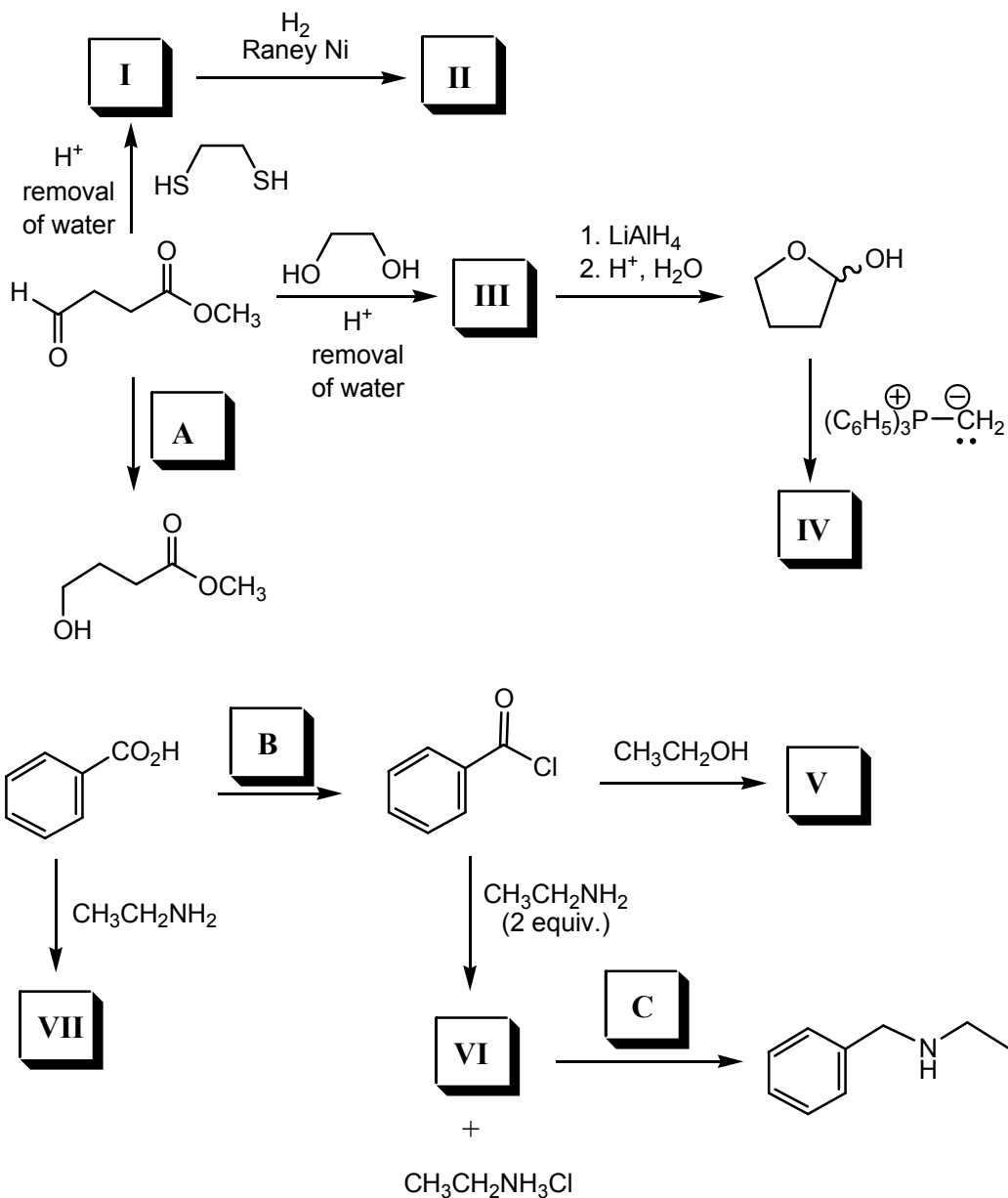
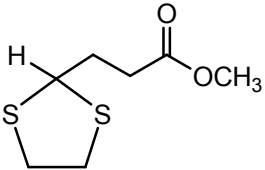
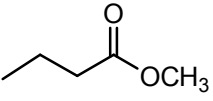
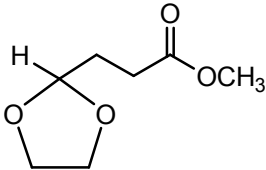
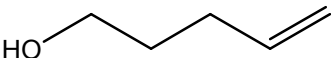
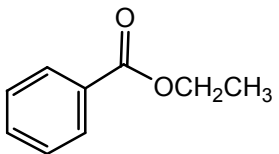
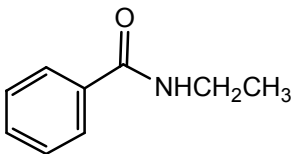
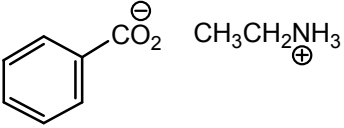


