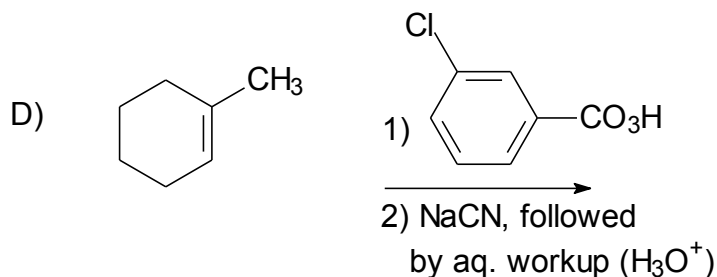
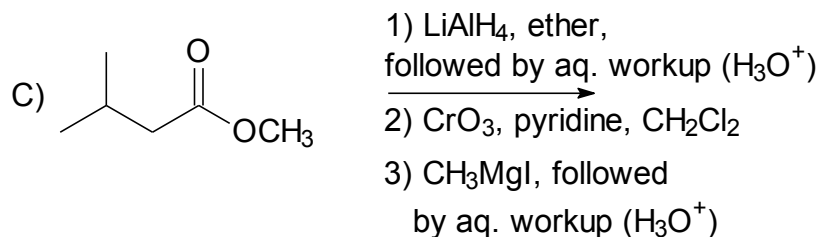
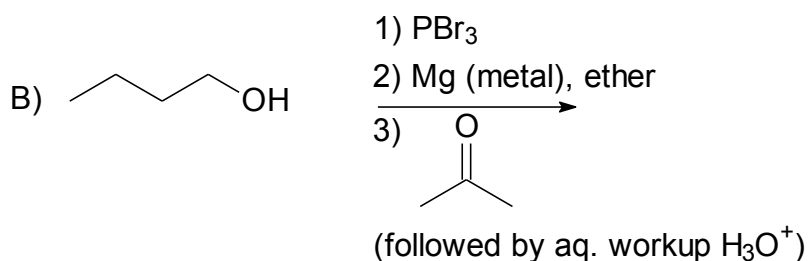
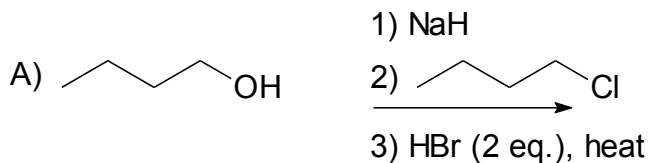
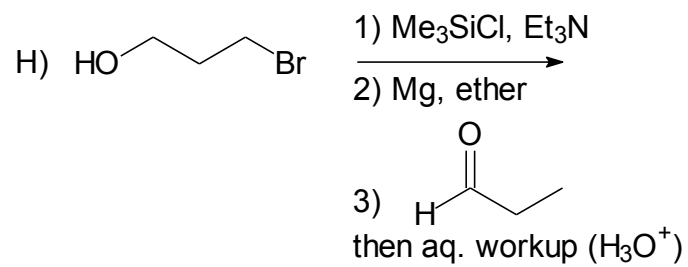
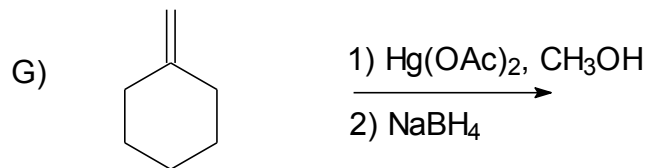
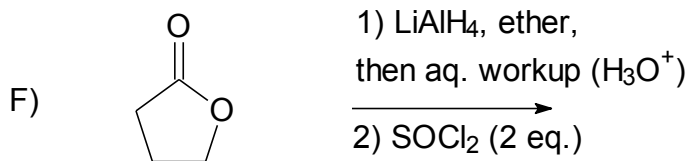
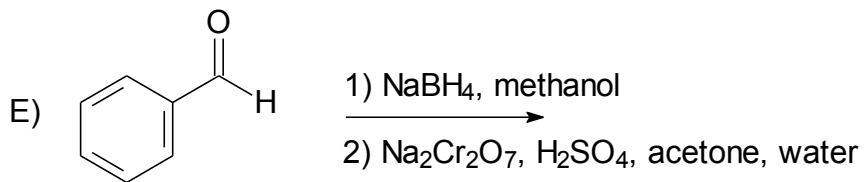
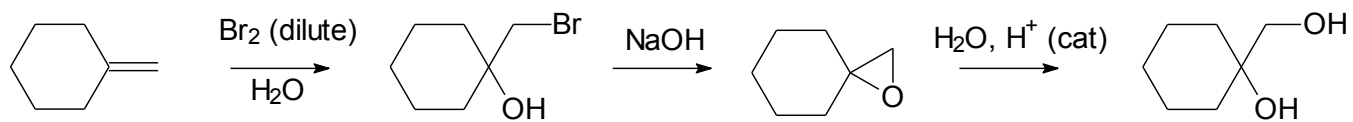


