



ORGANIC CHEMISTRY

NITROGEN COMPOUNDS: AMINES, IMINES, AND AMIDES

CHEMISTRY 165 // SPRING 2020

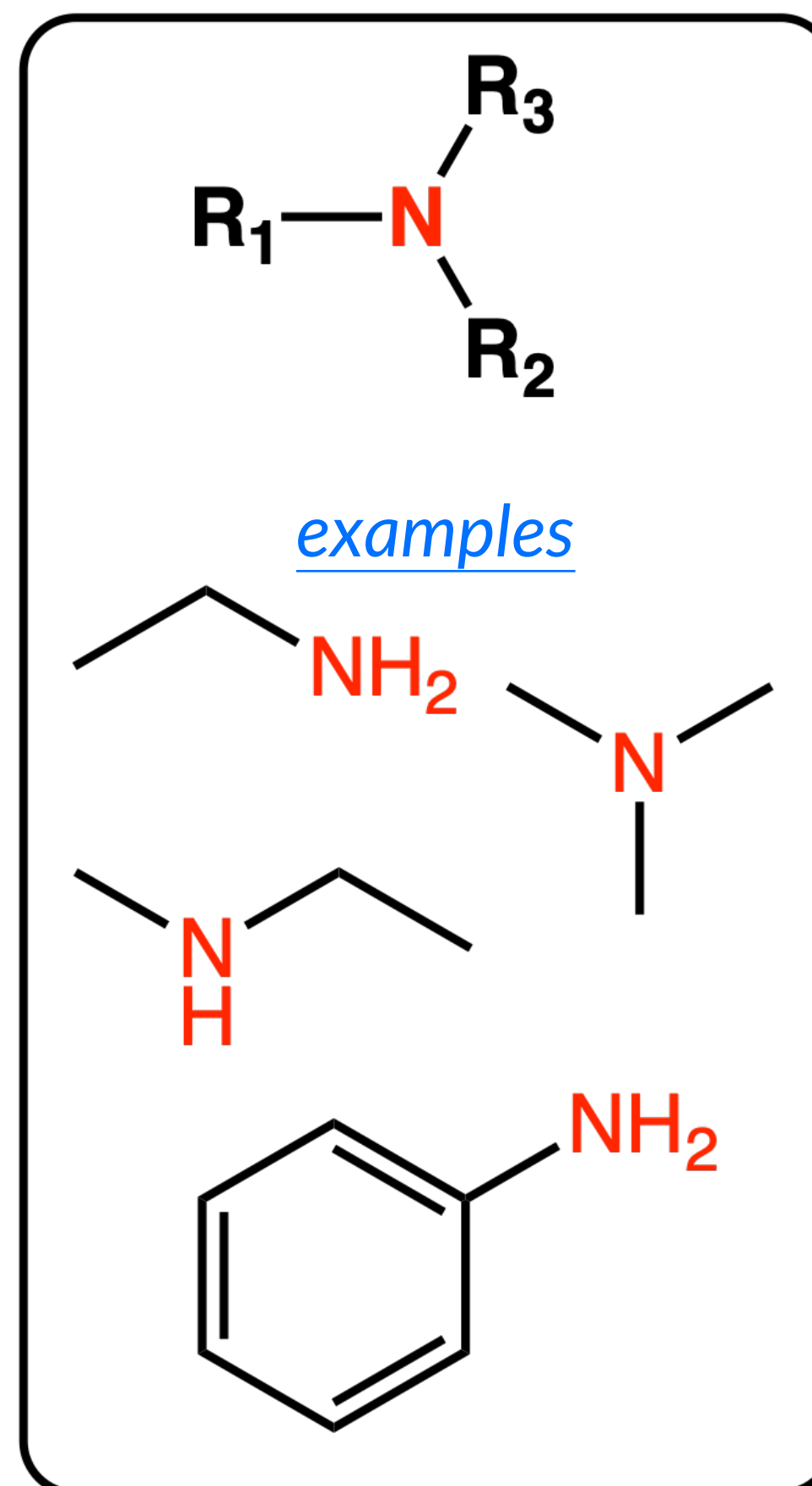
Nitrogen compounds: amines, imines, and amides

Organic chemistry and biochemistry also deal with many nitrogen-containing compounds.

