

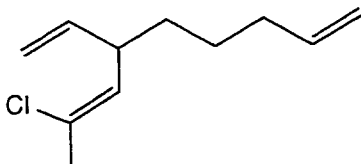
Final Exam, Fall 2002

Chem 3331
Bean-16

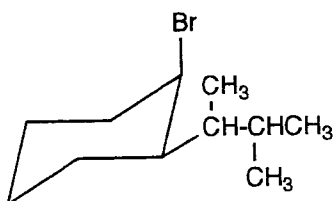
A. NOMENCLATURE: (12 points, 3 pts. each)

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

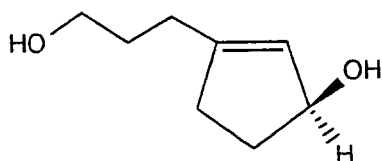
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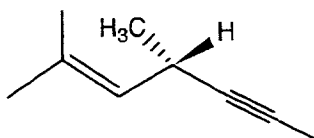
2.



3.

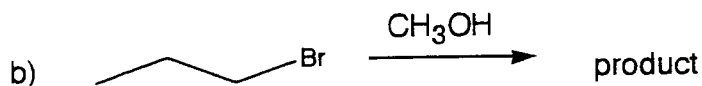
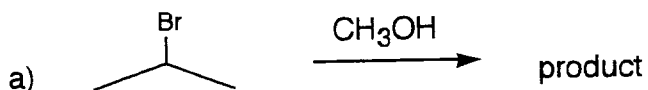


4.

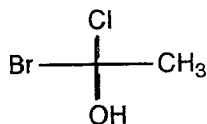
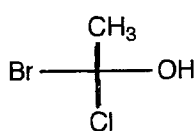


B. Facts: Total = 18 points

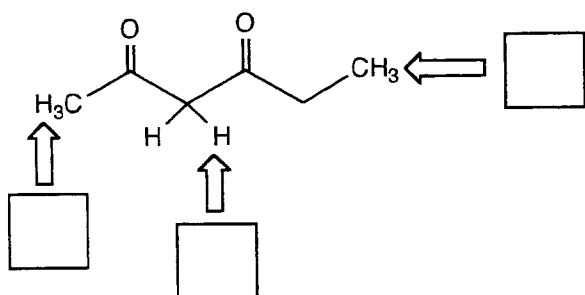
1. Compare the reaction rates of reaction **a)** and reaction **b)** and place the letter of the faster reaction in the box provided. (2 pts.)



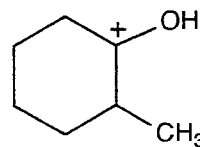
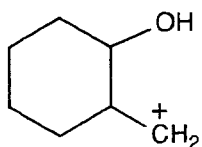
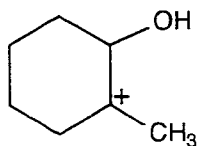
2. Label the pair of molecules as identical, enantiomers, diastereomers, or structural isomers. (2 pts.)



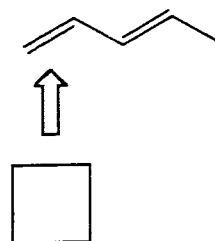
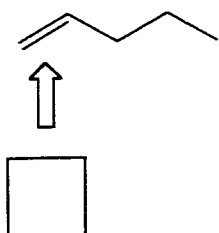
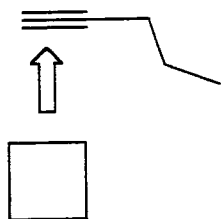
3. Place the hydrogens indicated in order of increasing acidity by placing the appropriate number in the box below each arrow. (1 = least acidic, 3 = most acidic) (3 pts.)