1. (40 pts) Draw the structure(s) of the major organic product(s) formed (after each step in a multistep sequence) in the following reactions. Draw the correct product stereochemistry where applicable.

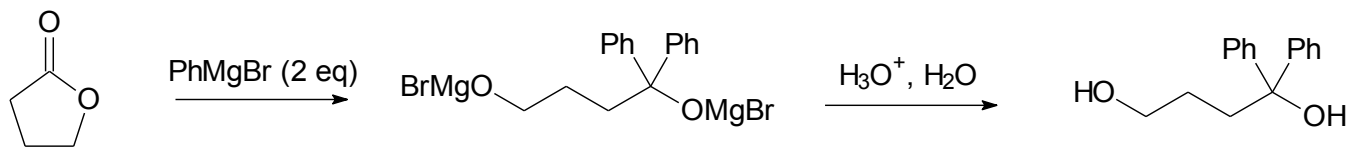




2. (15 pts) Provide a complete, step by step mechanism for the following transformation. Draw the structures of all intermediates formed in the mechanism.



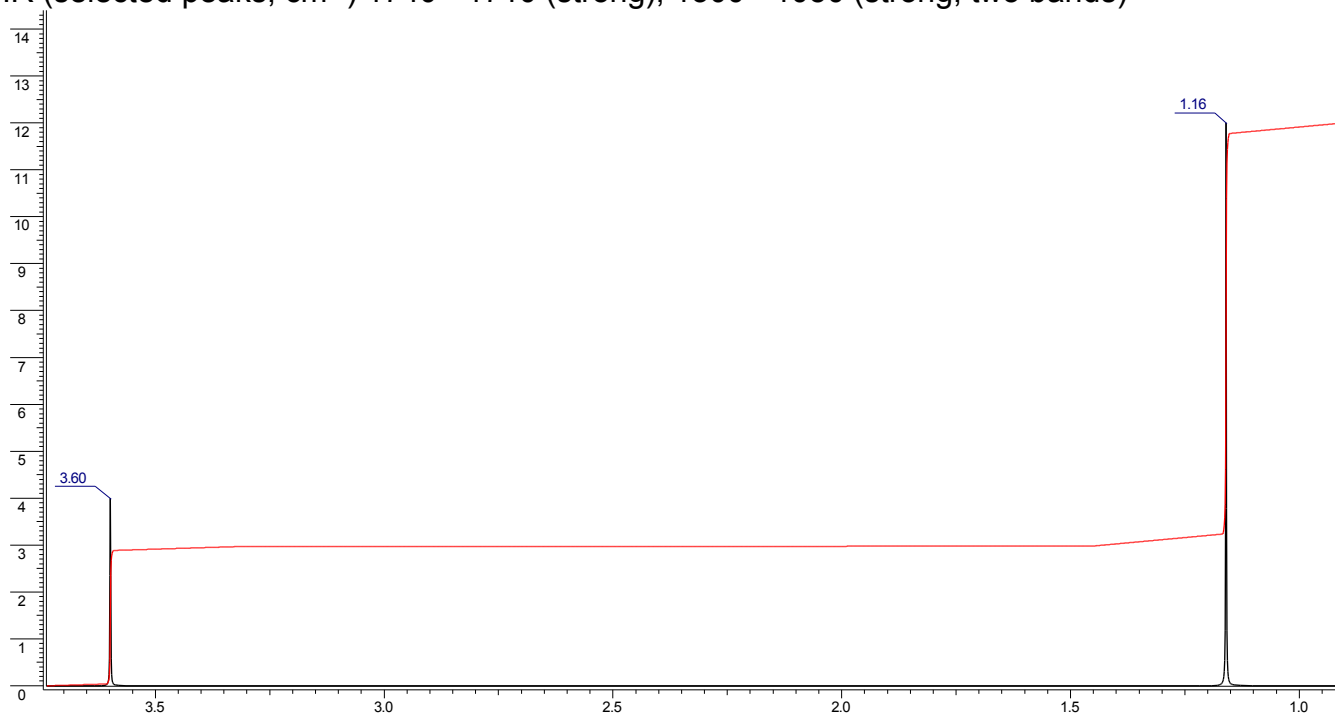
3. (15 pts) Provide a complete, step by step mechanism for the following transformation. Draw the structures of all intermediates formed in the mechanism.



