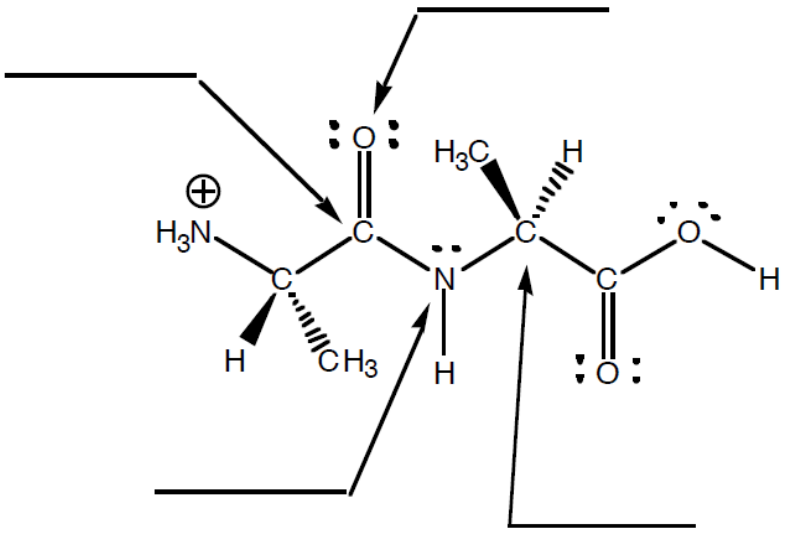
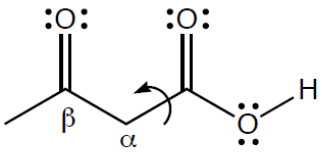
For the structure below, circle all C-N bonds that DO NOT rotate.

As drawn, is the structure at the appropriate protonation state for pH 2.0, pH 7.0, or pH 10.0 ?

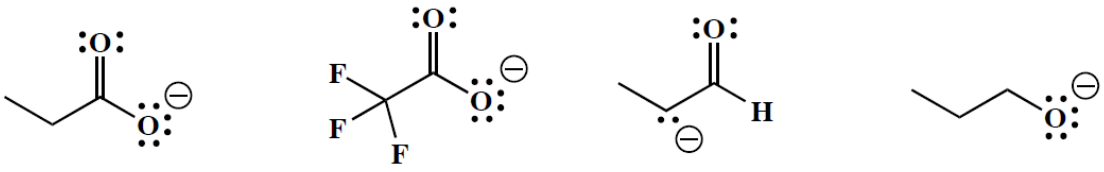
On the lines, indicate the hybridization state of each atom indicated by the arrows.



