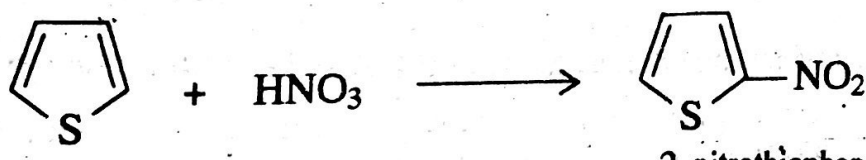
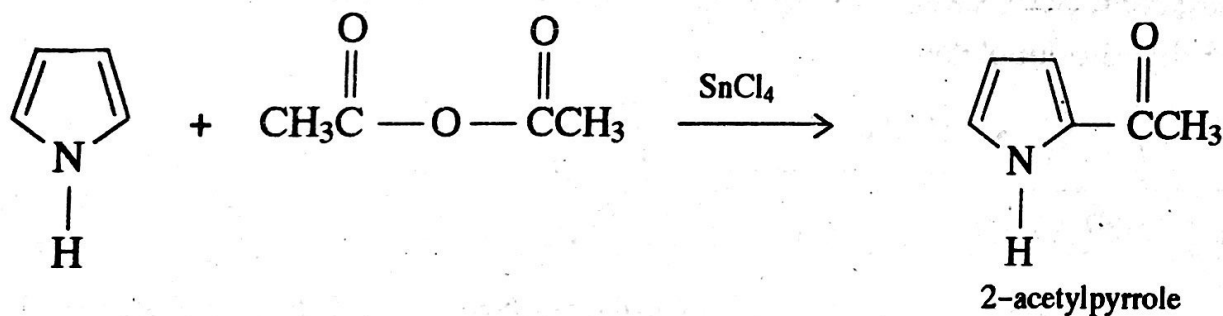
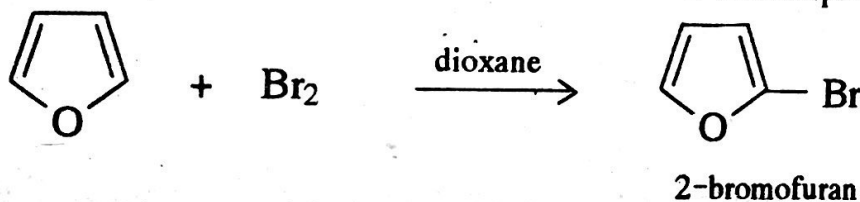
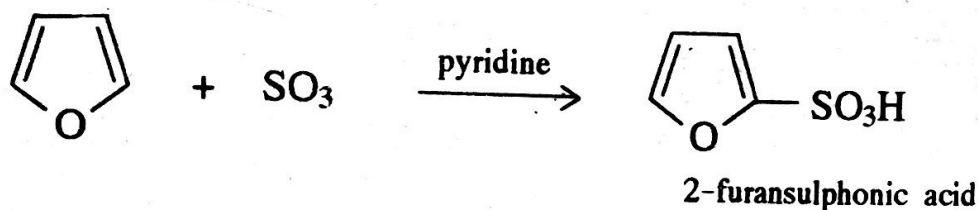


10.3.4 Reactions of Five-Membered Heterocyclic Compounds

Five membered heterocyclic compounds undergo electrophilic substitution reduction, Diels-Alder and ring expansion reactions.

i) Electrophilic Substitution Reaction

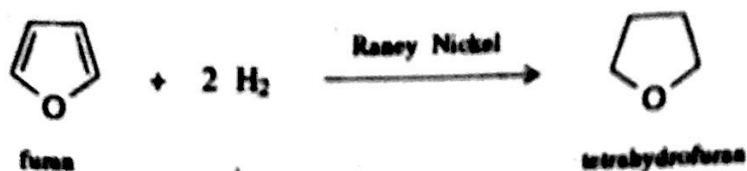
Like other aromatic compounds pyrrole, furan and thiophene commonly undergo electrophilic substitution reactions such as nitration, sulphonation, halogenation, Friedel Crafts acylation, e.g.,



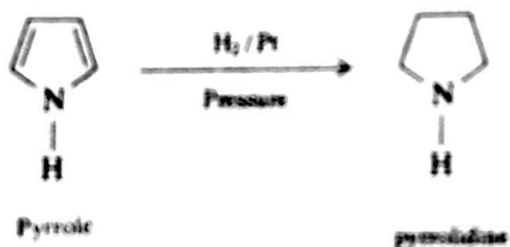
carbons

ii) Reduction

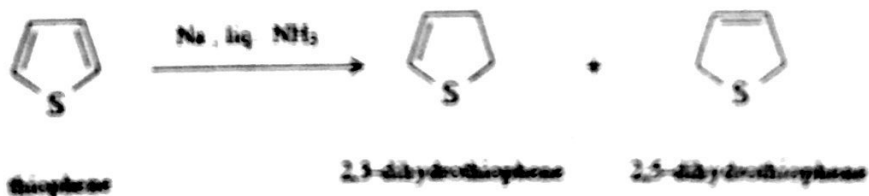
Tetrahydrofuran (THF) which is an industrially important solvent, results on catalytic reduction of furan over Raney Nickel catalyst.