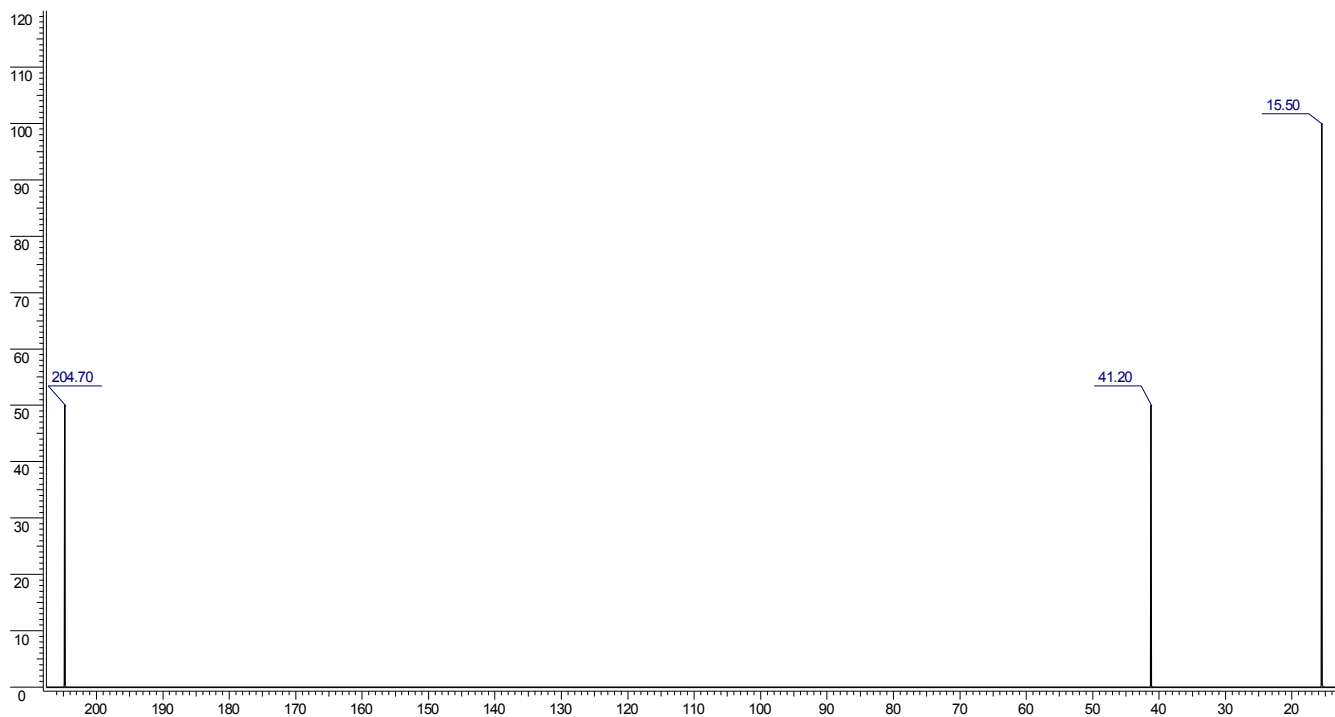
4. (20 pts) Propose a structure for each of the following compounds, based on the spectroscopic data provided. For full credit, assign as much of the provided spectroscopic data as needed to unambiguously confirm your proposed structure.

