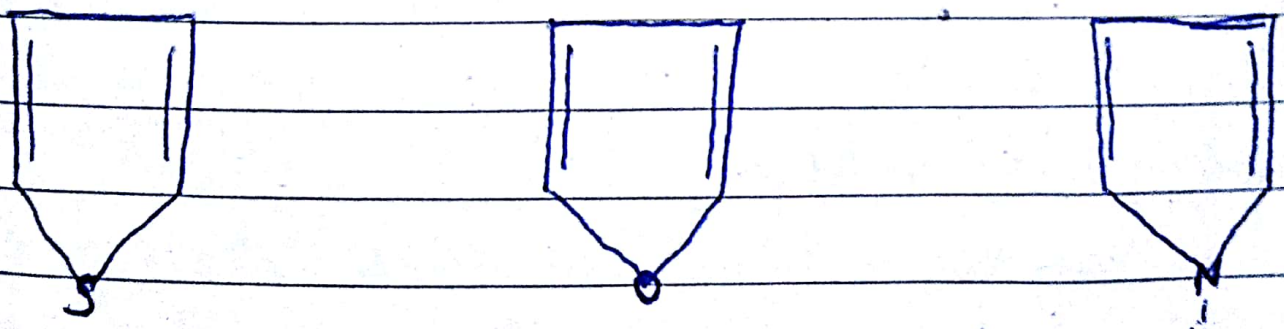
CHEMISTRY OF HETROCYCLIC COMPOUNDS:-

Heterocyclic compounds are compounds made up of two (2) or more atoms linked in a cyclic form, example of common five membered ring heterocyclic compounds are; Furan, pyrrole, and thiophene, And Six compounds are puridine (They resemble ben Zene) Structure of common Five rings.



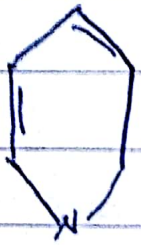
Thiophene Furan pyrrole

Cyclohexane
homocyclic compounds

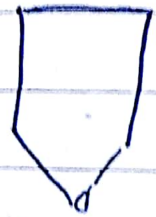
Benzene

5-membered
heterocyclic.

In 6-membered heterocyclic compound π-represent hetro atom e.g sulphur, oxygen, and nitrogen in any compound that contain hetro atom rather than carbon in it's ring structure.



6-membered
Pyridine

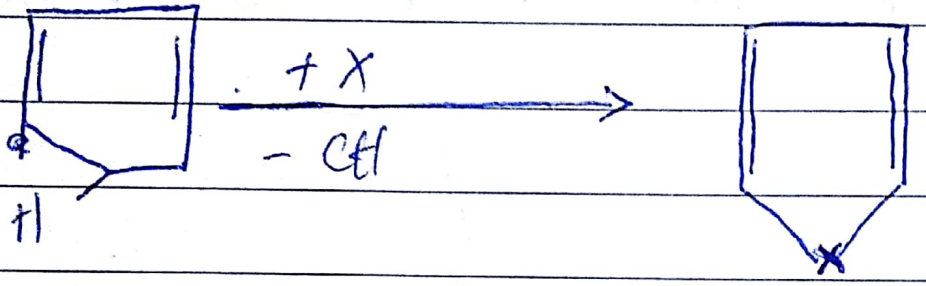


5-membered
Furan

thiophene.

Pyridine & Furan has similar characteristic of benzene, Benzene undergo substitution reaction than additional reaction & also heterocyclic compound undergo reaction, heterocyclic compound are pyrrole found in Chloropyl, vitamin B series i.e B_{12}, haemoglubin, Chromopyl & haemoglubin show similar structure with the difference of central Metal.