Decarboxylation of a β-Keto Acid

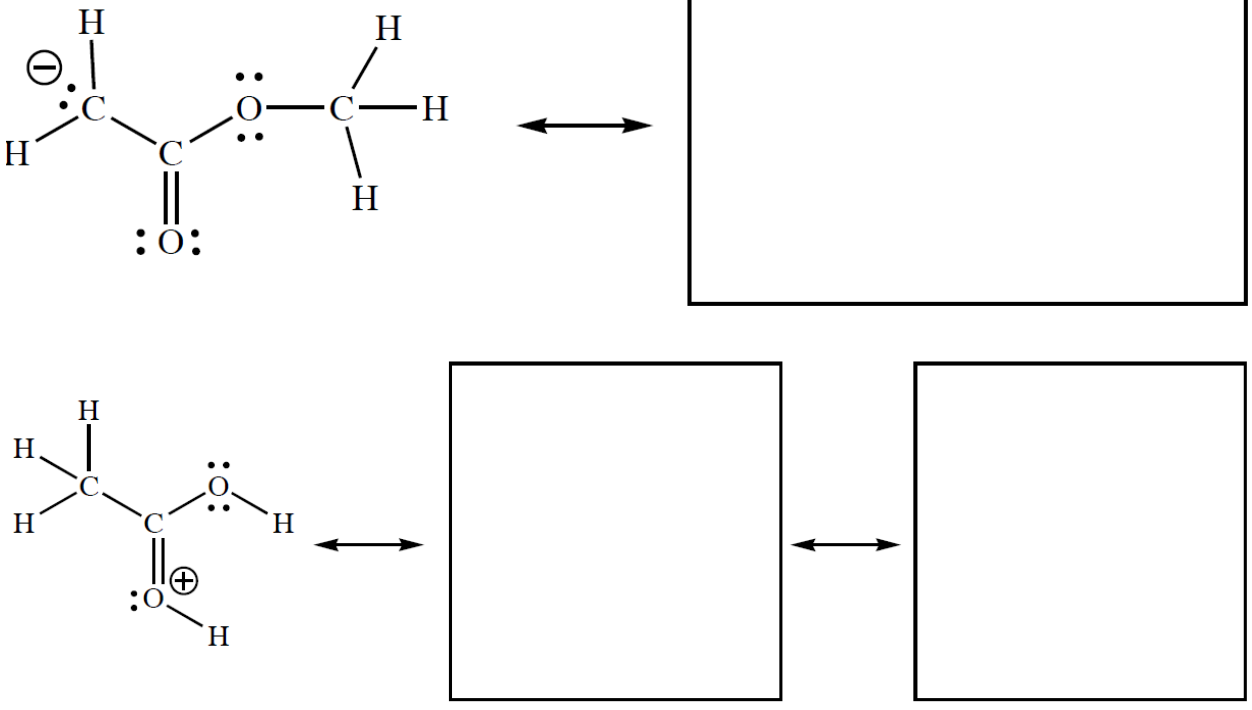


Rank the following in terms of anion stability, with a **1 under the anion that is the most stable** and a **4 under the anion that is least stable.**



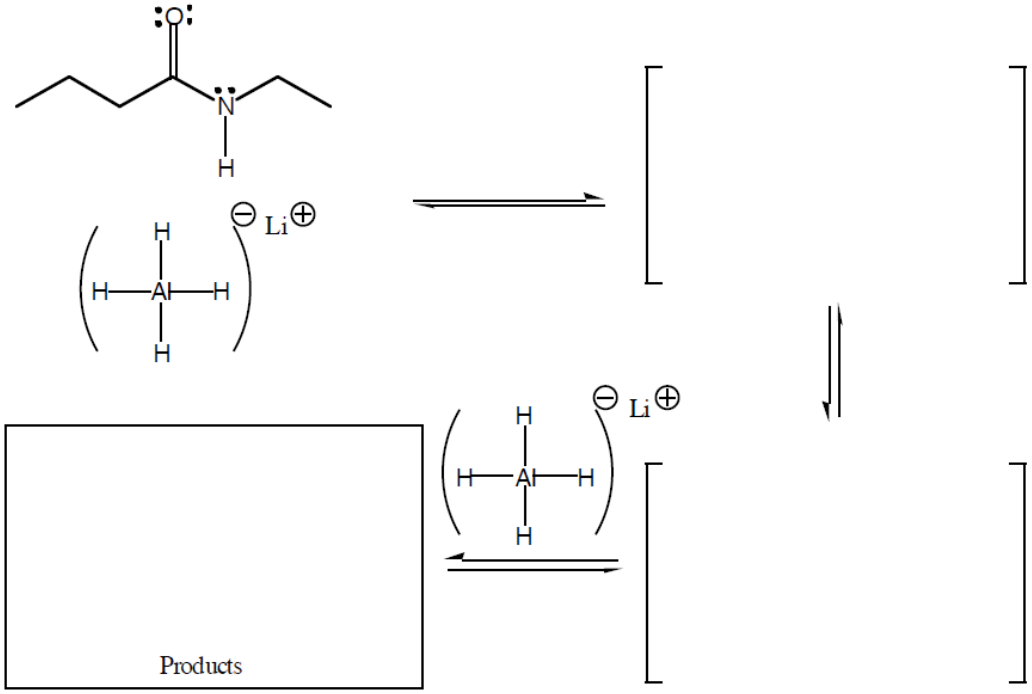
_____ _____ _____ _____

For the two molecules below, draw the indicated number of MOST important resonance contributing structures. Be sure to show all lone pairs and formal charges. You do not have to draw any arrows.