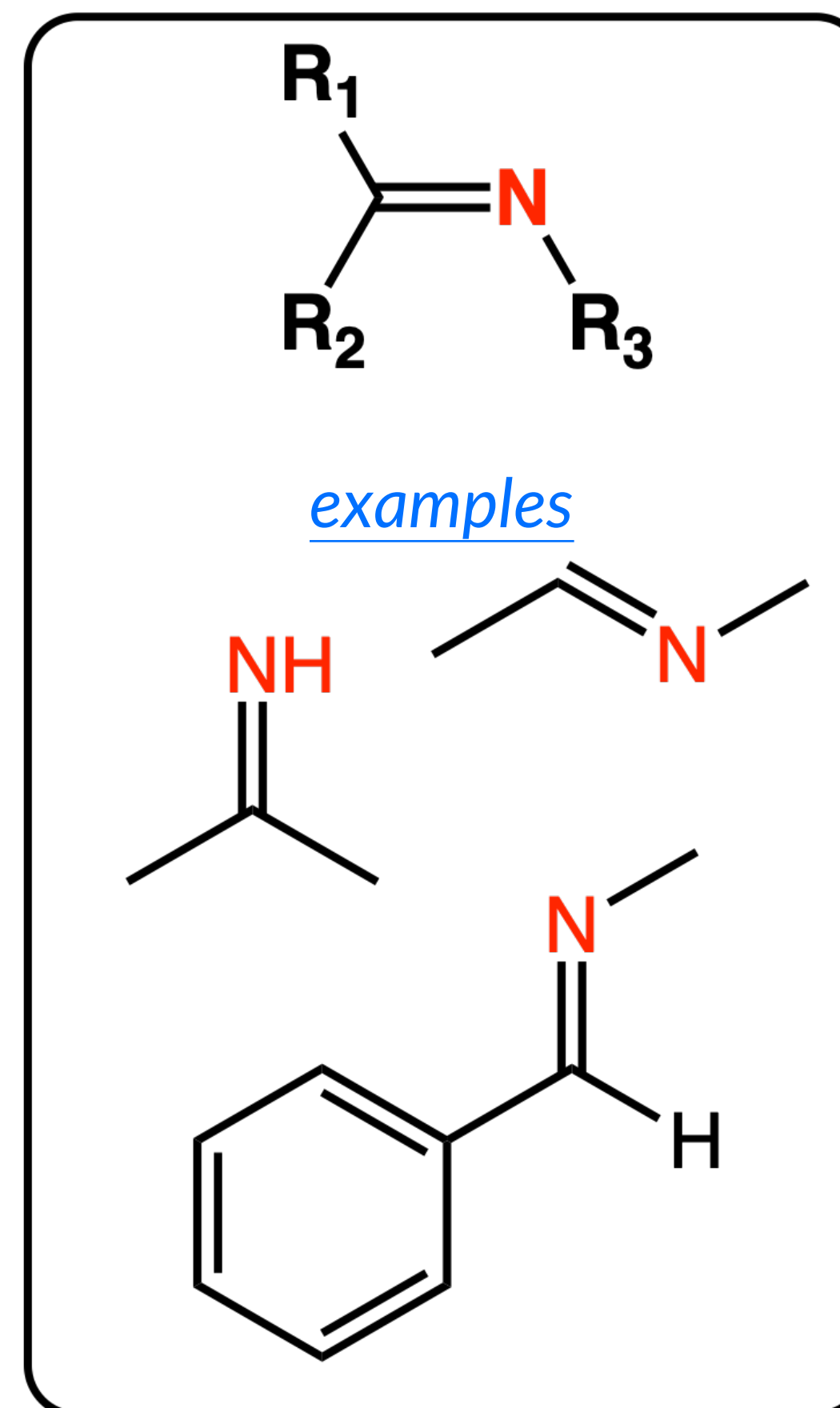
The main classes of nitrogen-containing compounds (amines, imines, and amides) are shown to the right, along with some example structures/molecules for each class.

Take notice of the differences between these classes in regards to the bonding around the nitrogen center.