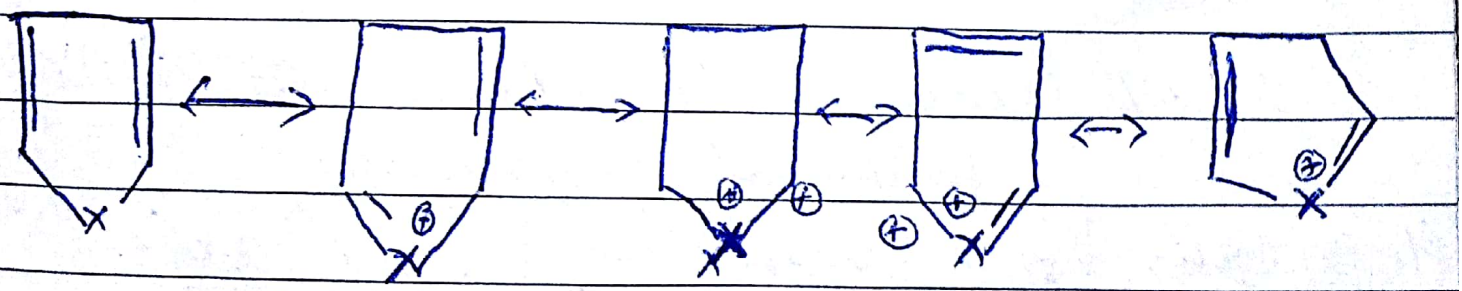
Heterocyclic compound that are non aromaticity compound carbohydrate (pyran) protins are heterocyclic in nature. purines are heterocyclic in natu 5- membered heterocycli system. eg thyrophene, furan, & pyrole are 5-membered heterocyclic system is considered to derived from cyclopentadiene.



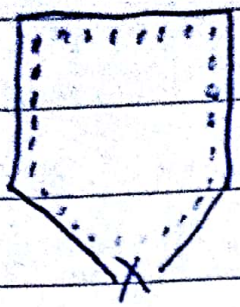
Where X = ~~Number~~ ~~5 or~~ Nitrogen, sulphur or oxygen.

The 5-membered heterocyclic are aromatic heavily conjugated pi (π) electron, heterocyclic are planar in nature and are sp^2 hybridized.

RESONANCE SUCTURE OF 5-MEMBERED HC



Furan & pyrrole can be represented by the above resonatic structure while Thyrophene has three resonatic structure apart from the above -ve sign signify π electron density. and the double ~~bo~~ electron also. In ideal way the resonance represent.

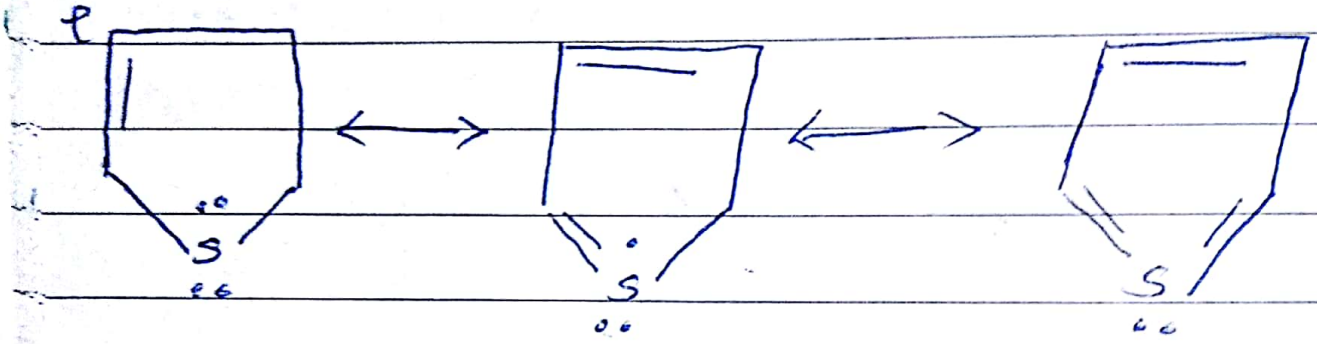


Shifting of electron result in resonating structure.

Catenation (conjugated) C=C-C=C-
double single double single system.

Pyrrole is unsaturated pyrieline. Alicyclic and reduced form of pyrole is saturated.

Additional resonating structure of Thiophene



this structure is possible of the additional d-orbital of sulphur. ~~bond length, bond angle of 5-membered~~

BOND LENGTH & BOND ANGLE OF 5-Membered HETEROCYCLIC COMPOUNDS.

