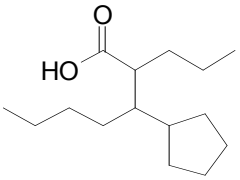
A. Nomenclature (11 total points)

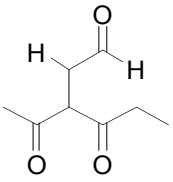
Please provide an acceptable name for each of the following compounds, noting stereochemistry where appropriate. (3 pts each)

1.



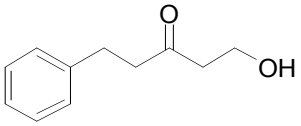
_____

2.



_____

3.

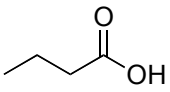


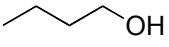
_____

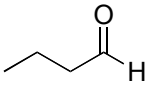
Draw the structure of pimelic acid. (2 pts)

B. Facts (15 total points)

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

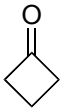






_____ _____ _____

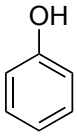
2. Rank the IR frequency of the following π bond(s) from lowest **(1)** to highest **(3)**. (1 pt each)

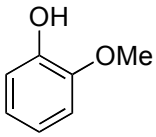


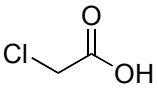
H−C≡N

_____ _____ _____

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

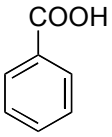






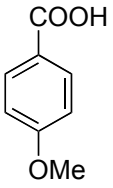
_____ _____ _____

4. Given that O is more electronegative than either H or Br, answer the following questions:



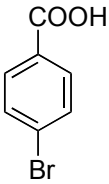
A

pKa = 4.19



B

pKa = 4.46



C

pKa = 4.00

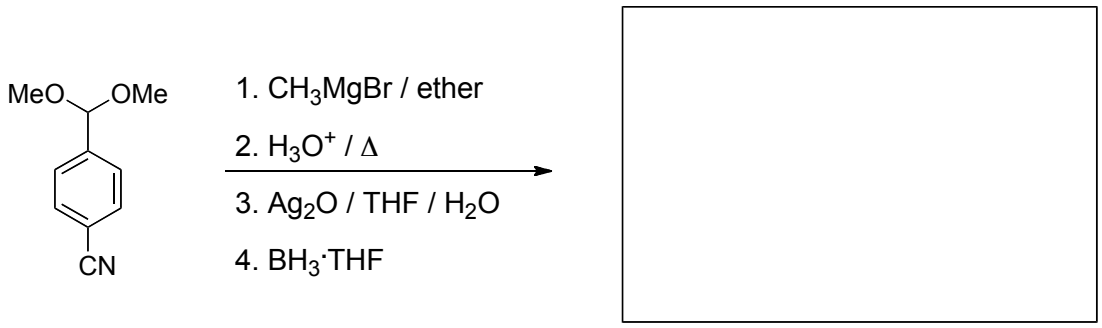
(i) Why is the pK_a of **B** greater than that of **A**? (2 pts)

(ii) Why is the pK_a of **C** less than both **A** and **B**? (4 pts)

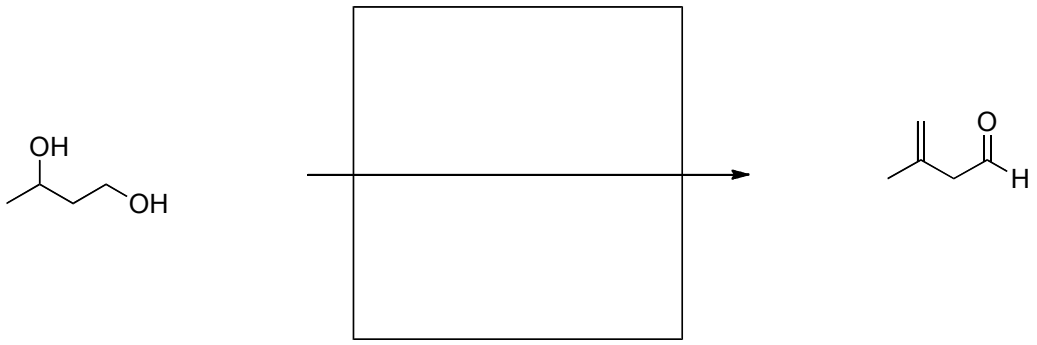
C. Reactions (8 points each; 32 total points)

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

1.

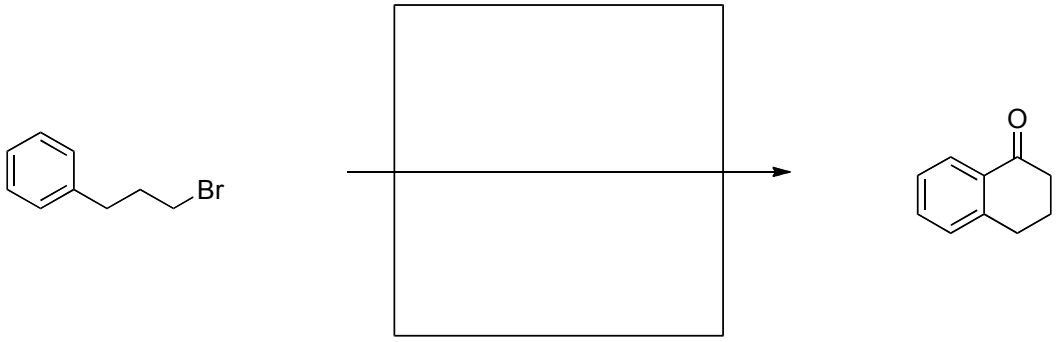


2.

