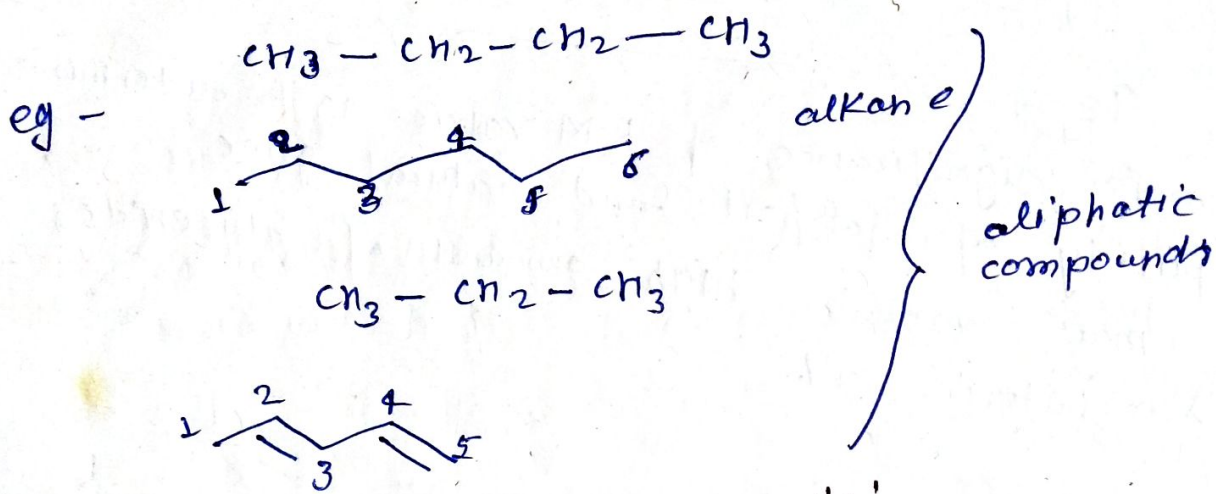
Unit - V cyclo alkane

Aliphatic hydrocarbon: -

Hydrocarbons are those compounds

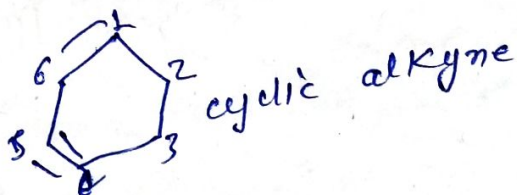
which are made by carbon & Hydrogen.

And the long chain of compounds of hydrocarbon is called aliphatic compound



Cyclic hydrocarbon compounds: -

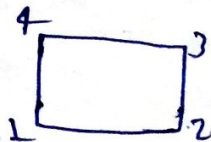
Those hydrocarbon chain in which first carbon is attached with last carbon is called cyclic hydrocarbon.



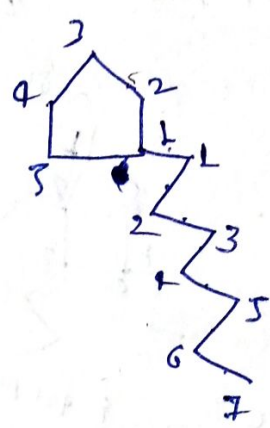
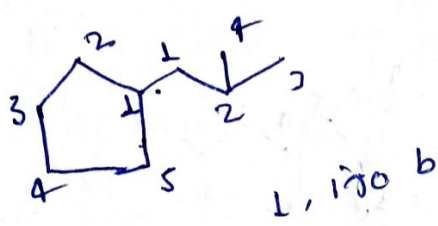
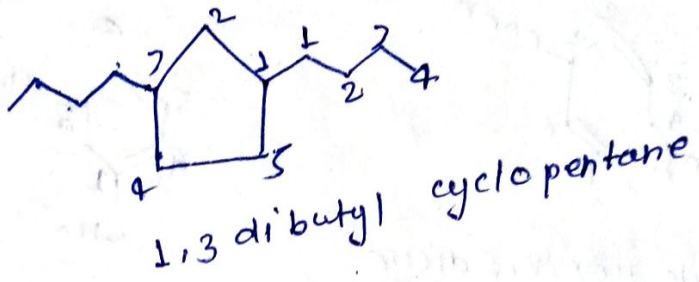
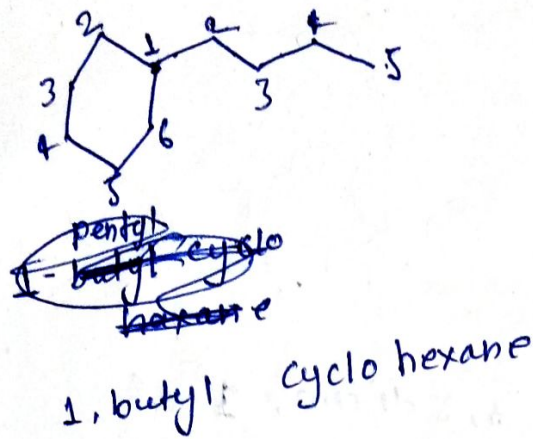
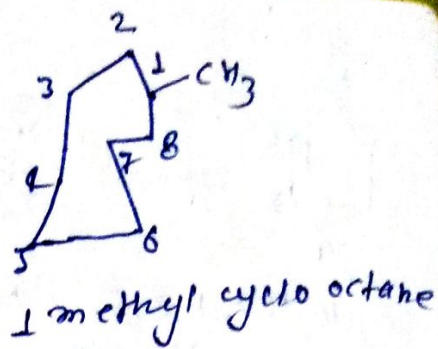
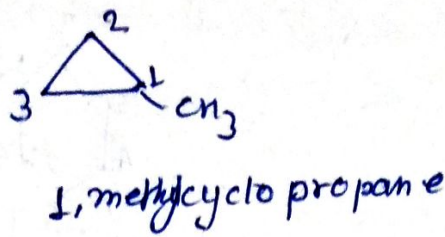
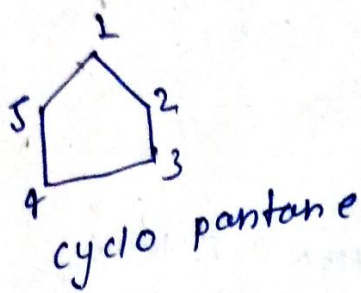
Nomenclature of cyclo alkane: -