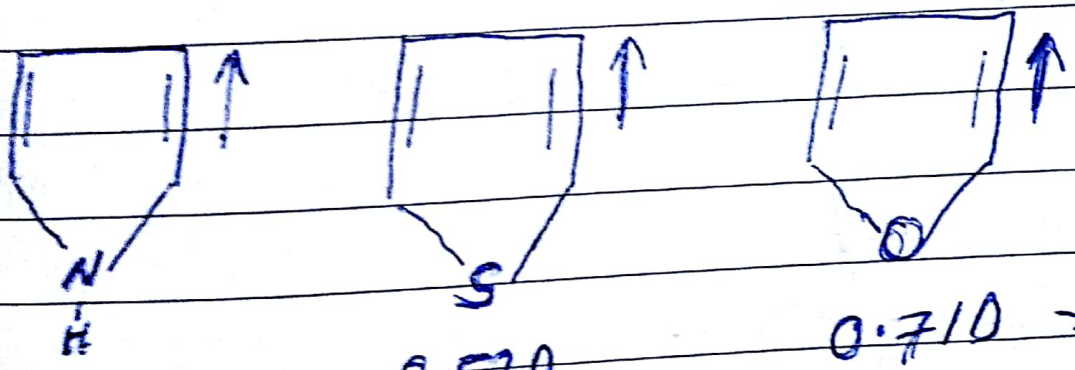
Heterocyclic	bond length (Å)	bond angle.
1. pyrrole	C-x, $C_2-C_3-C_3-C_4$	C-X-C_5 X-C_2-C_3, C_2
	1.3 - 1.382, 1.417	C_3-C_4 109.80, 107.70, 107.40
Pyrrolidine	1.470, 1.540	is not observed.
Furan	1.362 1.366 1.430	106.50, 110.65, 111.42

Pyrrolidine is a alicycle saturated compound is non aromatic pyrrole is Unsaturated, aromaticity brings about reduction in bond lengths.

Aromaticity brings about reduction in bonding 1,3,5 cyclohexadi-ene, the aromaticity order of 5-membered heterocycle:

Thiophene > Pyrrole > Furan

thiophene is the most stable among 5-membered they Undergo electrophilic substitution reaction easier than benzene it self, the number of resonance structure produce to stability



1.800 → 0.520 → 0.710 → dipolar end.

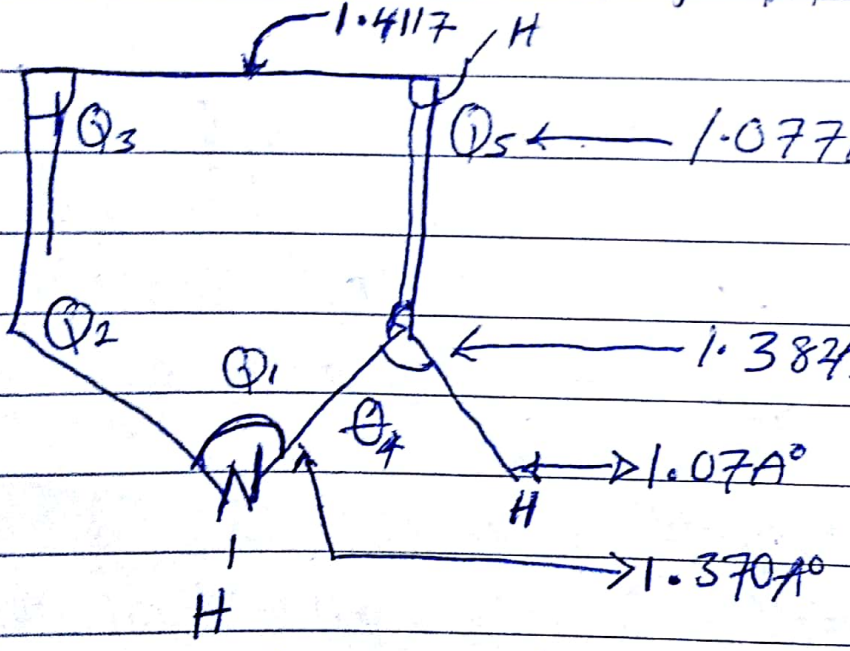
Pyrrole Thiophene Furan

Dipole moment :- Molarity index how polar electron density in a system when mesomeric effect & Induction effect are in play the dipole movement or not electron density is different

Mesomeric effect is caused due to the delo
lization of electrons, it can be transmitted
along any number of carbon atoms in a conju
gated system, it release atom away.