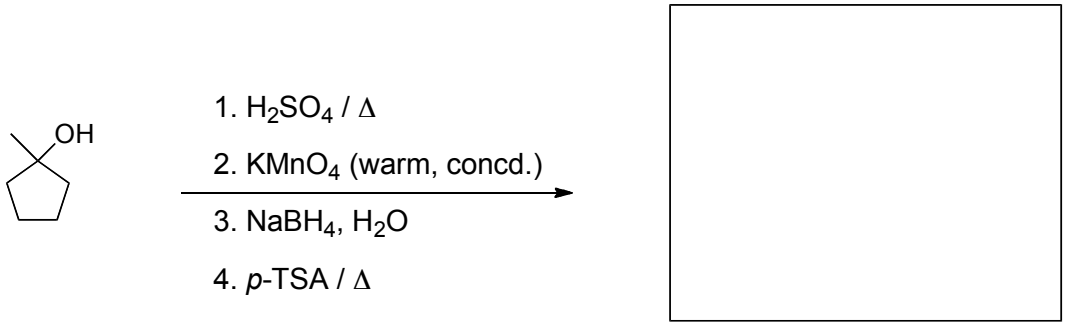


Reactions (continued)

3.

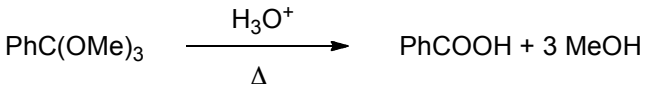


4.



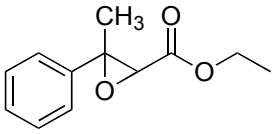
D. Mechanism (16 points)

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 (16 points)

Ethyl methylphenylglycidate, popularly known as "strawberry aldehyde", is often used as an artificial fruit flavor (for example, in Fanta™ Strawberry soda). Synthesize this non-aldehyde using any of the following reagents: **alkenes** and **alcohols** having **no more than <u>two</u> carbon atoms**, any inorganic reagents, any oxidizing or reducing agents, any peroxyacids, and **benzene**.

