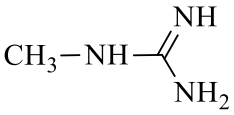
Problem Set 4.2

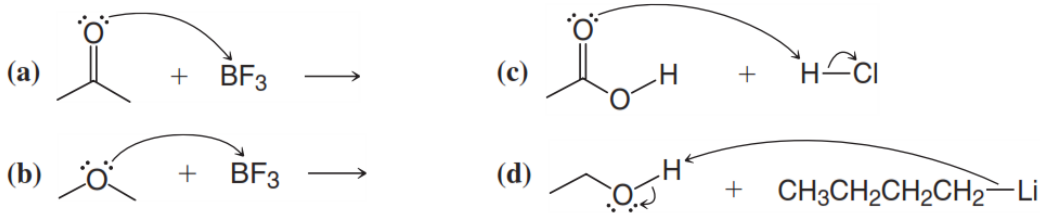
Introduction to organic reactions and their mechanisms

1) ** The following compound can become protonated on any of the three nitrogen atoms. One of these nitrogens is much more basic than the others, however.

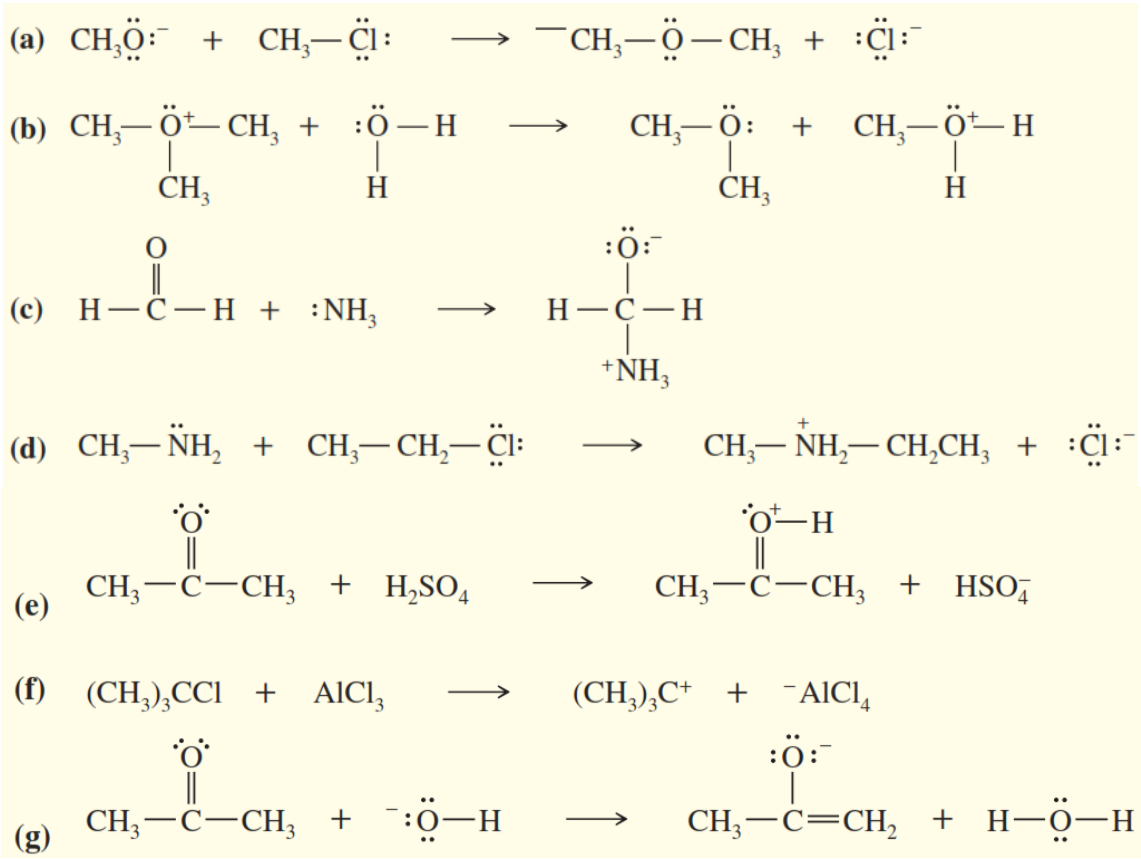


(a) Draw the important resonance forms of the products of protonation on each of the three nitrogen atoms.
(b) Determine which nitrogen atom is the most basic.

2) Follow the curved arrows and write the products.



3) Label the reactants in these acid–base reactions as Lewis acids (electrophiles) or Lewis bases (nucleophiles). Use curved arrows to show the movement of electron pairs in the reactions.



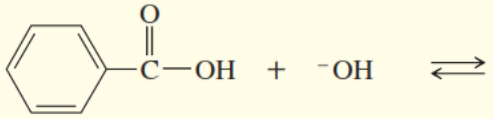
(h) $CH_2{=}CH_2 + BF_3 \longrightarrow \bar{B}F_3{-}CH_2{-}\overset{+}{C}H_2$

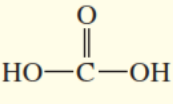
(i) $\bar{B}F_3{-}CH_2{-}\overset{+}{C}H_2 + CH_2{=}CH_2 \longrightarrow \bar{B}F_3{-}CH_2{-}CH_2{-}CH_2{-}\overset{+}{C}H_2$

4) Predict the products of the following acid–base reactions.

(a) $H_2SO_4 + CH_3COO^- \rightleftharpoons$

(b) $CH_3COOH + (CH_3)_3N: \rightleftharpoons$

(c)  $+ {}^-OH \rightleftharpoons$

(d)  $+ 2\ {}^-OH \rightleftharpoons$

(e) $H_2O + NH_3 \rightleftharpoons$

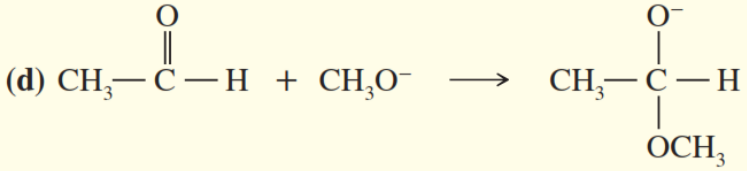
(f) $(CH_3)_3\overset{+}{N}H + {}^-OH \rightleftharpoons$

5) In each reaction, label the reactants as Electrophiles or nucleophiles. Use curved arrows to show the movement of electron pairs in the reactions. Draw in any nonbonding electrons to show how they participate in the reactions.

(a) $(CH_3)_2NH + HCl \longrightarrow (CH_3)_2\overset{+}{N}H_2 + Cl^-$

(b) $(CH_3)_2NH + CH_3Cl \longrightarrow (CH_3)_3\overset{+}{N}H + Cl^-$

(c) 

(d) 

(e)