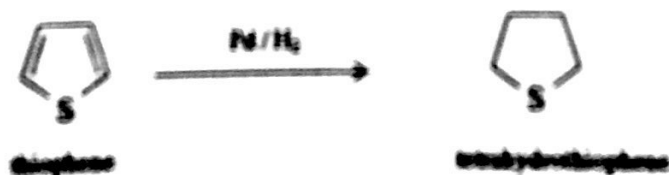
Mild reduction of pyrrole with zinc and ethanoic acid yields 3-pyrroline (2, 5 dihydro pyrrole). Catalytic reduction completely hydrogenates the ring system yielding pyrrolidine.



Birch reduction (with sodium in liquid ammonia) is used to obtain 2, 3 dihydrothiophene and 2, 5 dihydrothiophene.

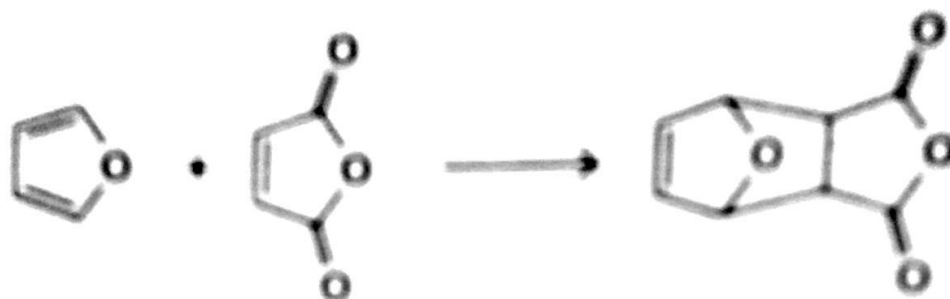


Tetrahydrothiophene is the product when a large amount of palladium is used as catalyst.

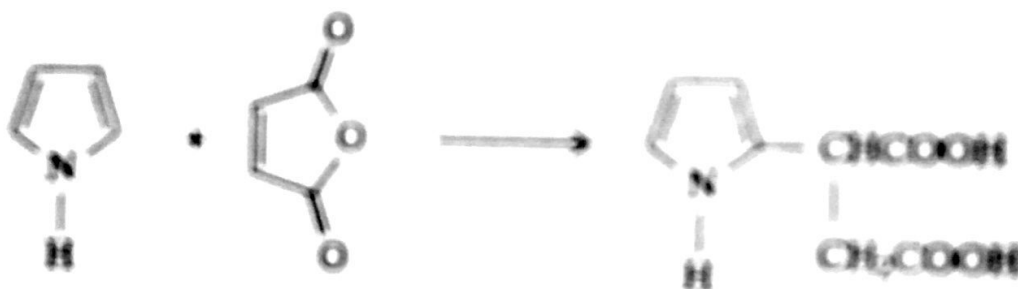


iii) Diels-Alder Reaction

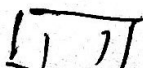
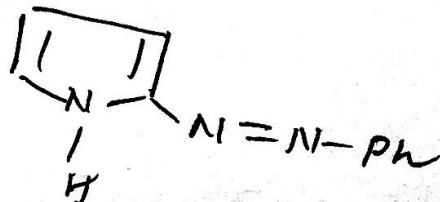
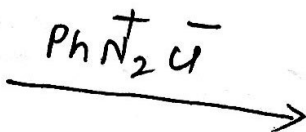
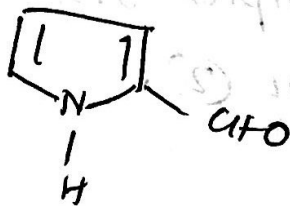
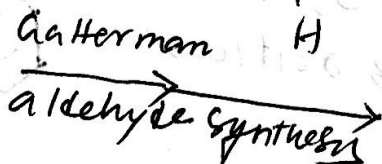
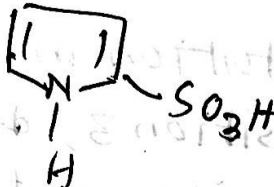
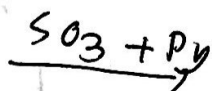
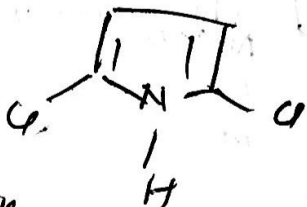
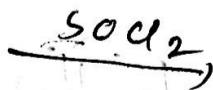
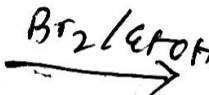
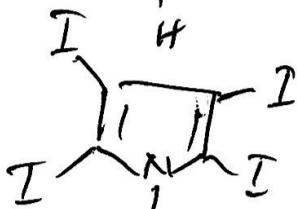
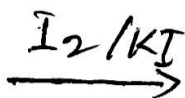
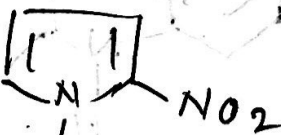
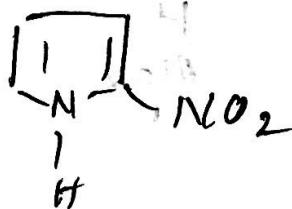
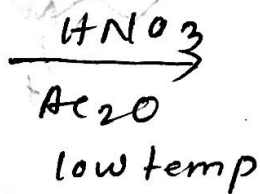
Furan has sufficient diene character to undergo Diels-Alder reaction with maleic anhydride to form an addition product.