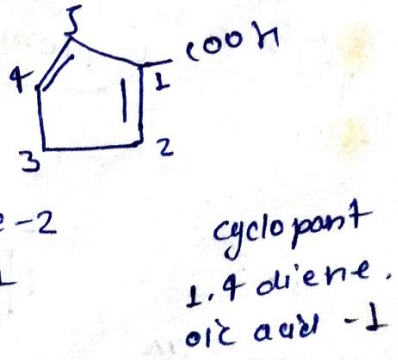
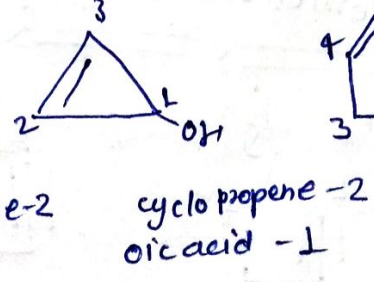
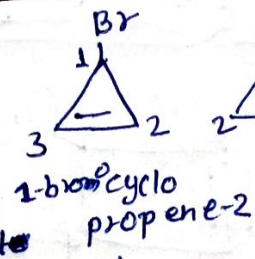
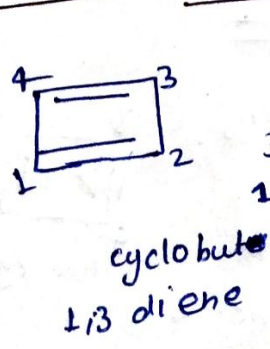
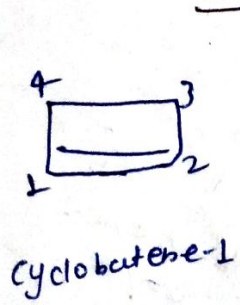
cyclo propane - IUPAC Name
 cyclo trimethyl - common name

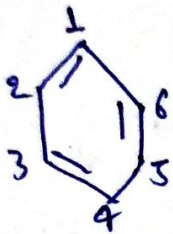


cyclo butane - IUPAC
 cyclo tetra methyl - common name

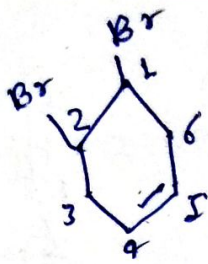


Nomenclature of alkenes:-

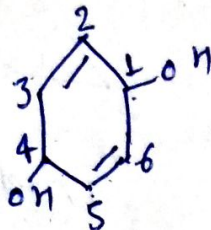




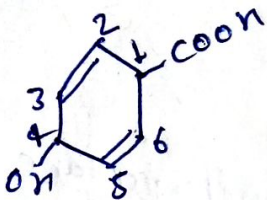
cyclo Hex 1,3,5 triene



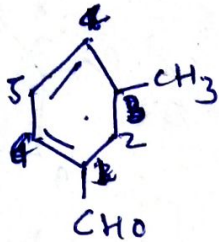
1,2, di bromo cyclo Hex - 4 ene



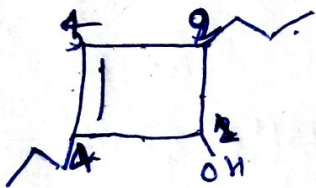
cyclo Hex 2,5 diene 1,4 diol



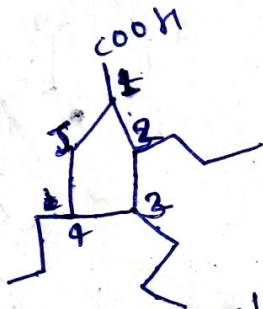
4-hydroxy cyclo Hex 2,5 diene 1, oic acid.