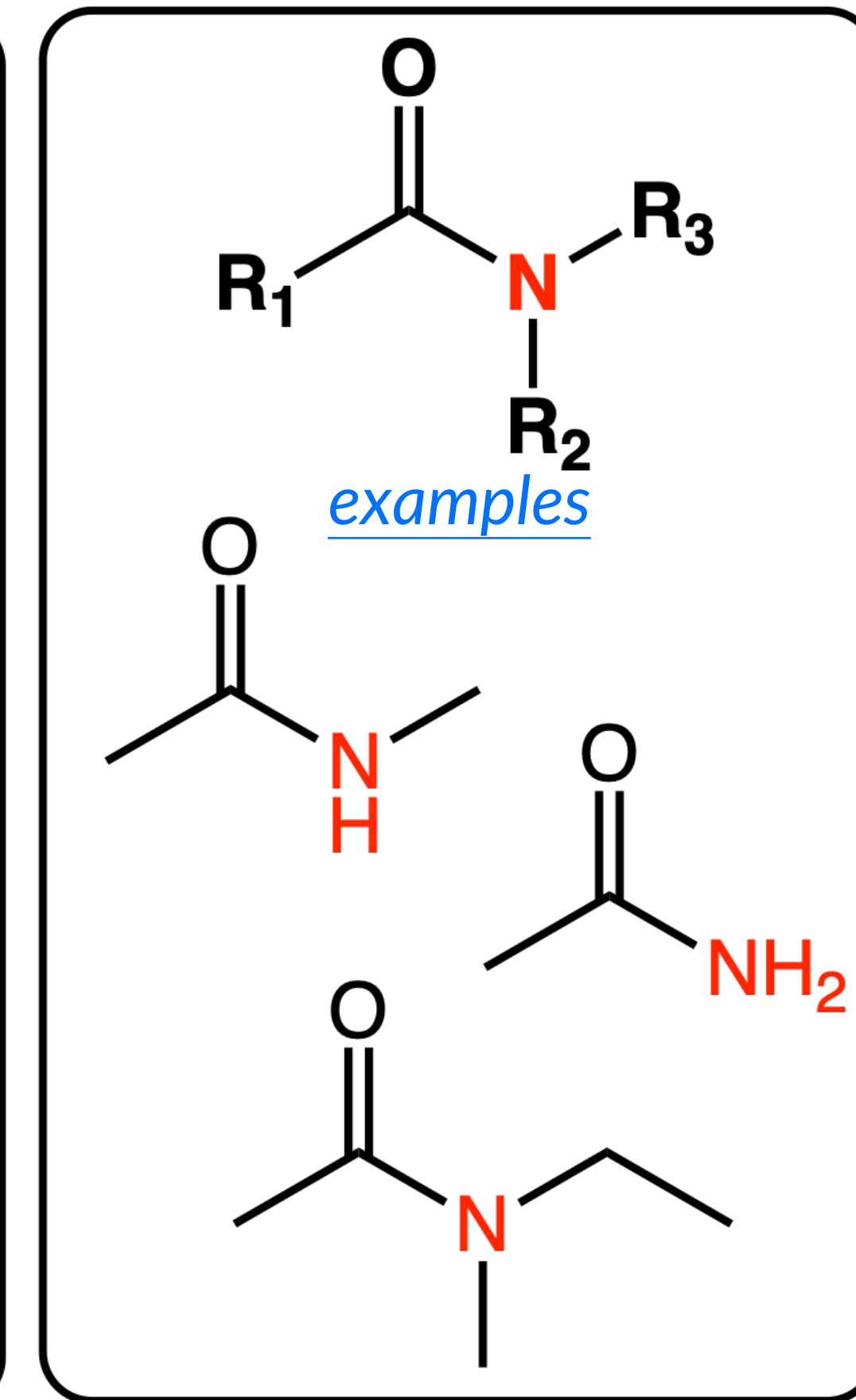
AMINES



IMINES



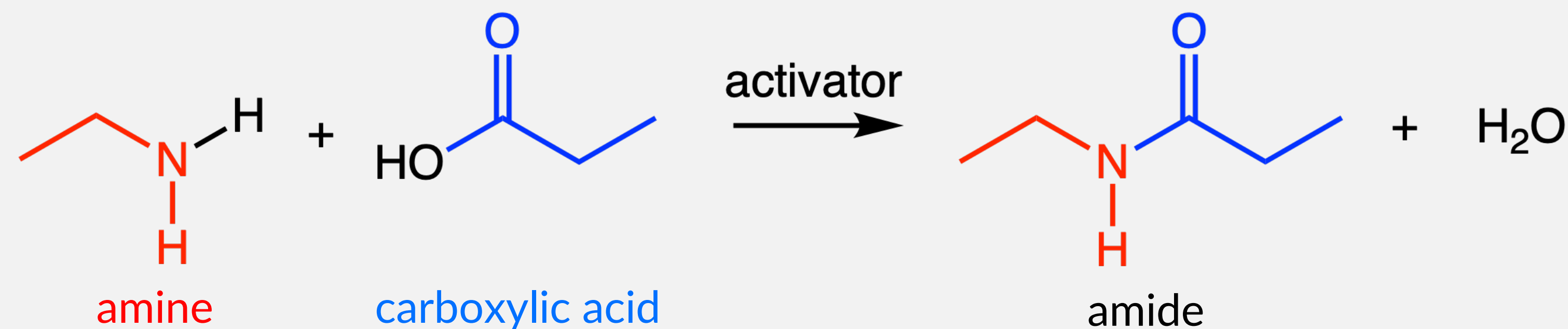
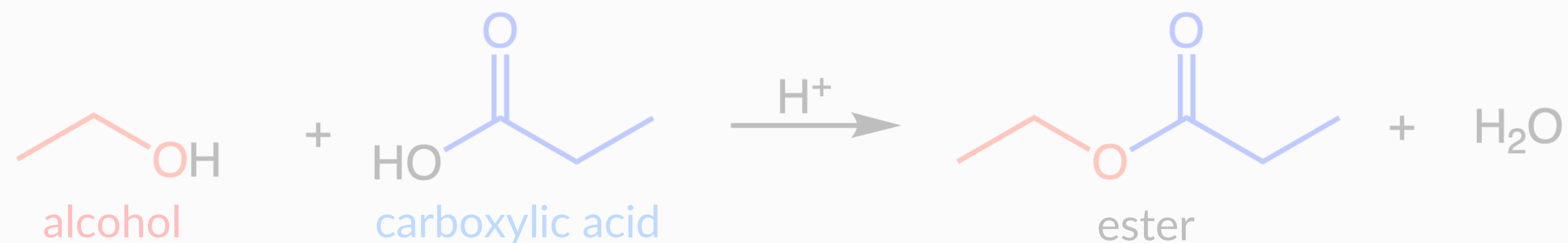
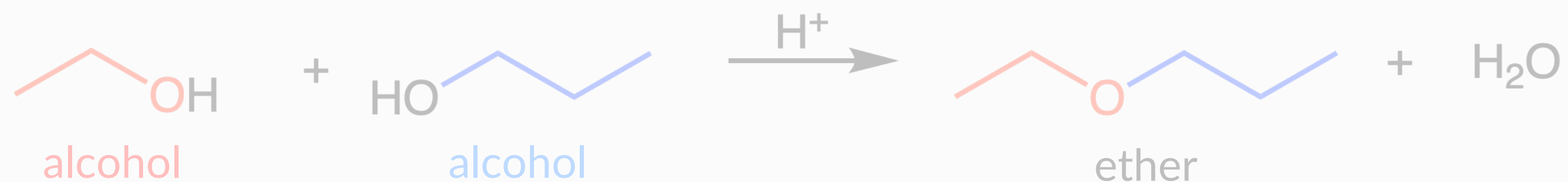
AMIDES



