CHAPTER 13

Hofmann Rearrangement

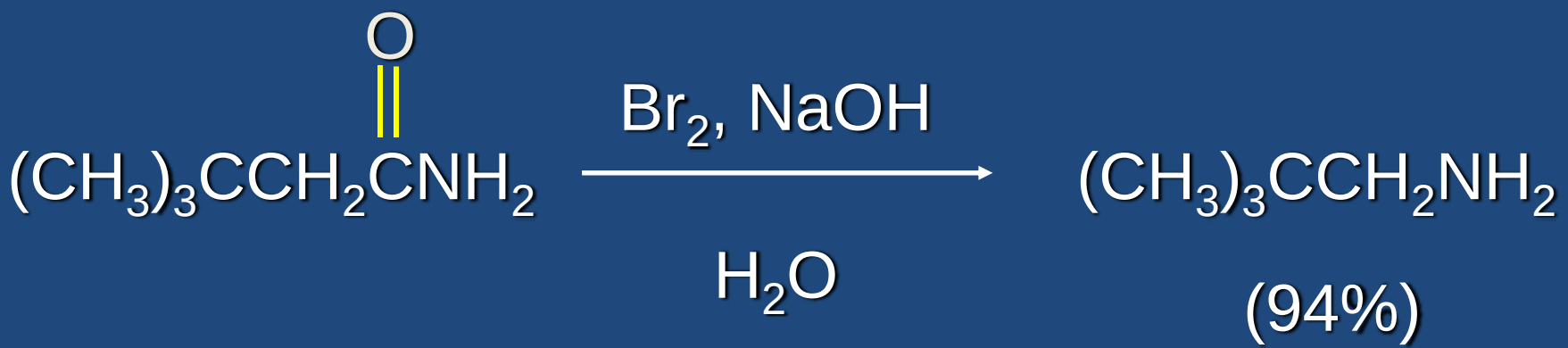
BY,

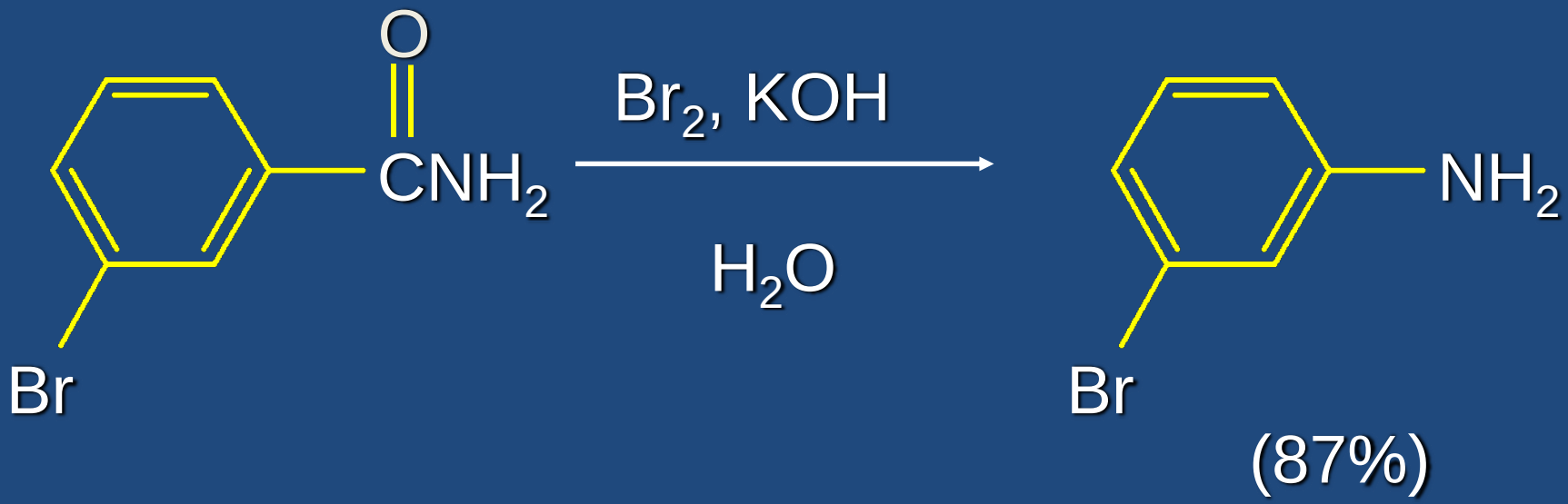
G.DEEPA

The Hofmann Rearrangement

Treatment of amides with bromine in basic solution gives an amine with loss of the carbonyl carbon.