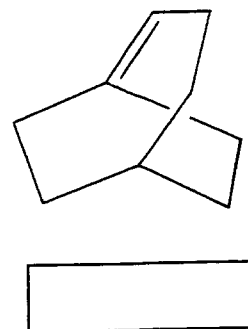
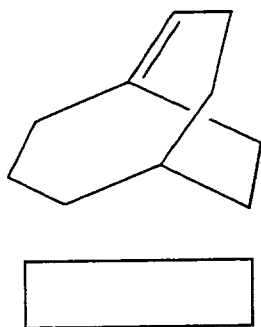
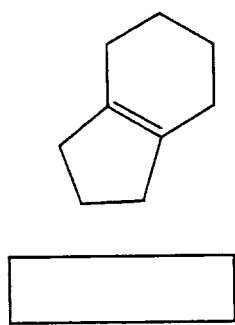
4. Place the following carbocations in order of increasing stability (1=least stable, 3=most stable). (3 pts.)



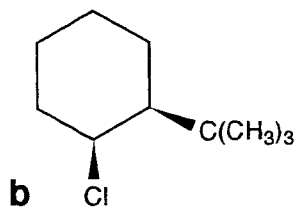
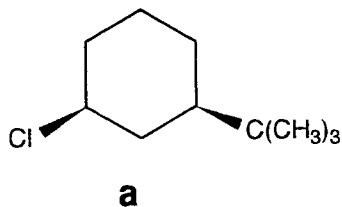
5. Place the following compounds in order of increasing frequency of the bond stretching vibration indicated by the arrow. (1 = lowest frequency, 3 = highest frequency) (3 pts.)



6. Label the alkenes as stable or unstable. (3 pts.)



7. Which of the isomers undergoes the E2 process more rapidly? Place the letter of the isomer in the box provided. (2 pts.)



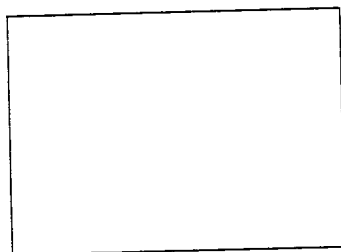
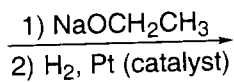
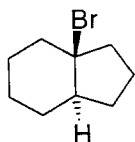
Answer:



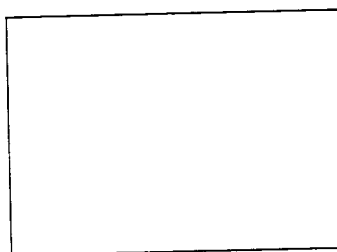
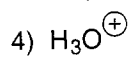
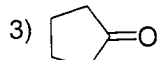
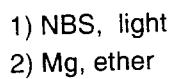
C. REACTIONS: (40 points, 4 pts. each)

Please give the final **major** product, the reagents, or the starting material for each of the following reactions in the box provided. Be sure your answers indicate **stereochemistry** where appropriate. Intermediate products may be placed below the reaction for partial credit but not in the answer box.

