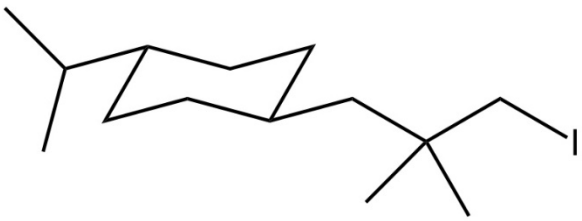
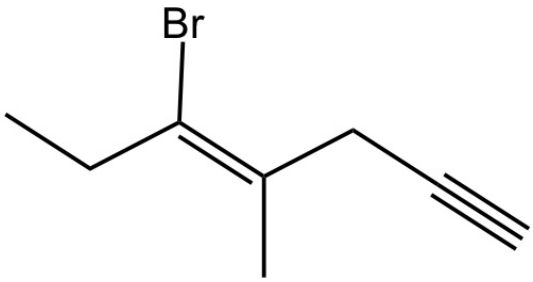
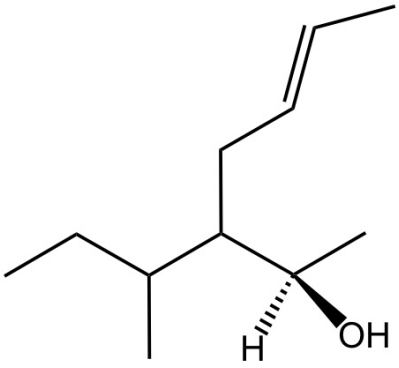
A. Nomenclature

Give an acceptable IUPAC name for each of the following compounds Be sure to note **stereochemistry** where appropriate.

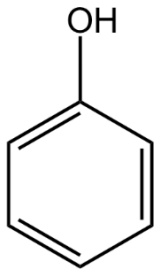
1. 

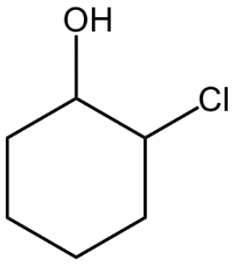
2. 

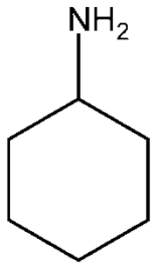
3. 

B. Facts

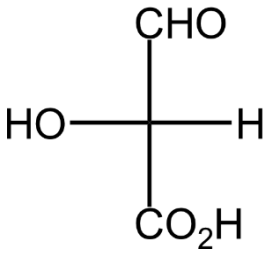
1. Place the following compounds in order of increasing acidity. (1=least acidic, 3=most acidic)

