B.Sc. Semester-VI
Organic Chemistry
Paper-XIV

3. Heterocyclic Compounds

Coverage:
7. Pyridines : Nucleophilic Reactions

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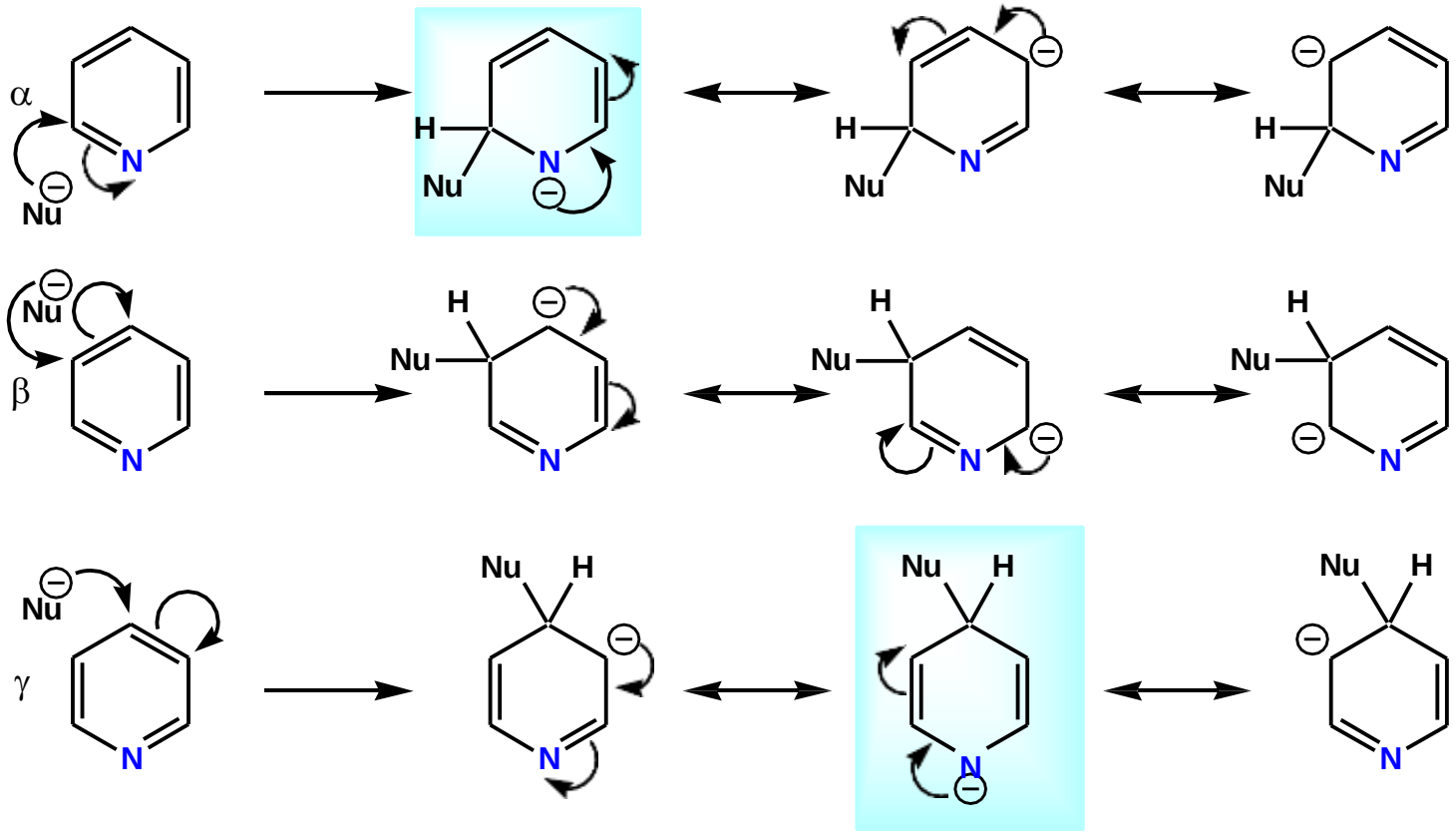
Pyridines – Nucleophilic Reactions