Examples

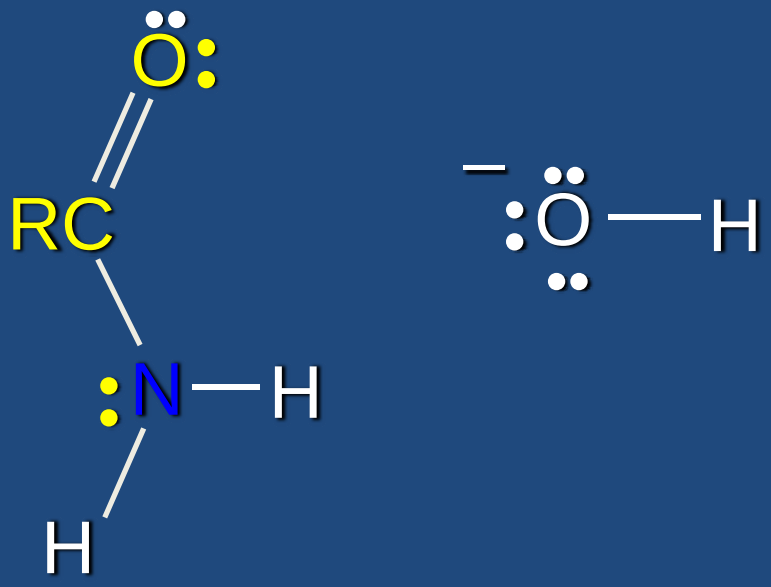

O
(CH3)3CCH2CNH2
Br2, NaOH
H2O
(CH3)3CCH2NH2
(94%)


O
CNH2
Br
Br2, KOH
H2O
NH2
Br
(87%)