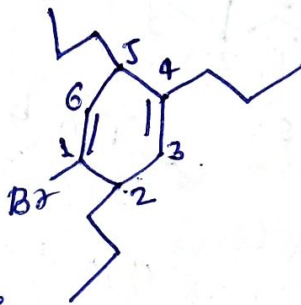
2-methylcyclo Hex 3,5 diene, 3-al



1,2,4 tri propyl cyclo but, 3 ene 2-ol



2,3,4 tri propyl cyclo pent-1-ene 1-oic acid

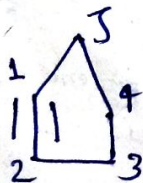


1 bromo cyclo Hex 1,3 diene 2,4,5 tri propyl

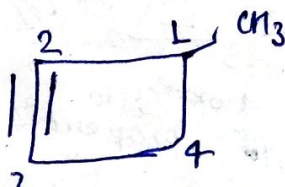
Nomenclature of alkyne:-



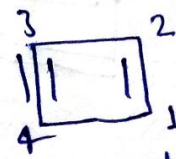
cyclo prop - 1 yne



cyclo pent - 1 yne



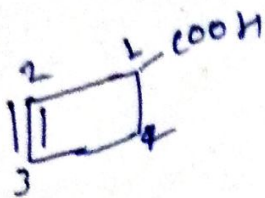
1-methyl cyclo but yne - 2



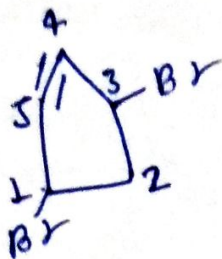
cyclo but, ene-1 3-yne



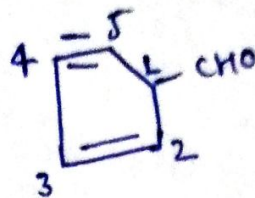
cyclo pent - 3 yne



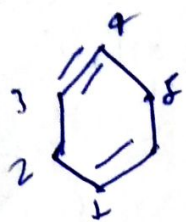
cyclo but yne-2
1-oic acid



1,3,di bromo
cyclopent yne-4



cyclo pent, 1-al
2-ene, 4-yne



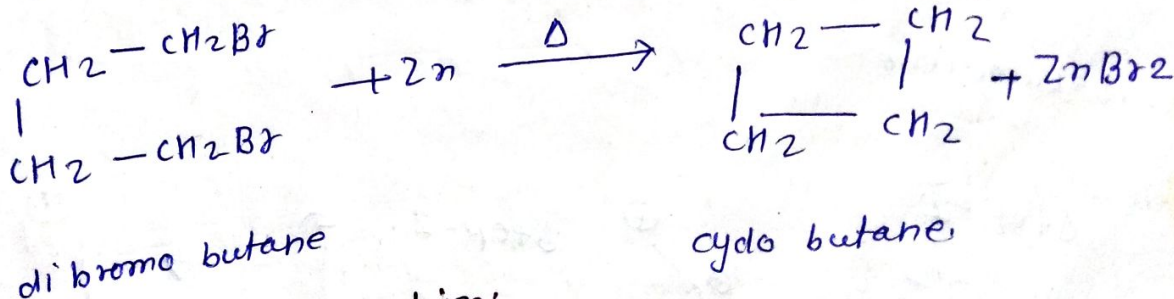
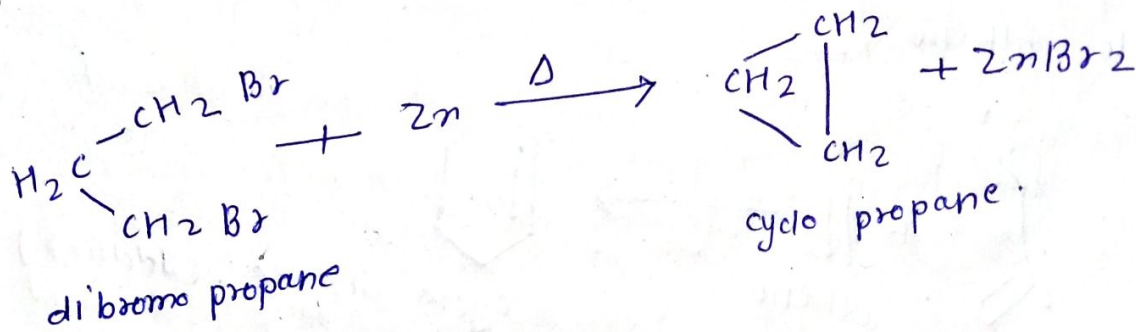
cyclo Hex 1-ene, 3-yne

~~Method of cyclo and cyclo prepⁿ of alkane~~

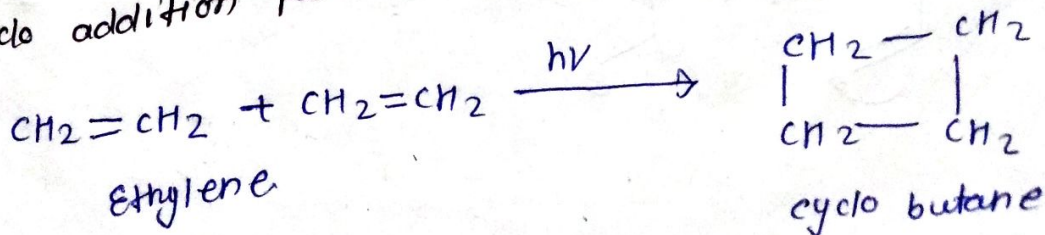
Method of prepⁿ of cyclo propane :-

①

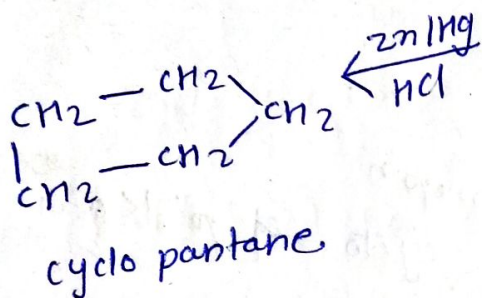
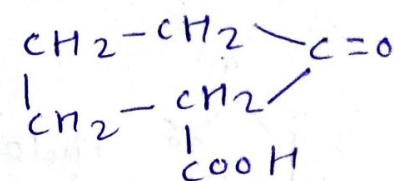
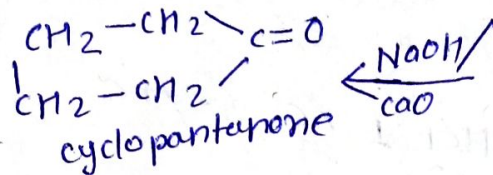
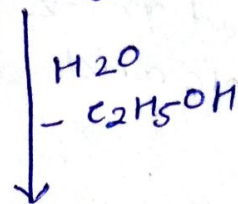
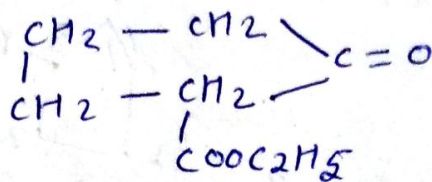
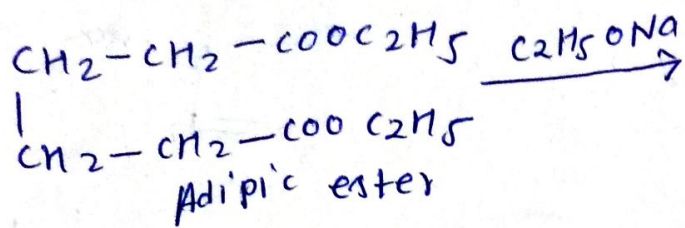
1 Freund's method :-



