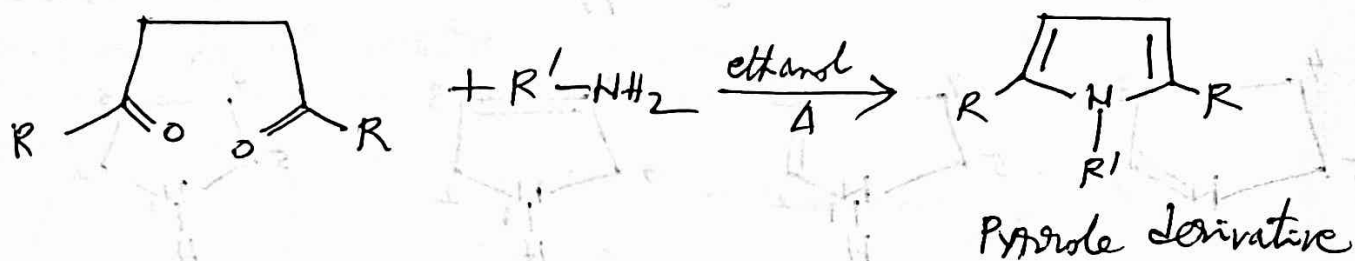


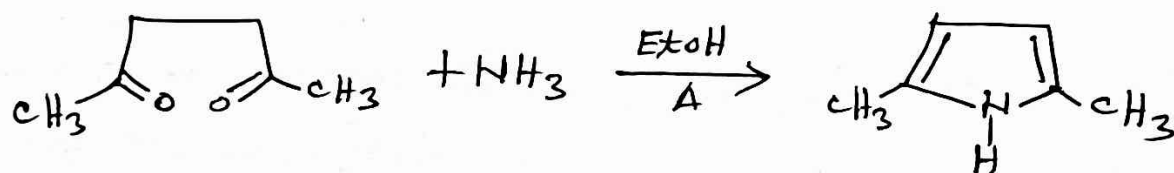
## Paal-Knorr Synthesis

When an enolizable 1,4-diketone is heated with ammonia or a primary amine, N-heterocycle pyrrole is formed.

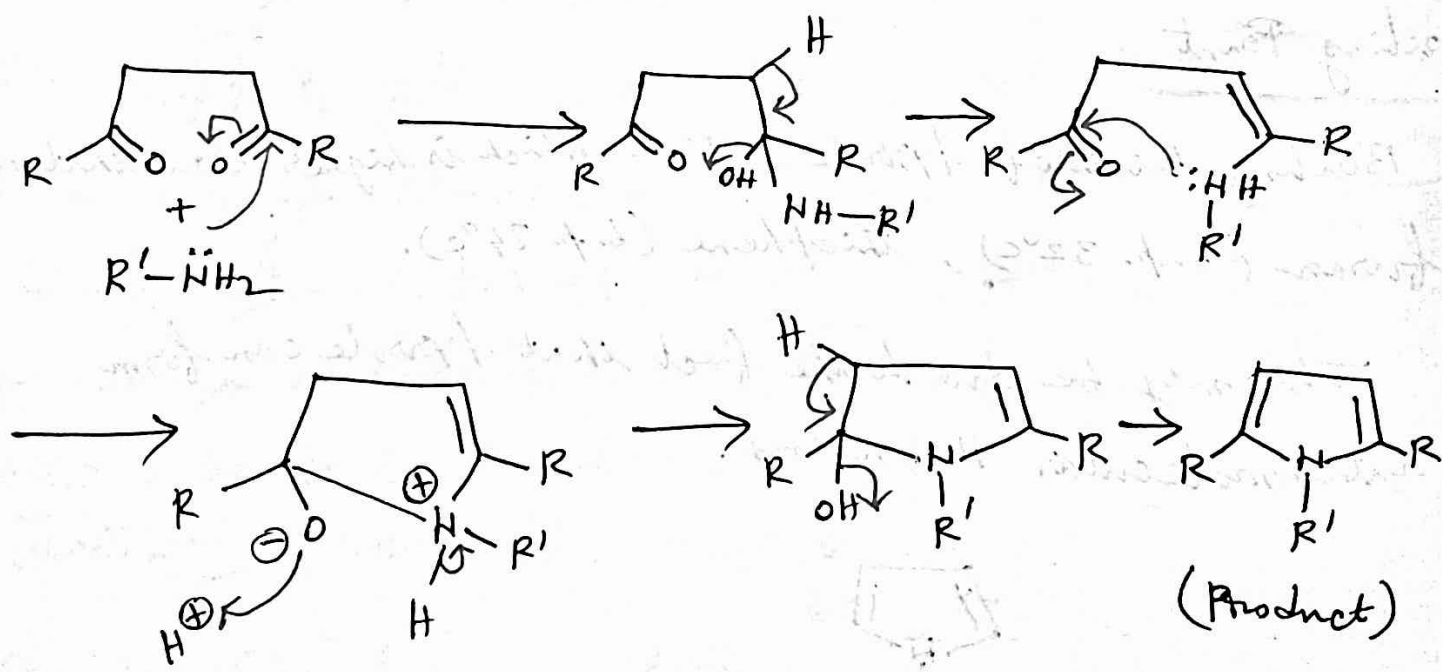
This reaction is known as Paal-Knorr synthesis.



