

1. \_\_\_\_\_

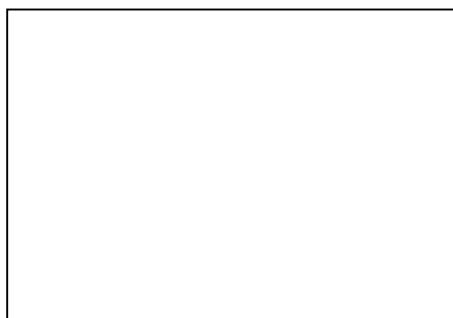
4. \_\_\_\_\_

2. \_\_\_\_\_

5. \_\_\_\_\_

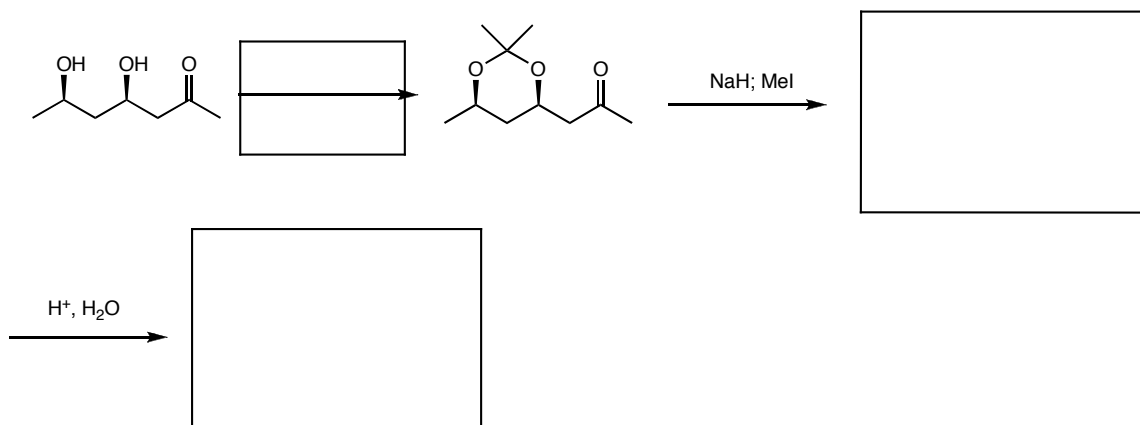
3. \_\_\_\_\_

6. \_\_\_\_\_

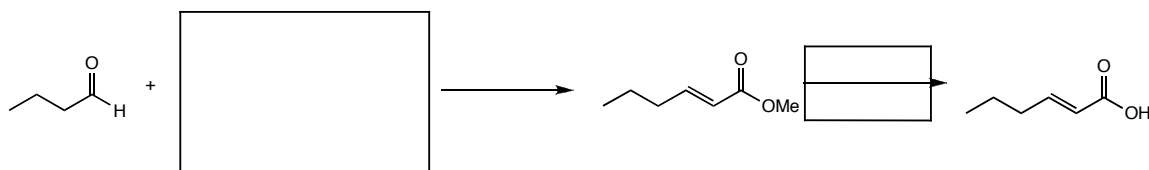


1. Fill in the blanks on the following reactions. Assume one equivalent unless otherwise noted, and that all reactions are quenched (5 pts ea.)

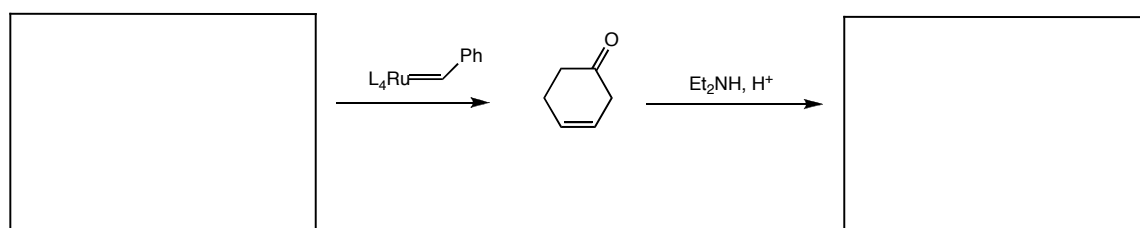
(a)



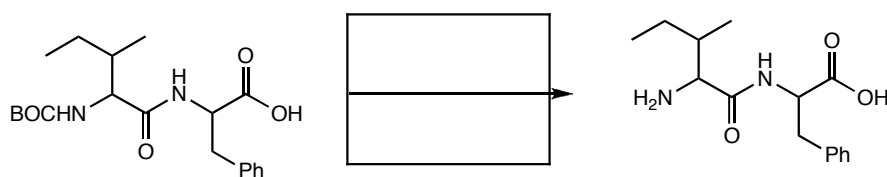
(b)