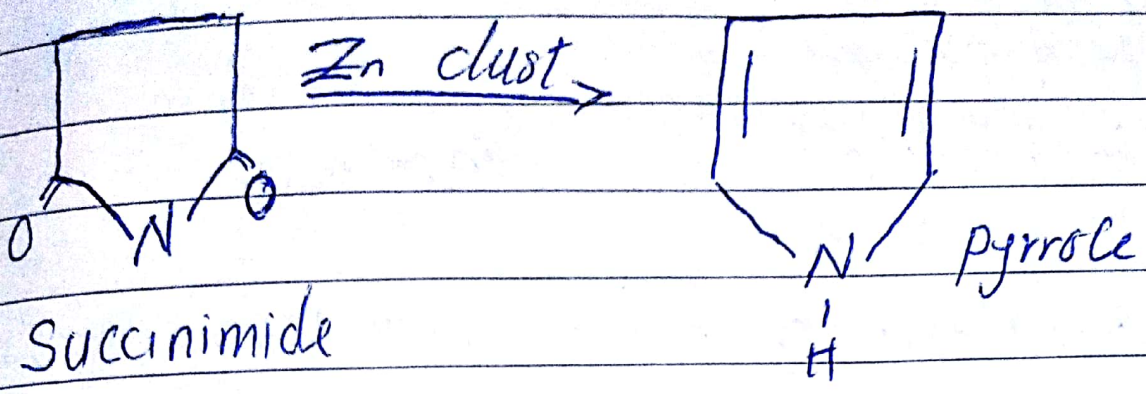
INDUCTIVE EFFECT is a result of the polarizati
of σ bond, the electronegativity difference between
the atoms in the bond directly affects on Inductiv
effect. bond length is also affecting factor, the
greater the distance, the weaker the effect. It's
opposite of mesomeric effect.

STRUCTURE OF PYRROLE & MOLECULARITY



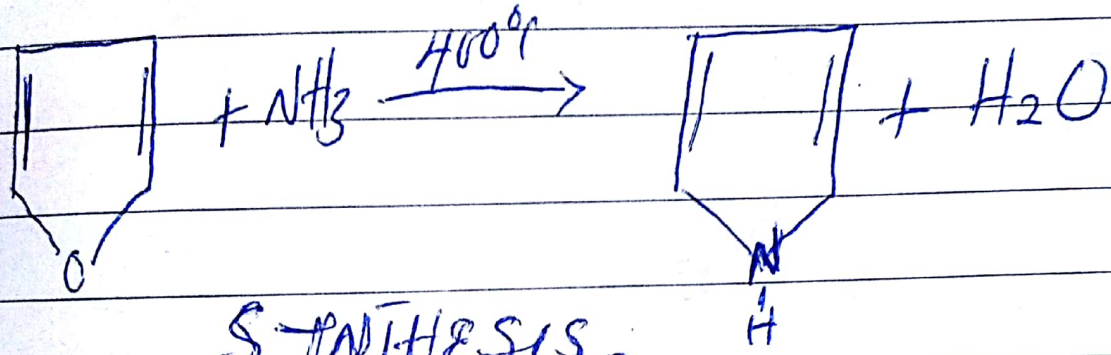
Q1- 109.8°
Q2- 107.7°
Q3- 107.4°
Q4- 121.5°
Q5- 125.5°

SYNTHESIZED BY FURAN



Succinimide

Pyrrole

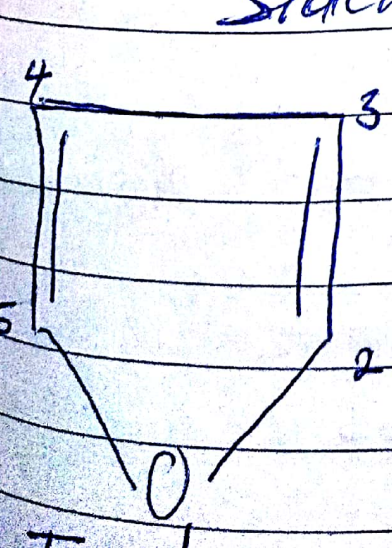


SYNTHESIS OF PYRROLE

1. Synthesis by furan with ammonia at 400°.

ii- Synthesized by succinimide in the present of Zinc dust to yield pyrole & H_2O the H_2O is in form of stream.

STRUCTURE OF FURAN & MOLECULARITY.