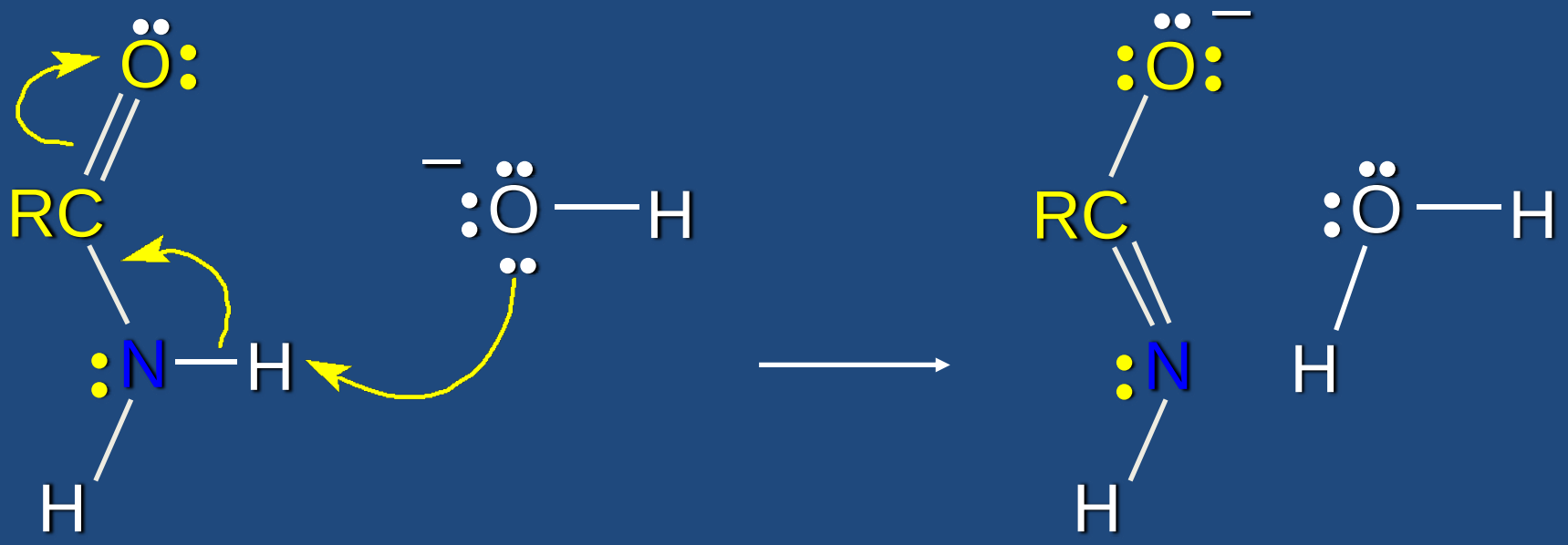
Mechanism of the Hofmann Rearrangement

- The Hofmann rearrangement involves 6 steps in 3 stages.
- 1. formation of an *N*-bromo amide (2 steps)
- 2. conversion of the *N*-bromo amide to an isocyanate (2 steps)
- 3. hydrolysis of the isocyanate (2 steps)