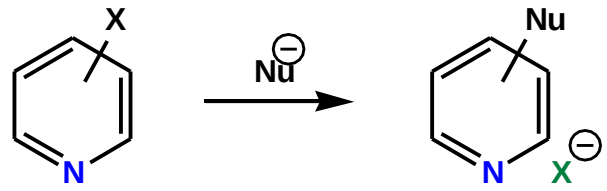
Regiochemical Outcome of Nucleophilic Addition to Pyridines



- Nitrogen acts as an electron sink
- β Substitution is less favoured because there are no stable resonance forms with the negative charge on *N*
- Aromaticity will is regained by loss of hydride or a leaving group, or by oxidation

Pyridines – Nucleophilic Reactions

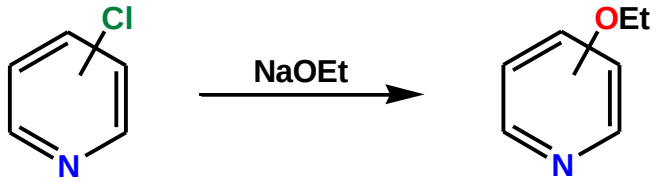
Nucleophilic Substitution

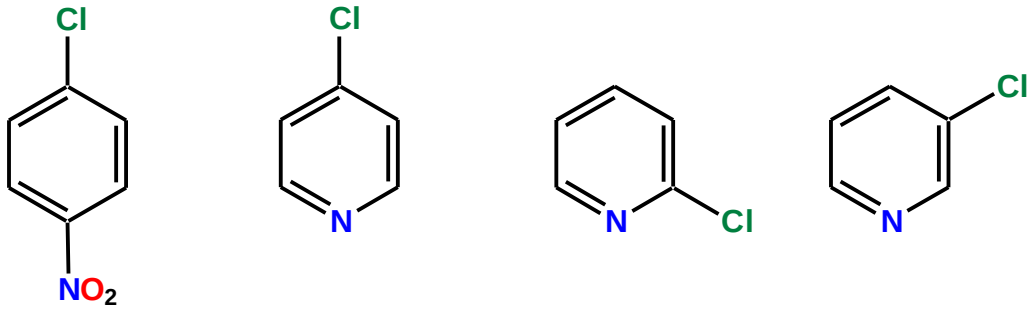


X = **Cl**, **Br**, **I**, (**NO_2**)

Nu = **MeO**$^{\ominus}$, **NH_3**, **PhSH** etc.

- Favoured by electron-withdrawing substituents that are also good leaving groups
- The position of the leaving group influences reaction rate ($\gamma > \alpha >> \beta$)