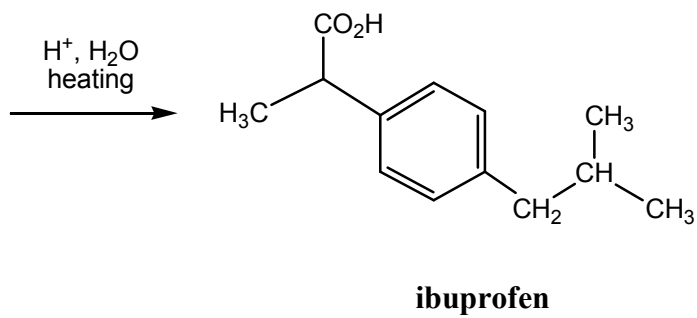
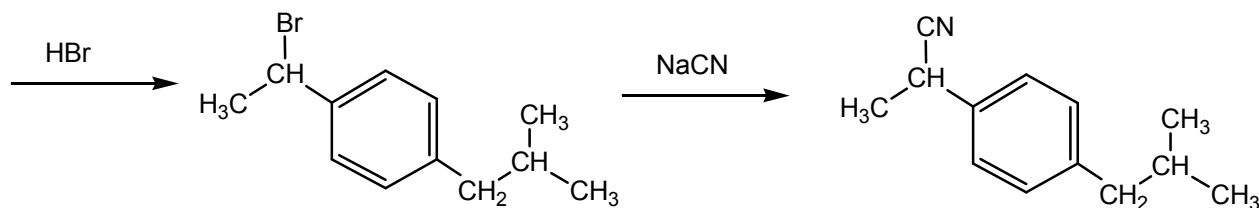
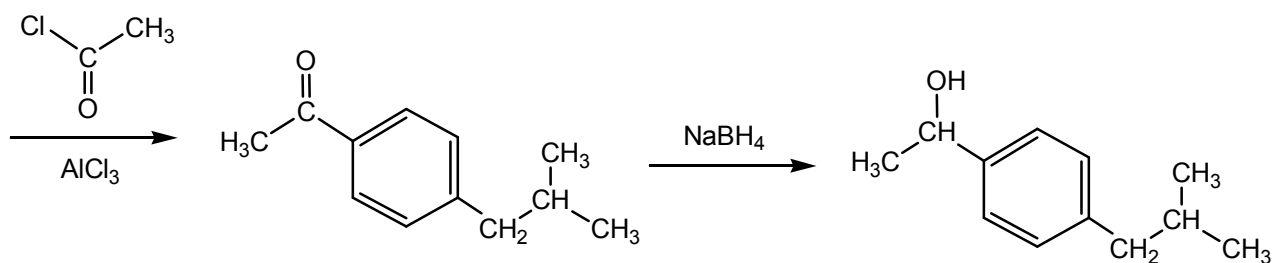
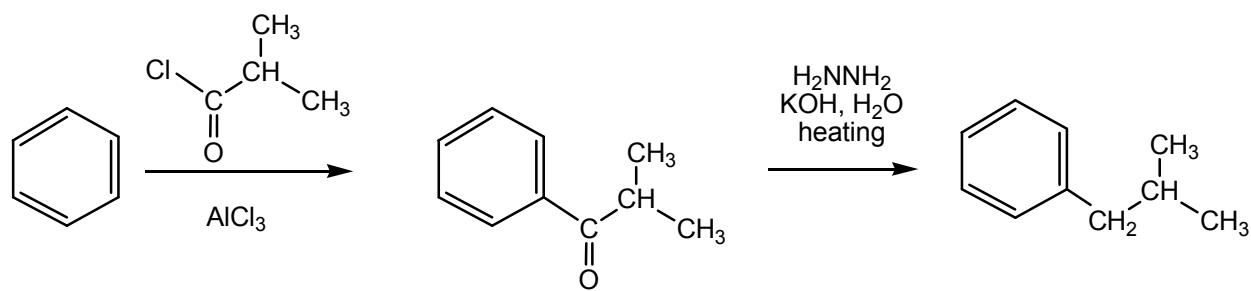
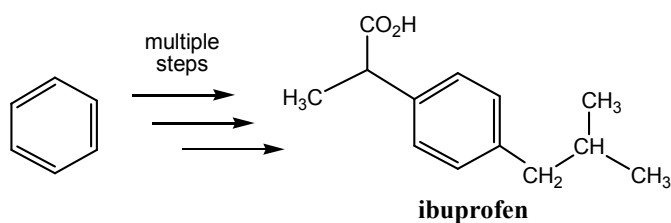
II. Use the provided table and fill in compound structures and reagents for the following synthesis. Make sure your answer is correctly put in the designated box of the given table. **No partial point will be given for the misplaced answer.** (20 points)