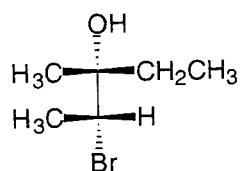
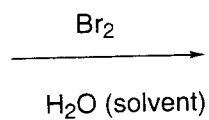
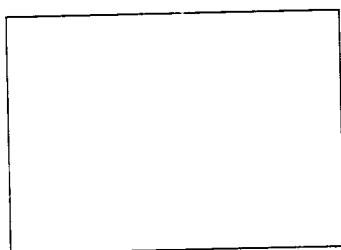
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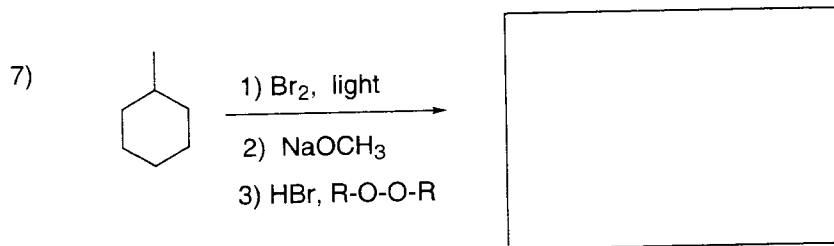
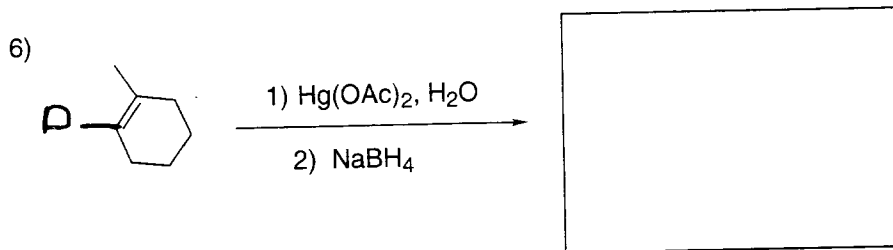
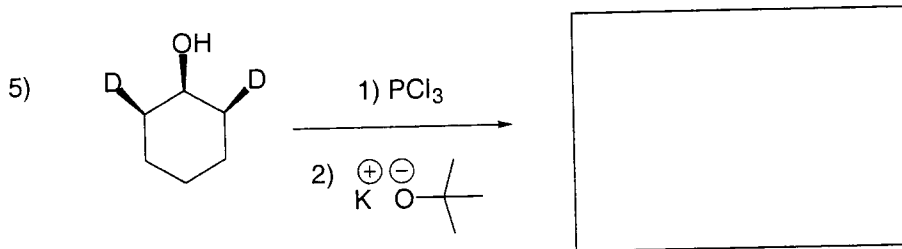
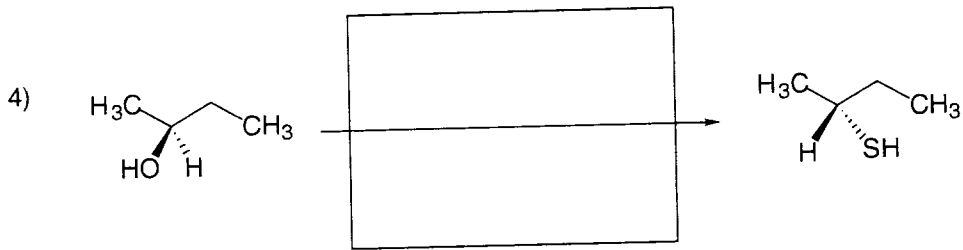


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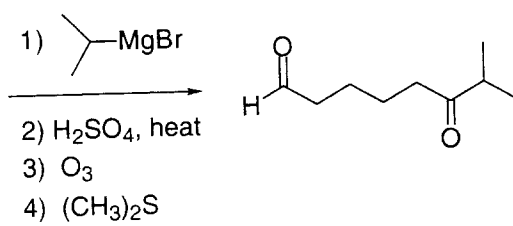
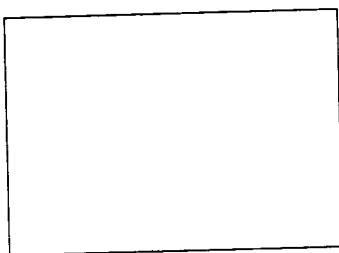


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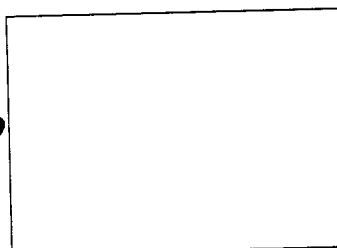
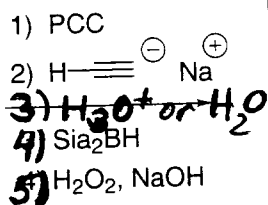
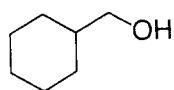




8)

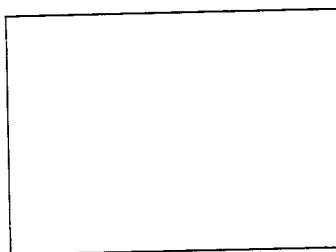
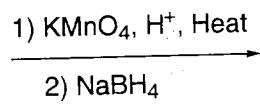
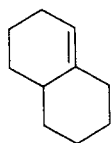


9)



