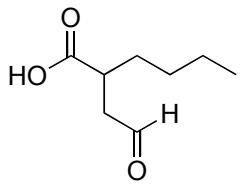
A. Nomenclature (3 points each; 9 total points)

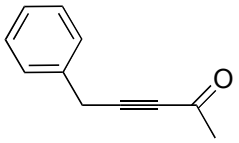
Please provide an acceptable name for each of the following compounds, noting stereochemistry where appropriate.

1.



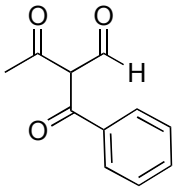
_____

2.



_____

3.



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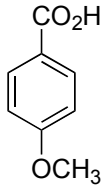
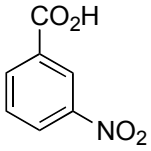
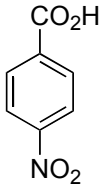
B. Facts (3 points each; 15 total points)

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

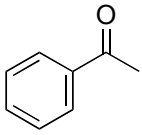


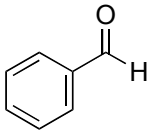


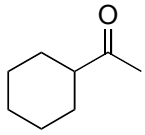


_____ _____ _____

2. Rank the following electrophiles from worst (**1**) to best (**3**) with regard to nucleophilic addition.

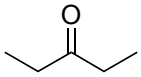


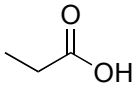




_____ _____ _____

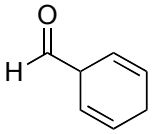
3. Rank the boiling points of the following molecules from lowest (**1**) to highest (**3**).

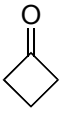


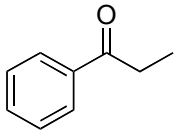


_____ _____ _____

4. Rank the IR absorption frequency of the following molecules from lowest (**1**) to highest (**3**).







_____ _____ _____

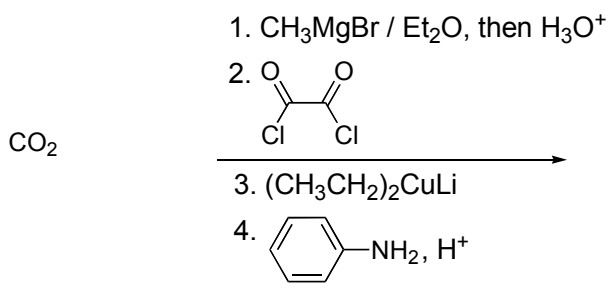
5. Draw the indicated molecules in the boxes below.

any cyclic dithiane	glutaric acid	any hydrazone

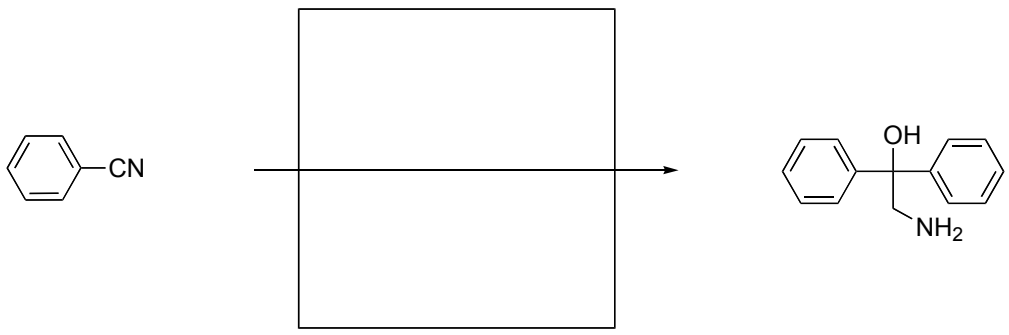
C. Reactions (8 points each; 32 total points)

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

1.

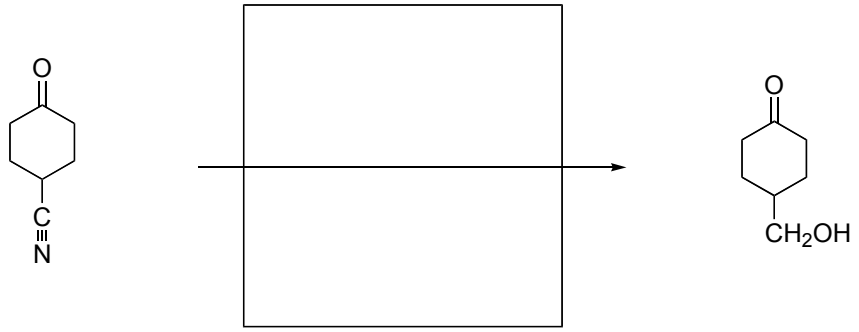


2.