Furan

bond angle

$C_2 - O - C_5 = 106.50°$

$O - C_2 - C_3 = 110.65°$

$C_2 - C_3 - C_4 = 106.07°$

$O - C_2 - C_4 = 115.98°$

$C_2 - C_3 - H = 127.83°$

BOND LENGHT

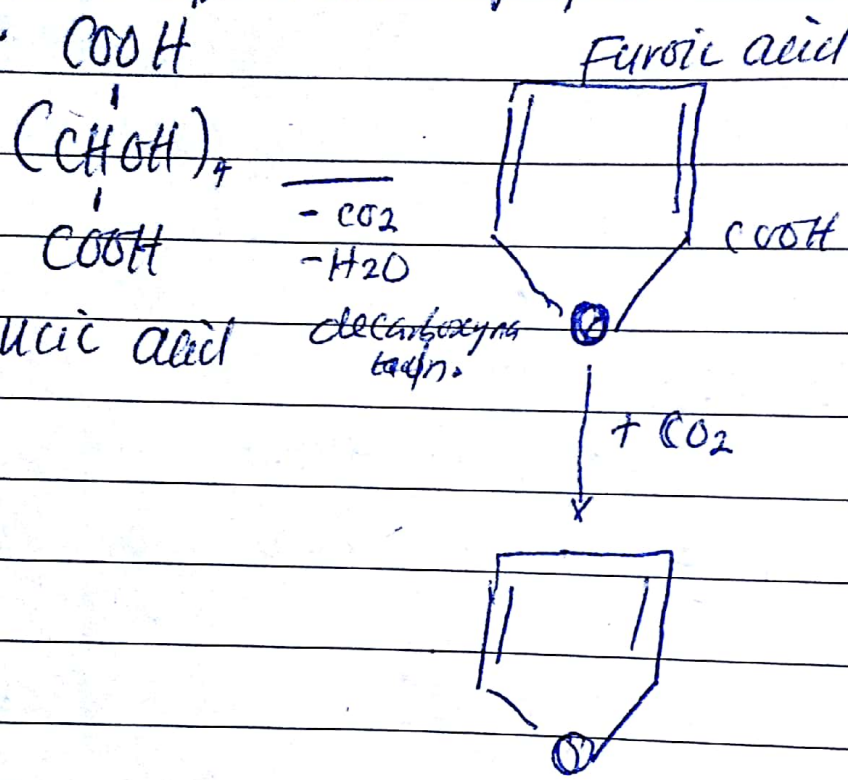
$O - C_2 = 1.362 A^\circ$ — A° = distance unit called Ampire.

$C_2 - C_3 = 1.36 A^\circ$

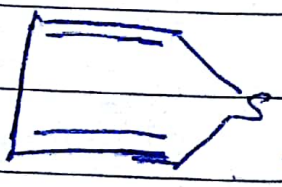
$C_2 - C_4 = 1.430 A^\circ$

$C_3 - H = 1.077 A^\circ$

Synthesis of Furan with Mucic Acid

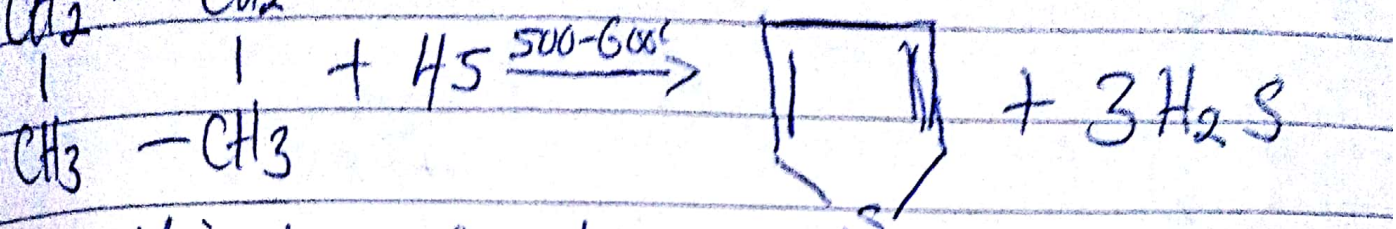
1. 

