Problems from Carey: 8.1; 8.4; 8.5; 8.6; 8.7; 8.17; 8.19; 8.31 (this is a really good problem!).

Additional nucleophilic substitution problems:

1. Give the product or products of the following reactions:

   a. 

   b. 

2. Supply the following reactions with starting materials which would give the observed products:

   a. 

   b. 

   c. 

3. Give the reagents over the arrow that would give the following products from the following starting materials (don't forget solvents!):

   a. 

   b. 

   c.
Problem Set 8.2

Problems from Carey: 8.9; 8.11; 8.23; 8.29.

Additional nucleophilic substitution problems:

1. Give the product or products of the following substitution reactions:

   a. \[ \text{CH}_3 \text{CH}_2 \text{CH}_2 \text{OH} \xrightarrow{\Delta} \text{OSO}_2\text{CH}_3 \]

   b. \[ \text{(CH}_3)_2\text{CH} \xrightarrow{\Delta} \xrightarrow{\Delta} \text{CH}_3\text{CH}_2\text{OH} \]

   c. \[ \text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\Delta} \xrightarrow{\Delta} \text{CH}_3\text{CH}_2\text{OH} \]

2. Supply the following reactions with starting materials which would give the observed products:

   a. \[ \text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\Delta} \xrightarrow{\Delta} \text{and} \text{OCH}_2\text{CH}_3 \]

   b. \[ \text{(CH}_3)_2\text{CHOH} \xrightarrow{\text{H}_2\text{SO}_4, \Delta} \xrightarrow{\text{(CH}_3)_2\text{CHOH}} \]

3. Give the reagents over the arrow that would give the following products from the following starting materials (don't forget solvents!):

   a. \[ \xrightarrow{\Delta} \text{OCH}_2\text{CH}_3 \text{CH}_2\text{OH} \]

   b. \[ \xrightarrow{\Delta} \text{Br} \xrightarrow{\Delta} \text{CH}_3\text{COOH} \]

4. Give the mechanisms for the starred transformations above.
Homework Sheet 8.3; Substitution and Elimination Problems
TOGETHER (the whole ball of wax)

Problems from Carey: 8.12; 8.13; 8.14; 8.16; 8.30; 8.31; 8.38.

Additional problems:

1. Predict all the products from the following reactions. If more than one of a particular kind of product (substitution or elimination) is formed, label them major or minor.

   a. 1-iodo-1-isopropylcyclopentane
      \[\text{CH}_3\text{OH}^{\text{Na}}\rightarrow\text{OCH}_3\]

   b. \[\text{CH}_3\text{CN}^{\text{NaN}_3}\rightarrow\text{OCH}_3\text{CH}_3\]

   c. \[\text{EtOH}^{\text{Na}}\rightarrow\text{OtBu}_{\text{EtMe}}\]

   d. \[\text{CH}_2\text{OH}^{\text{Na}}\rightarrow\text{OMe}_{\text{MeCH}_2\text{CH}_3}}

   e. \[\text{OH}^{\text{H}_2\text{SO}_4}\rightarrow\text{PhOH}, \Delta\]

   f. \[\text{CH}_2\text{OH}^{\text{Na}}\rightarrow\text{OEt}_{\text{EtOH}}\]
2. Supply starting materials that would give the observed products under the conditions shown:

a. \( \text{Br} \xrightarrow{\text{H}_2\text{O}, \Delta} \text{H} \)

\[ \text{NaOCH}_2\text{CH}_3 \xrightarrow{\Delta} \text{CH}_3 \text{-} \text{CH}_2\text{CH}_3 \text{CH}_2\text{CH}_3 \text{CH}_2\text{CH}_3 \]

ONLY THIS GEOMETRIC ISOMER!

b. 

\[ \text{H}_2\text{SO}_4 \xrightarrow{\text{EtOH}, \Delta} \text{CH}_3 \text{-} \text{CH}_2\text{CH}_2\text{CH}_3 + \text{CH}_2\text{CH}_2\text{CH}_3 \]

(only E1 products shown, SN1 possible but not shown)

d. 

\[ \text{K} \xrightarrow{\text{OCH(CH}_3)_2} \text{CH}_3 \text{OCH(CH}_3)_2 \text{CH}_2\text{CH}_2\text{CH}_3 \]

3. Supply reagents which will perform the conversion of the following starting materials to the products shown. Don't forget solvents!

a. 

\[ \text{OH} \xrightarrow{} \text{CH}_3 \text{C}_2 \text{H}_5 \text{C}_2 \text{H}_5 \text{C}_2 \text{H}_5 \text{C}_2 \text{H}_5 \]

(can you draw a mechanism to account for both of these E1 products?)

b. 

\[ \text{CCH}_2 \text{I} \xrightarrow{} \text{H} \text{-} \text{C} \equiv \text{C} \text{-} \text{H} \]

c. 

\[ \text{CH}_3 \text{-} \text{H} \text{OPO}_3\text{Et} \xrightarrow{} \text{Me} \text{-} \text{Me} \]

d. 

\[ \text{Br} \text{H} \xrightarrow{} \text{OEt} \text{H} \text{OEt} \]

4. a. In comparing the nucleophilicity of MeONa and MeCO\(_2\)Na, it was found that MeONa was the stronger nucleophile, why is this?
b. Which of the following two alcohols will undergo dehydration (elimination) faster under acidic conditions? Why?

\[ \text{OH} \quad \text{or} \quad \text{OH} \]

c. Ethers can be made by the reaction of alkyl halides and sodium or potassium alkoxides (see equation below). Using this method, outline all steps in two conceivable alternative routes to \( \text{tert} \)-butyl ethyl ether (\( t\text{-Bu-O-Et} \)). One of these routes gives excellent yields, the other is worthless. Which is the worthless route, and why? Explain using the mechanisms you outlined in your routes.

\[
\text{R-X} + \text{R'ONa} \rightarrow \text{R-O-R'} + \text{NaX}
\]

alkyl sodium ether halide alkoxide

5. The following are reactions which are not obvious, they are a little tricky. Look carefully and predict products based on what can happen (i.e. look at the mechanisms!). PS- something CAN happen, I’m not being that tricky!

a. 2-methyl-2-butene \( \xrightarrow{\text{CH}_3\text{CO}_2\text{Na, EtOH, } \Delta} \)

b. \( \xrightarrow{1) \text{HBr}} \)

\( \xrightarrow{2) \text{Na}\text{C} \equiv \text{CCH}_3, \text{DMSO}} \)