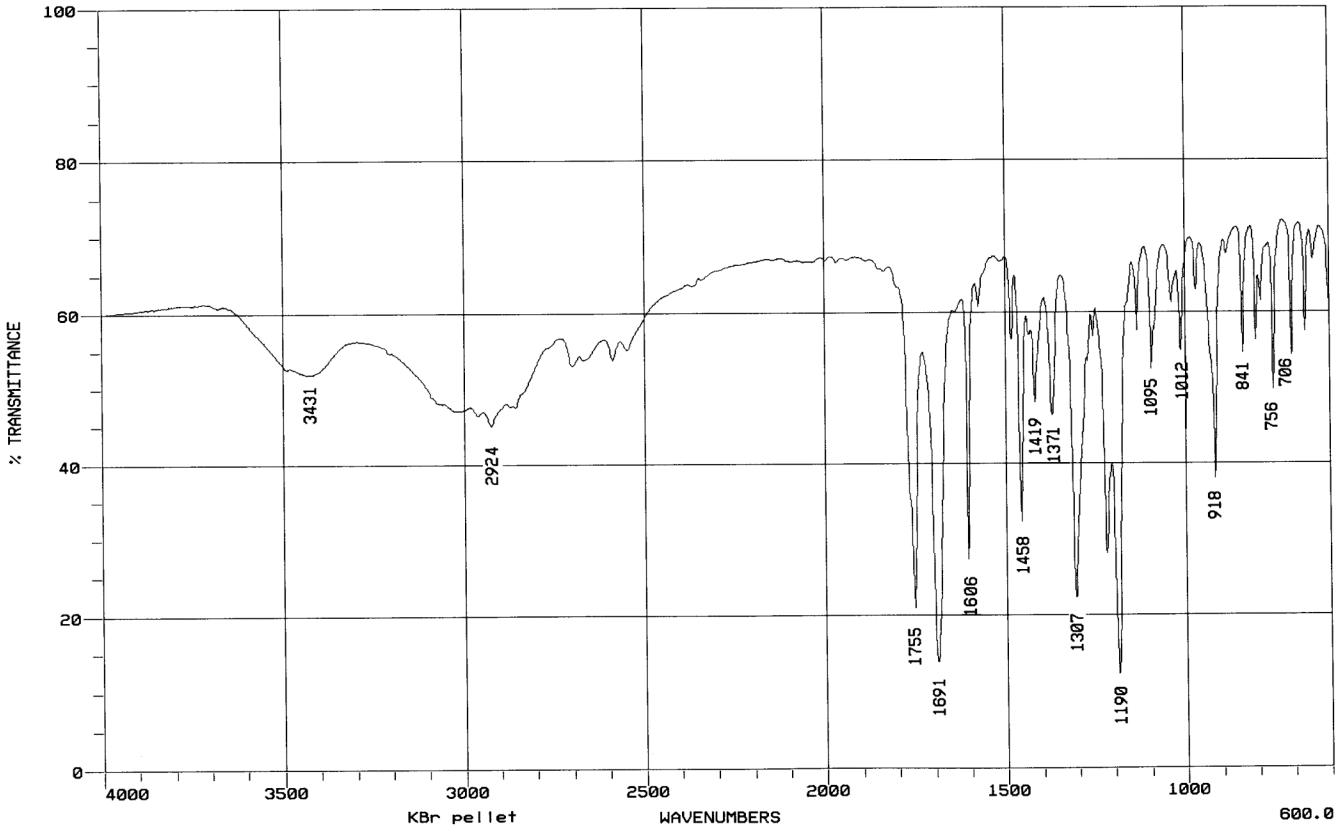


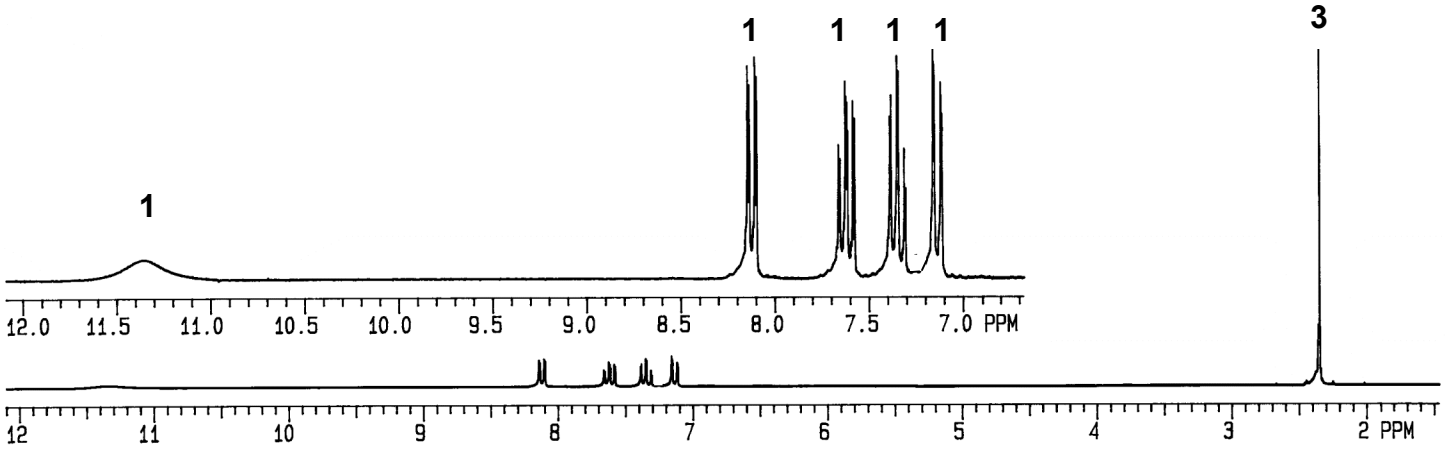
"strawberry aldehyde"

F. Spectroscopy (10 total points)

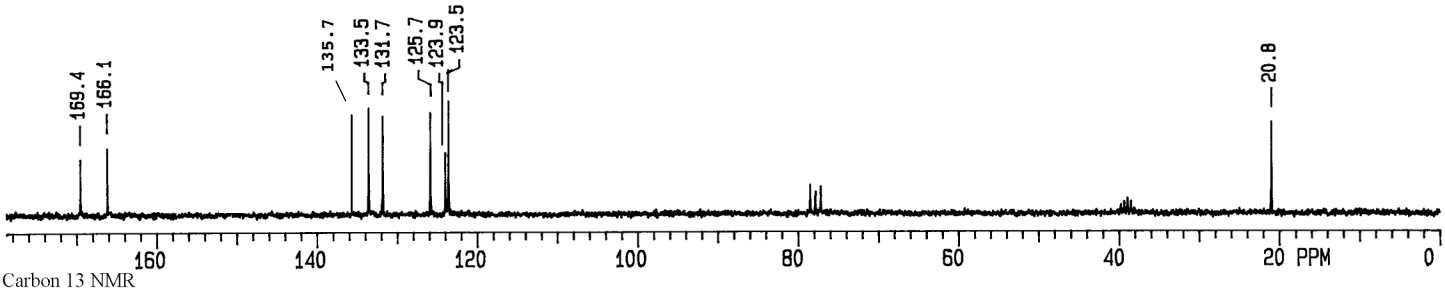
A compound with the formula $\mathbf{C_9H_8O_3}$ exhibits the IR, ^{1}H NMR, and proton-decoupled ^{13}C NMR spectra shown on the following page. Please identify this compound and draw the structure **in the box** provided below.

$C_9H_8O_3$





Proton NMR



Carbon 13 NMR