1. Decarboxylation of mucic acid [COOH (CHOH)4 COOH] to form Furan.

2. $CH \equiv CH$ (Acetylene) $+ H_2S \xrightarrow[673K]{\Delta}$  Thiophene

Synthesis of thiophene

1. Acetylene heated with H_2S to obtain thiophene.

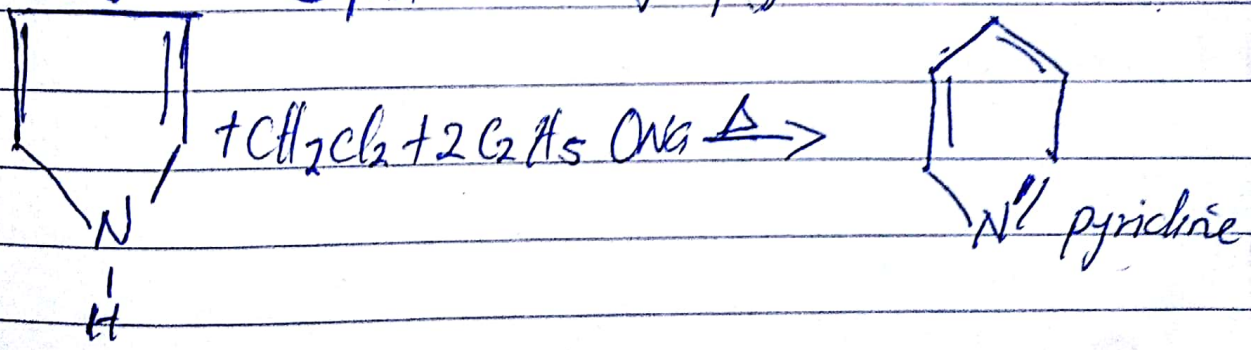


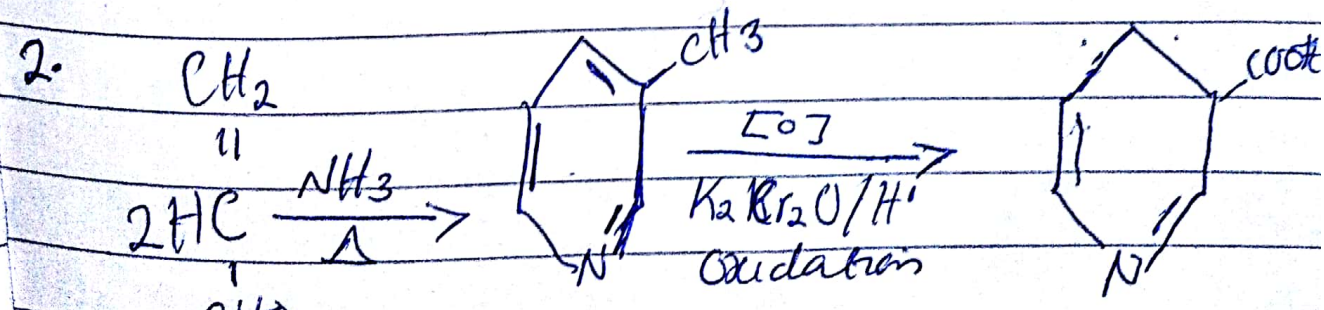
2. thiophene can be synthesis from butane with sulphur i.e from normal hydrocarbon to form thiophene and H_2S gas.

pyridines: It's aromatic in nature and boiling about improtency and it's a six six-membered hetrocyclic it can be synthesis from Pyrrole

pyridine

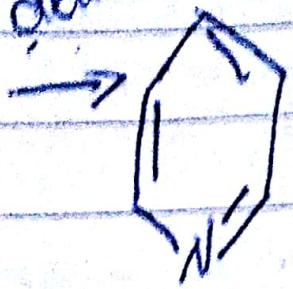
Synthesis of pyridine





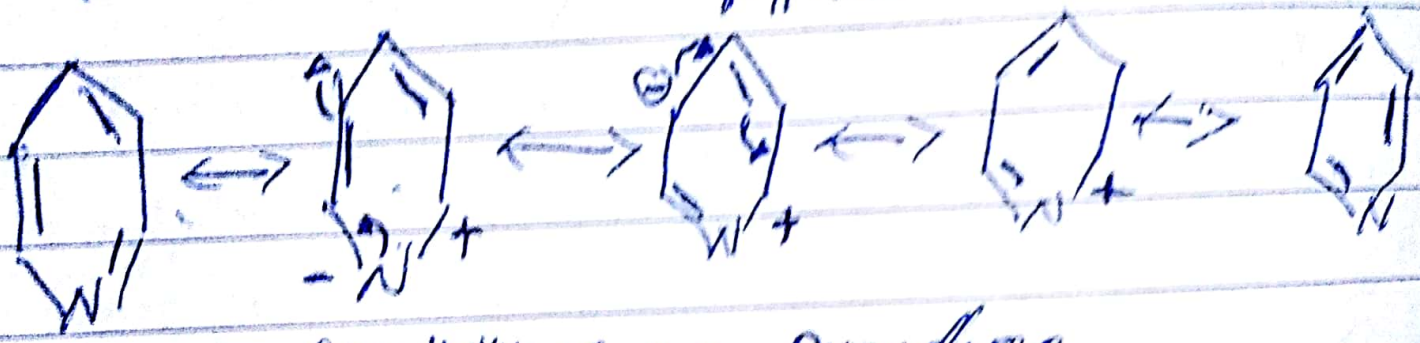
acrolyne.

delolization



pyridine.

Pyridine RESONATING STUCTURE OF PYRIDINE



features of Pyridine

- sp^2 hydrbicdized obital
- Six membered hetrocyclic compound.
- It undergo substitution reaction.
- it has pie electron.