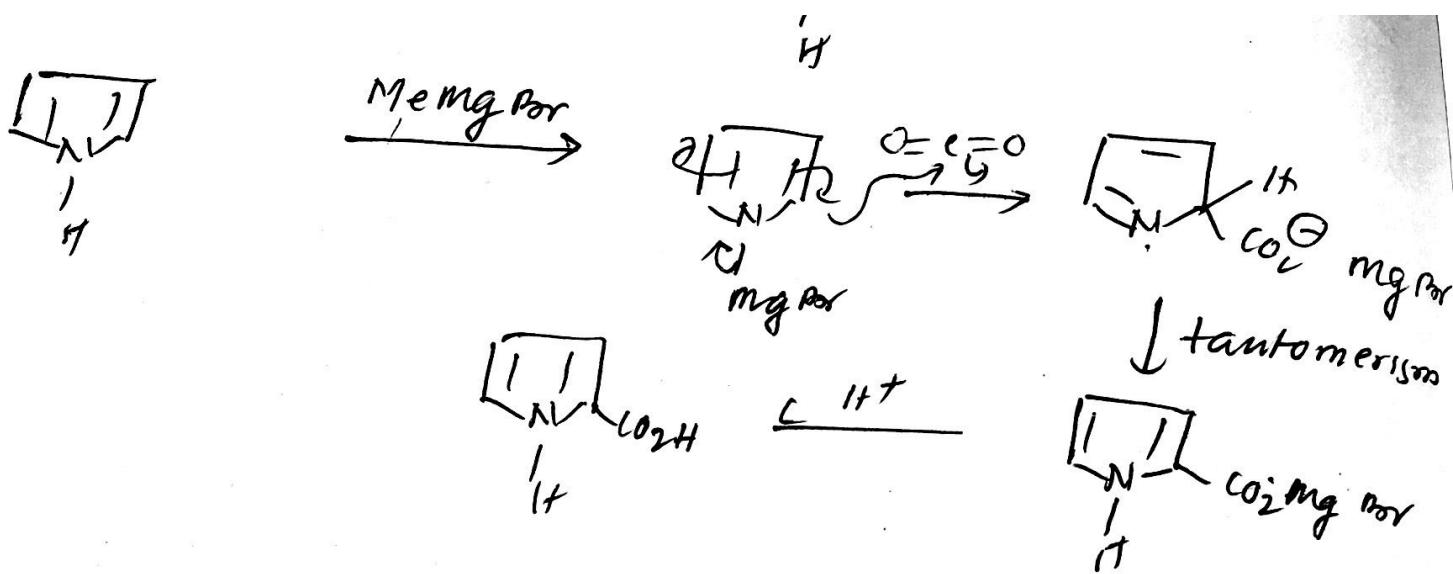
Pyrrole does not undergo Diels-Alder reaction on treatment with maleic anhydride. Rather a substitution product is obtained.

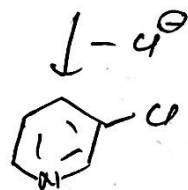
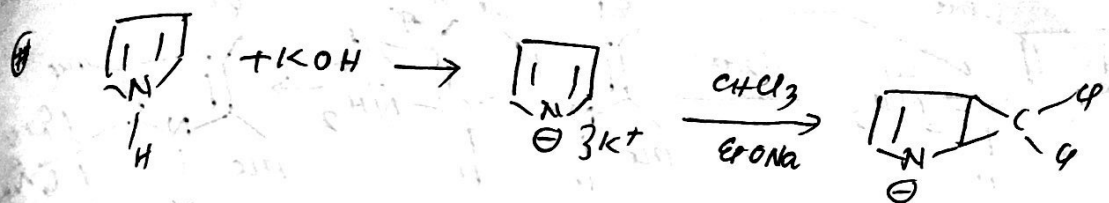


Pyrrrole:

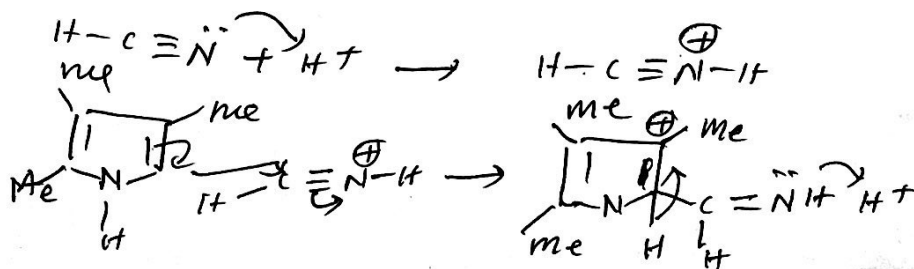
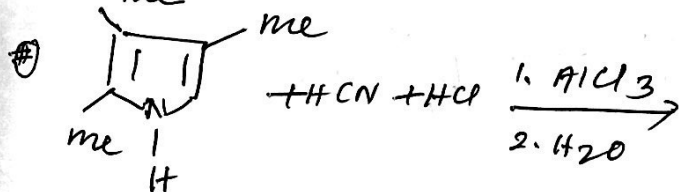
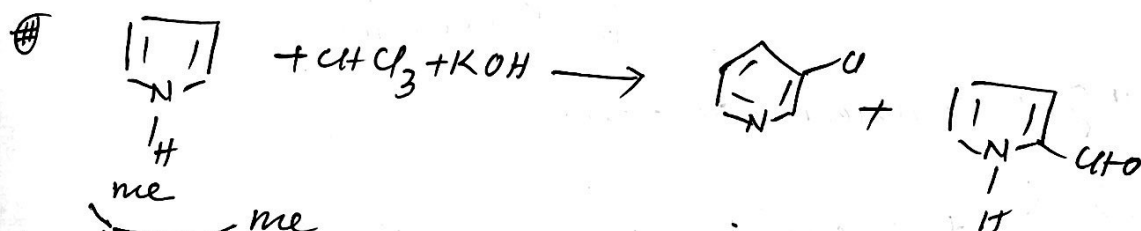
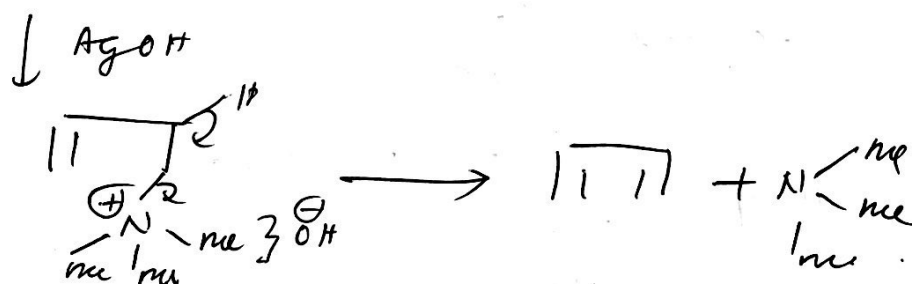
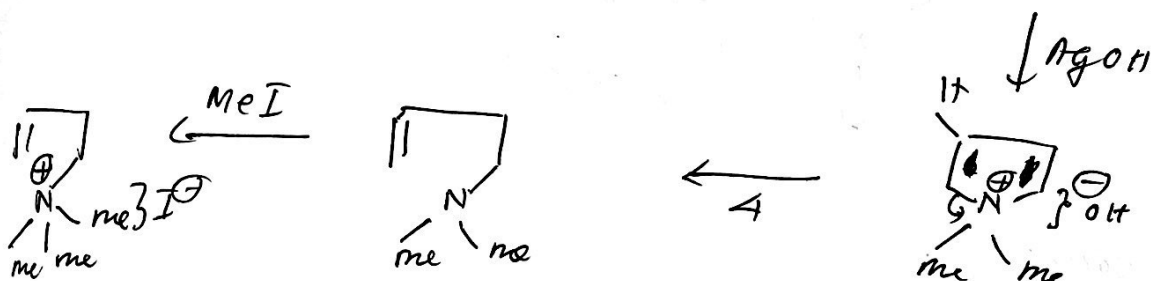
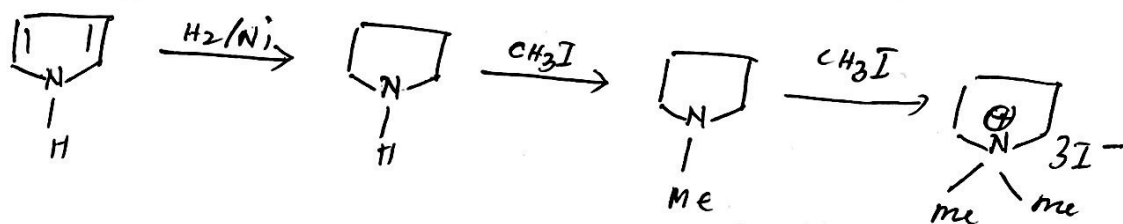