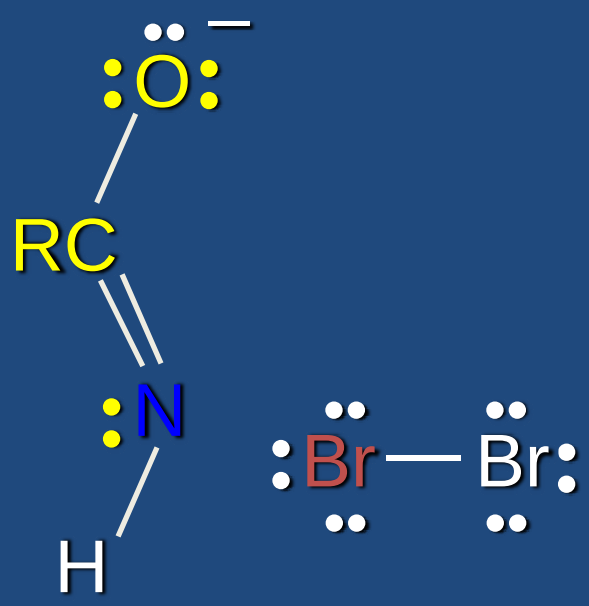
Step 1



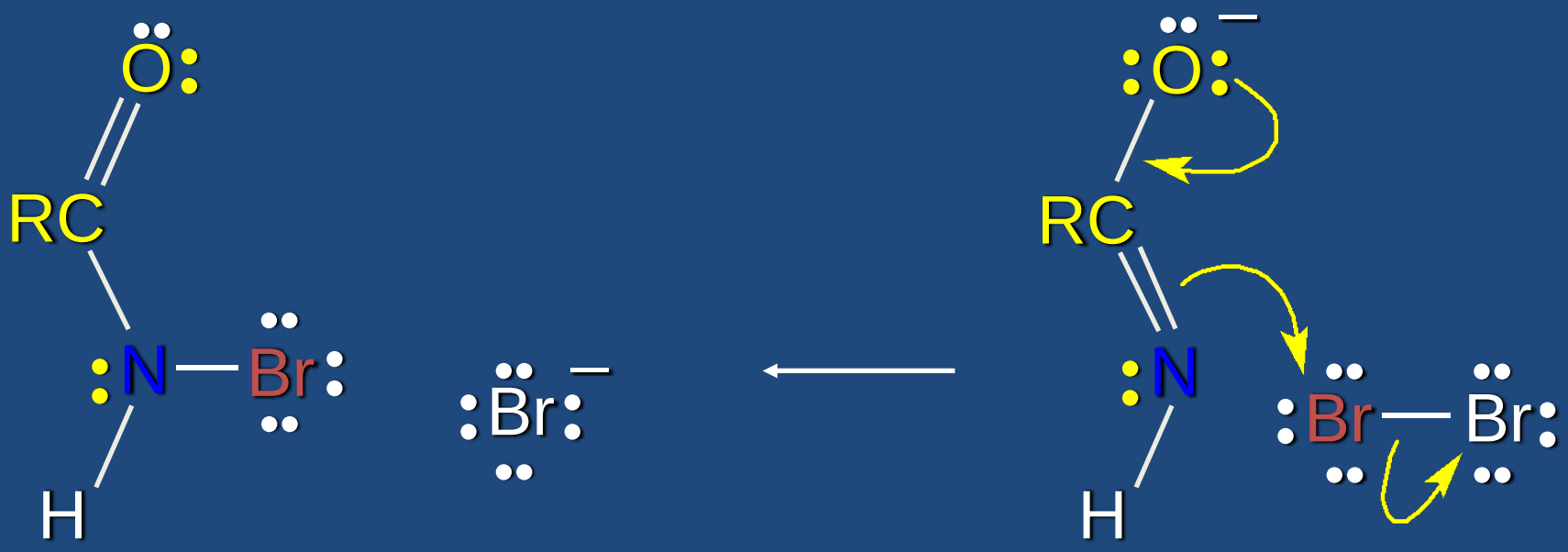
Step 1



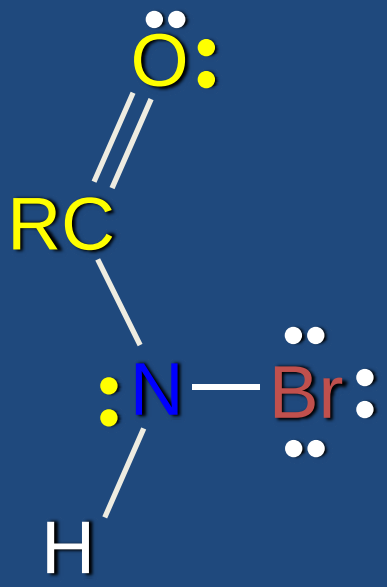
Step 2

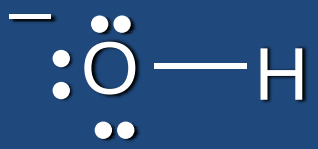


Step 2

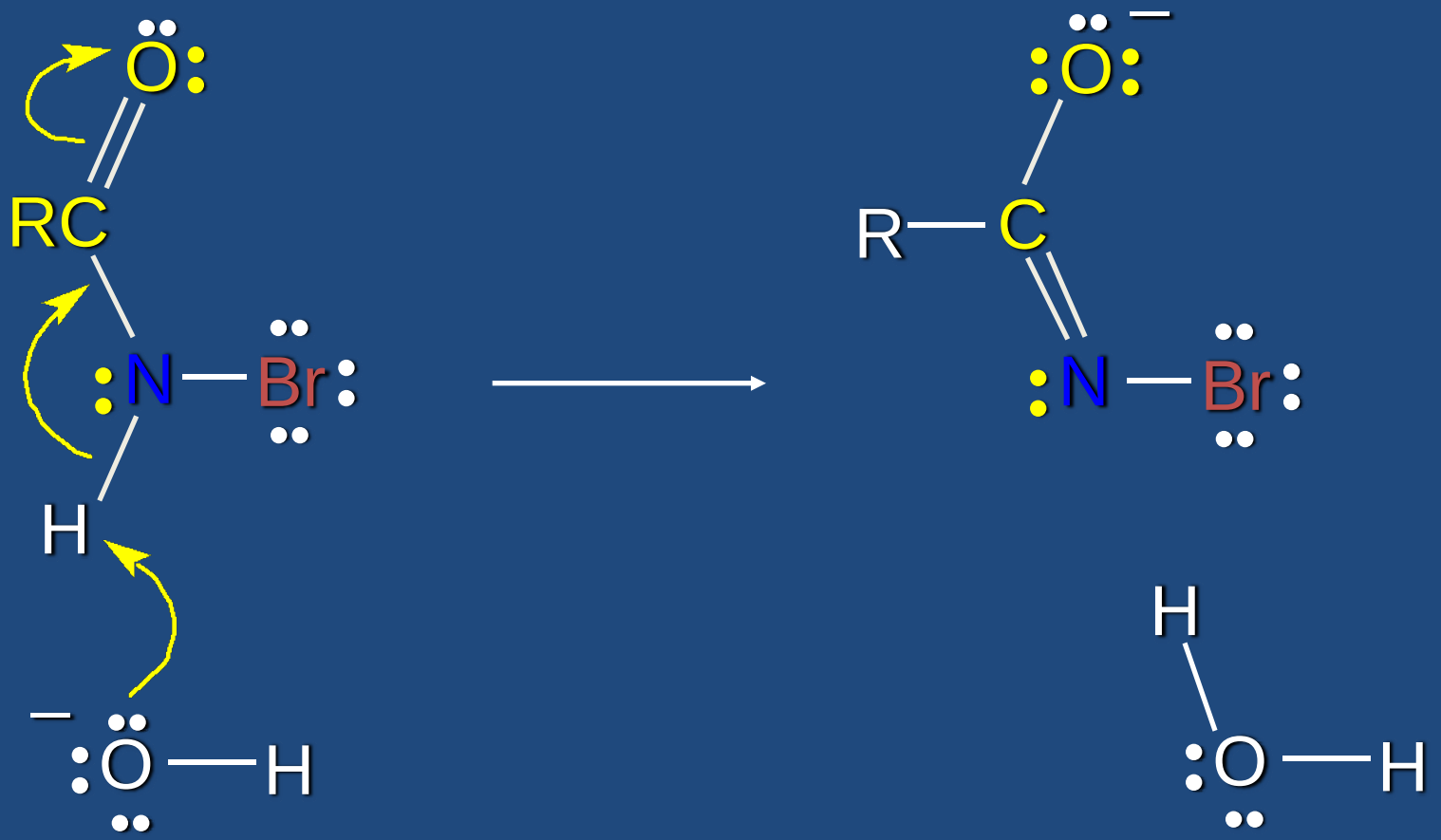


Step 3

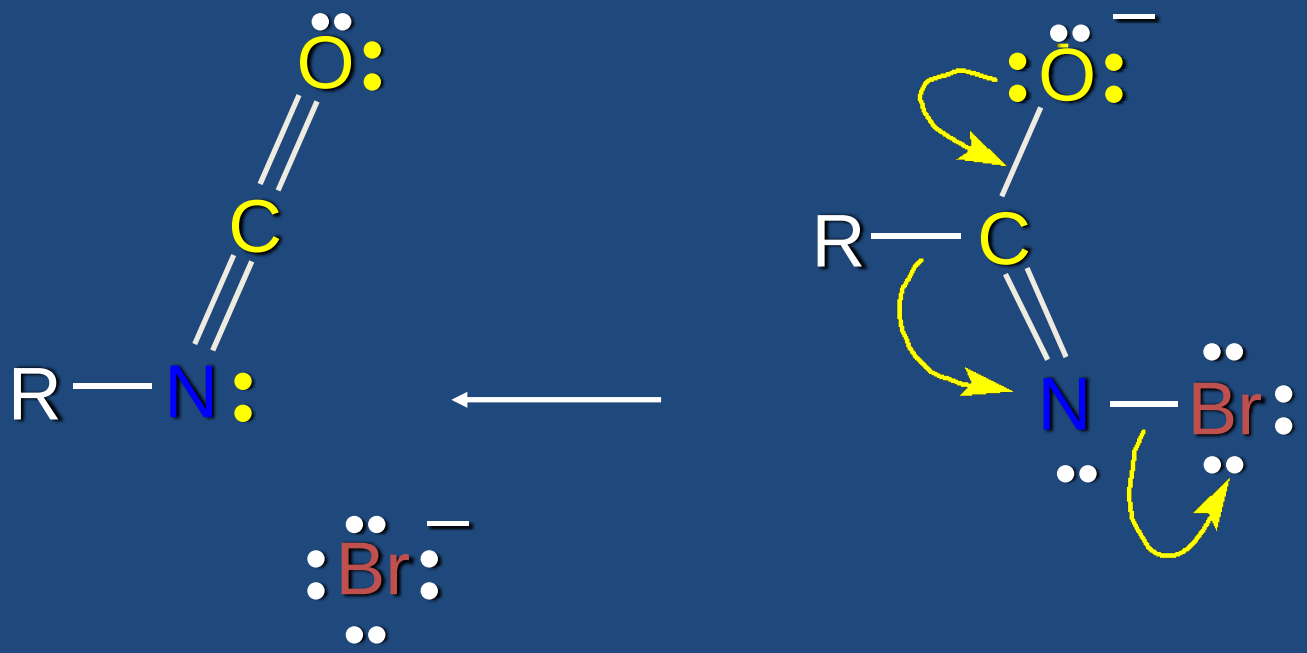




