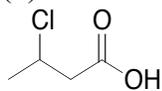
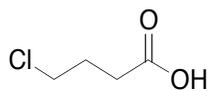


1. Rank the following molecules in acidity from most acidic to least acidic.

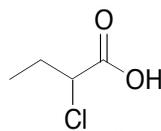
(1)



A

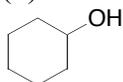


B

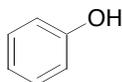


C

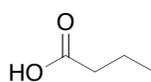
(2)



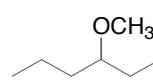
A



B

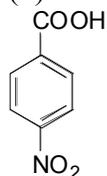


C

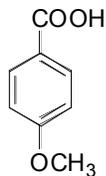


D

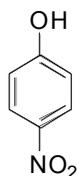
(3)



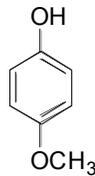
A



B

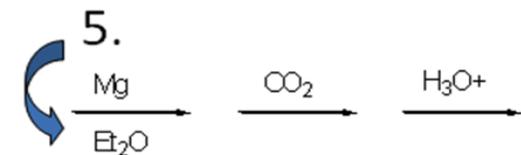
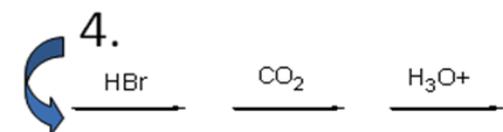
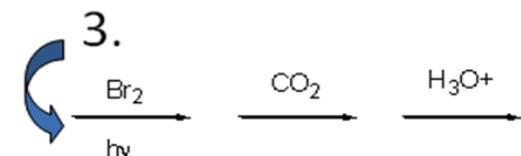
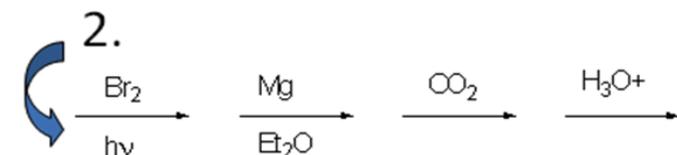
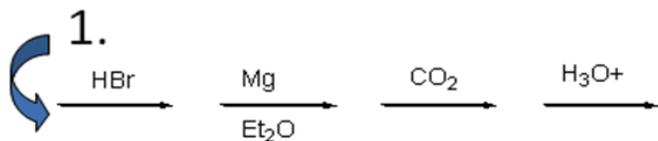
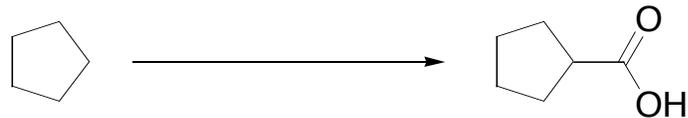


C

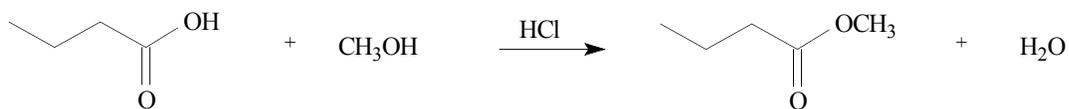


D

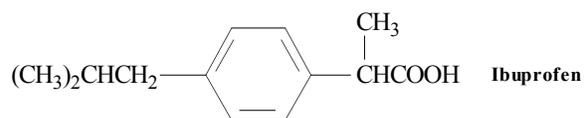
2. What sequence of reagents will accomplish the following transformation?



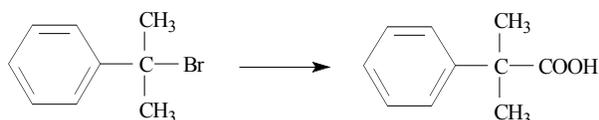
3. Methyl butanoate has been isolated from pineapple oil and can be prepared by the Fischer esterification reaction shown below. Write the complete stepwise mechanism for this reaction. Show all electron flow with arrows and include all intermediate structures.