For example

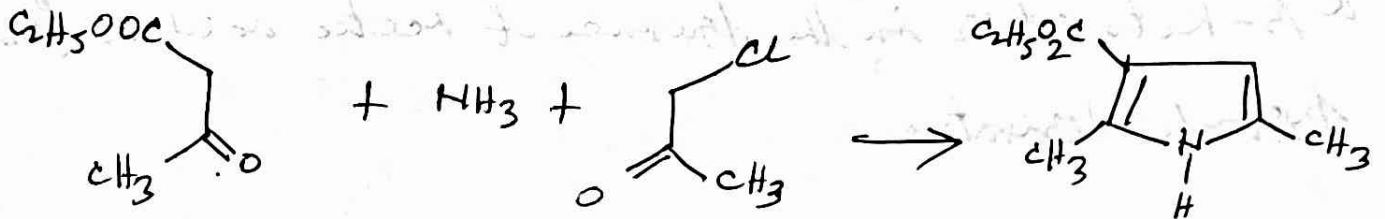


Mechanism



# Hantzsch Pyridine Synthesis

This reaction involves the condensation of an  $\alpha$ -haloketone with a  $\beta$ -keto ester in the presence of ammonia or a primary amine.

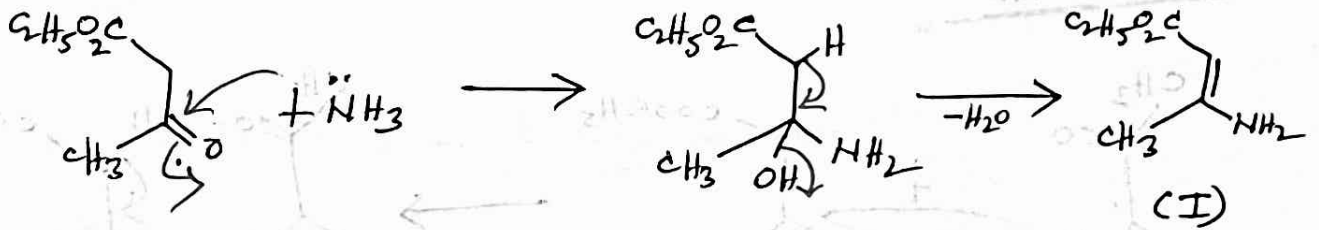


ethylacetoacetate  
( $\beta$ -keto ester)