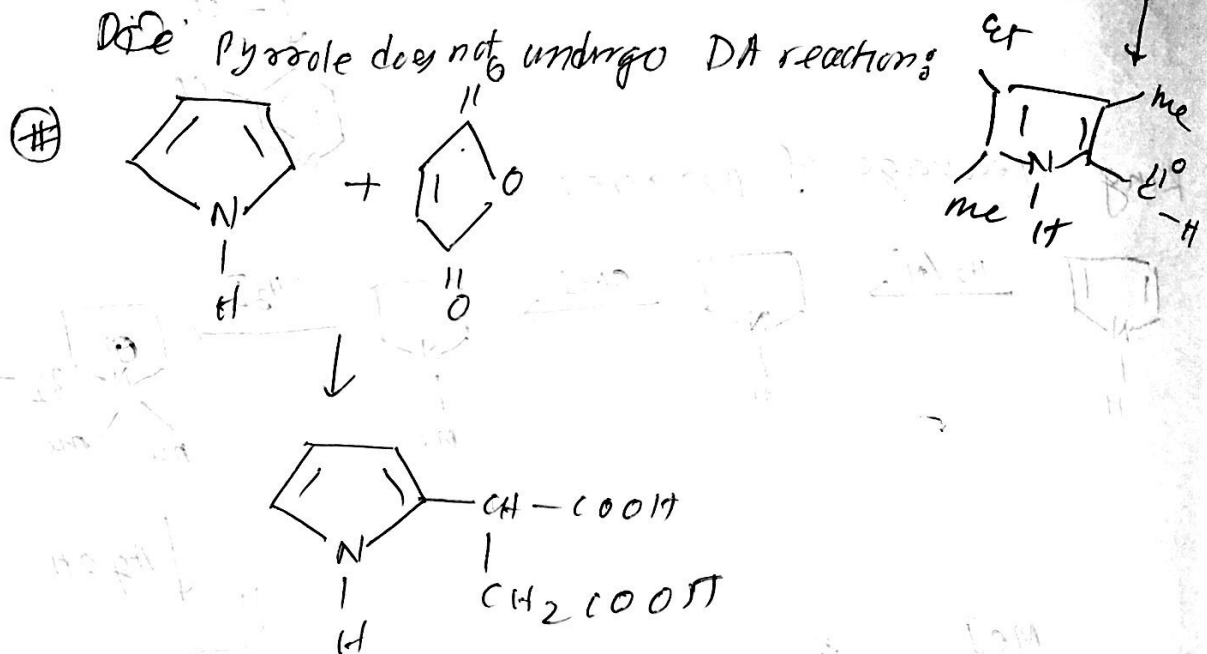
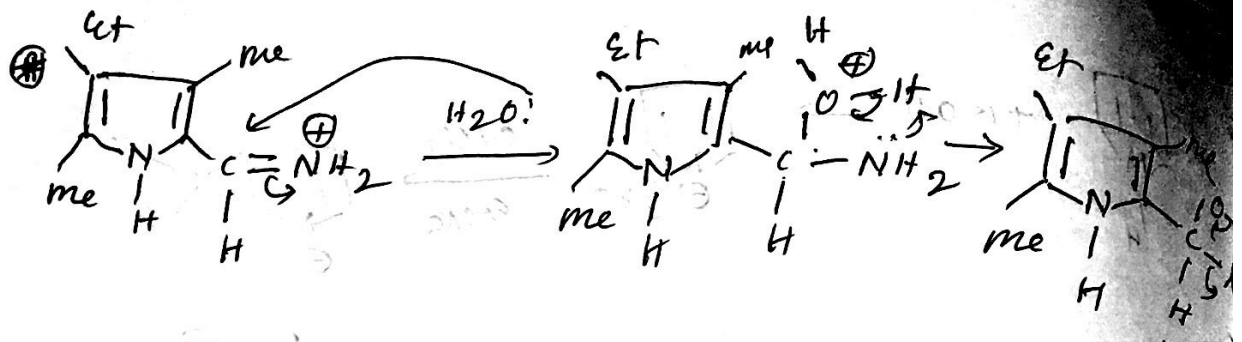
Meema



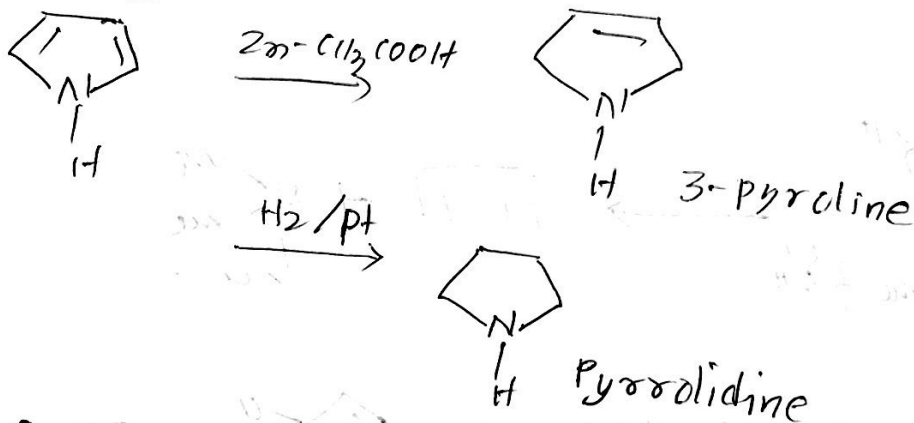


② Ring cleavage of pyrrole:

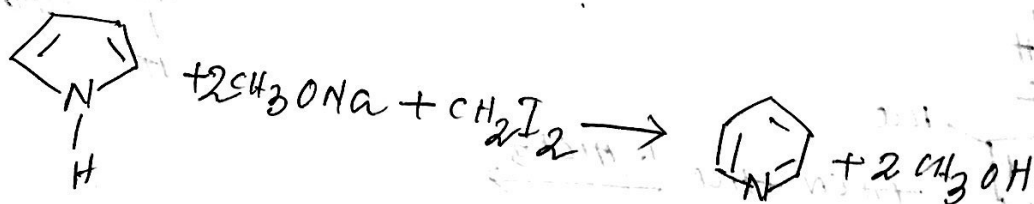




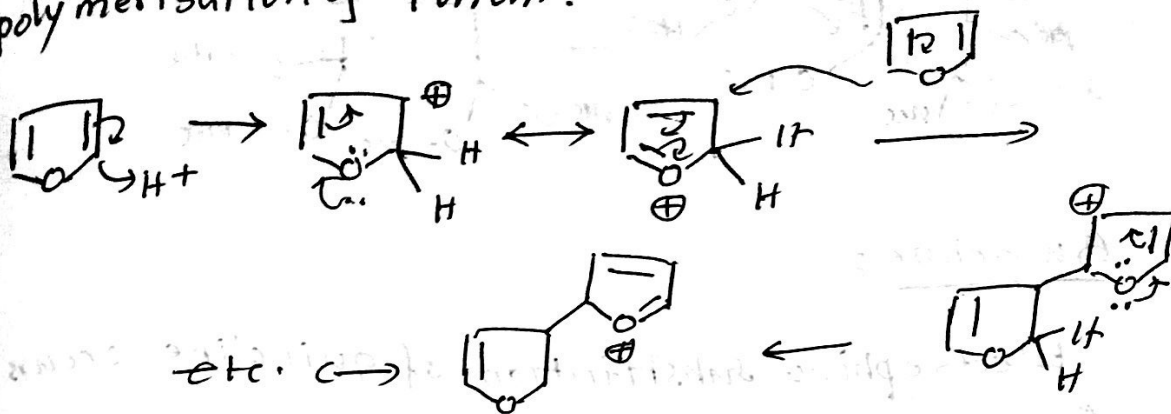
Reduction:



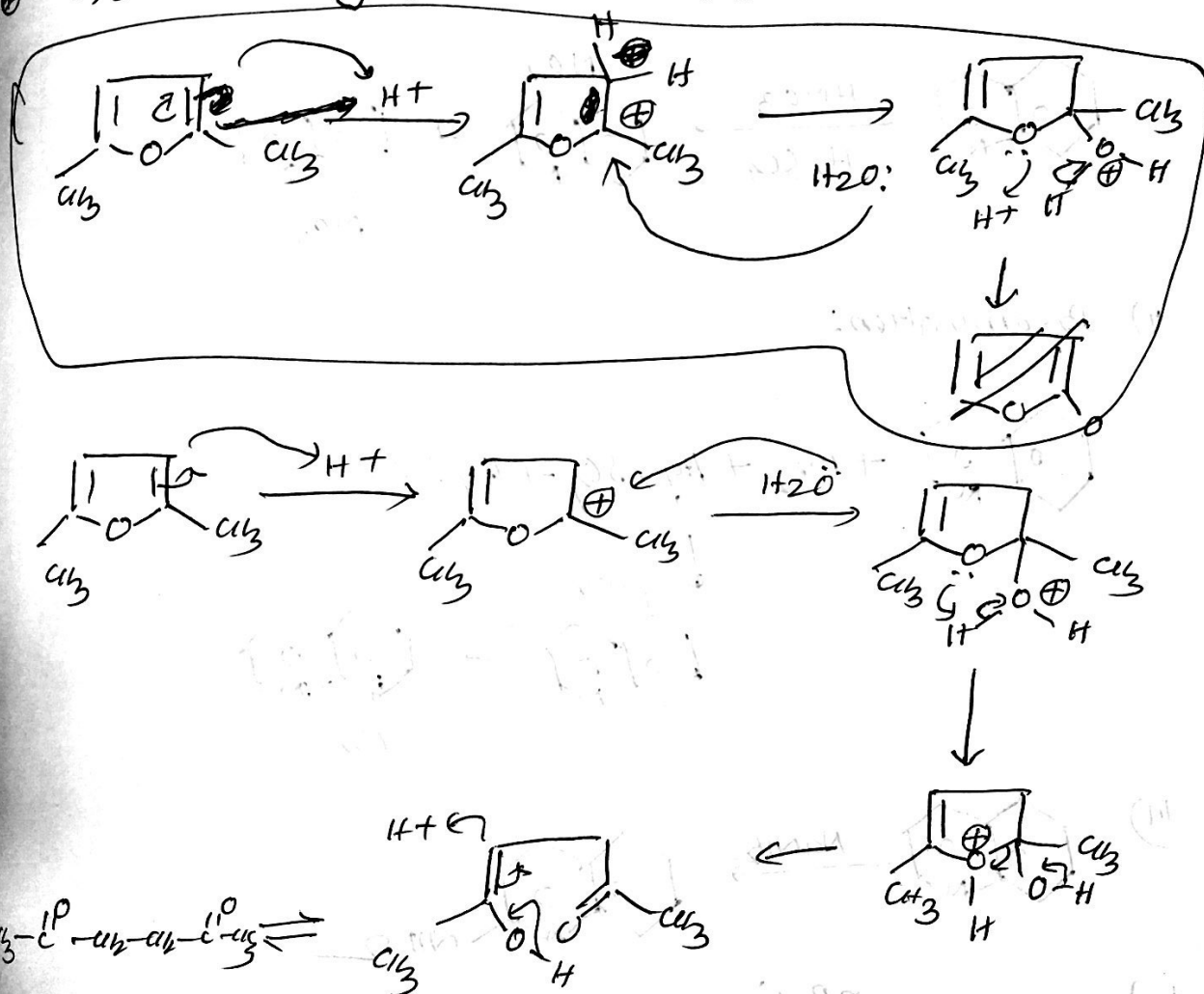
Ring expansion reaction:



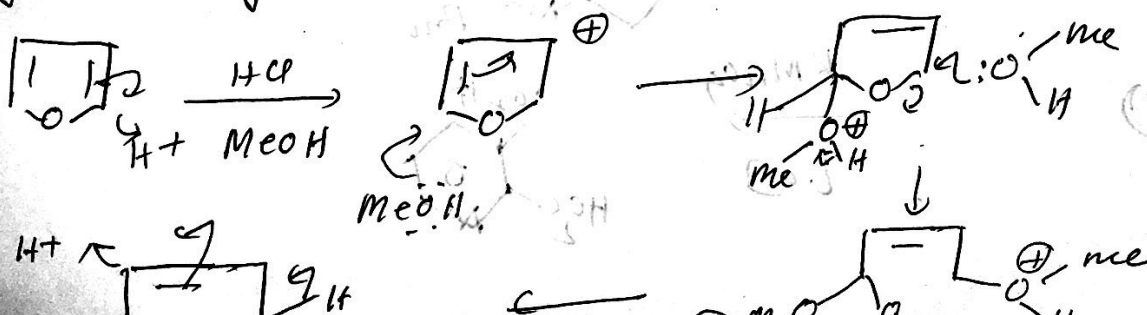
polymerisation of Furan:

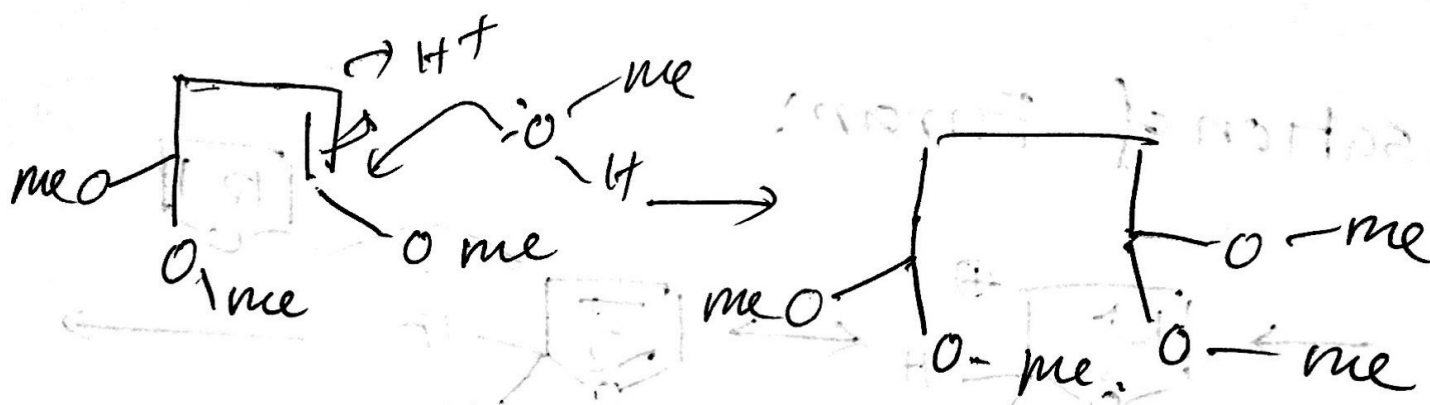


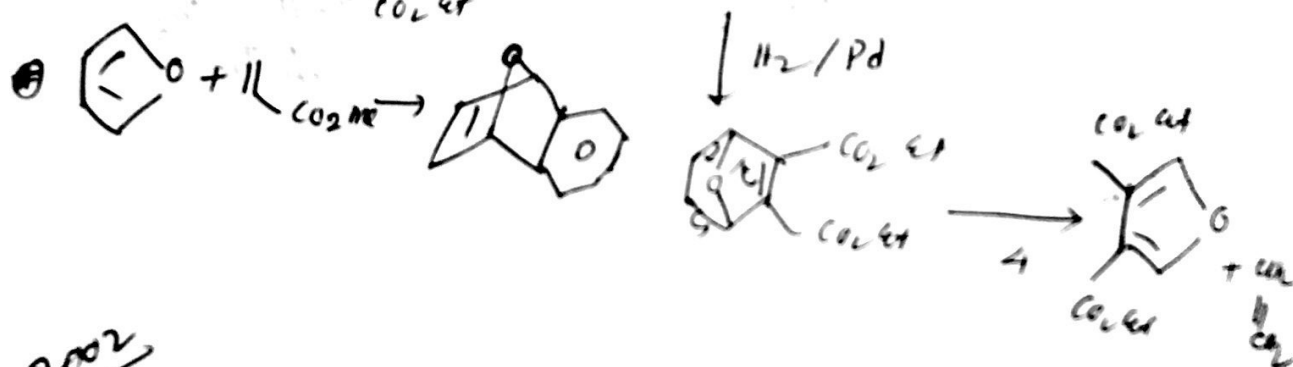
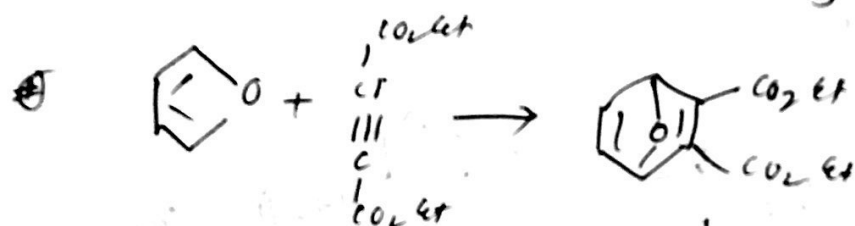