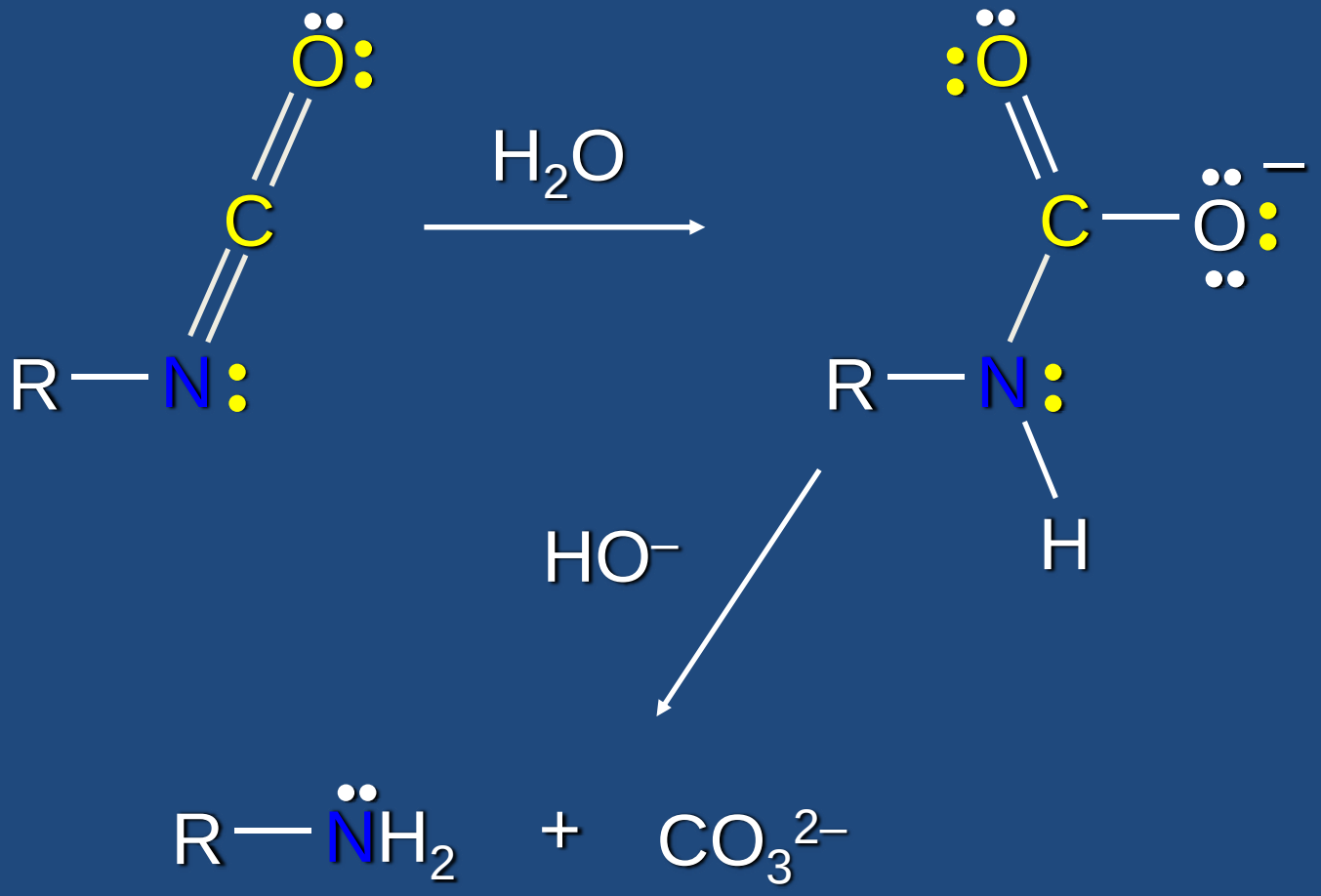
Step 3



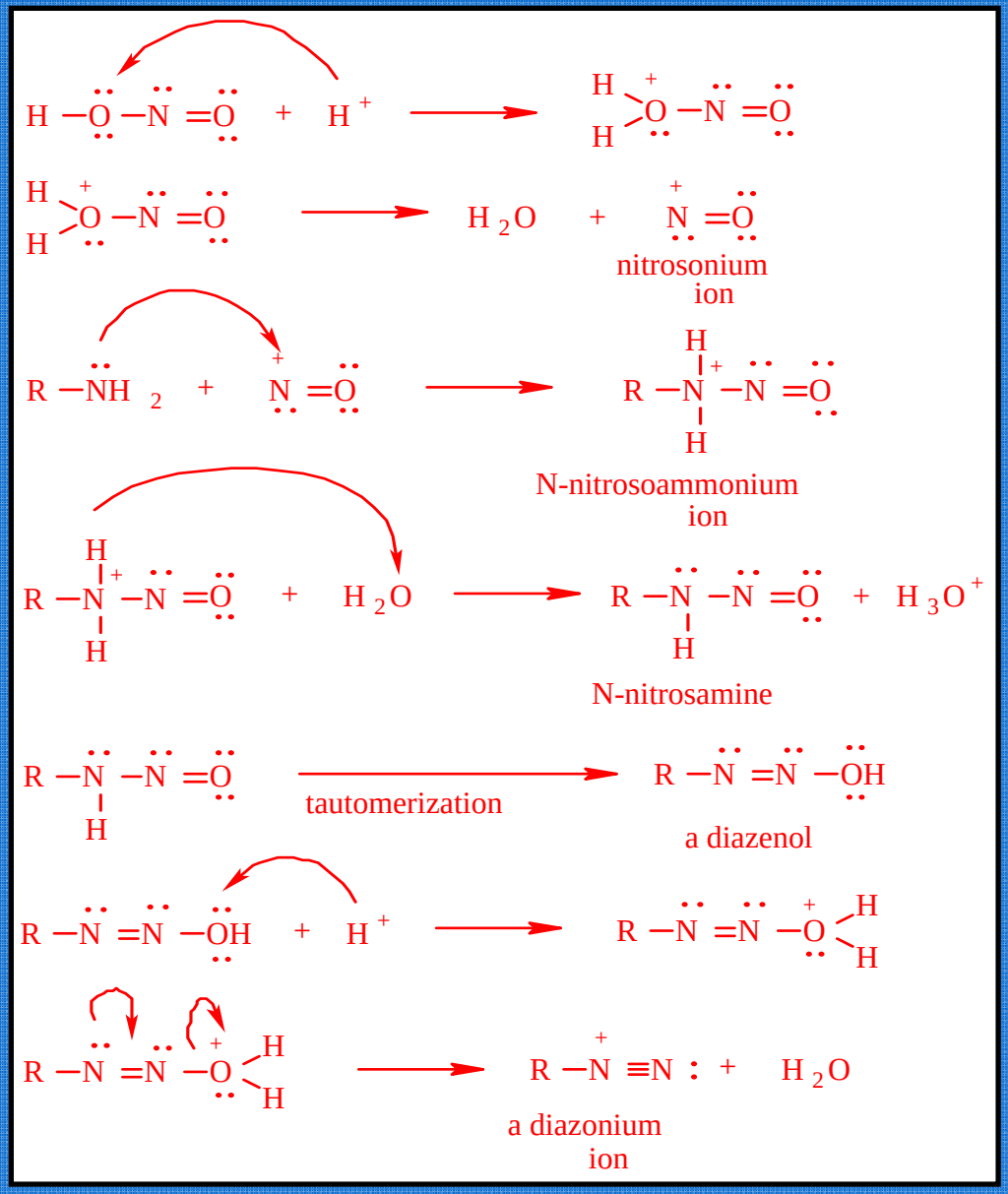
Step 4



Steps 5 and 6



Mechanism of Diazonium salt formation



Basicity of amines

The greater the availability of the lone pair electrons on nitrogen, the greater the base.

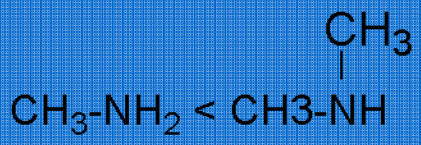
In the old days, pK_b was a measure of base strength.

$Kb = [RNH_3^+] [OH^-] / RNH_2$ $\quad\quad$ $pK_b = - \log K_b$

The stronger the base the lower the pK_b

EFFECTS ON AMINE BASICITY

1. INDUCTIVE EFFECT - ALKYL SUBSTITUTION



METHYL GROUP INCREASES ELECTRON DENSITY ON N

2 METHYLS ARE BETTER THAN ONE

WATCH OUT THREE METHYL GROUPS DECREASES BASICITY $pK_b = 4.26$ - Steric inhibition of solvation of HOH with the NH^+ of the $R3NH^+$ cation.

The greater the availability of the lone pair electrons on nitrogen, the greater the base.

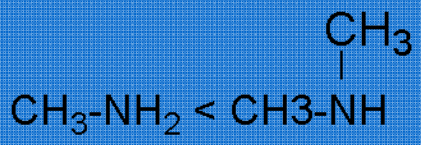
In the old days, pK_b was a measure of base strength.