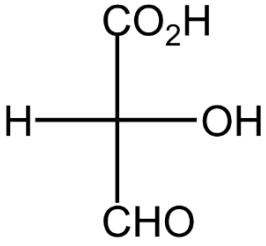




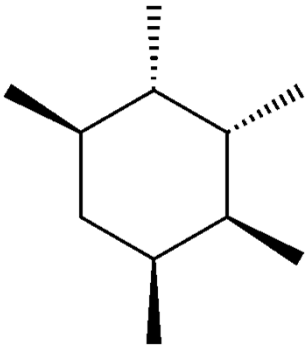


2. Label the following pair as identical, structural isomers, enantiomers or diastereomers.



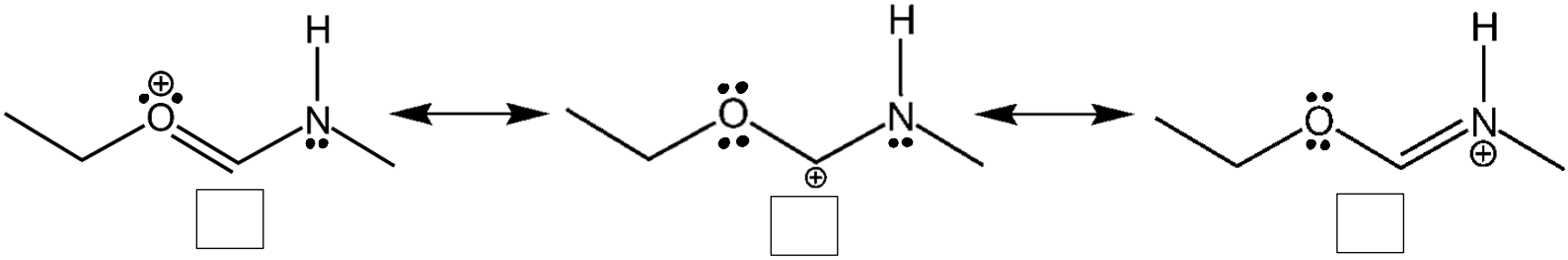


3. Consider the substituted cyclohexane below. In the more stable chair conformation, how many methyl groups are in **equatorial** positions?



answer:

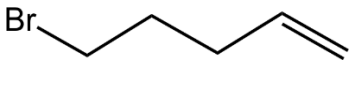
4. Consider the resonance contributors below.

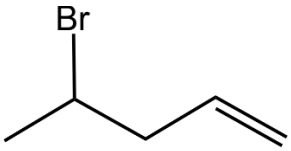


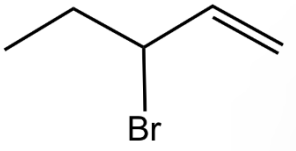
a. Place the contributors in order of increasing importance to the hybrid (1=contributes least, 3=contributes most)

b. Place the hybridization of the nitrogen atom.

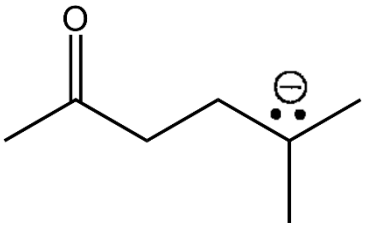
5. Place the following compounds in order of increasing reaction rate with CH_3CH_2OH/Heat. (1=slowest, 3=fastest rate)

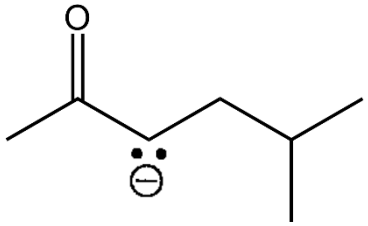


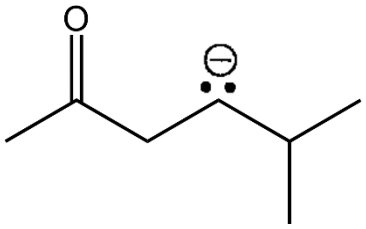




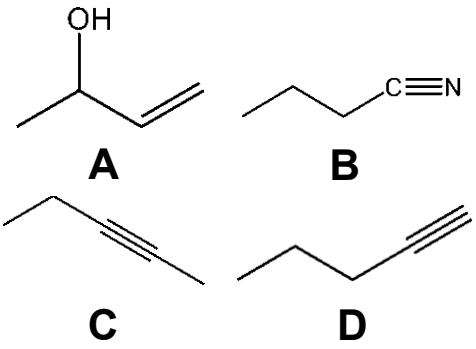
6. Place the following carbanions in order of increasing stability. (1=least stable, 3=most stable)