<b>I:</b> 	<b>II:</b> 	<b>III:</b> 
<b>IV:</b> 	<b>V:</b> 	<b>VI:</b> 
<b>VII:</b> 	<b>A:</b> 1) $\text{NaBH}_4$ 2) $\text{H}_2\text{O}, \text{H}^+$	<b>B:</b> $\text{SOCl}_2$ or $\text{PCl}_3$
<b>C:</b> 1) $\text{LiAlH}_4$ 2) $\text{H}_2\text{O}, \text{H}^+$		

**Continue to the Next page**

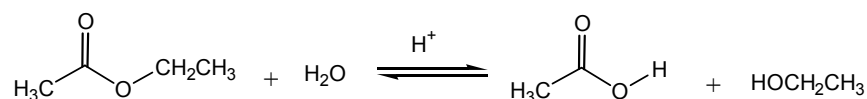
III. Show how ibuprofen can be prepared from benzene. You can use any reactants with four or less carbons. (10 points)



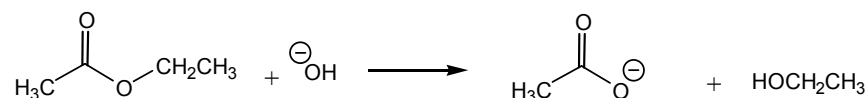
**Continue to the Next page**

IV. Propose an electron-pushing mechanism for each of the following reactions. Briefly explain why the hydrolysis of ester in acidic condition is reversible (reaction a) while in basic condition (reaction b) is irreversible. (10 points)

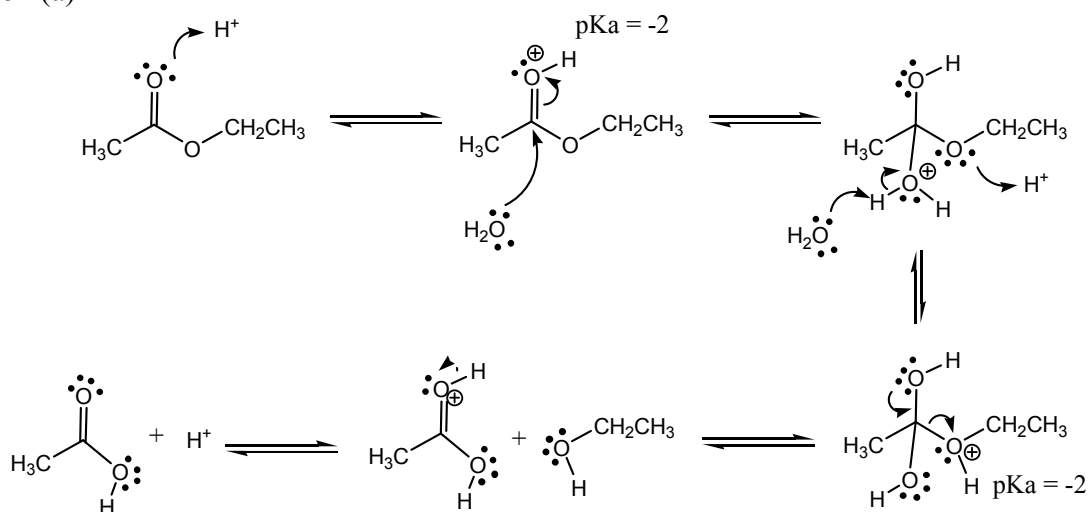
(a)



(b)

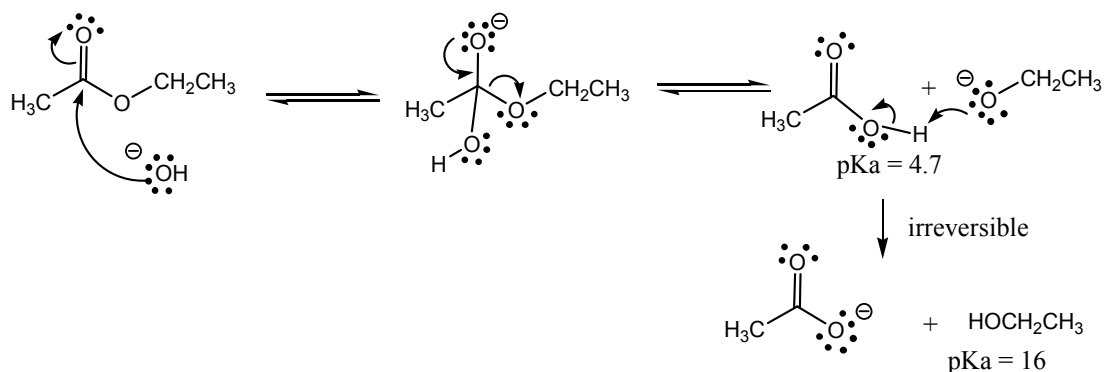


For reaction (a)



Every step is reversible due to the similar pKa of the acidic protons of intermediates and acid catalyst.

For reaction (b)



The last step is irreversible due to the large difference in the pKa between carboxylic acid and ethanol.