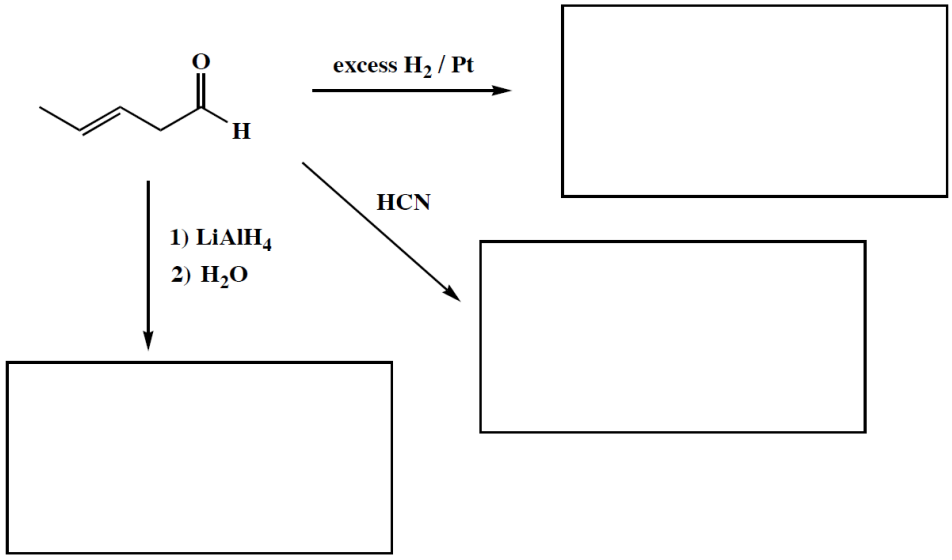
15. (13 points) Complete the following mechanism. Be sure to use arrows to indicate movement of all electrons and show all lone pairs and formal charges. Also, you must show all the products of each step. For resonance stabilized intermediates, you only need to draw one important contributing structure.

