PRACTICE EXAM 1 (SAMPLE PROBLEMS FROM OLD EXAMS)

Department of Chemistry
University of Vermont

Chem 142/144
Spring 2001
Exam 1

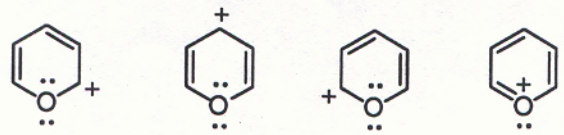
Name:

Problem	points (total)	Grader
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____
	_____	_____

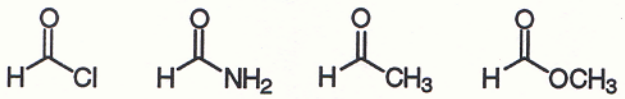
Score:_____

For each question in this section, circle the correct answer. Each problem is worth 3 points.

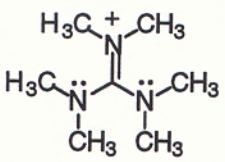
1. Which resonance structure makes the biggest contribution to the hybrid?



2. Which of the following molecules would you expect to have the greatest electron density at the carbonyl oxygen?

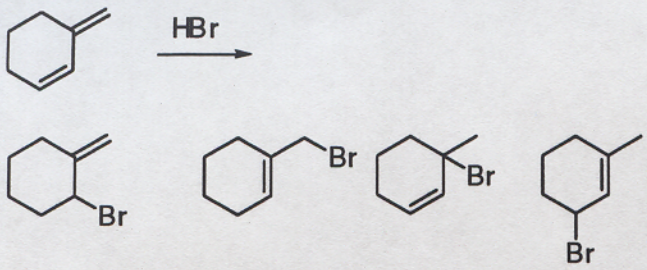


3. How many distinct signals would the ^1H NMR spectrum of the ion below exhibit? Hint: begin by thinking resonance.

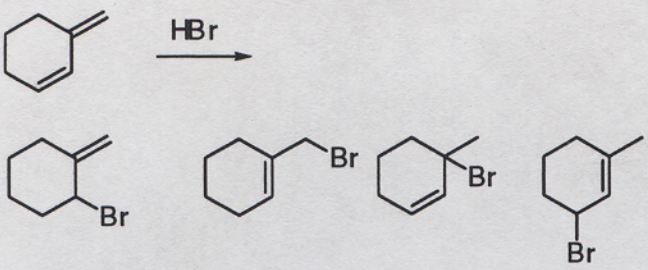


a) 1
b) 2
c) 3
d) 4

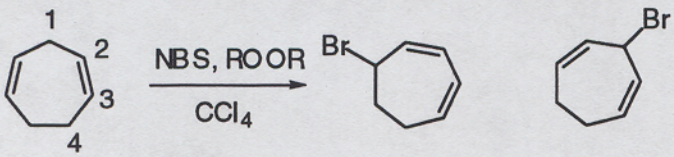
4. Consider the following reaction. Which would be the major product expected under conditions of kinetic control?



5. Consider the following reaction. Which would be the major product expected under conditions of thermodynamic control?

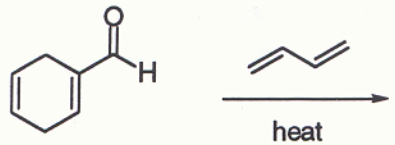


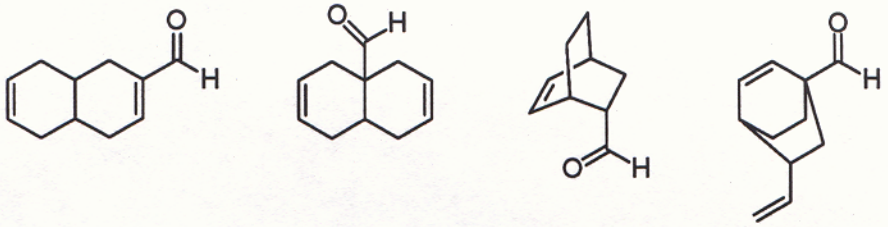
6. The following reaction affords the two isomeric bromo dicycloheptenes. For these products to form, the starting material underwent the initial hydrogen abstraction on which carbon?



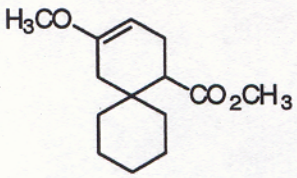
a) 1
b) 2
c) 3
d) 4

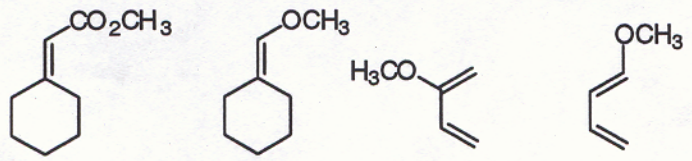
7. What is the major product expected for the following transformation?





8. Which diene and dienophile pair will give the product shown below?

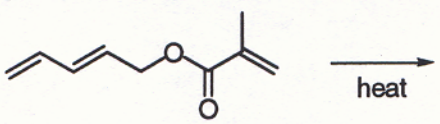


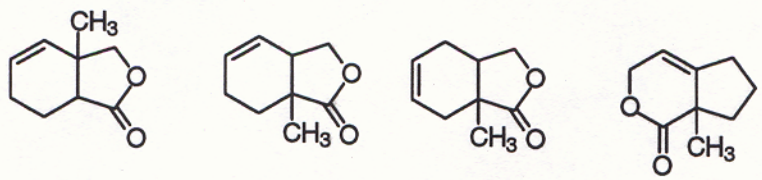


I II III IV

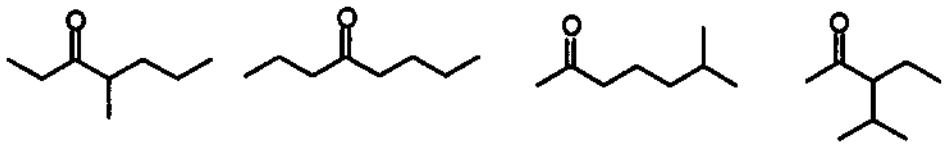
a) I and III
b) I and IV
c) II and III
d) II and IV