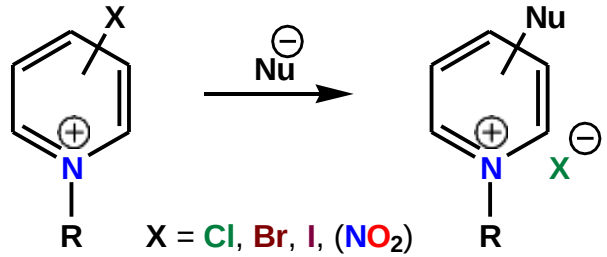




Relative rate	80	40	1	3×10^{-4}

Pyridinium Ions – Nucleophilic Reactions

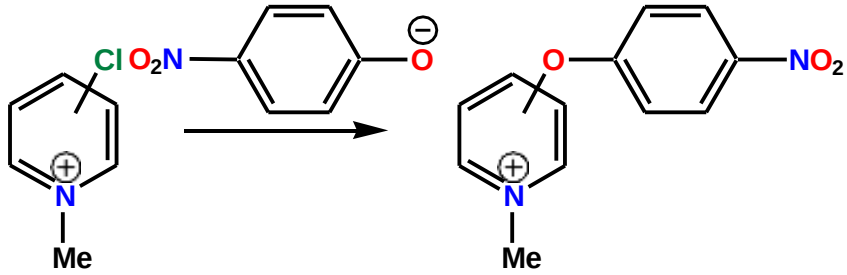
Nucleophilic Substitution

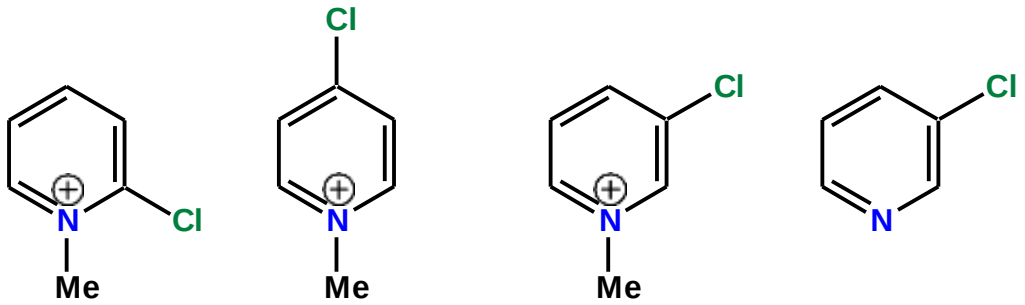


X = Cl, Br, I, (NO_2)

Nu = MeO, NH_3, PhSH etc.

- Conversion of a pyridine into the pyridinium salt greatly accelerates substitution
- Substituent effects remain the same (α, γ >> β) but now α > γ