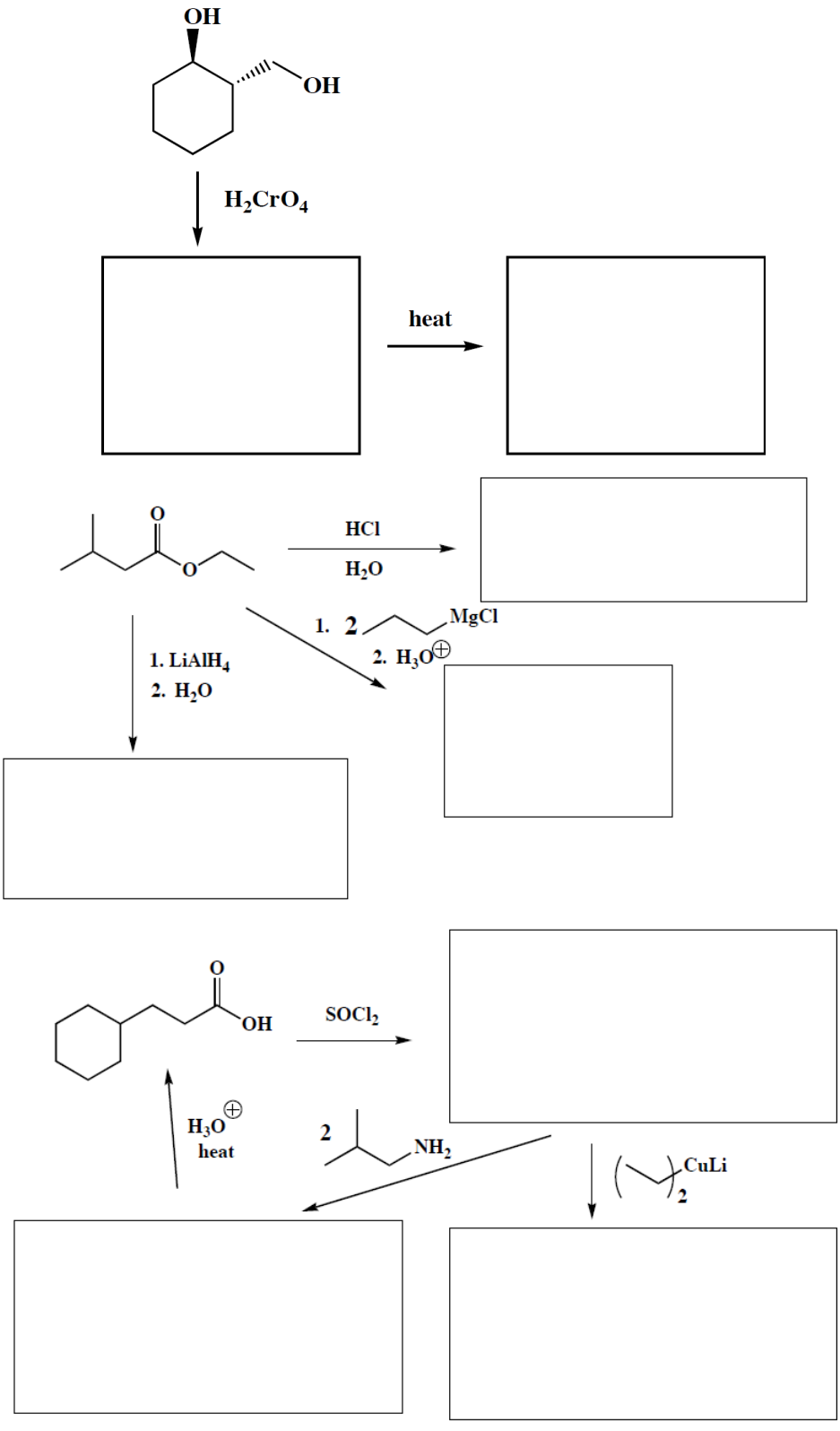
Reduction of Amides with $LiAlH_4$



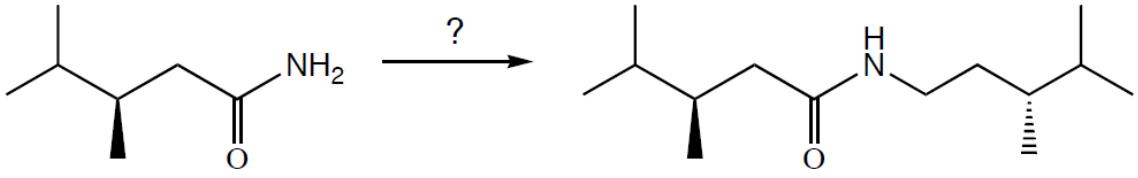
Note: In this reaction the chemist opens the flask and adds water in a second step that quenches any excess $LiAlH_4$. Therefore, you need a second step to add water when using this reaction in synthesis even though it is not shown in the mechanism above.

Complete the reactions below:

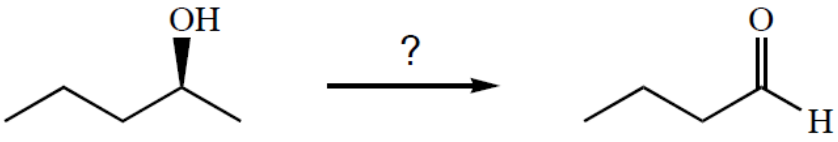



OH
OH
H_2CrO_4
heat
O
O
HCl
H_2O
1. 2
MgCl
2. $H_3O^{\oplus}$
1. $LiAlH_4$
2. H_2O
O
OH
$SOCl_2$
$H_3O^{\oplus}$
heat
2
NH_2
CuLi
2

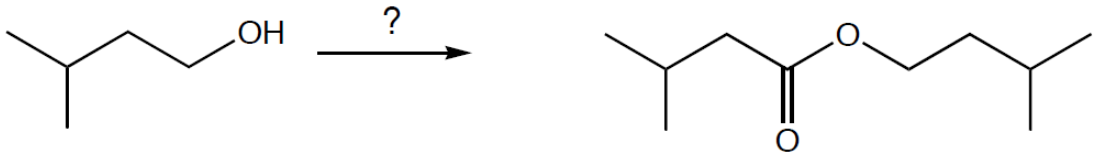
All of the carbons of the product must come from the given starting material.



All of the carbons of the product must come from the given starting material.



All of the carbons of the product must come from the given starting material.



All of the carbons of the product must come from the given starting materials.