9. What is the major product of the following transformation?

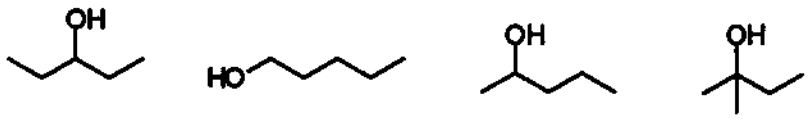




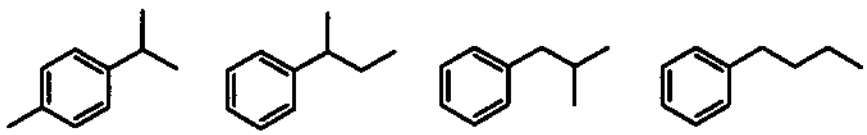
10. The mass spectrum of one of the following isomeric ketones gives fragments at m/z = 43, 100 and 113. Which is that ketone?



11. The mass spectrum of one of the following isomeric alcohols gives fragments at m/z = 31 and 70. Which is that alcohol?



12. The mass spectrum of one of the following isomeric arenes gives fragments at m/z = 105 and 119. Which is that arene?



13. Each problem in the next section is worth 6 points. Please note that the values for the integrations have been determined for you. In addition, there is a label below each resonance that indicates the splitting pattern. The designations are as follows; s=singlet, d=doublet, t=triplet, q=quartet, dd=doublet of doublets. Doublets of doublets that look like apparent triplets are labeled dd. In addition, for sections e-h on the upper right hand corner you will find the ^{13}C NMR shifts. Use these to correlate the signals you see in the ^{13}C spectrum (some may be difficult to detect). The triplet at 77.7 ppm in the carbon spectrum is $CDCl_3$ (solvent). You may want to circle fragments and put a square around your final answer to get partial credit.

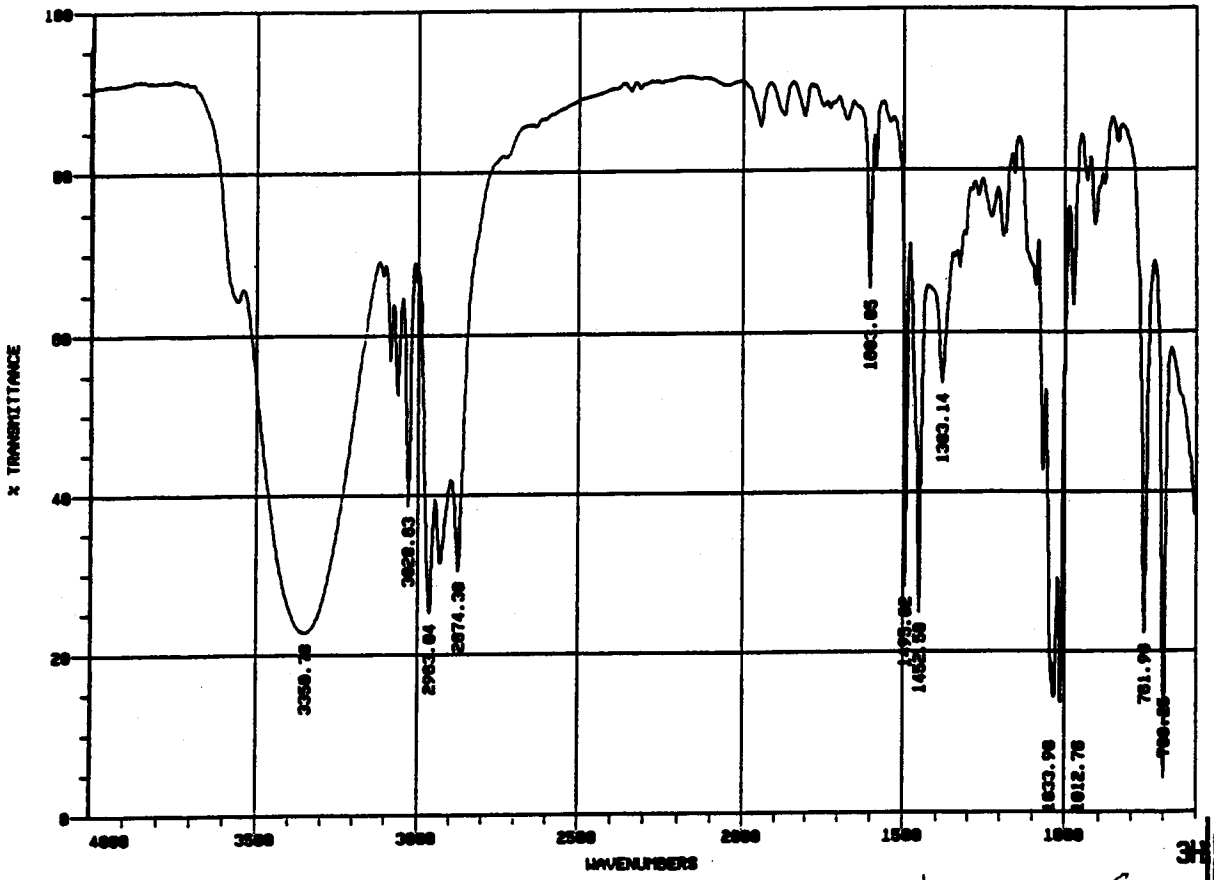
(A)