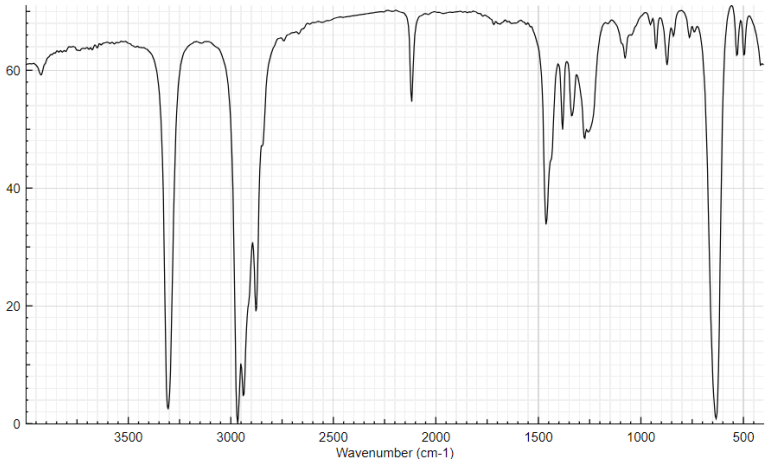




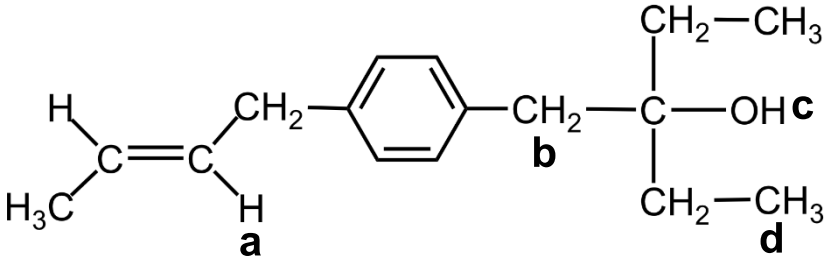


7. Carefully examine the spectrum and the compounds below. Place the letter of the correct compound in the box besides the spectrum.





8. Answer the following questions for the molecule shown below and place the answers in the following boxes. (i) What are the theoretically predicted multiplicities (splitting patterns) of the signals for the protons labeled **a** and **b**? (ii) Under ultrapure conditions, what is the theoretically predicted multiplicity of the signal for the proton labeled **c**? (iii) What is the theoretically predicted multiplicity of the signal for the carbon atom labeled **d** in the proton spin-coupled C-13 NMR?



(i) multiplicity of H_a

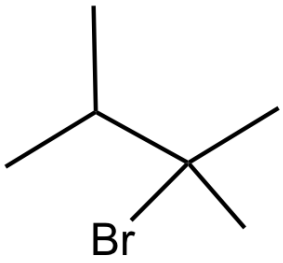
multiplicity of H_b

(ii) multiplicity of H_c

(iii) multiplicity of C_d

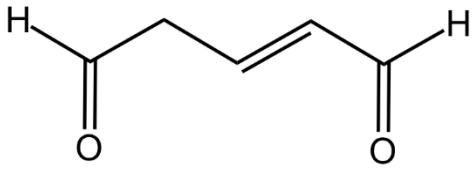
C. Reactions

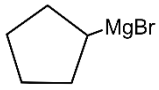
Please provide the reagents or the major products in the answer box. Indicate **stereochemistry** if applicable. **Full credit is awarded only when the product of each step in a multi-step reaction is shown below the reaction.**

1. 

CH_3OH/ Heat →

Major + Minor

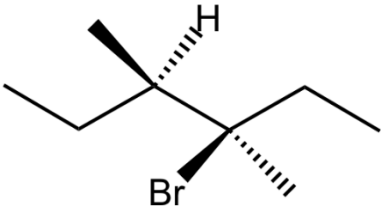
2. 

1. 

, then H_3O^+

2. PCC / CH_2Cl_2

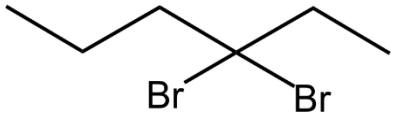
3. H_2 / Ra-Ni

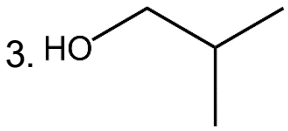
3. 