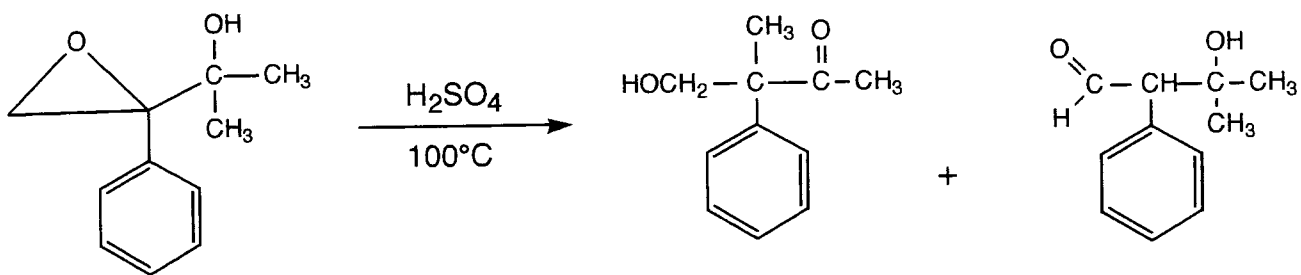
PCC: pyridinium chlorochromate

10)



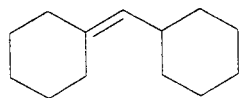
D. Mechanism: 10 points

For the following reaction, propose a detailed, step by step mechanism to explain the formation of the product. Show all intermediates and formal charges, and use curved arrows to indicate electron flow.



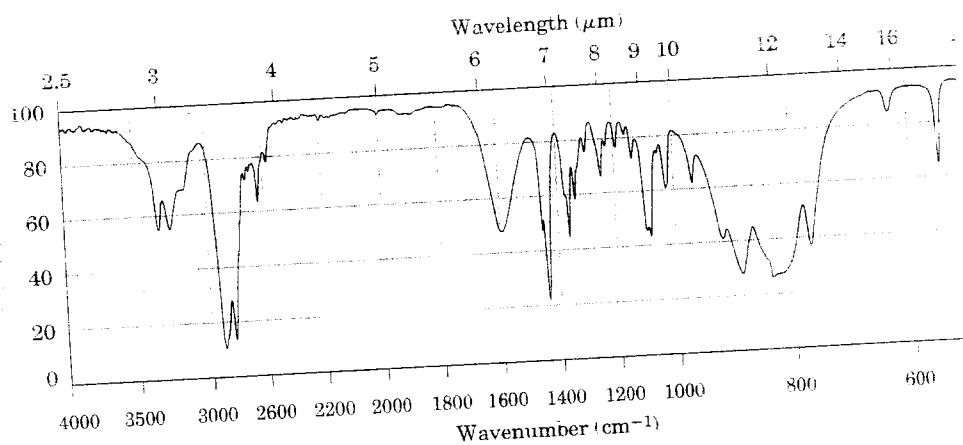
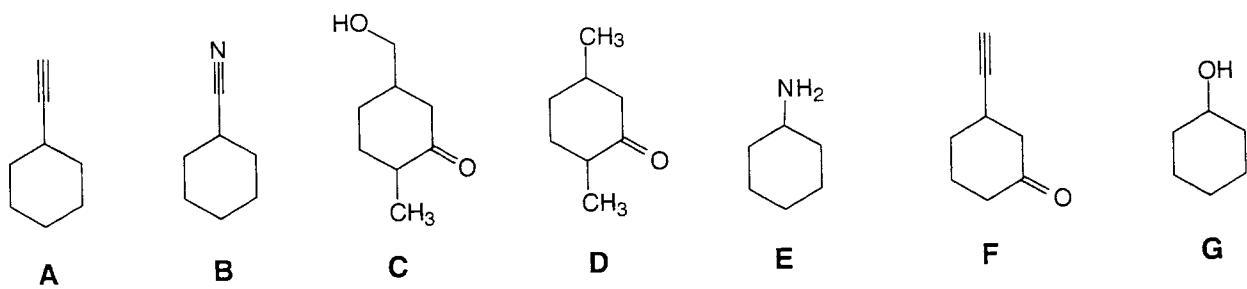
E. SYNTHESIS (10 points)