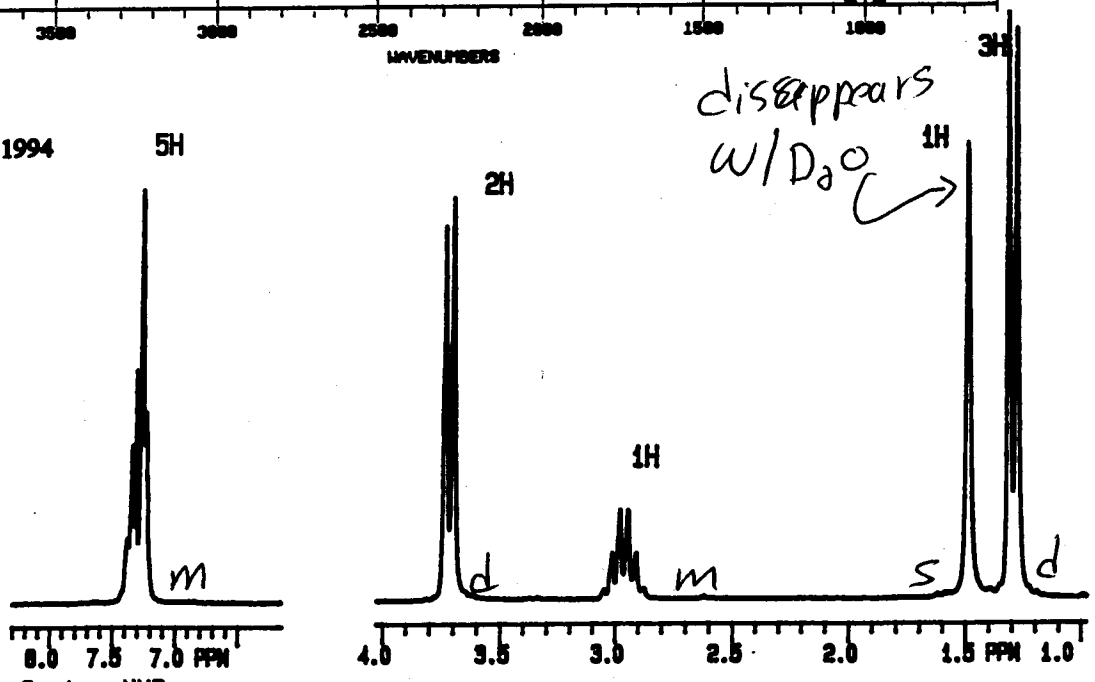
MF $C_9H_{12}O$

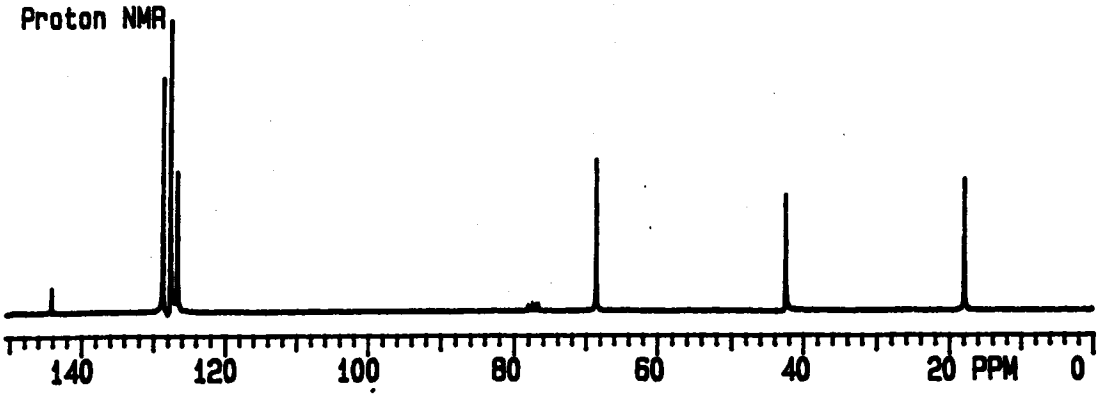
MW 136

%C 79.4

%H 8.9