a) $C_6H_{12}O_2$: 1H NMR δ 3.60 (3H, s), 1.16 (9H, s).

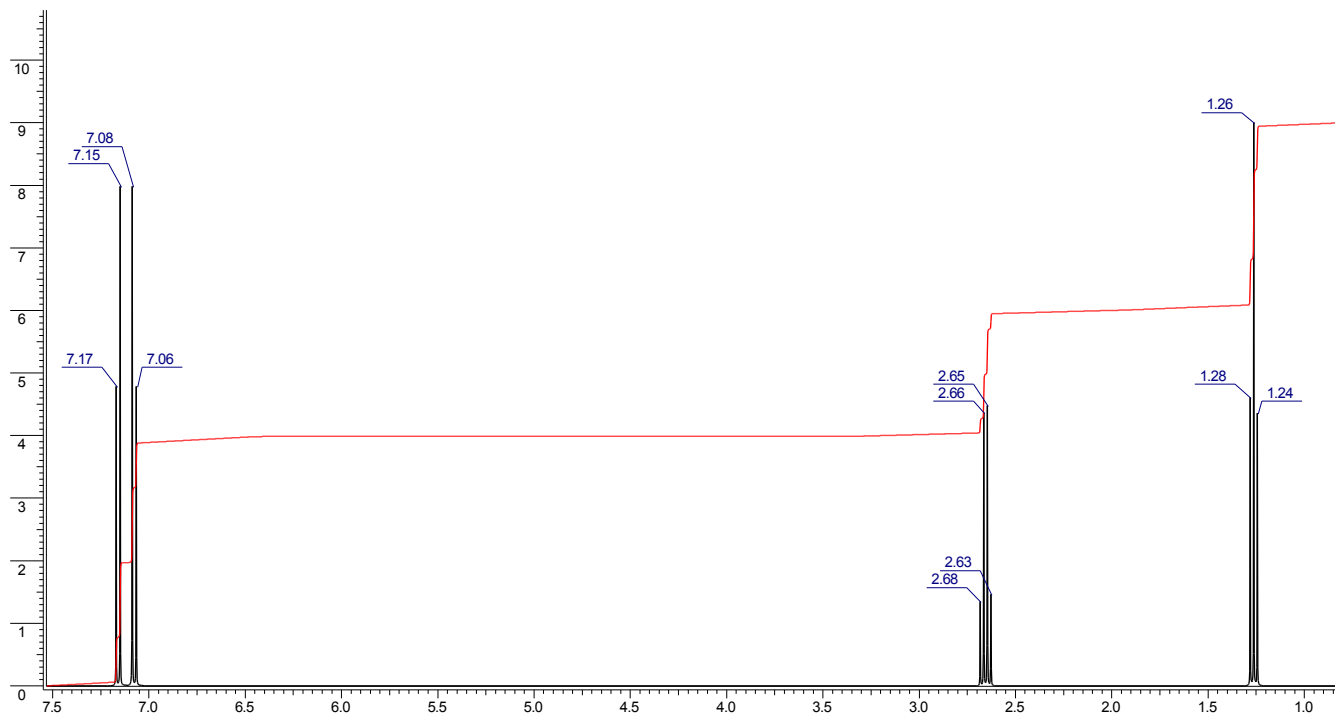
IR (selected peaks, cm^{-1}) 1740 - 1710 (strong), 1300 - 1050 (strong, two bands)