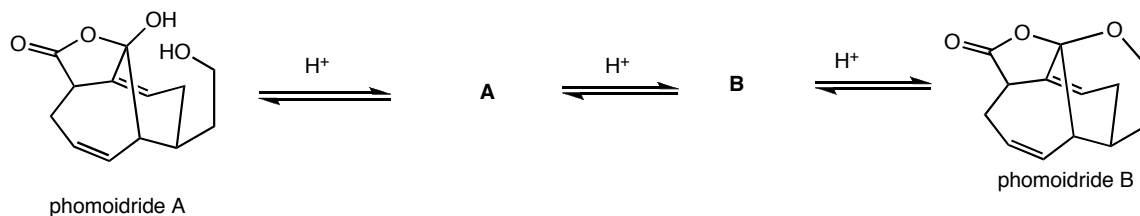
(c)



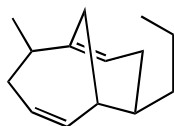
(d)



2. Two natural products, phomoidride A and B, have been isolated by Pfizer from the fermentation broth of a fungus growing on a Juniper tree in Texas. A small portion of phomoidrides A and B is shown below. The ratio of the two compounds in aqueous solution is pH dependent, and is proposed to proceed through two intermediates **A** and **B**.

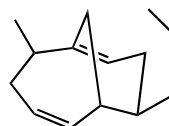


(a) Propose a structure for compounds **A** and **B**. Some important structural features for each one are provided below. For your convenience, a partial skeleton is provided below. Simply fill in the appropriate functional groups. (4 pts)



**A**

$^{13}\text{C}$ : contains a carboxylic acid or ester  
and a ketone.  
IR: broad OH

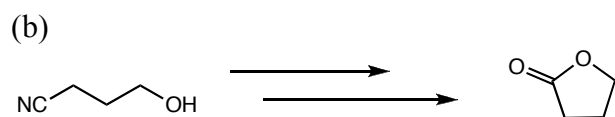
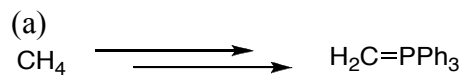


**B**

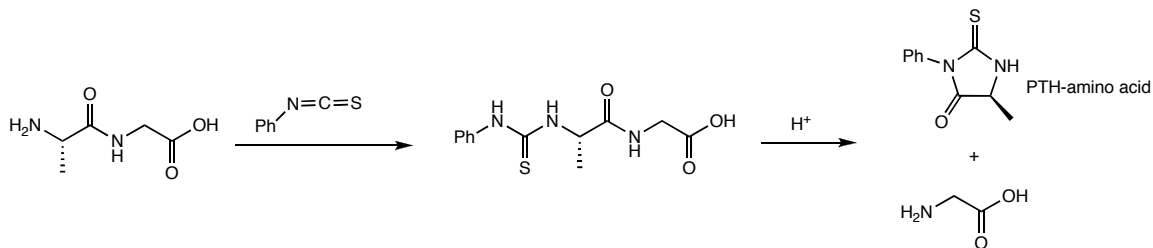
$^{13}\text{C}$ : contains a  
carboxylic acid or ester  
IR: broad OH

(b) Propose a mechanism for the conversion of phomoidride A into phomoidride B, going through the intermediates **A** and **B**. You may make liberal use of R groups, and do not have to draw the complicated ring system above. (10 pts)

3. Propose a synthesis of the following compounds, using the given starting materials, and any other organic or inorganic reagent needed. (8 pts ea.)

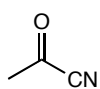


4. In order to determine the sequence of amino acids in a peptide, researchers often use the Edman degradation, which cleaves one peptide at a time from the *N*-terminus. The cleaved amino acid is converted into a PTH-amino acid, which can be characterized to determine which amino acid was cleaved. An example of the Edman degradation is shown below.



Propose a mechanism for the formation of the intermediate above and the PTH-amino acid. (10 pts)

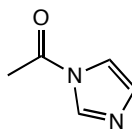
5. Rank the following carbonyls according to their reactivity in a nucleophilic acyl substitution (relevant pKa values are given below). (6 pts)



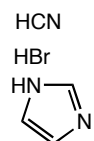
**A**



**B**



**C**



pKa

9.4

-9

19

most reactive

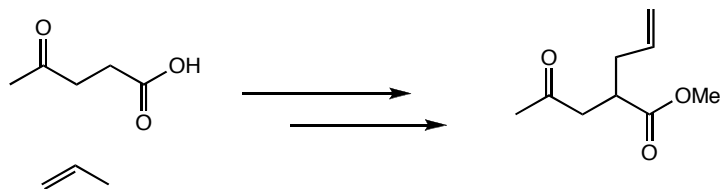
least reactive

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

6. Given the starting materials on the left, propose a synthesis of the target compound. You may use any other organic or inorganic reagent necessary. (14 pts)



6. Sketch a ddd (doublet of doublet of doublets), in which all three coupling constants are different. (8 pts)