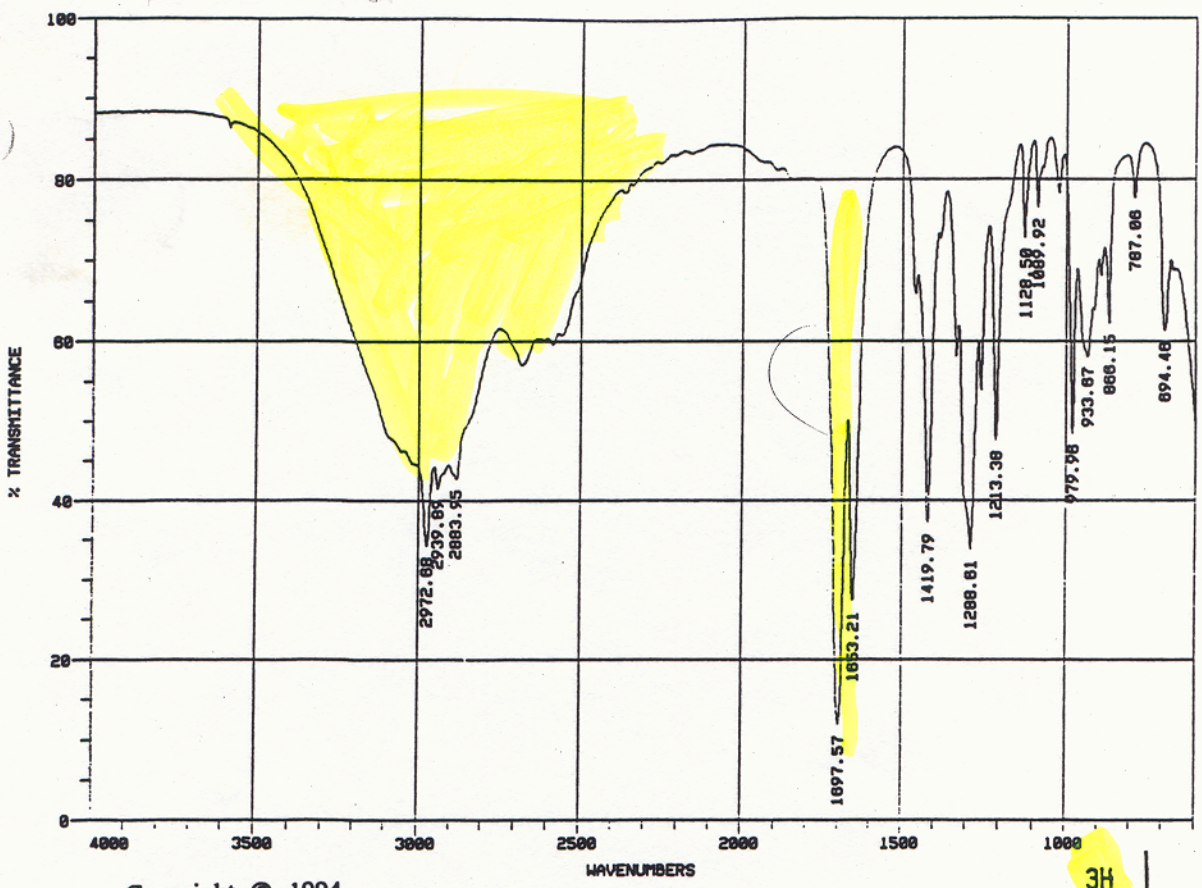


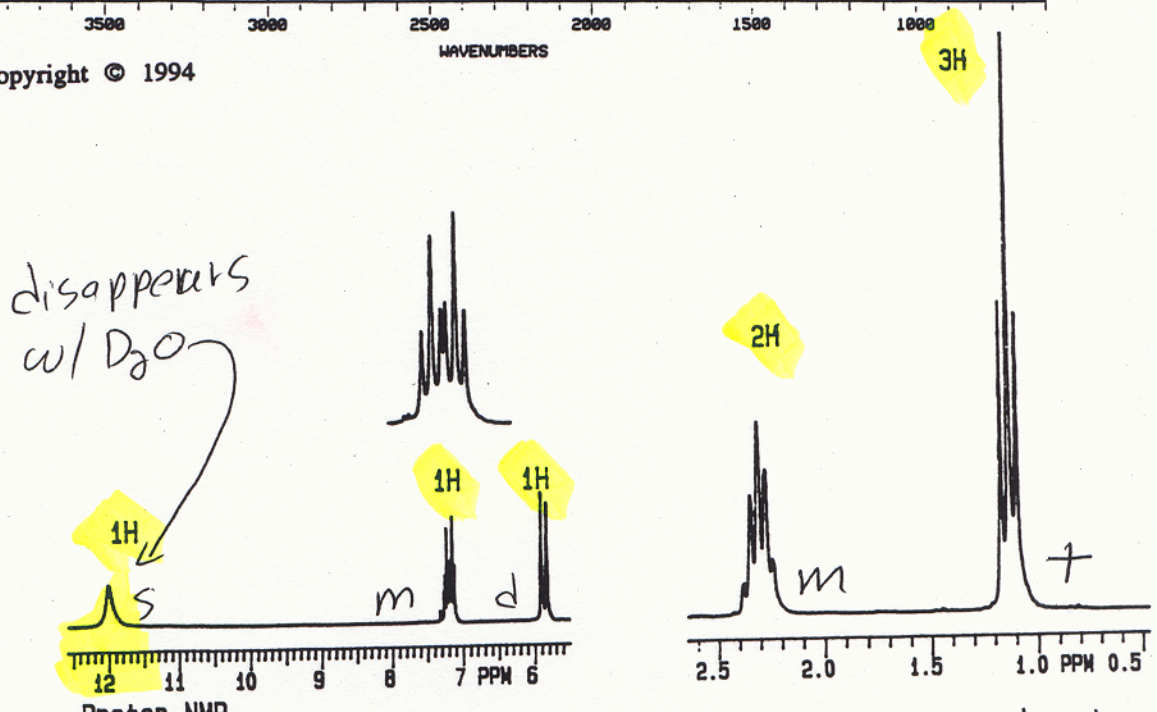




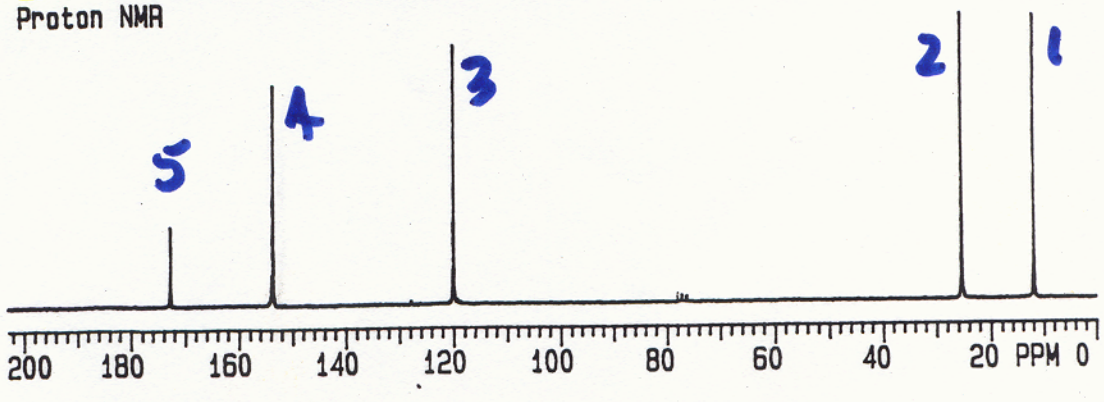
Carbon 13 NMR

(B)