2 cyclo addition reaction :-

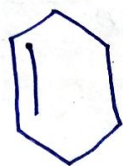
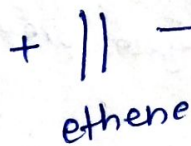
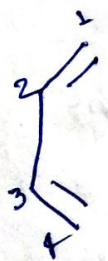


8. Dieckmann condensation :-



4. Diels - alder reaction :-

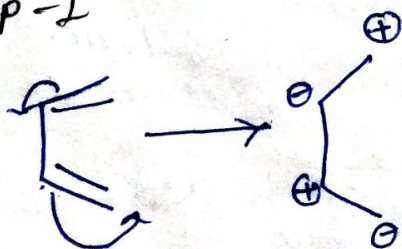
In diels-alder reaction when butadiene compounds reacts with alkene then after cyclo addition reaction it gives cyclo alkene.



cyclo alkene (adduct)

1,3-butadiene

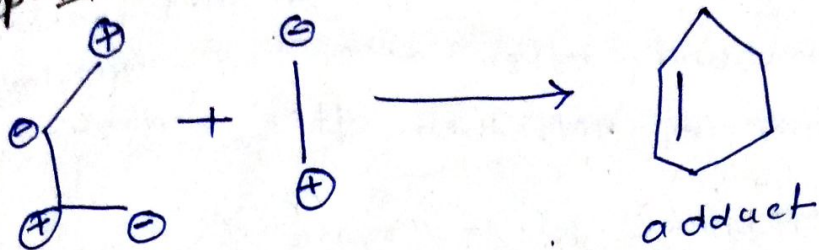
Mech - step - I



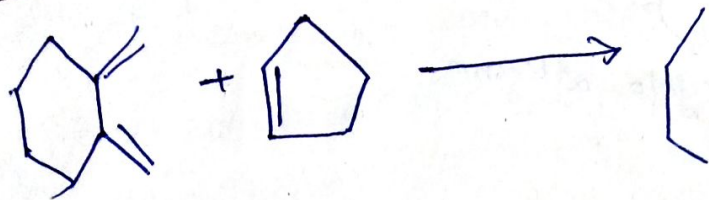
Step - 2.



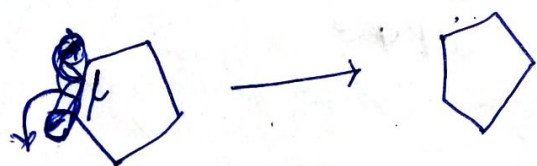
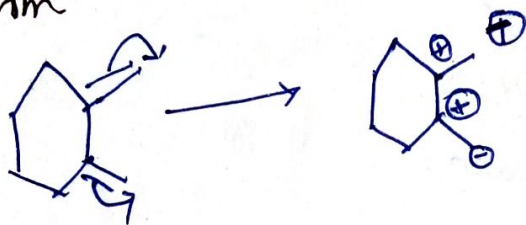
Step-III



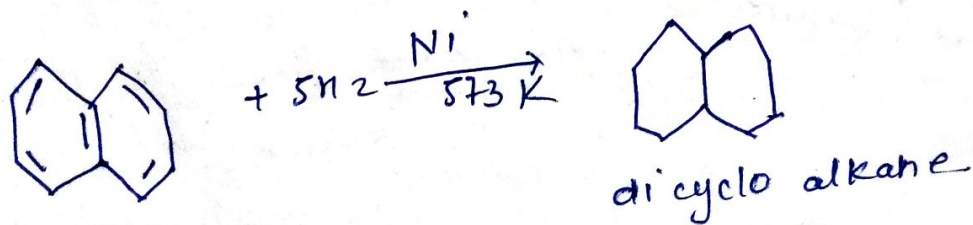
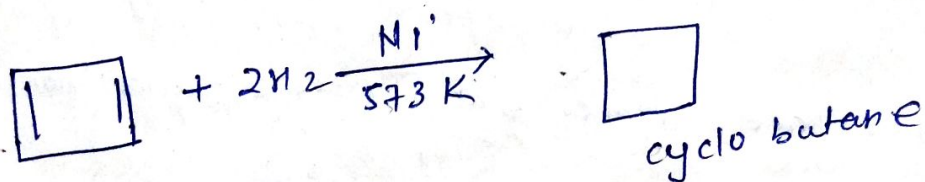
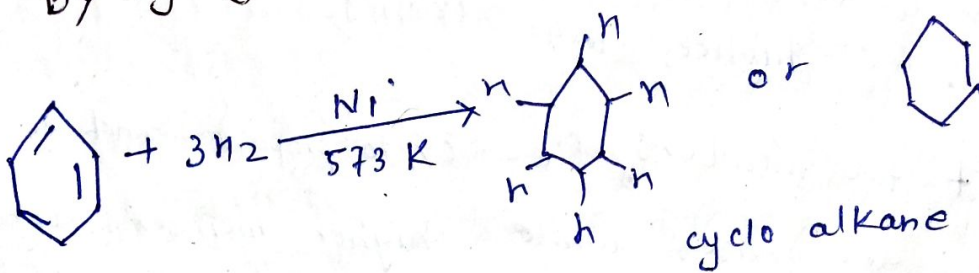
example -