1. CH_3O^- Na^+/ CH_3OH

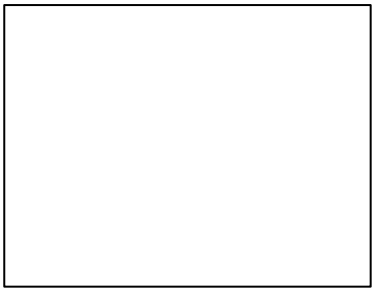
2. MCPBA

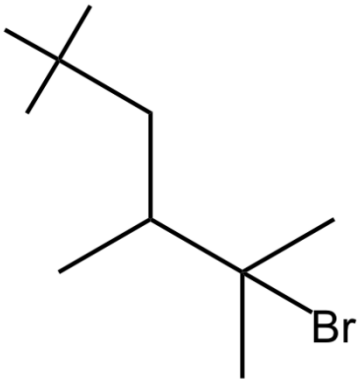
3. H_3O^+

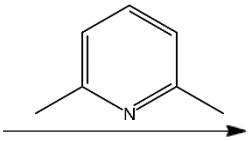
4. 

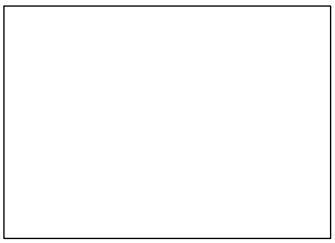
1. KOH/200°C
2. O_3/H_2O
3. 

/ H^+



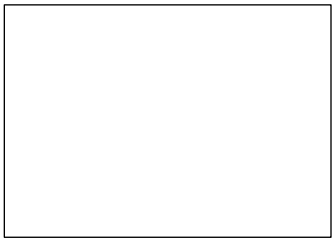
5. 



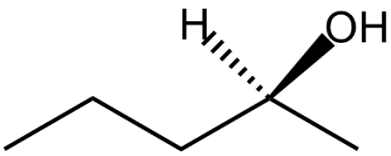


Major

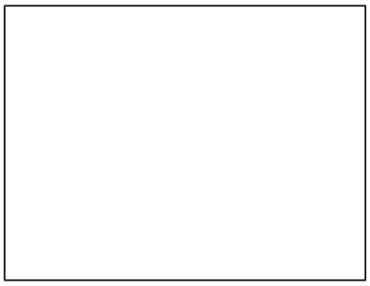
+

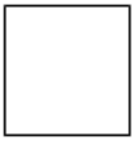


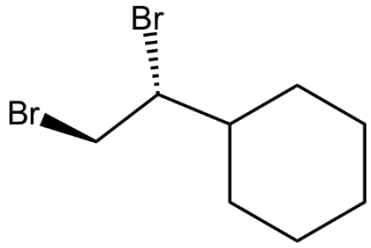
Minor

6. 

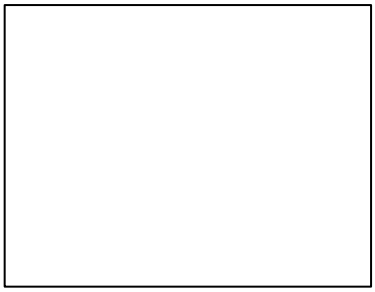
1. PBr_3
2. CH_3S^- / CH_3SH

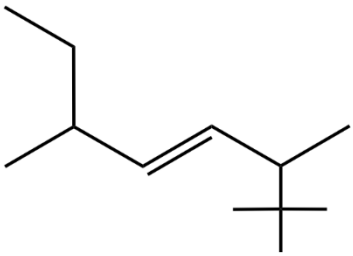




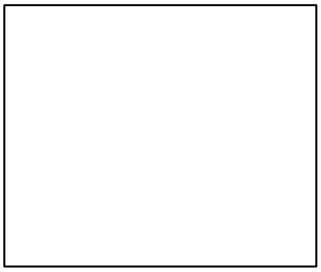
7. 

1. KI / acetone
2. $CHBr_3$/KOH



8. 