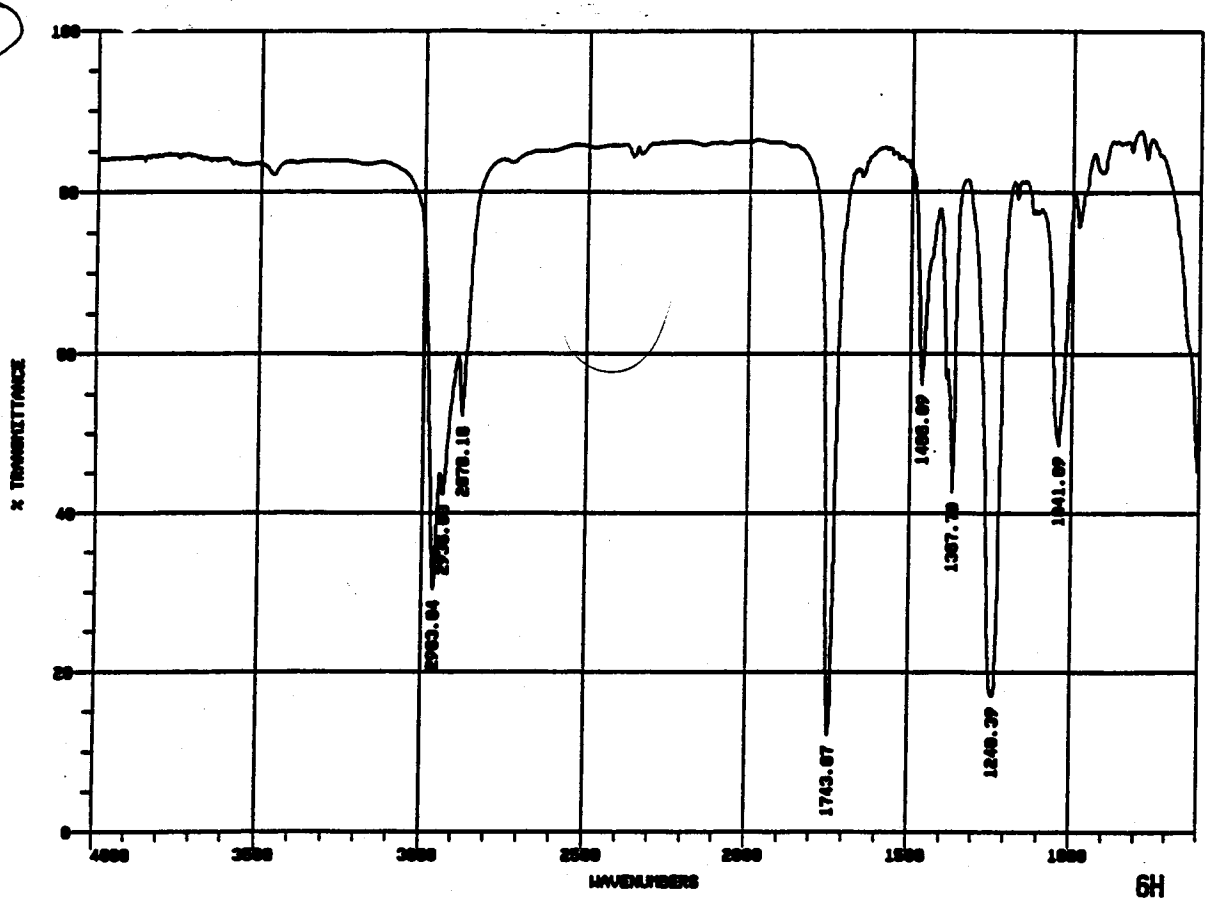


Proton NMR



Carbon 13 NMR

(C)