Recall: Making amides via condensation

In general terms, condensation reactions are: $A + B \rightarrow A-B + \text{small molecule (such as: H}_2\text{O, NH}_3\text{, HCl, etc.)}$

Reaction: combine two oxygenates into another oxygenate; requires an acid catalyst (H^+) or activator.



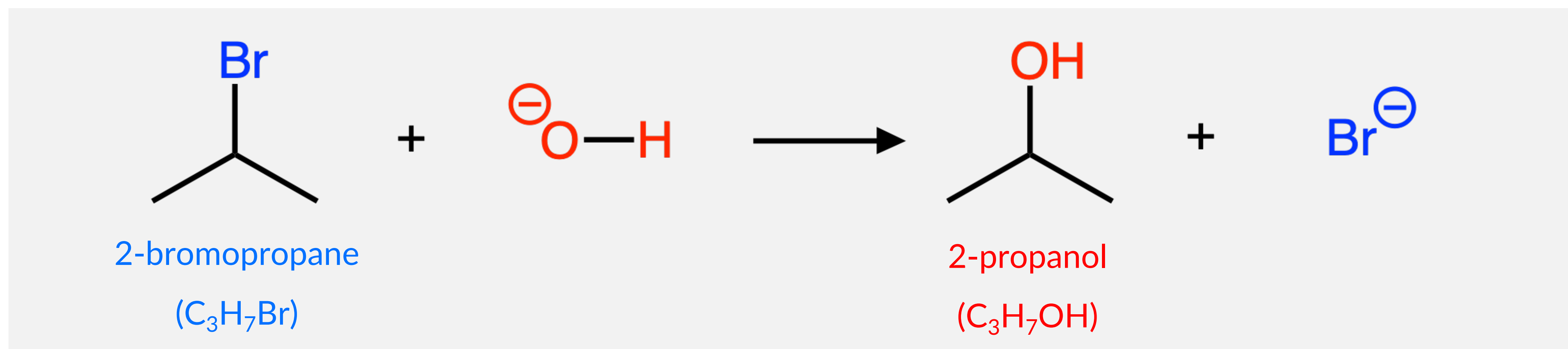
Recall: Nucleophilic substitutions (S_N)

This reaction requires a electrophile on the alkylhalide and a nucleophile.

Nucleophile: a group that is electronegative (negatively charged, an anion, a lone pair, etc.)

Electrophile: a group that is electron-deficient (positively charged, a cation, etc.)

Reaction: substitute an electrophile with a nucleophile on an alkylhalide (C_xH_yX , where $X = Cl, Br, I$).