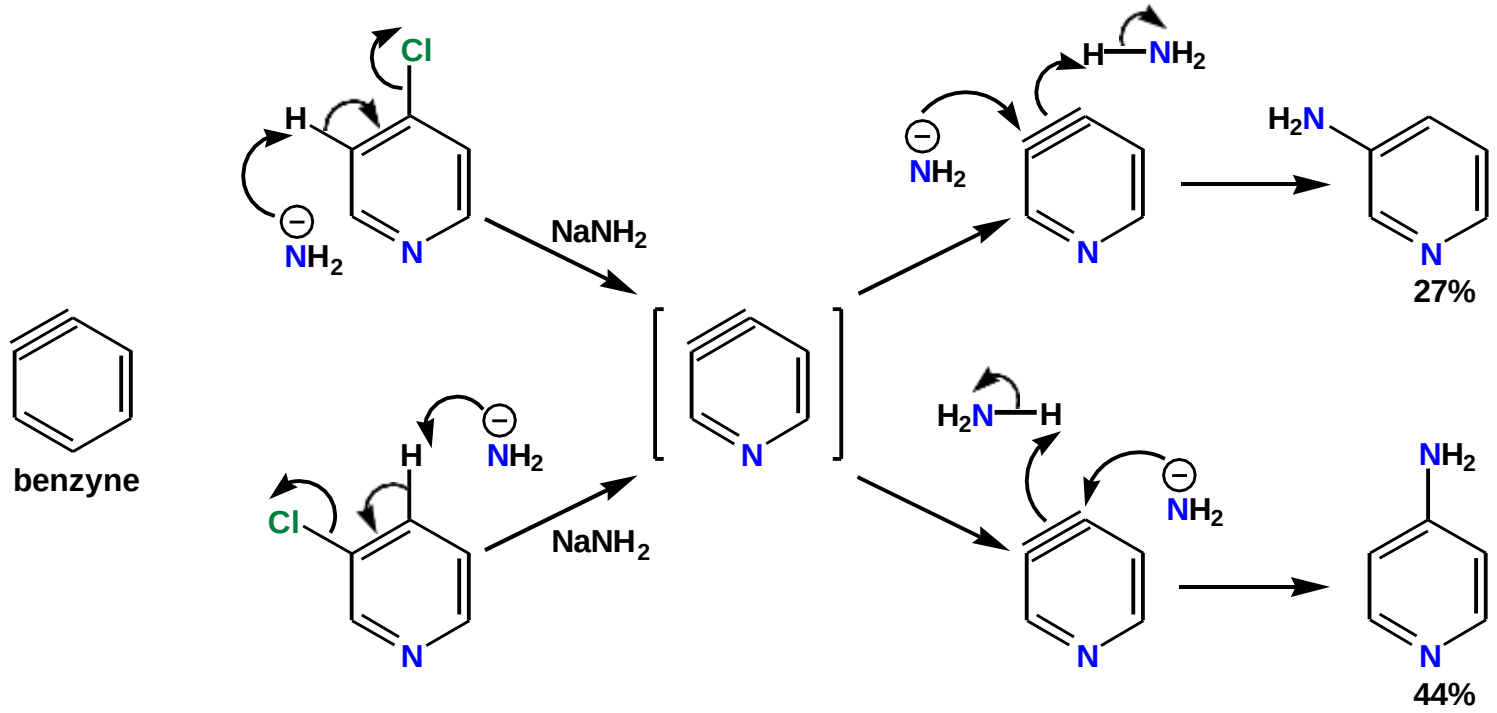




Relative rate	5×10^7	1.5×10^4	1	10^{-4}

Pyridines – Pyridyne Formation

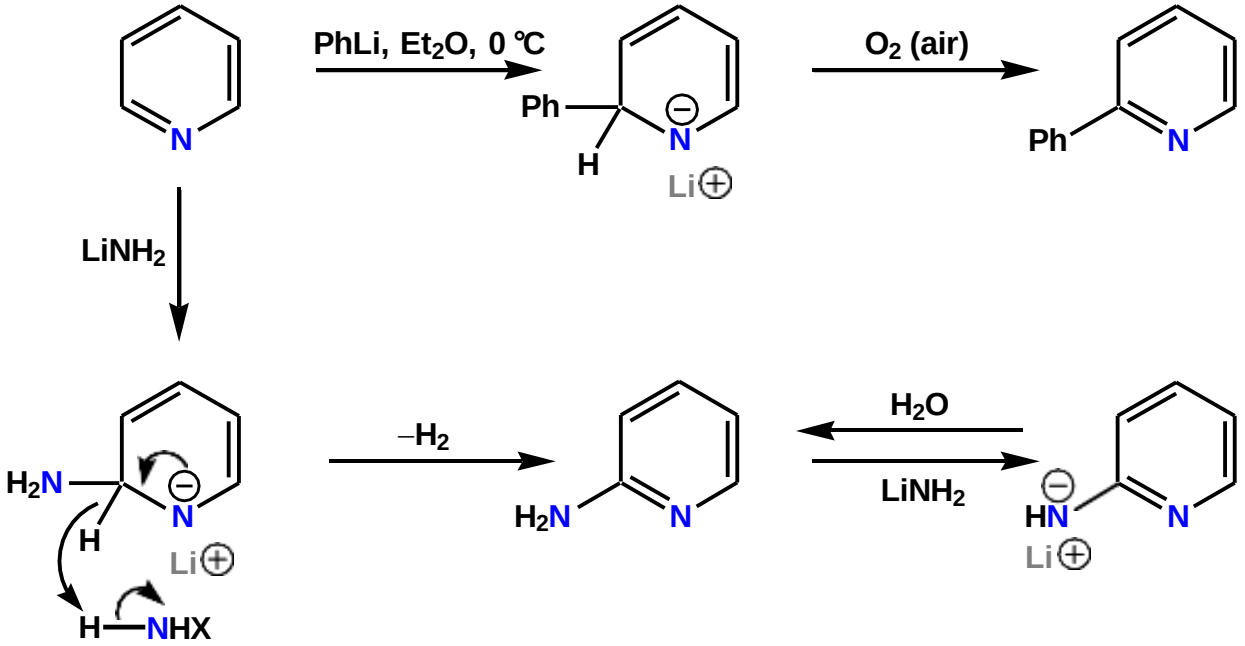
Substitution via an Intermediate Pyridyne



- When very basic nucleophiles are used, a pyridyne intermediate intervenes
- Pyridynes are similar to benzynes and are very reactive (not isolable)

Pyridines – Nucleophilic Reactions

Nucleophilic Attack with Transfer of Hydride : Chichibabin Reaction



- A hydride acceptor or oxidising agent is required to regenerate aromaticity
- The reaction with $LiNH_2$ is referred to as the Chichibabin reaction.

THANK YOU