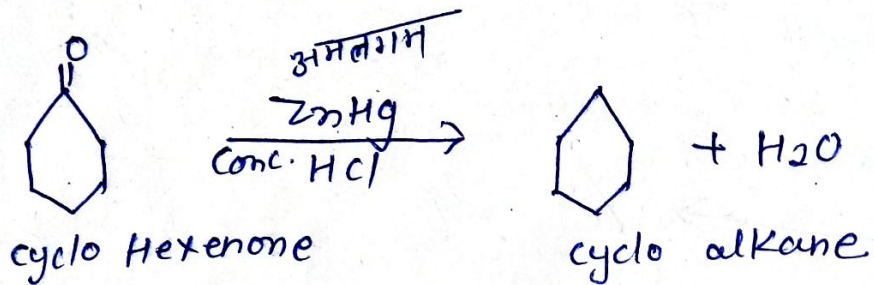
Mechanism



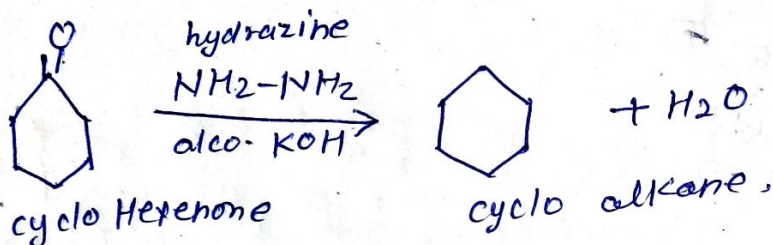
2. By hydrogenation of aromatic compound :-



6. By Clemmensen's Reduction reaction: - In this reaction cyclo hexanone compound after reactⁿ with amalgamated zinc in the presence of HCl then after reduction it gives cyclo alkane.



7. Wolf Kishner reactⁿ: -




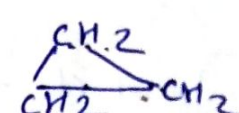
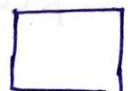
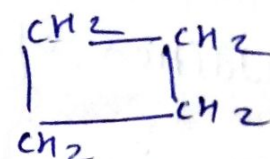

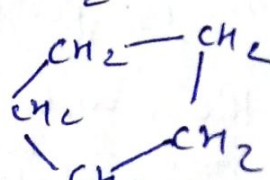

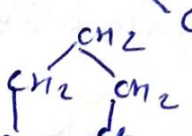
Physical property of cyclo alkane

1. Its boiling point, melting point and density are higher than alkenes.
2. The first two members i.e. cyclo propane and cyclo butane are gases while higher members are liquid.
3. Cyclo alkanes are lighter than water and non-polar in nature.

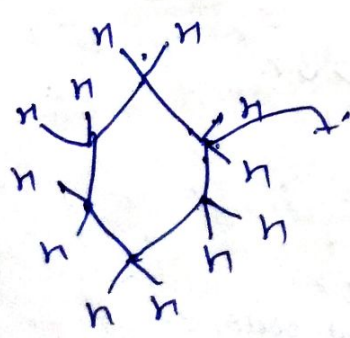
- * cyclo alkanes are water insoluble but they are soluble in CCl_4 non-polar solvent.
- * Cyclo alkanes are lighter than water.

Chemical properties of cyclo alkanes: - (C_nH_{2n})

The general formula of cyclo alkanes are C_nH_{2n} and they are saturated, and their chemical properties are very similar to the alkane

C_nH_{2n}	formula	Structure
$n=3$	C_3H_6	 or 
$n=4$	C_4H_8	 or 
$n=5$	C_5H_{10}	 or 
$n=6$	C_6H_{12}	 or 

