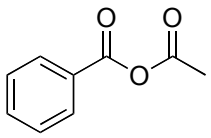
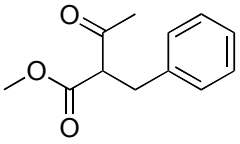
A. Nomenclature (12 total points)

Please provide an acceptable name for each of the following compounds, noting stereochemistry where appropriate.

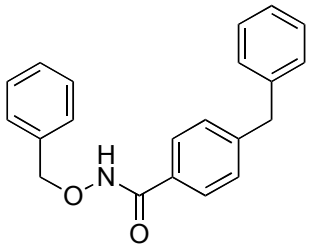
1.



2.



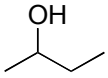
3.



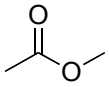
Draw the structure of adipic acid. (2 pts)

B. Facts (13 total points)

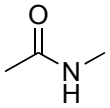
1. Rank the boiling point of the following molecules from lowest **(1)** to highest **(4)**. (1 pt each)



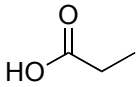
MW 74.12



MW 74.08

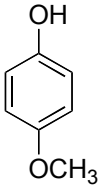


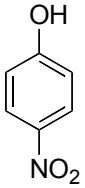
MW 73.09

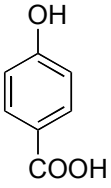


MW 74.08

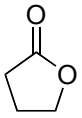
2. Rank the pK_a of the following molecules from lowest (**1**) to highest (**3**). (1 pt each)



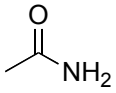


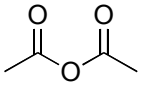


3. Rank the IR frequency of the following π bond(s) from lowest **(1)** to highest **(3)**. (1 pt each)



4. Rank the hydrolysis rate of the following molecules from slowest **(1)** to fastest **(3)**. (1 pt each)

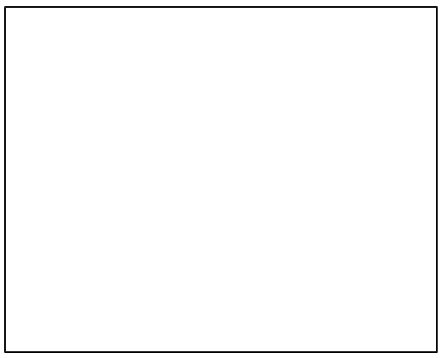




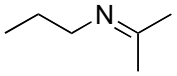
C. Reactions (8 points each; 32 total points)

Please provide the **major product**, **necessary reagents**, or **starting materials** in the **box** provided below. Be sure your drawing indicates stereochemistry if applicable.

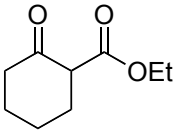
1.

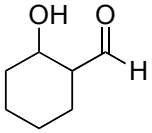


1. CH_2N_2
2. NH_3 / Δ
3. $LiAlH_4$
4. H_2O
5. Acetone / H^+



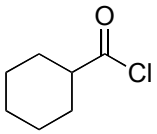
2.





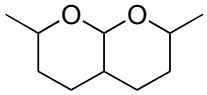
Reactions (continued)

3.



1. NH_3
2. $POCl_3$
3. CH_3MgBr, Et_2O
4. H_3O^+
5. $Ph_3P{=}C(CH_3)_2$

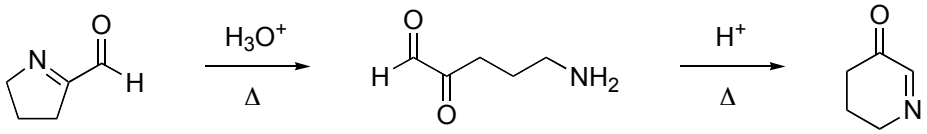
4.



1. H_3O^+ / Δ
2. $Na_2Cr_2O_7$ / H_2SO_4
3. B_2H_6
4. H_2NNH_2, H^+
5. KOH / H_2O / Δ

D. Mechanism (16 points)

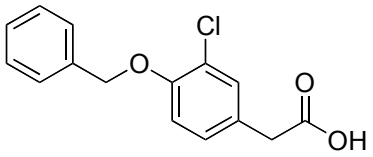
Using curved arrows to indicate "electron flow", provide a reasonable mechanism for the following transformation. **Show all intermediates and all formal charges.** If there is more than one resonance structure, you must show the "best" (lowest energy) structure.



E. Synthesis (17 points)

Alclofenac is one of many non-steroidal anti-inflammatory drugs (NSAID) used to reduce pain, fever, and inflammation. Synthesize the following compound using any of the following reagents: **alkanes**, **alkenes**, and **alkynes**, having **no more than <u>two</u> carbon atoms**, any inorganic reagents, any oxidizing or reducing agents, any peroxyacids, and **benzene**.