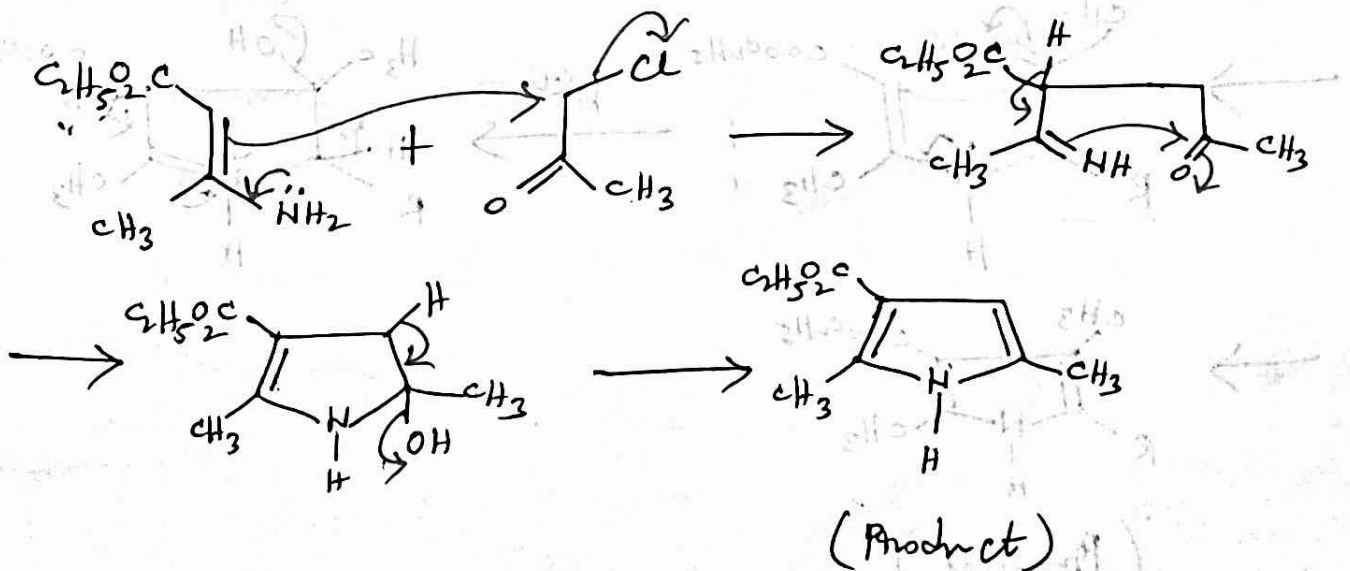
$\alpha$ -halo ketone

## Mechanism

### Step-I



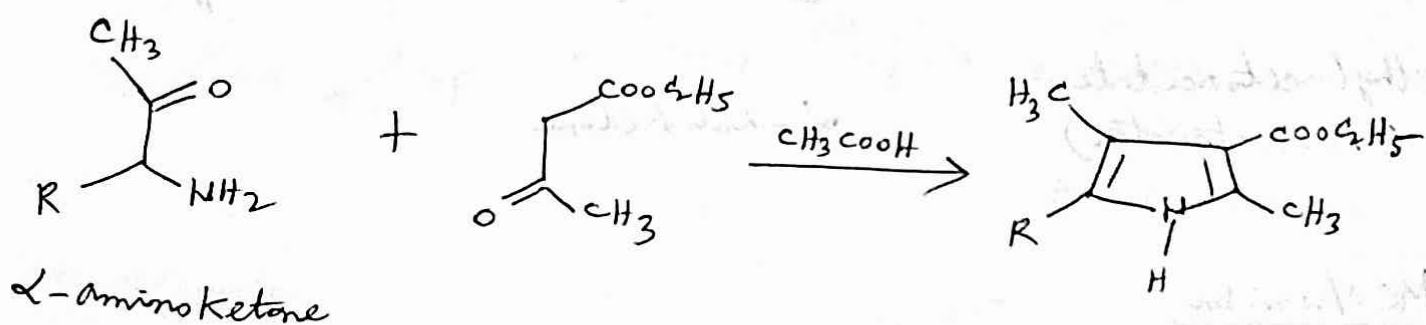
### Step-II



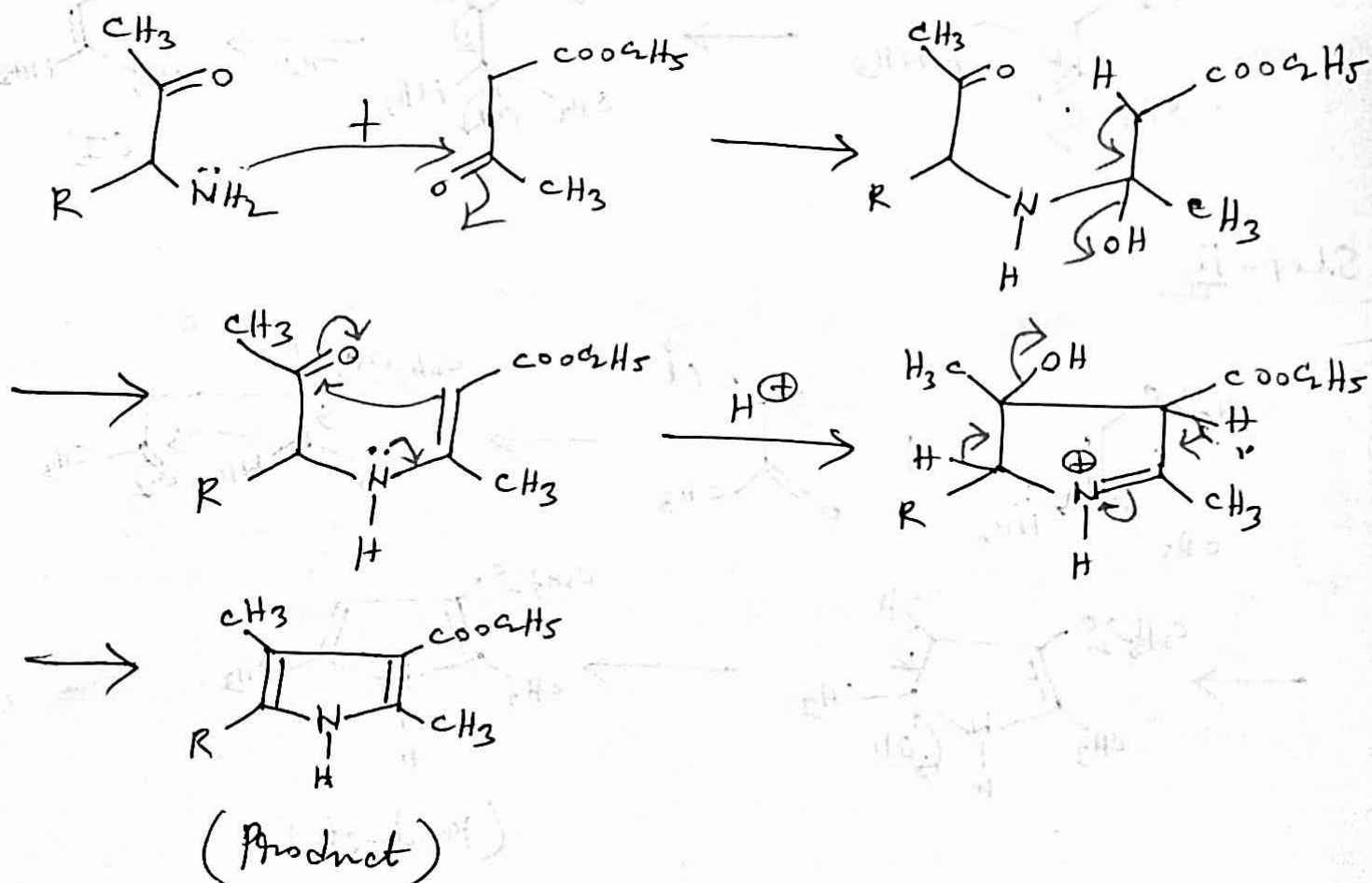
# Knorr Pyrrole Synthesis

This is the most widely used synthesis for synthesizing a wide variety of pyrrole derivatives.

In this method, an  $\alpha$ -amino ketone condenses with a  $\beta$ -keto ester in the presence of acetic acid to form pyrrole derivative.

