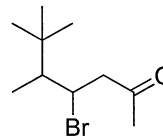
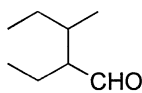
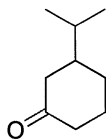
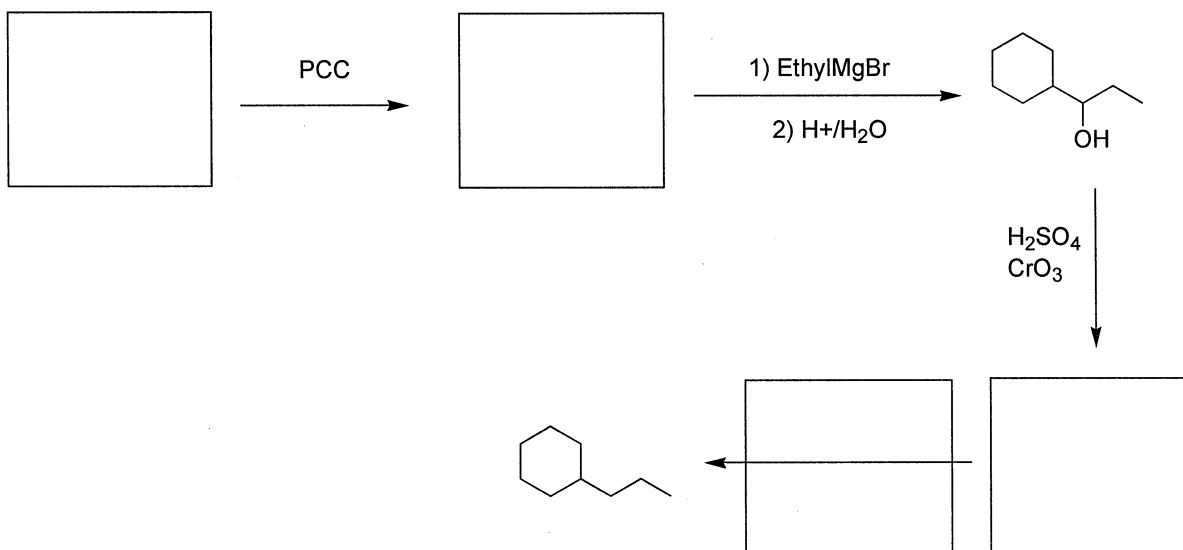


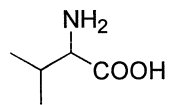
1. (3 pts each) Provide the IUPAC names for the following compounds:



2. (3 pts each) Provide the missing starting materials, reagents, or products.

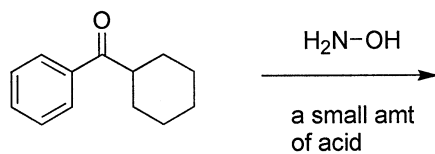
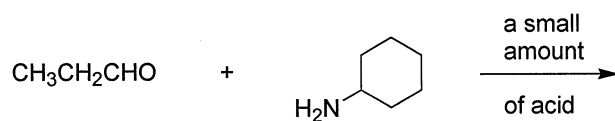


3. (5 pts) Suggest a synthesis of **valine** (an alpha-aminoacid) starting from **2-methylpropanal**.

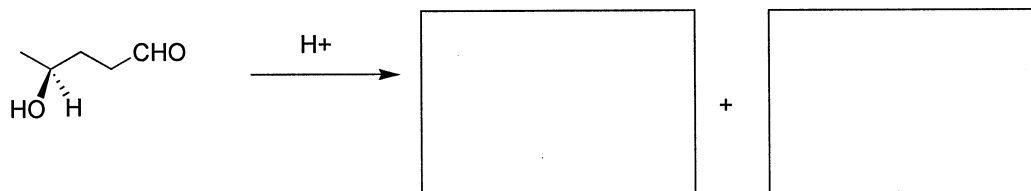


Valine

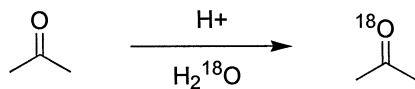
4. (3 pts each) Draw all organic products of the following reactions. **Do not forget stereoisomers!** There is no need to show mechanism in this problem; however, your knowledge of mechanism may help you solve the problem.