NBS / Light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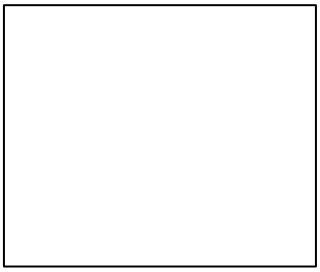
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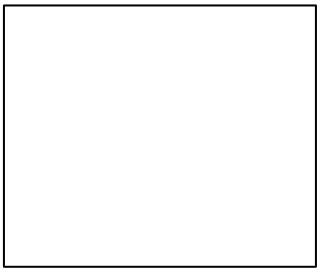
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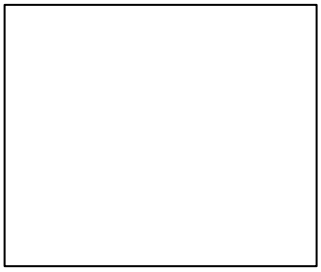
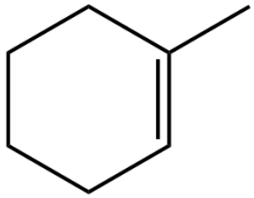
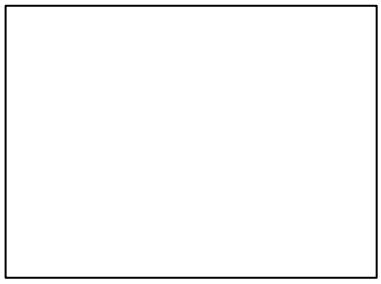
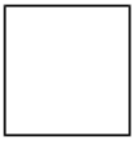


9. 

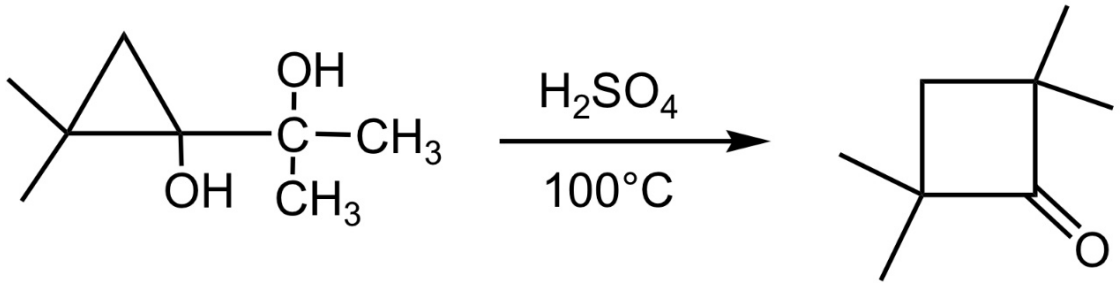
1. OsO_4 / H_2O_2 / OH^-
2. HIO_4
3. $\ominus$≡—Na^+, then H_3O^+
4. $Na_2Cr_2O_7$ / H_2SO_4 / H_2O





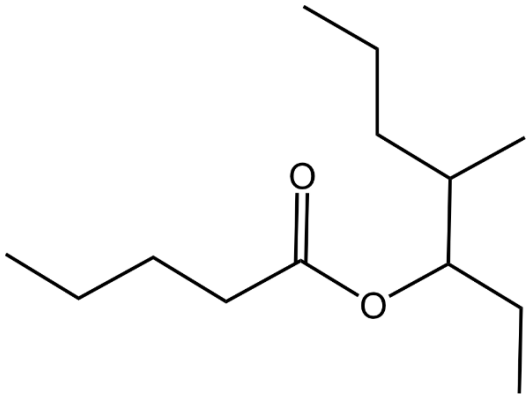
D. Mechanism:

Provide a clear mechanism to explain the formation of the product. Use curved arrows to indicate “electron flow.” **Show all intermediates and all formal charges. When more than one resonance contributor may be drawn, be sure to draw the most stable contributor.**



E. Synthesis:

Synthesize the molecule below using any of the following reagents: **alcohols**, **alkenes** of **four carbons** or less, any inorganic reagents, and any oxidizing or reducing agents.



F. Spectroscopy:

A compound with the formula $C_4H_{10}O$ exhibits the IR, ^1H NMR, and ^{13}C NMR spectra shown below. Please identify this compound and draw the structure in the box provided below.