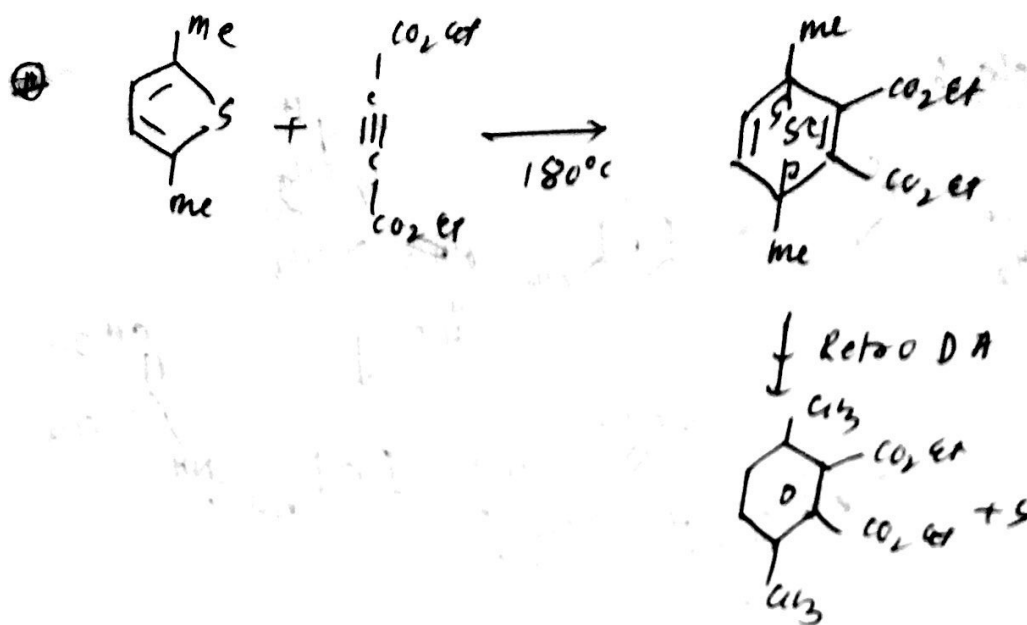
2,5-Dimethyl furan $\rightarrow$ 2,5 hexadione



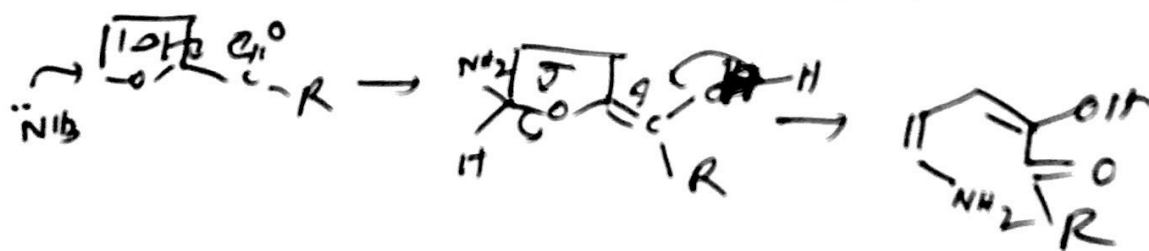
Ring opening:







2002
 Furan α-aldehyde → 3-Hydroxy pyridine:



Heated with ammonia and NH₂Cl.