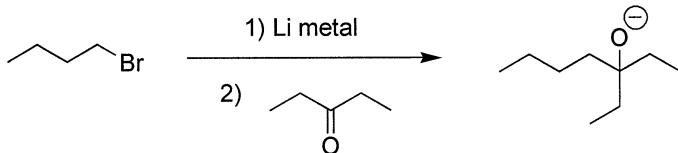
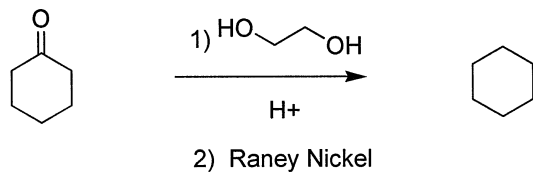
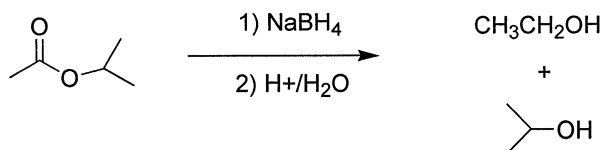
5. (5 pts) Hydroxy aldehyde **A** readily cyclizes (reacts with itself) in mild acid to form a **hemiacetal**. Draw the two stereoisomers formed in this reaction. **What is the relationship** (enantiomers, diastereomers, same compound) between the two drawn stereoisomers?



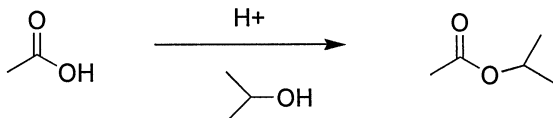
6. (4 pts) When acetone is dissolved in aqueous acid containing isotopically labeled H_2O (H_2^{18}O), the carbonyl group becomes labeled with ^{18}O . **Draw the mechanism** that explains this observation. **Hint: think hydrate formation!**



7. (2 pts each) The following syntheses do not yield the indicated product. **State why.**

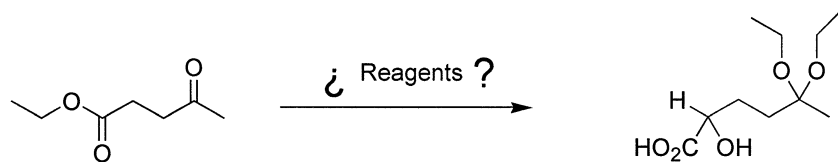


8. (4 pts) Draw the mechanism for the following Fischer esterification reaction.

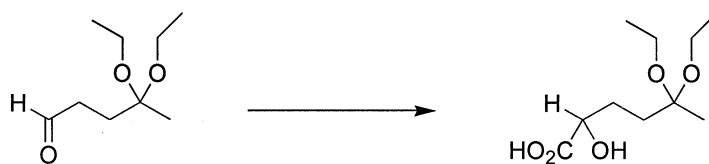


Extra Credit!

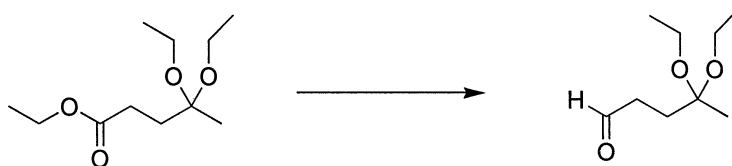
The following transformation requires multiple steps. Consider it carefully and answer the following questions to think "backwards" from the product.



9. (3 pts) The final product is an alpha-hydroxyacid. How do you go forward to the product?



10. (3 pts) How can you get to the above aldehyde from an analogous ester?



11. (3 pts) Finally, how do we go forward from the starting material to the above ester?