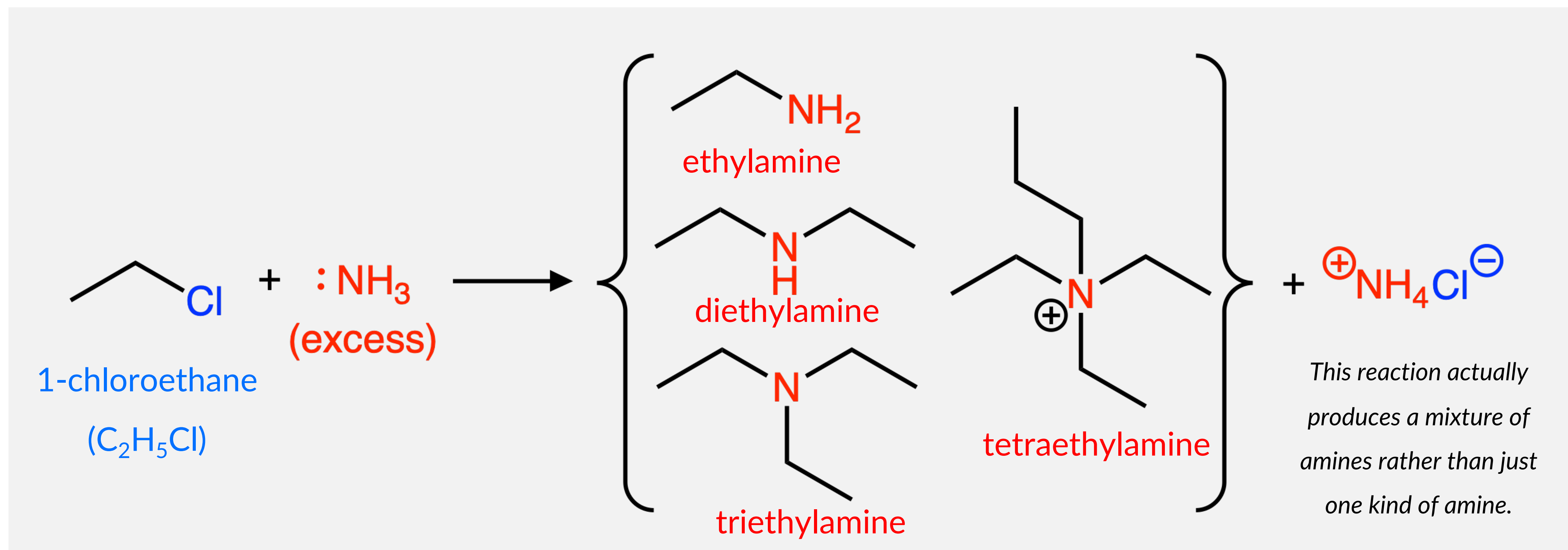
Making amines: Nucleophilic substitution (S_N)

This reaction requires an electrophile on the alkylhalide and a nucleophile.

Nucleophile: a group that is electronegative, **which is the lone pair on the ammonia (NH_3)**

Electrophile: a group that is electron-deficient (positively charged, a cation, etc.)

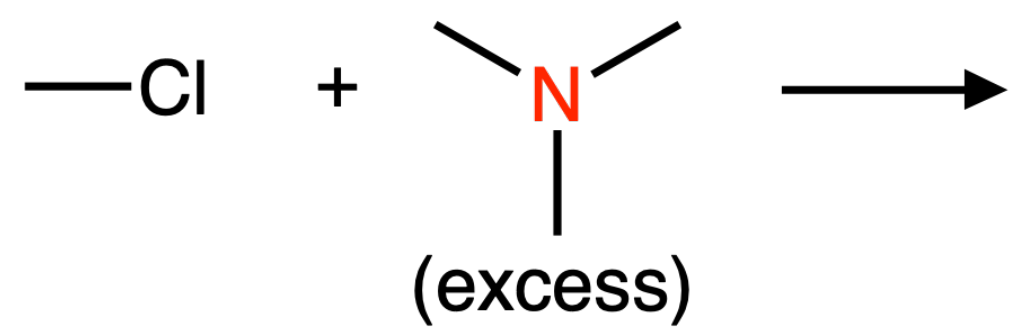
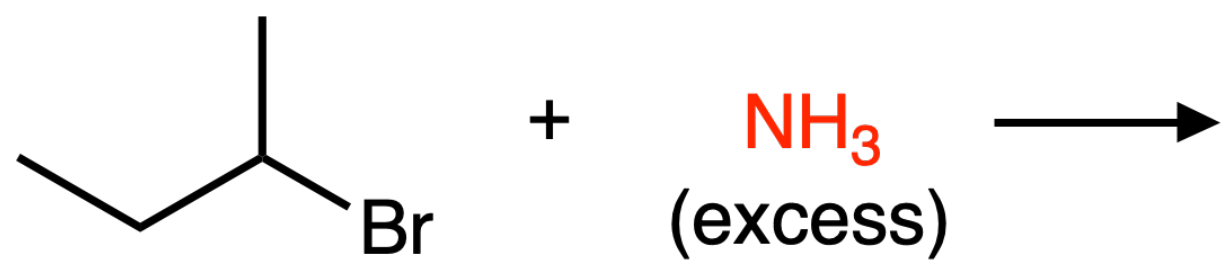
Reaction: substitute an electrophile with a **nucleophile (NH_3)** on an alkylhalide (C_xH_yX , where $X = Cl, Br, I$).



PRACTICE PROBLEM 1

Predict the amine(s) produced from the following nucleophilic substitution reactions.