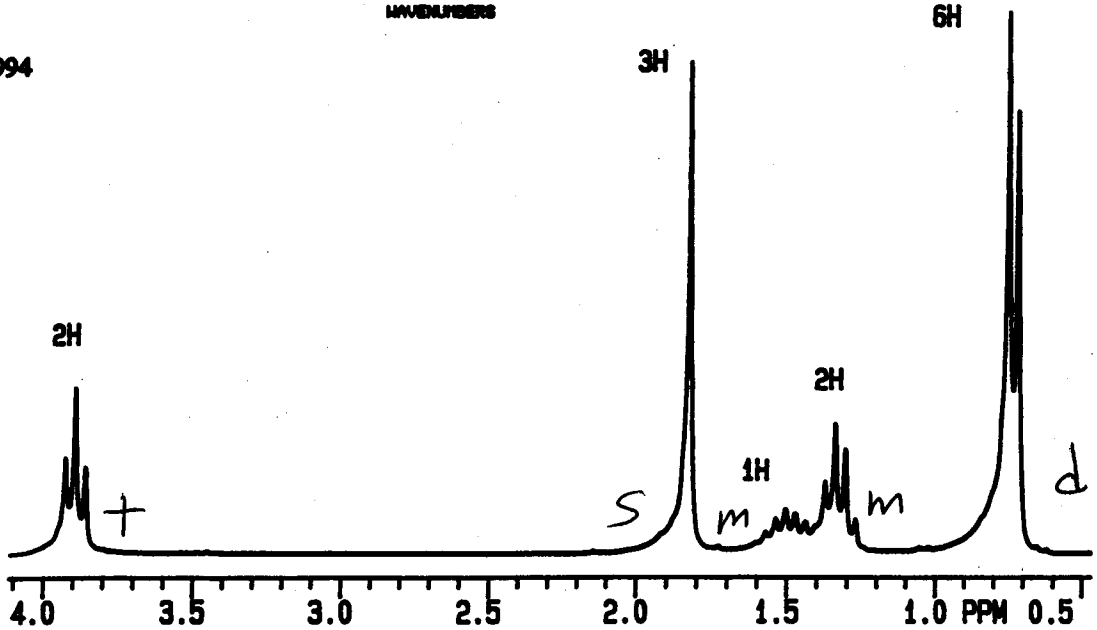


MF $C_7H_{14}O_2$

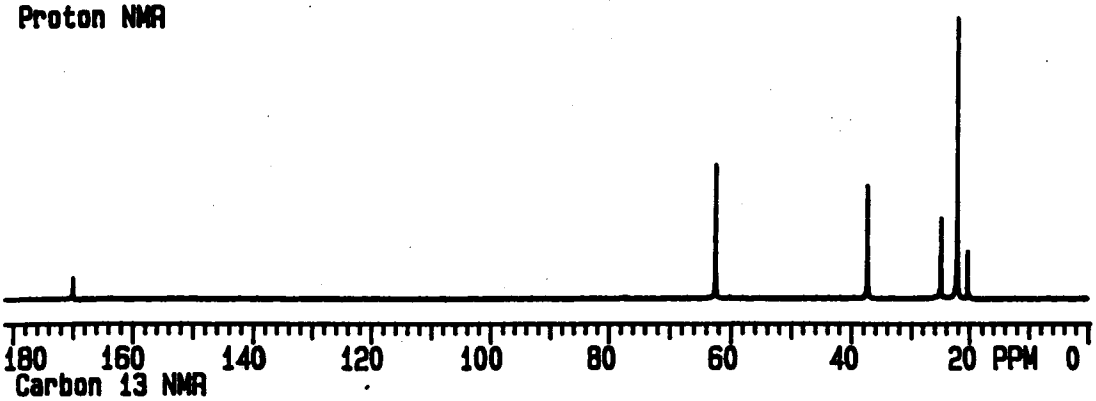
MW 130

%C 64.6

%H 10.8

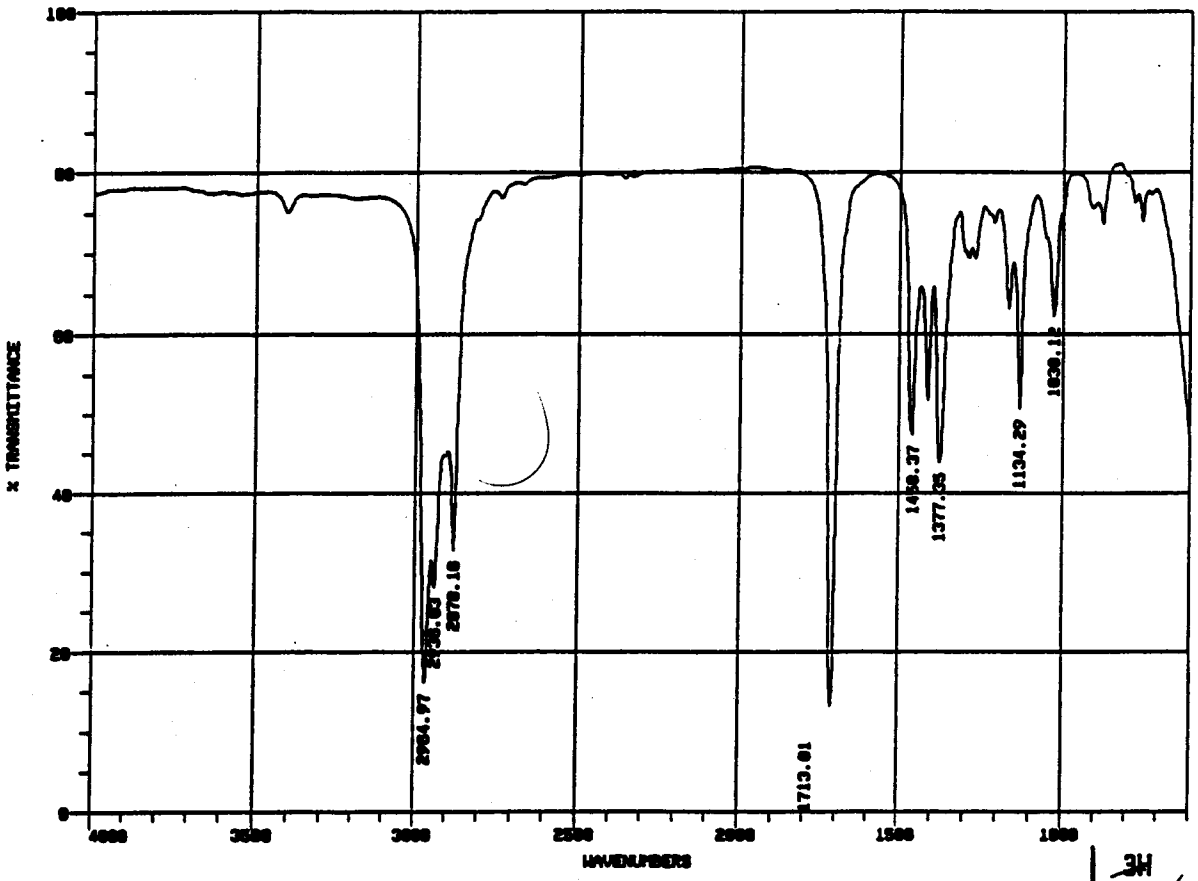


Proton NMR



Carbon 13 NMR

(D)