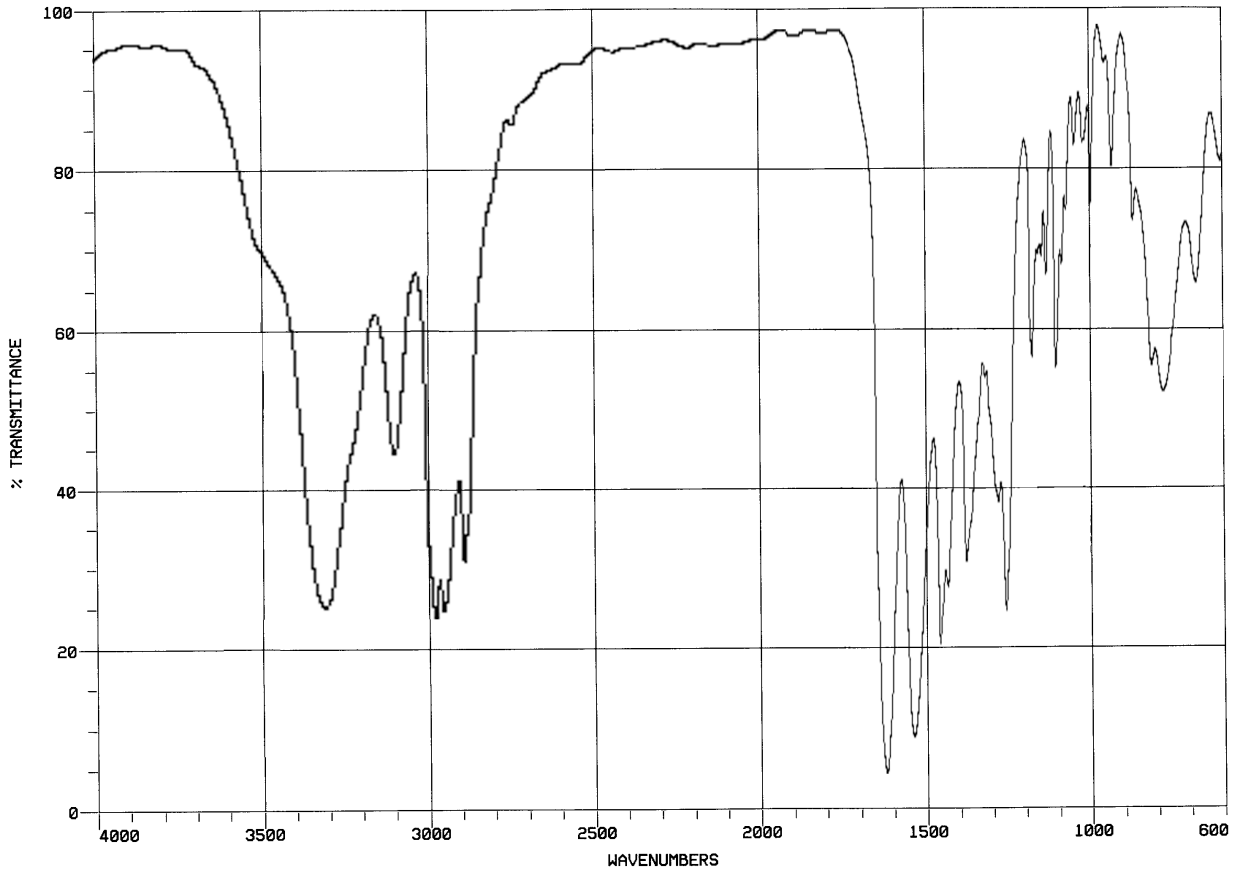
Improved version of Alclofenac

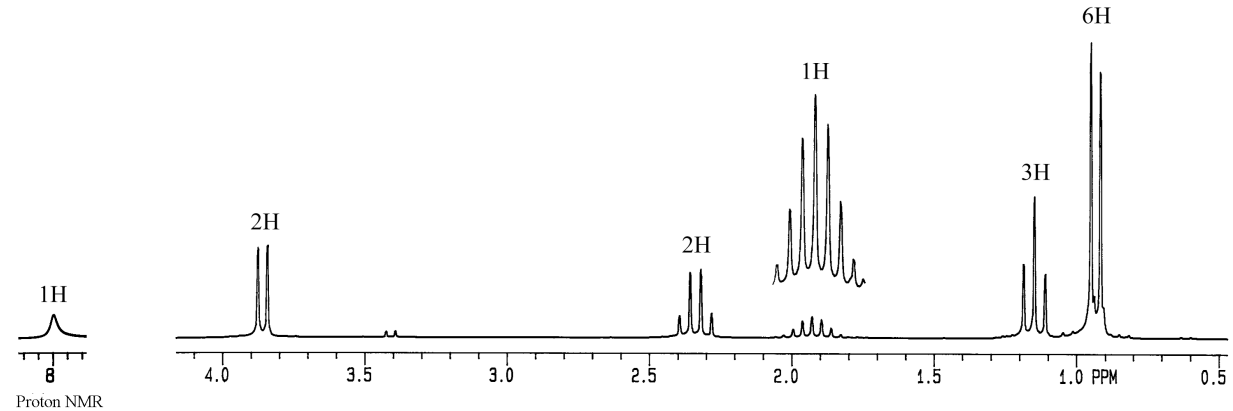


F. Spectroscopy (10 total points)

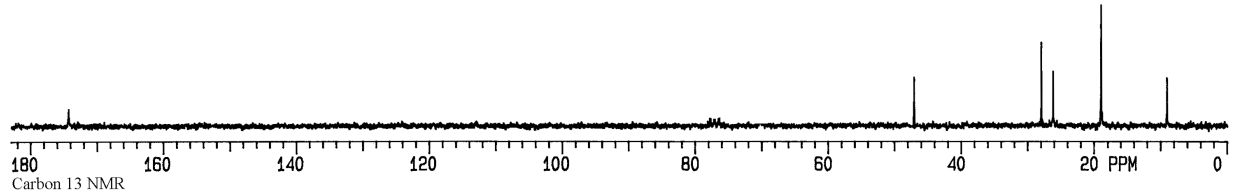
A compound with the formula $\mathbf{C_7H_{15}NO}$ exhibits the IR, ^{1}H NMR, and proton-decoupled ^{13}C NMR spectra shown on the following page. Please identify this compound and draw the structure **in the box** provided below.

MF $C_7H_{15}NO$





Proton NMR



Carbon 13 NMR