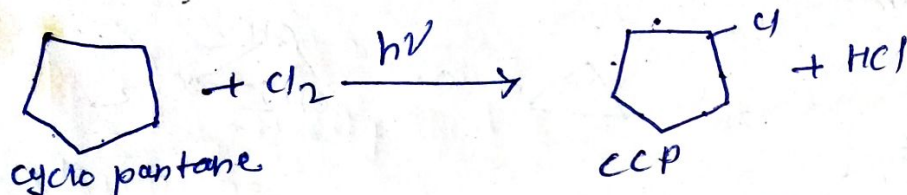
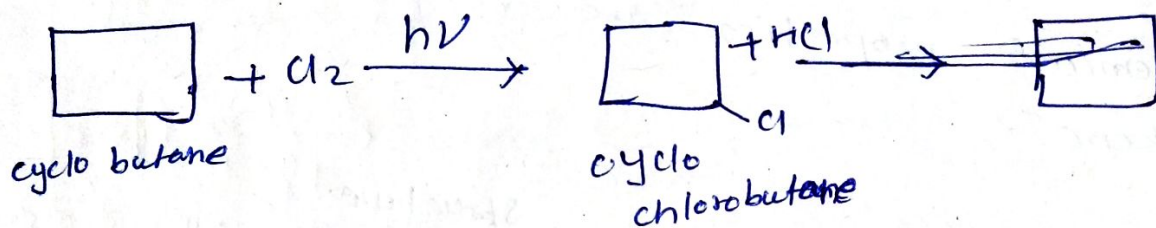
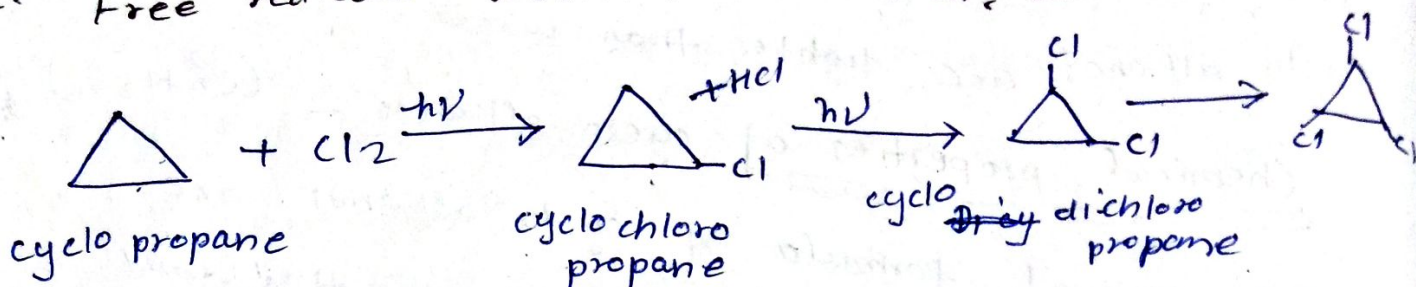
In cyclo alkanes each carbons are connected with four sigma bond so their hybridization is sp^3



sp^3 hybridization

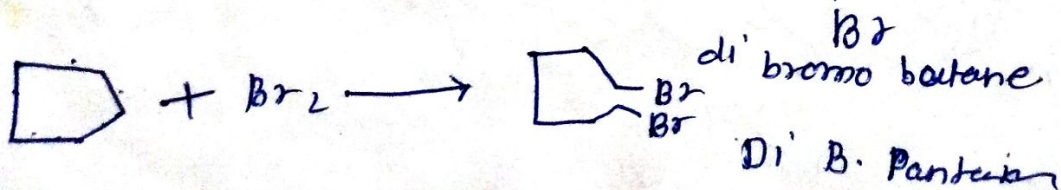
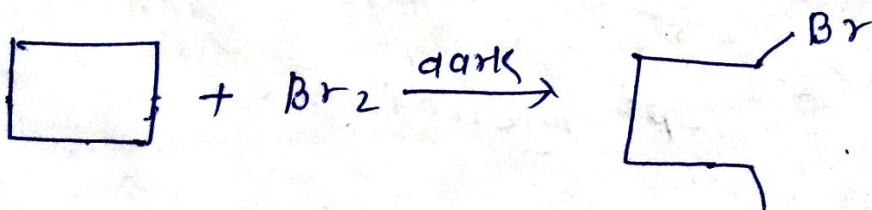
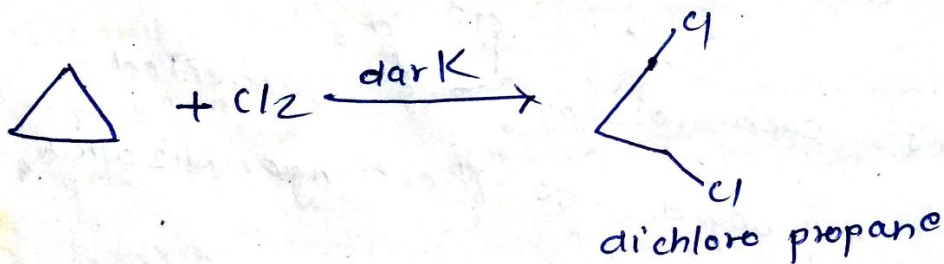
* Chemicals reactions of cyclo alkanes:

1. Free radical substitution reaction: -

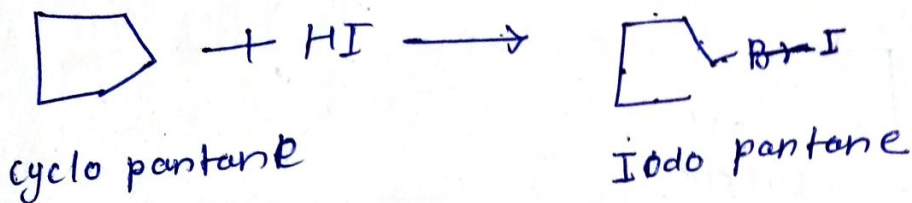
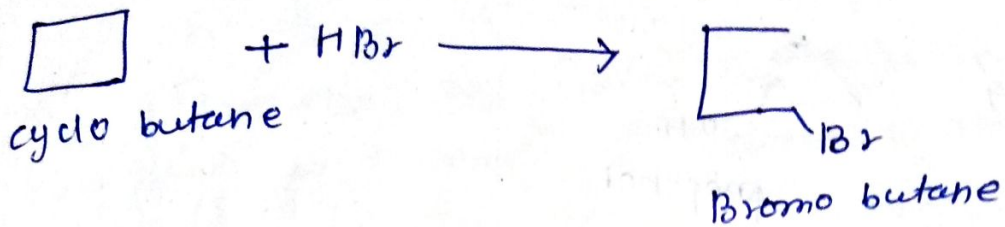
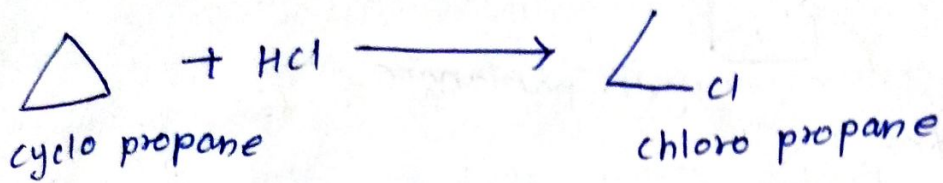