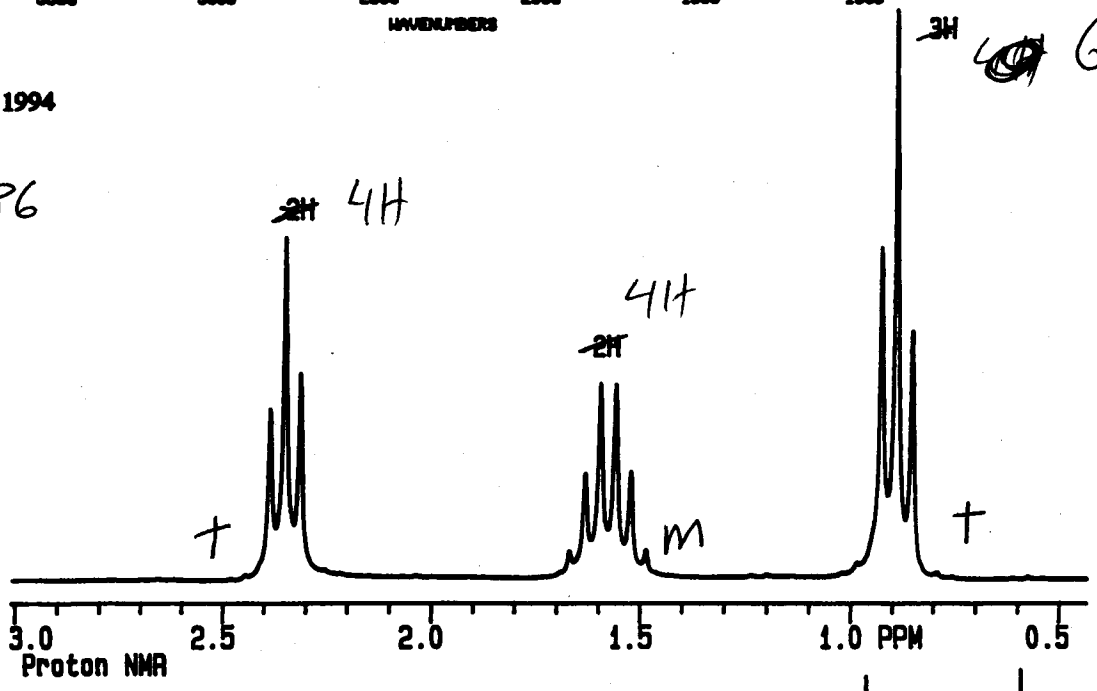
MF $C_7H_{14}O$

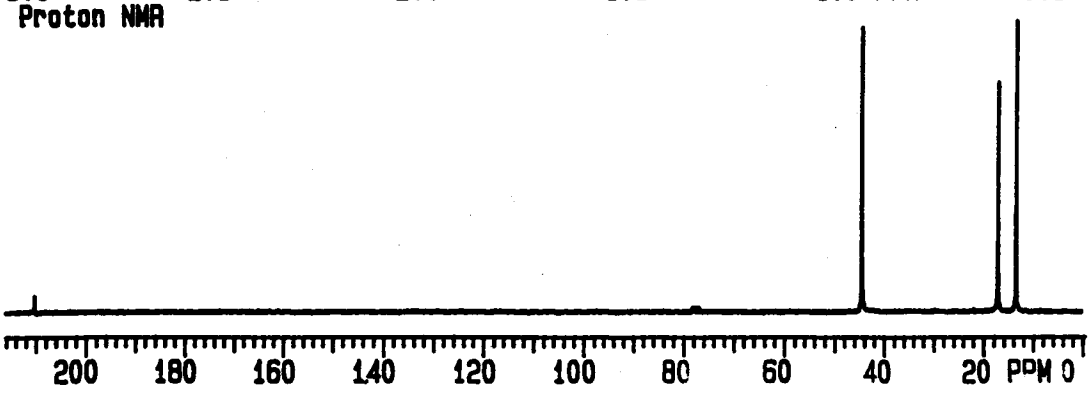
MW 114

%C 73.6

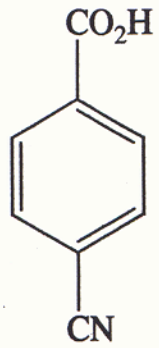
%H 12.4

m/z = 71, 86





(8) 1. Write the name of the following compounds on the line under each structure:



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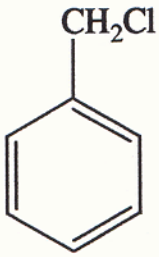

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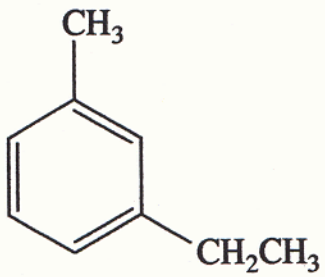

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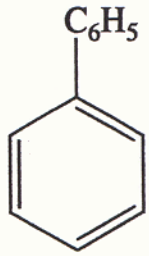

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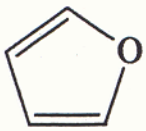

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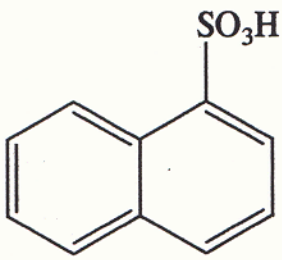

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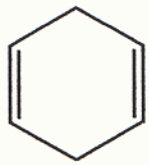

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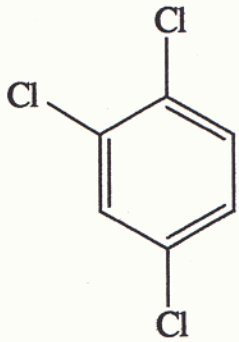