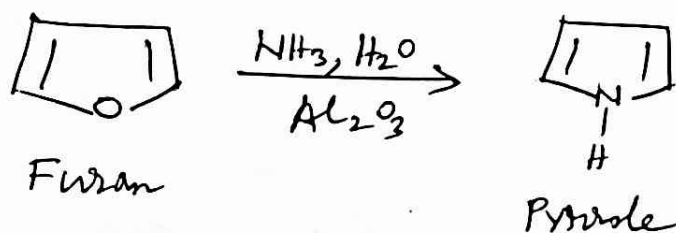


## Mechanism



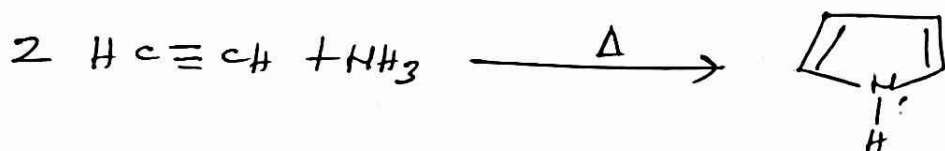
## Pyrrrole From Furan

Pyrrrole can be prepared by passing a mixture of furan, ammonia and steam over alumina catalyst.



## Pyrrrole from Acetylene

Pyrrrole is formed when a mixture of acetylene and ammonia is passed through a red hot tube.



## Pyrrrole from Ammonium succinate