2. Addition of halogen Reactⁿ.

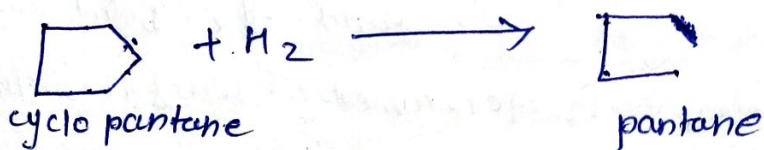
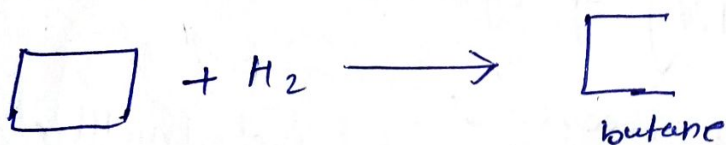
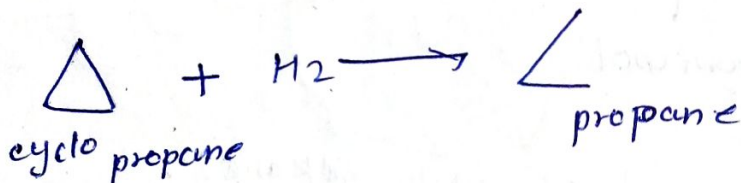
when halogenation reactⁿ is performed in the absence of sunlight then the cyclo alkane compound is convert into open chain halo alkanes.



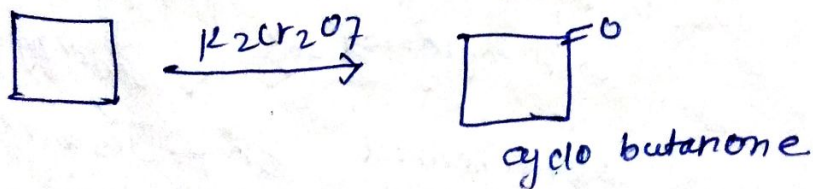
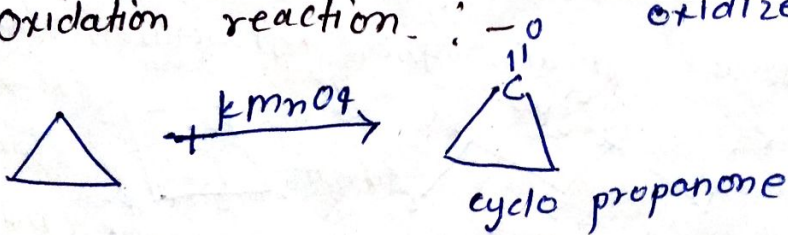
3. Addition of Halogen acid:- HCl , HBr , HI etc

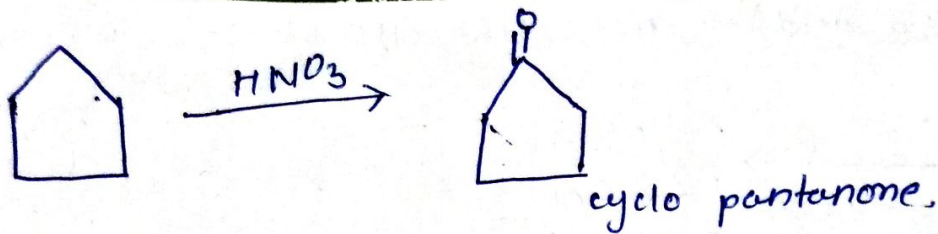


4. Addition of hydrogen or Reduction:-

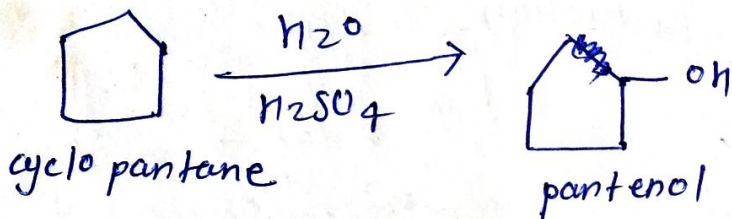
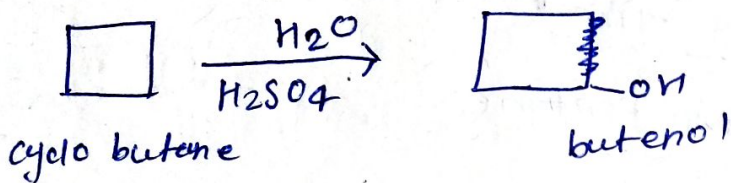
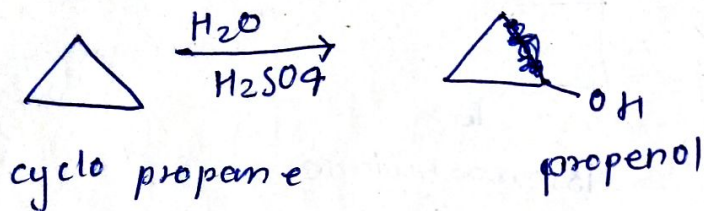