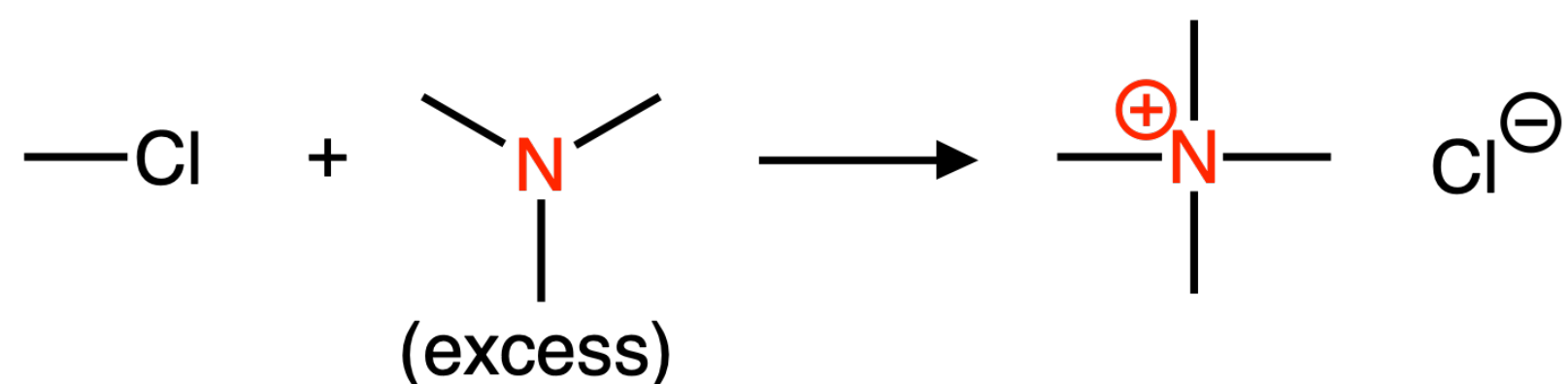
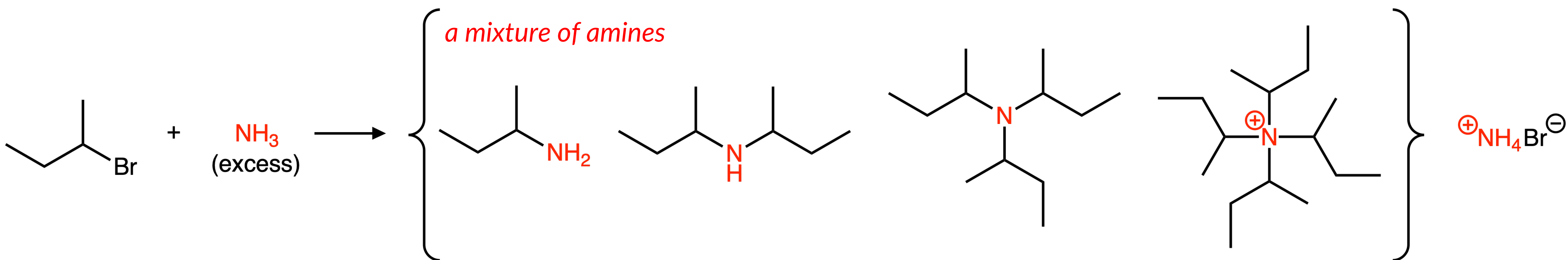
— *answer* —



PRACTICE PROBLEM 1

Predict the amine(s) produced from the following nucleophilic substitution reactions.