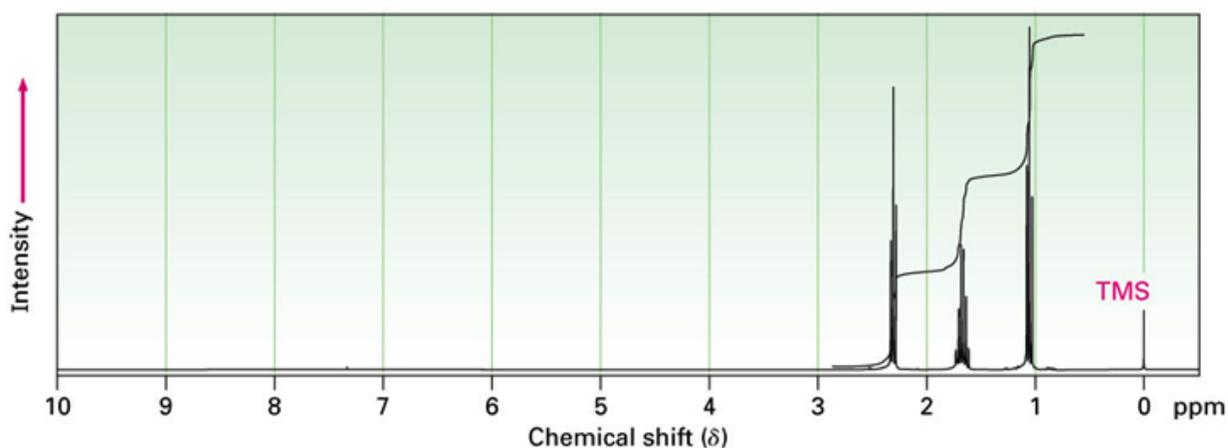
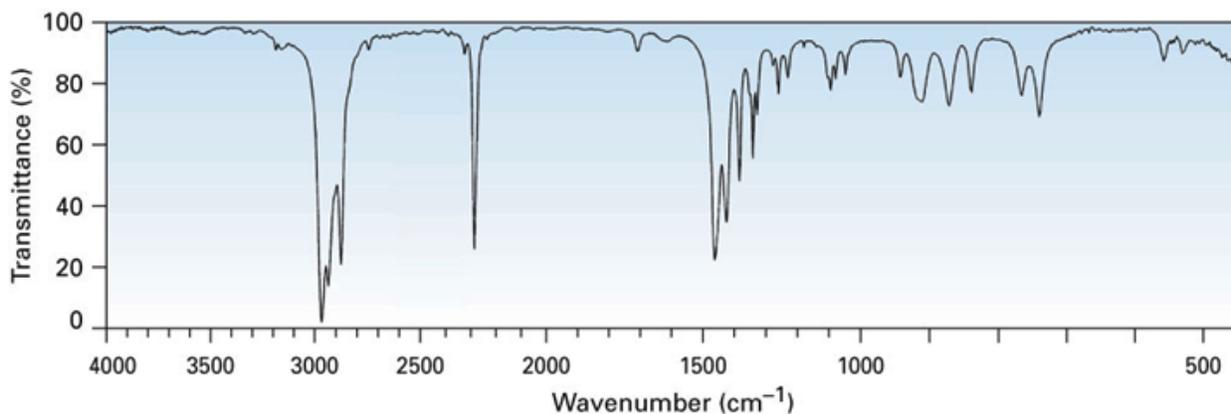
4. Propose a synthesis of the anti-inflammatory drug Ibuprofen from benzene. Show all reagents and all intermediate structures. Assume that *ortho* and *para* isomers can be separated.



5. Carboxylic acids are synthesized from alkyl halides via Grignard reagent carboxylation or nitrile hydrolysis. Choose the best method for effecting each of the following conversions. Explain each of your choices. If neither method is appropriate, explain.



6. Propose a structure for a compound C_4H_7N that exhibits the following infrared and 1H NMR spectra. [Note: The NMR signal at δ 1.1 is a triplet, δ 1.6 is a multiplet and δ 2.3 is a triplet.]



- Calculate the degree of unsaturation for this compound.
- What functional group is indicated by the IR data?
- Propose a structure that is consistent with the provided spectroscopic data.
- In your final structure label the non-equivalent hydrogens as *a*, *b*, *c*... etc. and write those same letters above the corresponding peaks in the 1H NMR spectrum.