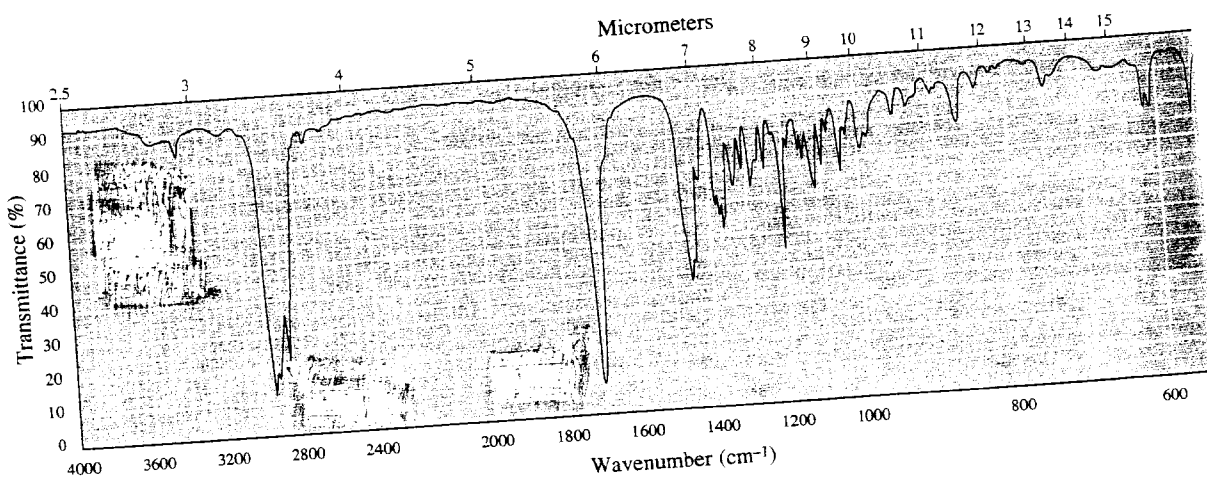
From cyclohexane, methanol, and any inorganic reagents, synthesize the compound below.



F. SPECTROSCOPY (10 points)

Carefully examine the five infrared spectra and the compounds below. Place the letter of the compound in the box beside its spectrum.





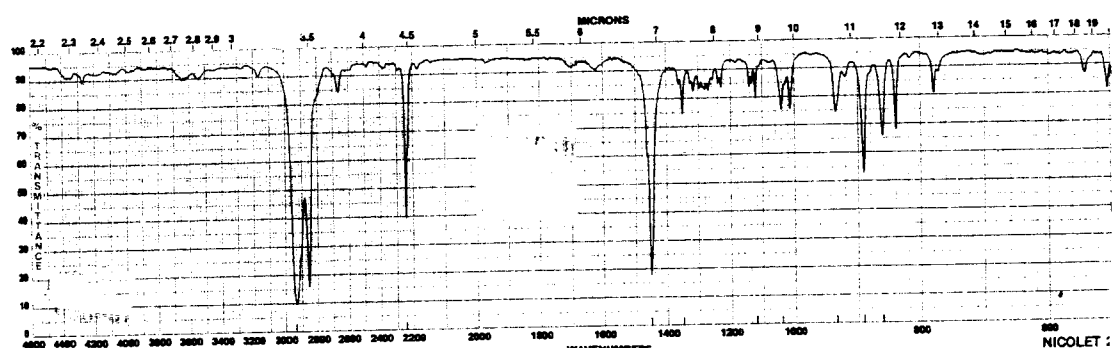
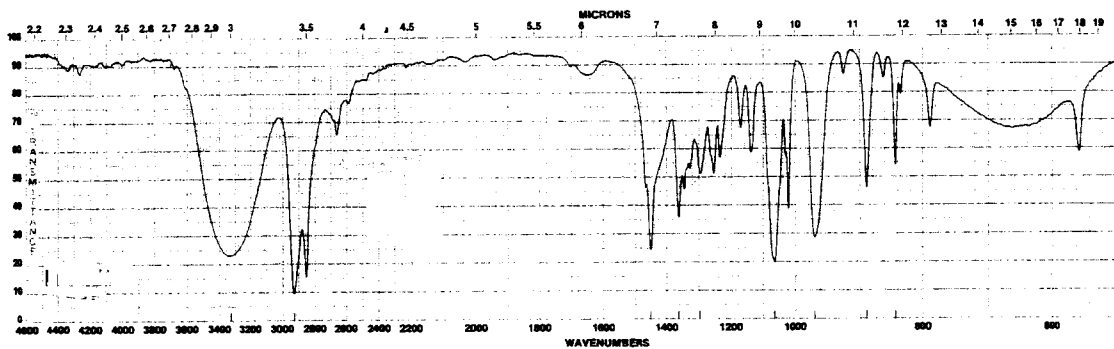
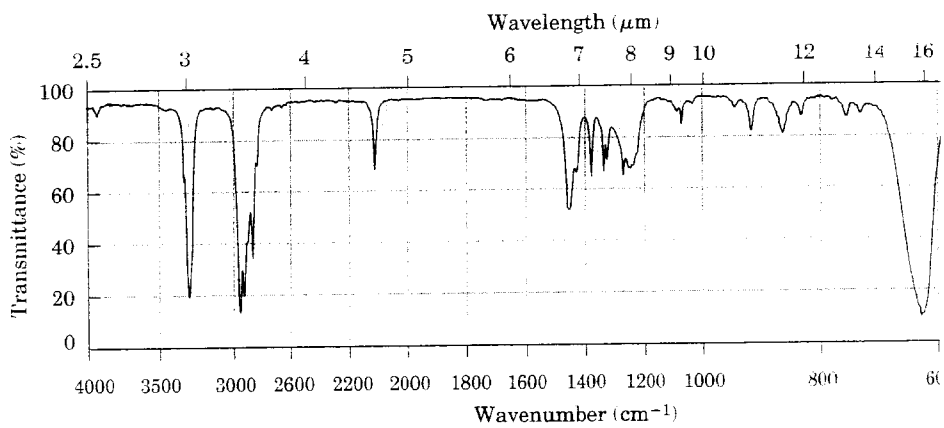