— answer —



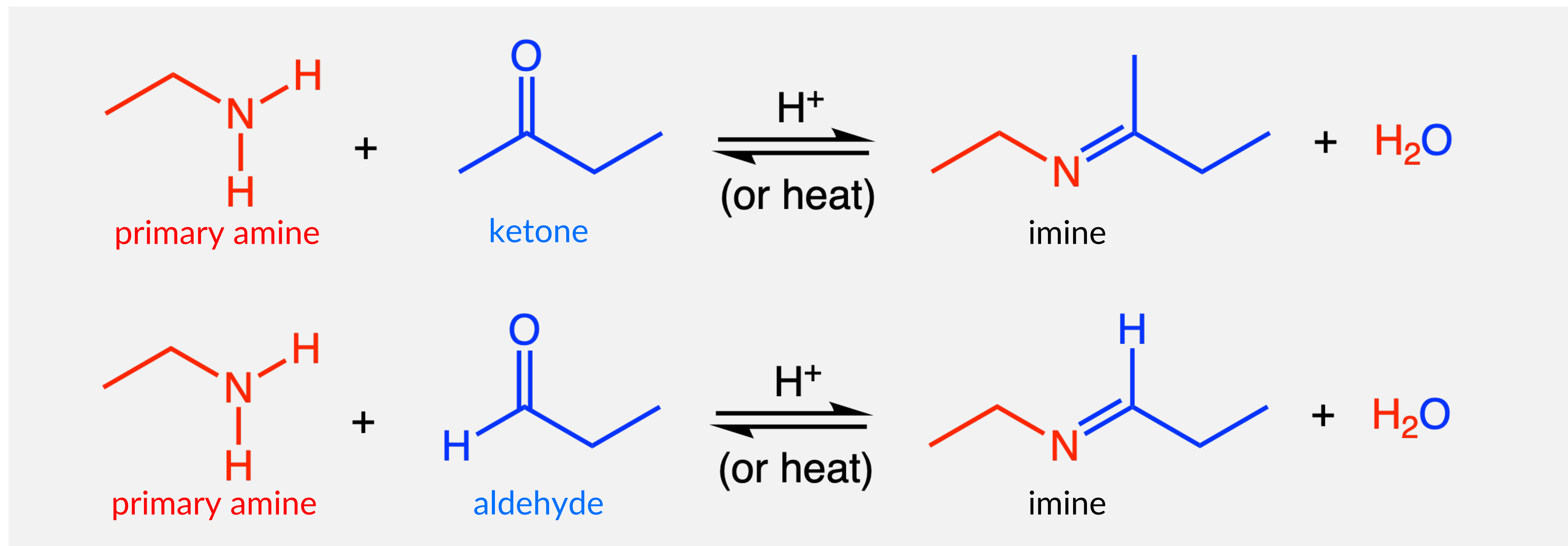
The first reaction shows the disadvantage of making amines using nucleophilic substitution because a mixture of substituted amines is produced.

The second reaction shows that this type of reaction could be useful for creating tetra-alkyl amines.

Making imines: Condensation reaction

This reaction requires a ketone or an aldehyde, a primary (1°) amine, and acid catalyst (H^+ , H_3O^+ , H_2SO_4 , etc.).

