1. (24) Show the first complete step of the arrow-pushing mechanism for each of the following, and, for parts a through d only, draw the consequence of your arrows:

a) \[
\text{O} + \text{LiN}^3\text{Pr}_2 \quad \rightarrow \quad \text{"LDA"}
\]

b) \[
\text{O} + \text{HBr} \quad \rightarrow
\]

c) \[
(\text{MeO}_2\text{C})_2\text{CHLi} + \quad \rightarrow
\]

d) \[
\text{HB} + \quad \rightarrow
\]

e) \[
\text{H}_3\text{C} + \quad + \quad \text{H}_3\text{O}^+ \quad \rightarrow
\]

f) \[
\text{NaBHEt}_3 + \quad \rightarrow
\]

g) \[
\text{O} + \quad + \quad \text{NH} \quad \rightarrow
\]
*2. (5) In each of the following, show one other satisfactory resonance form involving both functional groups.

a) ![Resonance form a)](image)

b) ![Resonance form b)](image)

*3. (21) Show reasonable products, or missing reactants, for each of the following.

a) ![Reaction a)](image)

b) ![Reaction b)](image)

c) ![Reaction c)](image)

d) ![Reaction d)](image)

You need not show absolute stereochemistry but you should show relative stereochemistry.

e) ![Reaction e)](image)
5. (6) Circle the most acidic H in each of the following (you may have to draw the H).

a)  

b)  

c)  

d)  

6. (13) Show reasonable, complete arrow-pushing mechanisms for each of the following.

a)  

Show the arrow-pushing mechanism for Steps A and B only.

b)  

+  \rightarrow  +  

*7. (8) For each of the following reactions, explain briefly but clearly the observed results.

a)  

\[
\begin{align*}
\text{Ph} - \text{N} - \text{Ph} + \text{PhLi} &\rightarrow \text{Ph} - \text{H} - \text{N} - \text{Ph} \\
\text{H}^+ &\rightarrow \text{Ph} - \text{C} - \text{H} \quad + \quad \text{HN} - \text{Ph}
\end{align*}
\]

The top reaction is much faster than the bottom reaction. Why?

b)  

\[
\begin{align*}
\text{OH} \quad \text{OH} &\rightarrow \text{OH} \quad \text{CH}_3\text{OC} \quad \text{Ph}_3\text{CCl} \quad \text{Et}_3\text{N}
\end{align*}
\]

No reaction at the other OH functionality
8. (5) For the reaction shown, draw the likely intermediate and explain the product stereochemistry.

\[
\text{LDA} \quad \text{intermediate} \quad \text{Br} \quad \text{product}
\]

9. (10) Indicate whether each of the following would usually be a nucleophile / base or an electrophile. You need not explain your answer.

a) POCl₃  b) MnO₂  c) LiAl(O^tBu)_3H  d) F₂  e) SF₆

f) Me₂N(CH₂)₂NH₂  g) Me₃SiBr  h) HOCl  i) LiMe₃BH  j) Al^tPr₃

10. (5) Show two routes for the transformation of the starting material to the product shown.

\[
\text{starting material} \quad \text{product}
\]

11. (3) What is wrong with the process shown below?

\[
\text{starting material} \quad \text{BuLi} \quad \text{MeI} \quad \text{product}
\]