Reactions (continued)

3.

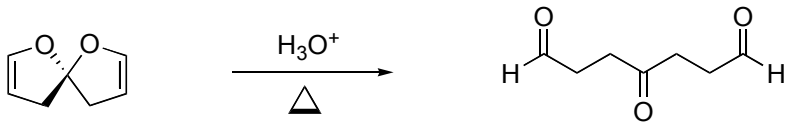


4.

1. Benzoyl chloride / $AlCl_3$
2. Raney Ni - H_2
3. CO / HCl / $AlCl_3$ / CuCl (1 equiv)
4. $Na_2Cr_2O_7$ / H_2SO_4 / 0 °C
5. B_2H_6

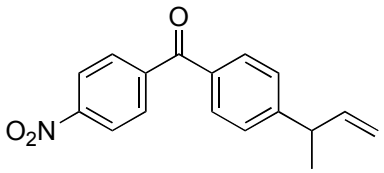
D. Mechanism: (15 points)

Provide a reasonable mechanism for the following transformation. Use curved arrows to indicate "electron flow". **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: (18 Points)

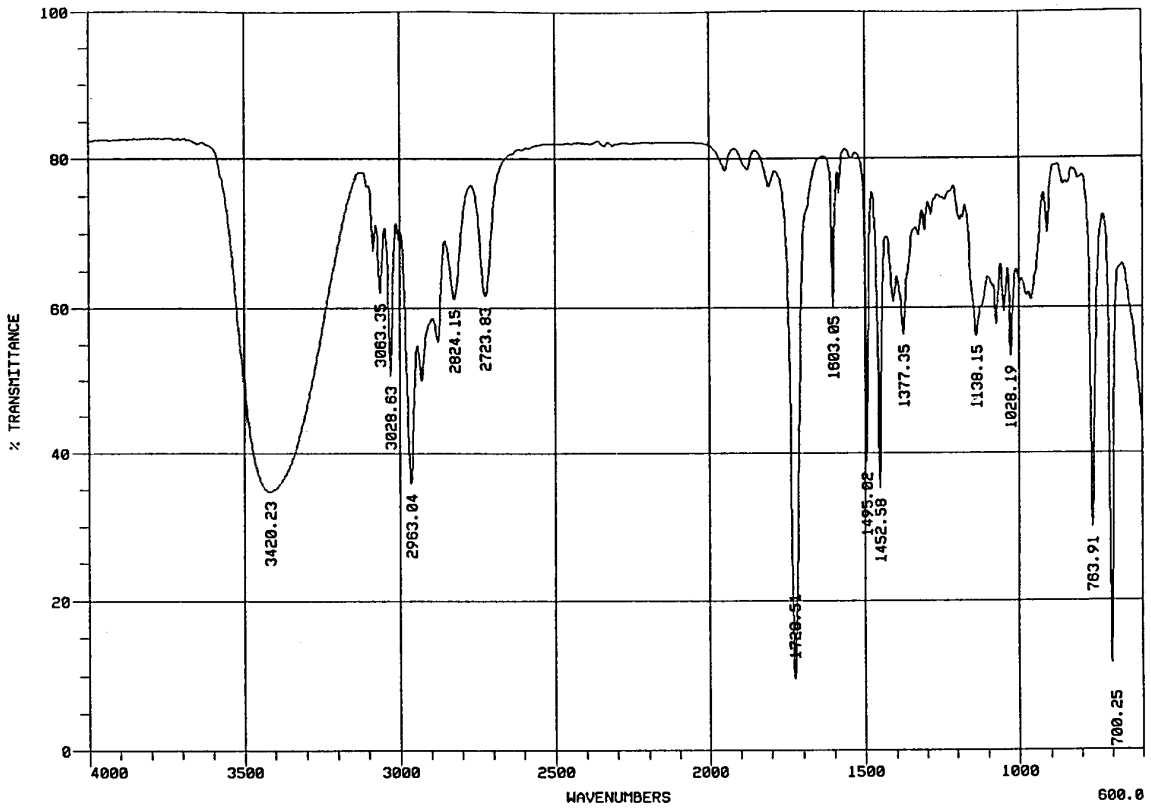
Synthesize the molecule below using any of the following reagents: alkanes, alkenes, or alkynes having **no more than <u>two</u> carbon atoms**, benzene, CO, formaldehyde, phenol, triphenylphosphine, any inorganic reagents, any oxidizing or reducing agents, and any peroxyacids.