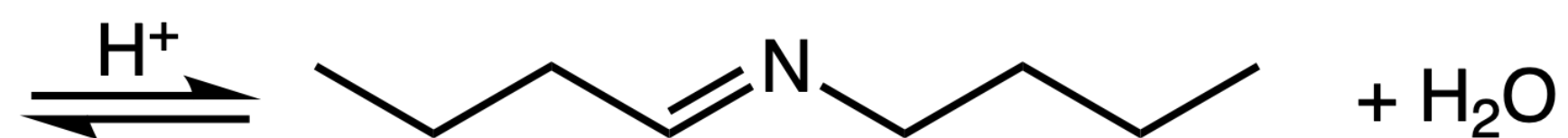
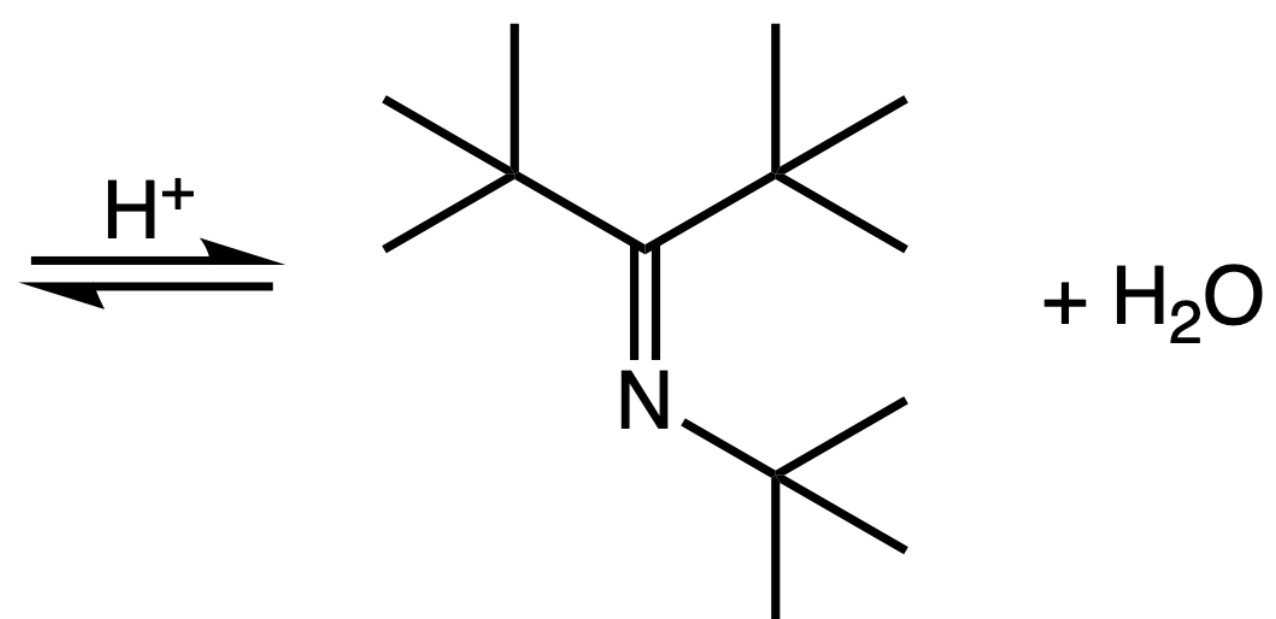
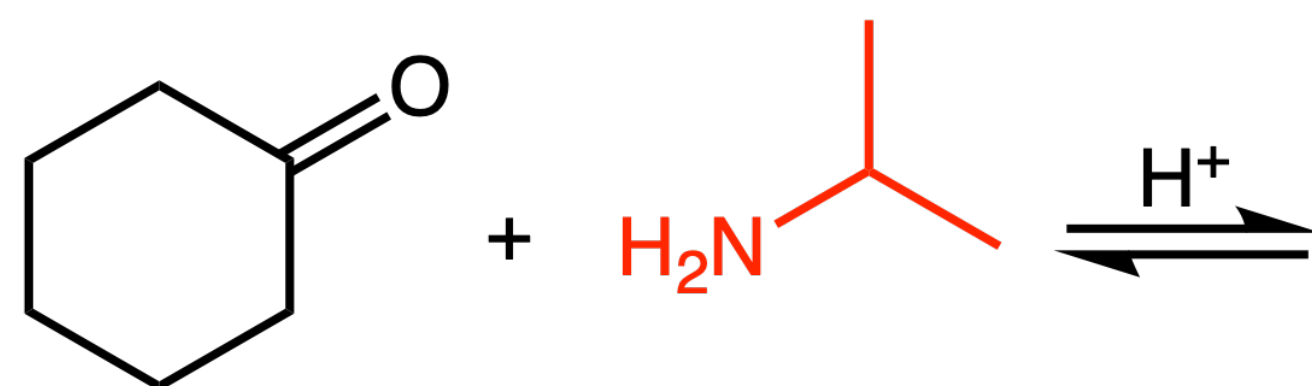
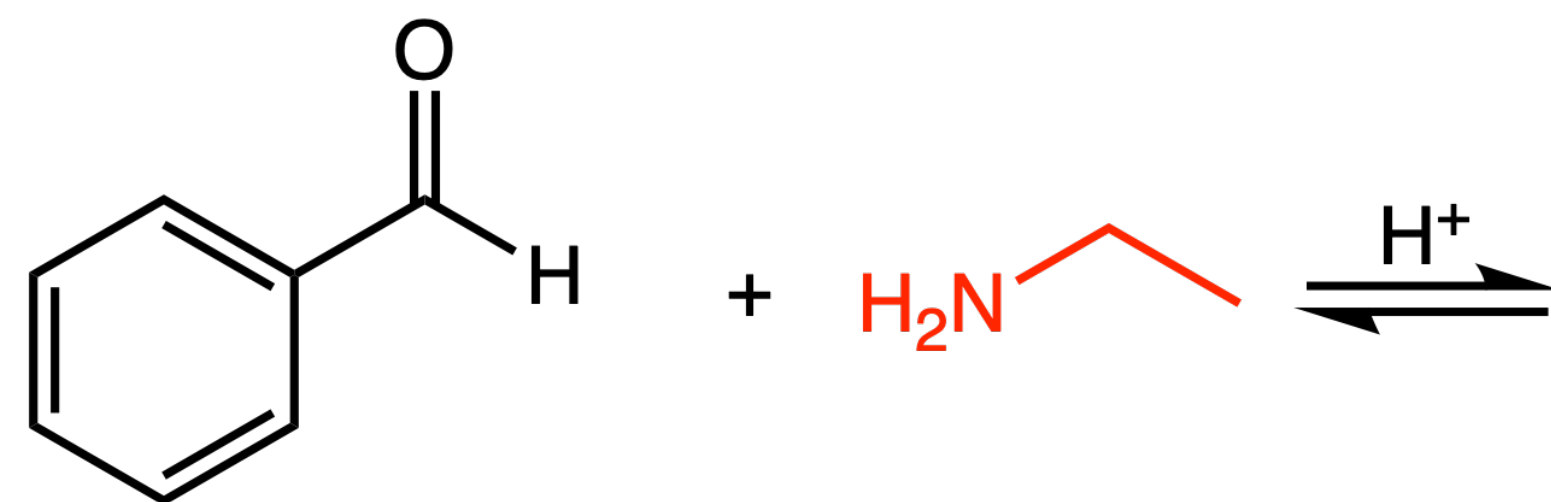
Reaction: combine an oxygenate and a primary amine with loss of a water (H_2O) molecule



PRACTICE PROBLEM 2

Provide the missing reactant(s) or product(s) for the following imine-synthesis reactions.

— answer —



PRACTICE PROBLEM 2

Provide the missing reactant(s) or product(s) for the following imine-synthesis reactions.

— answer —