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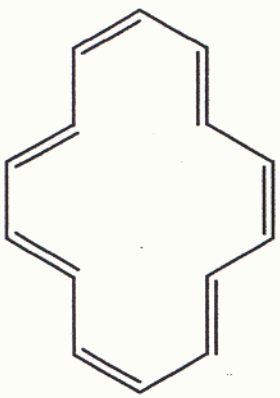
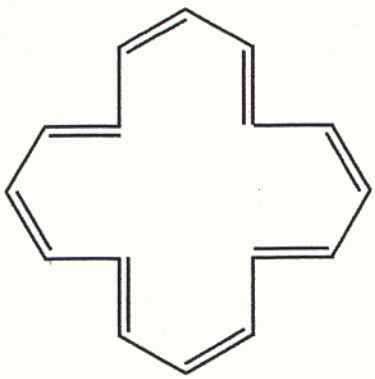
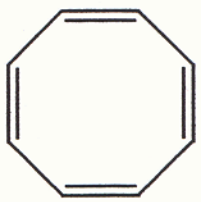
(2) 2. Circle the aromatic species. You must circle all aromatics for credit.



A



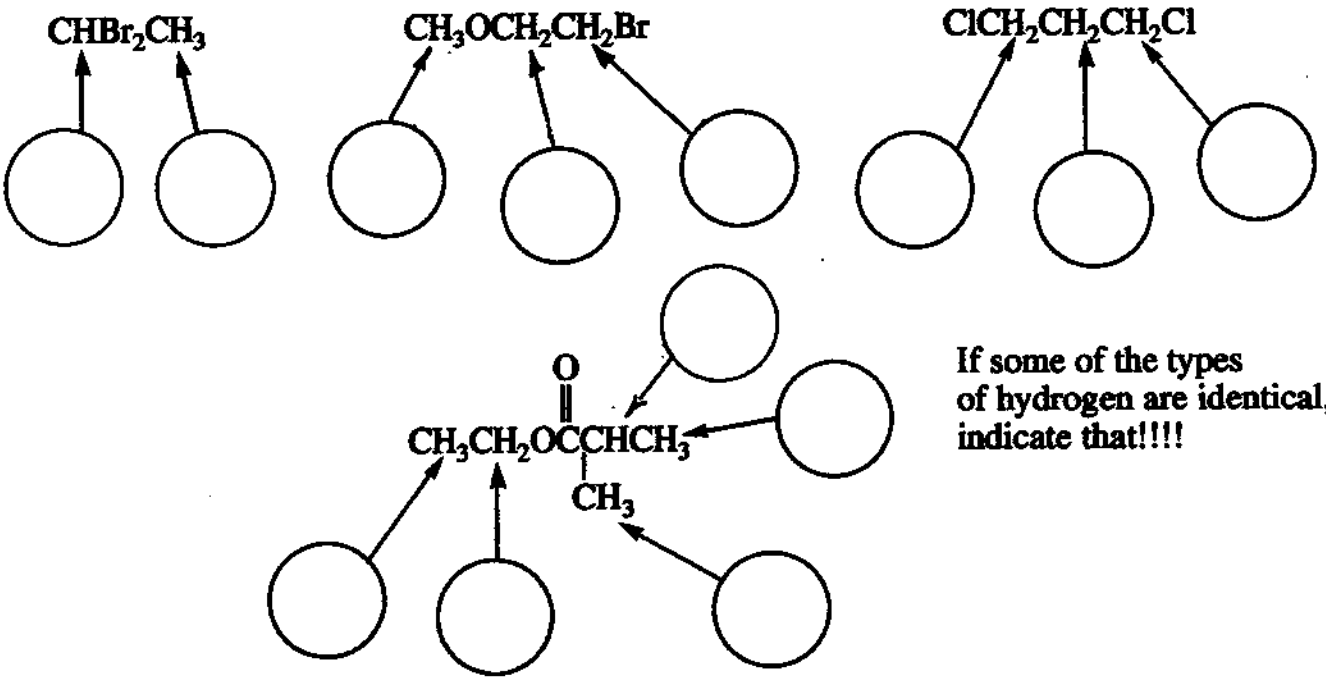
B



C

(1) 3. How many pi MO's does B have? _____

(13) 15. Predict the splitting patterns you would expect for each proton in the pmr spectrum of these molecules: (s=singlet, d=doublet, t=triplet, q=quartet, quintet, sextet, septet)



If some of the types of hydrogen are identical, indicate that!!!!

(6) 16. Draw structures for compounds that meet these descriptions:

C_2H_6O; one singlet →

C_3H_7Cl; one doublet and one septet →

$C_4H_8O_2$; one singlet, one triplet and one quartet →

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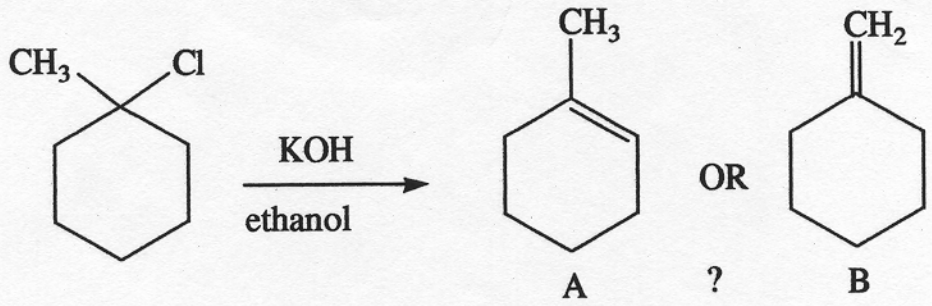
(3) 17. The following reaction was carried out to give a single product:



Indicate how a CMR spectrum would clearly distinguish which product was obtained.

(3) 18. How might IR spectroscopy help distinguish between these pairs of isomers? Be **specific** about absorptions:

CH_3CH_2OH and CH_3OCH_3 ⟶

cyclohexane and 1-hexene ⟶

CH_3CH_2COOH and $HOCH_2CH_2CHO$ ⟶