5. Oxidation reaction: HNO_3 , $\text{K}_2\text{Cr}_2\text{O}_7$, KMnO_4 oxidizing agent



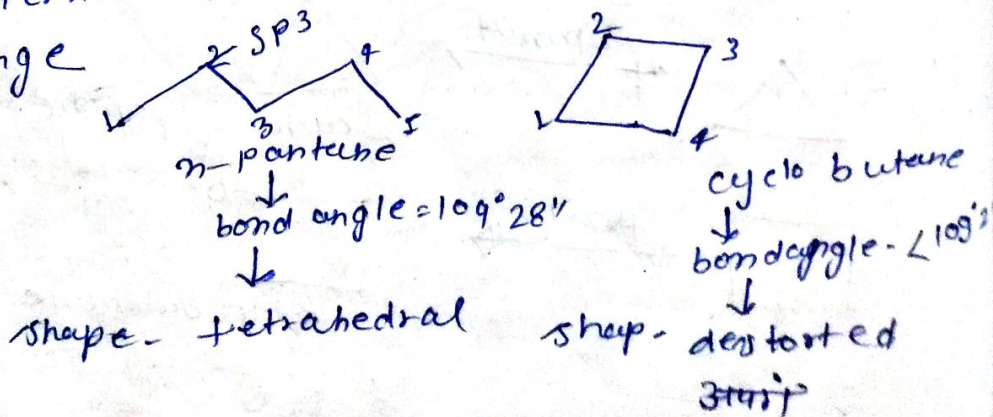


6: Addition of water



Relative stability of cyclo alkane:

1) Bayer's strain theory - In the structure of alkane the hybridization is sp^3 and the bond angle is $109^\circ 28'$ and shape is tetrahedral. But in the case of cyclo alkane hybridization is same sp^3 but due to internal strain their structure and stability is change

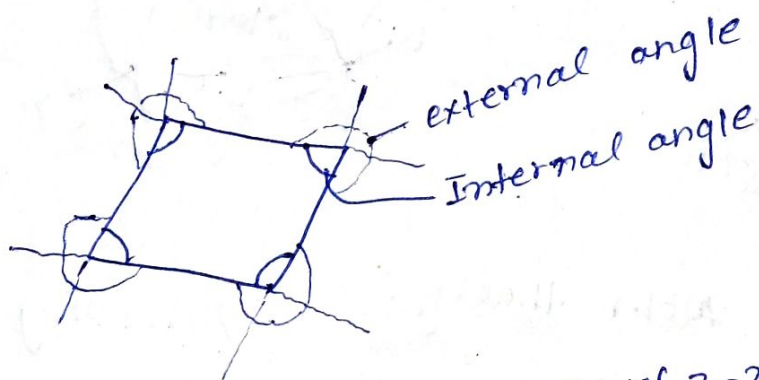


The stability of cyclo alkanes can be explained by following theories -

Bayer's strain theory :- This theory explain the new bond angle of cyclo alkane compounds after strain. when cyclo alkane is exist in a plane then due to change in the internal bond angle thier shape and actual bond angle is change according to this formula -

$$\text{Angle strain} = \frac{109.5^\circ - \text{Internal bond angle in a planer ring}}{2}$$

$$\text{Internal bond angle} = \frac{180 \times (n-2)}{n}$$



$$\text{for cyclo propane } n=3 = \frac{180 \times (3-2)}{3} = \frac{180 \times 1}{3} = 60^\circ$$

$$\text{Angle stream} = \frac{109.5 - 60}{2} = 24.$$

$$\text{for cyclo butene } n=4 = \frac{180 \times (4-2)}{4} = \frac{180 \times 2}{4} = 90^\circ$$

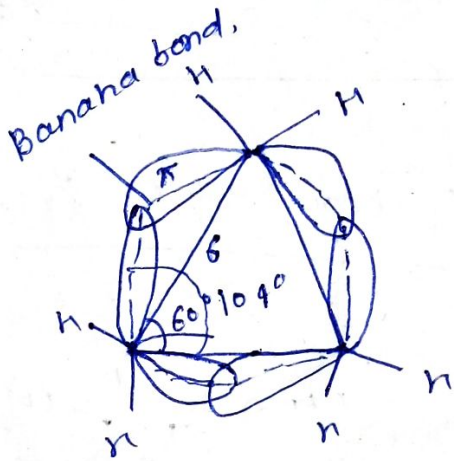
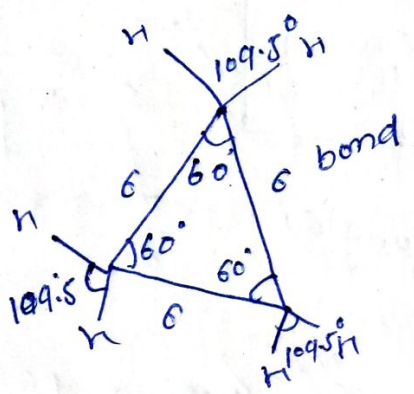
$$\text{angle stream} = \frac{109.5 - 90}{2} = 9.50$$

2. Coulson & Moffitt's modification:- This strain theory is only applicable for cyclo propane.

In the cyclo propane structure the internal bond angle of 60° is produced which cause the strain and the cyclo propane st. is modified in to a new structure.

In this new structure the bond b/w C-C contains both sigma (σ) and pie (π) character so this is also known as banana bond.

In C-C bond pie (π) is present but in C-H bond only sigma (σ) character is present.



3. Sachse & Mohr theory:- According to this theory

the strain in the structure is seen in only up to cyclo pentane ring but in higher structure like cyclo hexane and cyclo heptane no strain is present so called strainless ring.

For ex. cyclo hexane is a multipanner structure and it exist in two form chair form & boat form so they can change thier shape and do not show the strain.