$Kb = [RNH_3^+]\,[OH^-] / RNH_2$ $\qquad$ $pK_b = -\log K_b$

The stronger the base the lower the pK_b

EFFECTS ON AMINE BASICITY

1. INDUCTIVE EFFECT - ALKYL SUBSTITUTION

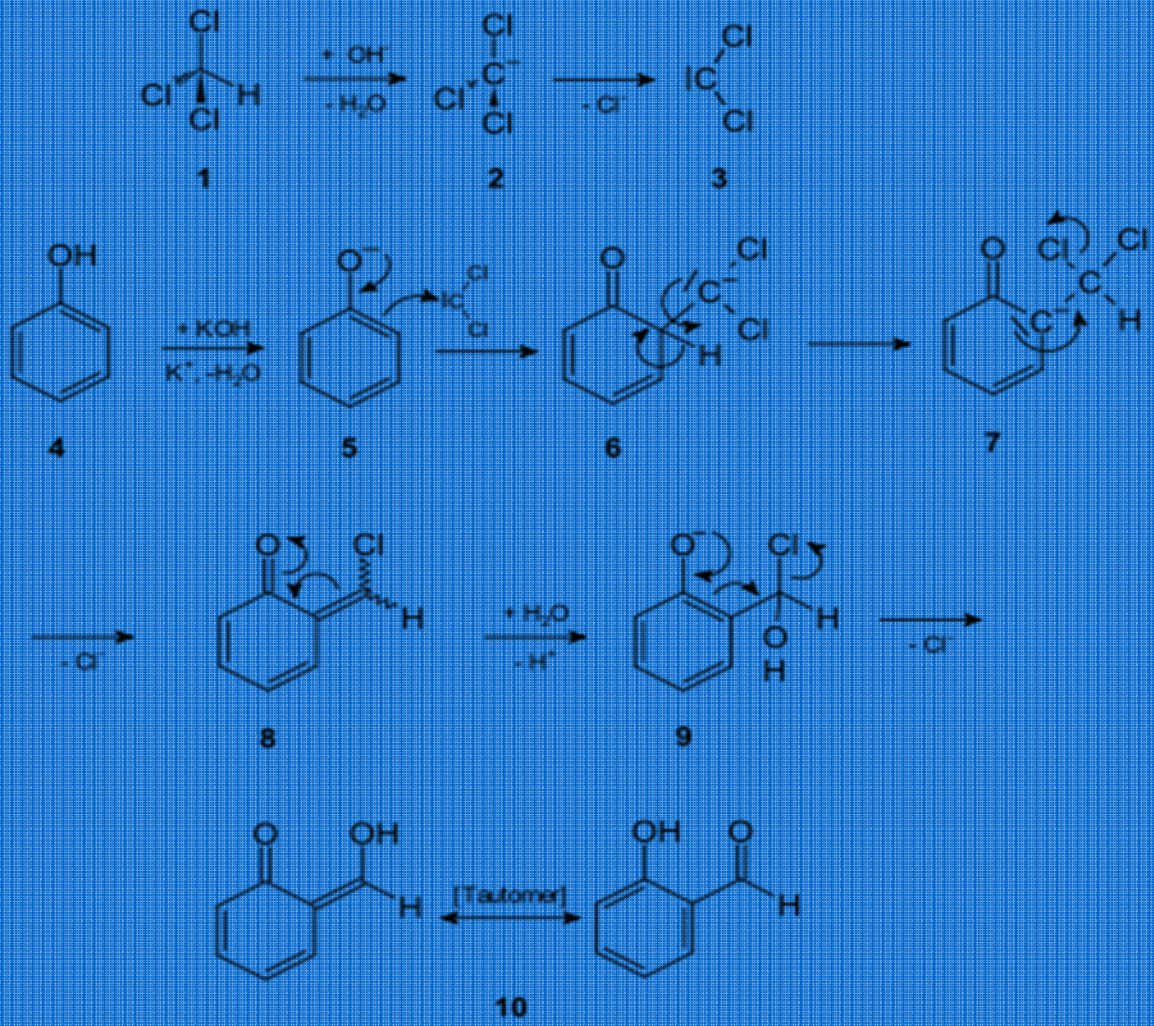


METHYL GROUP INCREASES ELECTRON DENSITY ON N

2 METHYLS ARE BETTER THAN ONE

WATCH OUT THREE METHYL GROUPS DECREASES BASICITY $pK_b = 4.26$ - Steric inhibition of solvation of HOH with the NH^+ of the $R3NH^+$ cation.

Reimer-Tiemann Reaction Mechanism



THANK YOU