TABLE 13.2 Characteristic infrared absorptions of groups

GROUP	FREQUENCY RANGE (cm ⁻¹)	INTENSITY ^a
A. Alkyl		
C—H (stretching)	2853–2962	(m–s)
Isopropyl, —CH(CH ₃) ₂	1380–1385	(s)
	and 1365–1370	(s)
<i>tert</i> -Butyl, —C(CH ₃) ₃	1385–1395	(m)
	and ~ 1365	(s)
B. Alkenyl		
C—H (stretching)	3010–3095	(m)
C=C (stretching)	1620–1680	(v)
R—CH=CH ₂	985–1000	(s)
	and 905–920	(s)
R ₂ C=CH ₂	880–900	(s)
<i>cis</i> -RCH=CHR	675–730	(s)
<i>trans</i> -RCH=CHR	960–975	(s)
	(out-of-plane C—H bendings)	
C. Alkynyl		
≡C—H (stretching)	~ 3300	(s)
C≡C (stretching)	2100–2260	(v)
D. Aromatic		
Ar—H (stretching)	~ 3030	(v)
Aromatic substitution type (C—H out-of-plane bendings)		
Monosubstituted	690–710	(very s)
	and 730–770	(very s)
<i>o</i> Disubstituted	735–770	(s)
<i>m</i> Disubstituted	680–725	(s)
	and 750–810	(very s)
<i>p</i> Disubstituted	800–840	(very s)
E. Alcohols, Phenols, and Carboxylic Acids		
O—H (stretching)		
Alcohols, phenols (dilute solutions)	3590–3650	(sharp, v)
Alcohols, phenols (hydrogen bonded)	3200–3550	(broad, s)
Carboxylic acids (hydrogen bonded)	2500–3000	(broad, v)
F. Aldehydes, Ketones, Esters, and Carboxylic Acids		
C=O (stretching)	1630–1780	(s)
Aldehydes	1690–1740	(s)
Ketones	1680–1750	(s)
Esters	1735–1750	(s)
Carboxylic acids	1710–1780	(s)
Amides	1630–1690	(s)
G. Amines		
N—H	3300–3500	(m)
H. Nitriles		
C≡N	2220–2260	(m)

^a Abbreviations: s = strong, m = medium, w = weak, v = variable, ~ = approximately.