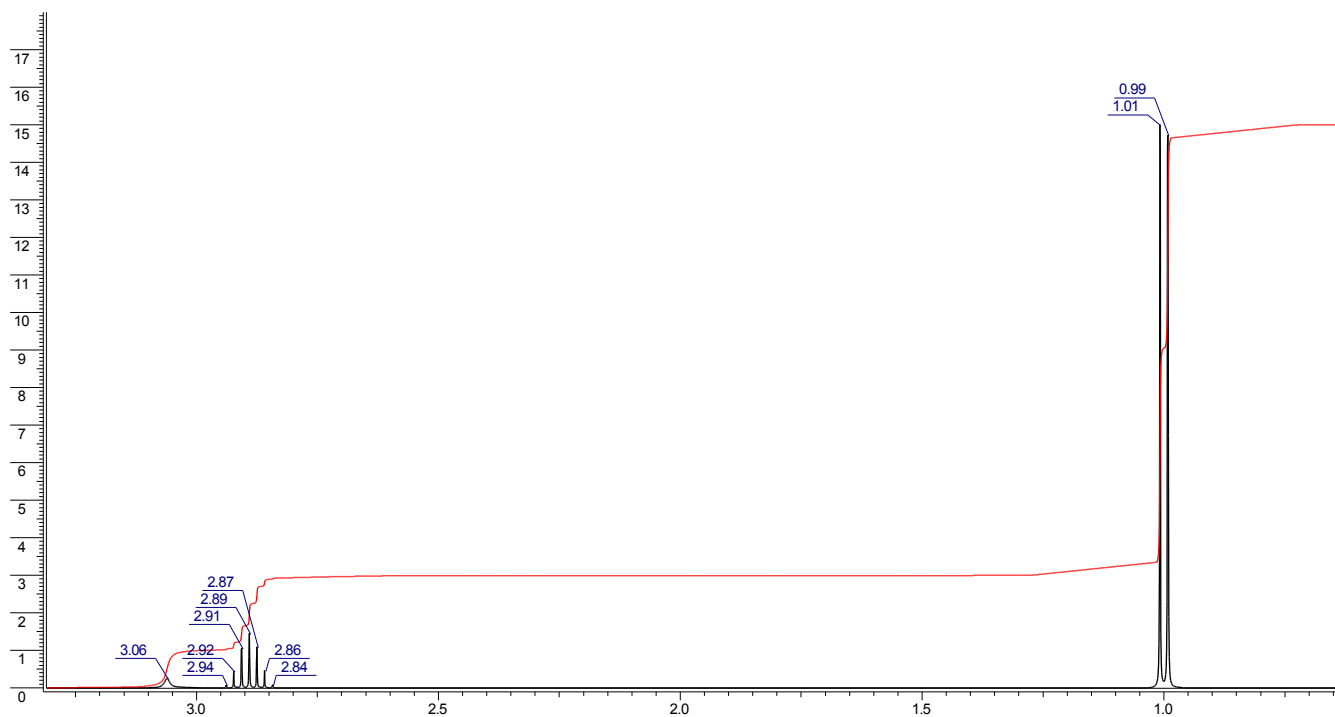
b) C_4H_8O : ^{13}C NMR δ 204.7 (d), 41.2 (d), 15.5 (q).



c) C_8H_9Cl 1H NMR δ 7.16 (2H, d), 7.07 (2H, d), 2.66 (2H, q), 1.26 (3H, t).



d) $C_8H_{15}N$ 1H NMR δ 3.10-3.01 (1H, broad singlet), 2.89 (2H, septet), 1.00 (12H, d).



5. (10 pts) Match the IR spectrum with the compounds provided.

Assign all C-H, N-H, C=C, C≡C, and C=O stretching, (where applicable) in each spectrum.

