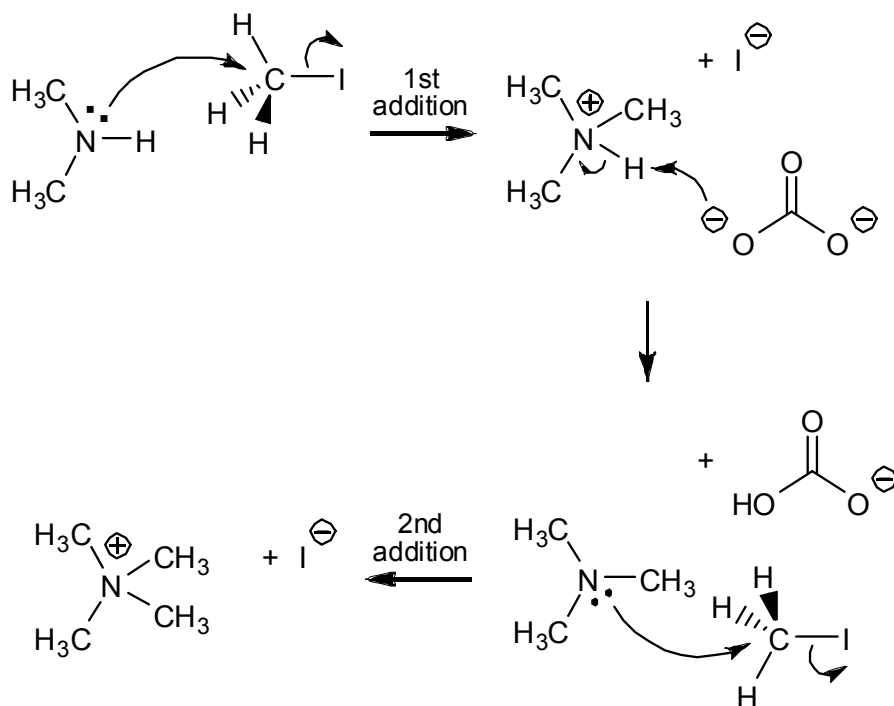
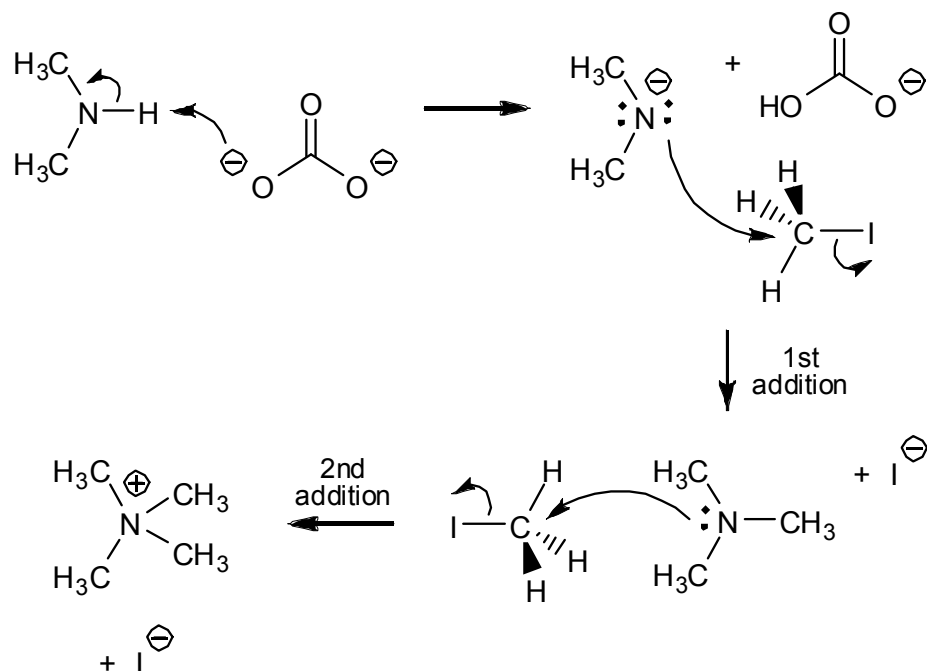


Workshop 13 Solutions
Multistep Reaction Mechanisms

Another way that you *might* have started this problem would be to deprotonate the nitrogen first, and then add two molecules of CH_3I (instead of doing $\text{S}_{\text{N}}2 \rightarrow \text{acid-base} \rightarrow \text{S}_{\text{N}}2$ like I did above):



Although this alternative mechanism is fine from a purely accounting standpoint, I think the first acid-base exchange is *extremely* unlikely. The amine is structured like ammonia (NH_3), and the pK_a of ammonia is ~ 35 , making it a horrible acid. (Mathematically speaking, ammonia is 20 orders of magnitude less likely to give up a proton than water.) On the other hand, ammonia is a good base, and willing to give up its electron pair—to an acidic proton, or to an electrophile in an $\text{S}_{\text{N}}2$ reaction. So I'd put my money on the first mechanism.

So why can't the second addition be stopped? Trimethylamine is a stronger nucleophile than dimethylamine, because the methyl groups are electropositive and push electron density onto the nitrogen. The more methyl groups, the more pushing, and so trimethylamine should be that much more willing to donate its lone pair.