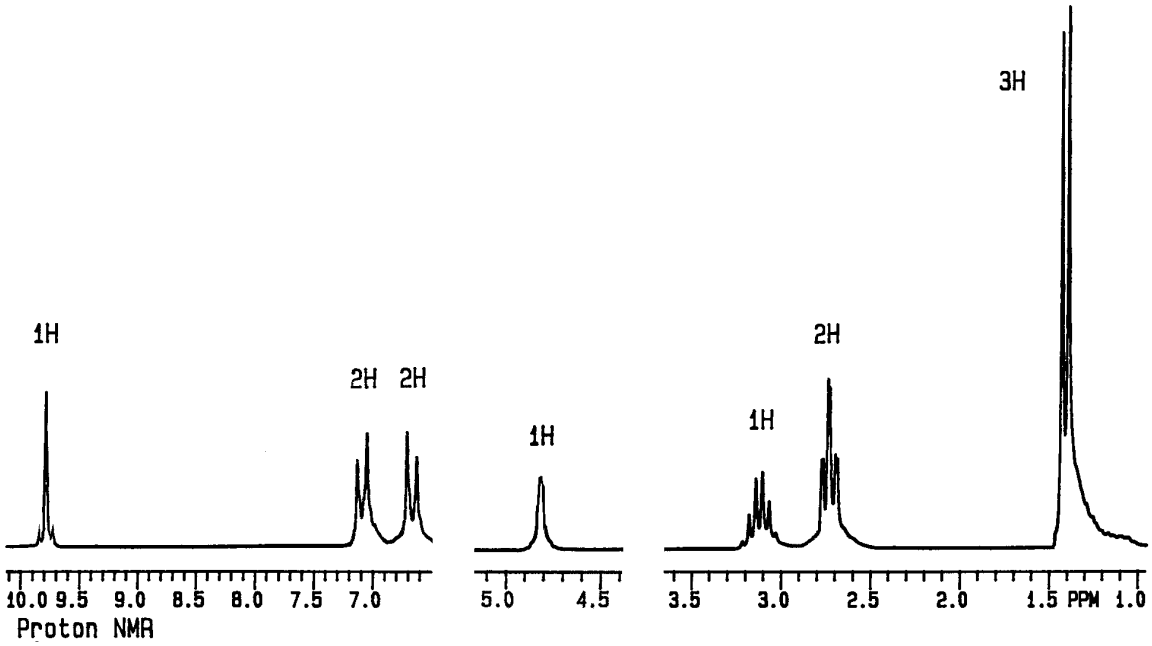


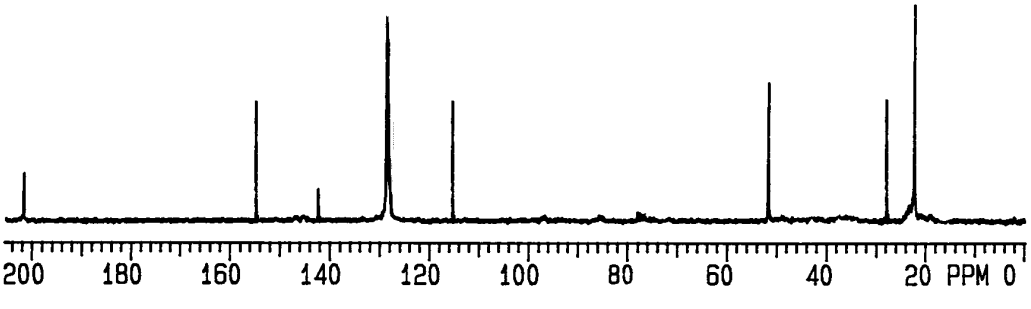
F. Spectroscopy: (11 points)

A compound with the formula $\mathbf{C_{10}H_{12}O_2}$ 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 $C_{10}H_{12}O_2$


% TRANSMITTANCE
100
80
60
40
20
0
3420.23
3063.35
3028.63
2963.04
2824.15
2723.83
1683.05
1452.58
1377.35
1138.15
1028.19
783.91
700.25
4000
3500
3000
2500
2000
1500
1000
600.0
WAVENUMBERS


1H
2H 2H
1H
1H
2H
3H
10.0 9.5 9.0 8.5 8.0 7.5 7.0
5.0 4.5
3.5 3.0 2.5 2.0 1.5 PPM 1.0
Proton NMR


200 180 160 140 120 100 80 60 40 20 PPM 0
Carbon 13 NMR