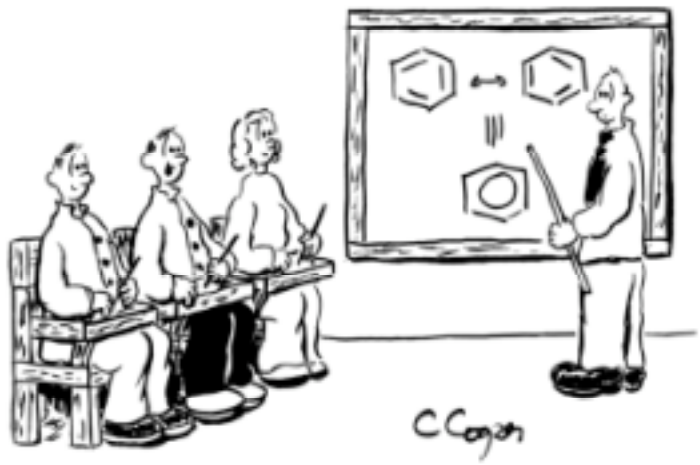
Chem 342

Exam 01
13 February 2004

NAME_____



"Define 'resonance'? Sure, that's where you live."

Please read through each question carefully and answer in the spaces provided.

A good strategy is to go through the test and answer all the questions you can do easily. Then go back and tackle the more difficult problems.

Please make sure your structures are drawn clearly and indicate any stereochemistry with bold or dashed bonds.

Finally, think about what you know. Reason and common sense can often help you out.

Problem 1	12 pts _____	Problem 6	10 pts_____
Problem 2	8 pts _____	Problem 7	20 pts _____
Problem 3	12 pts _____	Problem 8	18 pts _____
Problem 4	12 pts _____		
Problem 5	8 pts _____	TOTAL	100 pts_____

1. Indicate whether the following statements are True for False. (12 pts)

☐ The area under a peak in proton NMR tells us how many hydrogens are neighboring it.

☐ The ENDO product is usually preferred in the Diels-Alder cycloaddition.

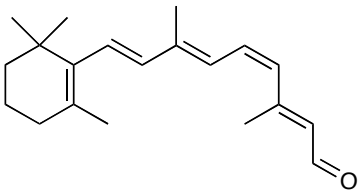
☐ Any compound with 4n+2 electrons will be Aromatic.

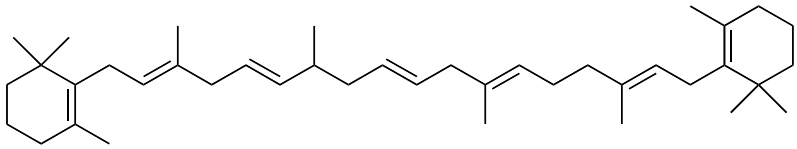
☐ Friedel-Crafts Acylation is usually better than Alkylation for obtaining mono-substitution products.

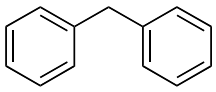
☐ In a kinetically controlled reaction the major product is the one that forms the fastest.

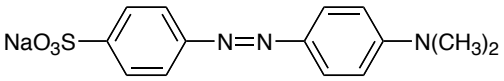
☐ Electrophiles will add to a pi-bond of a benzene ring

2. Circle all of the following molecules that you would expect to be colored (absorb light in the visible region above 400 nm). (8 pts)

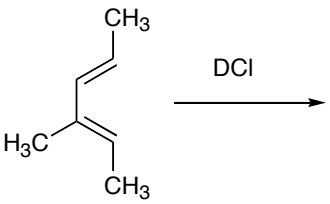






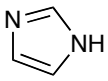
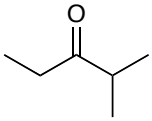
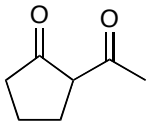


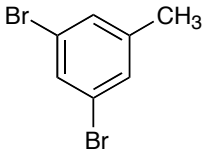
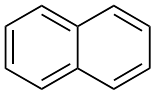
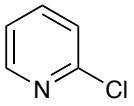
3. The unsymmetric diene shown below will react with DCl to give two different 1,2-products and two different 1,4-products. Draw the four possible products. (12 pts)



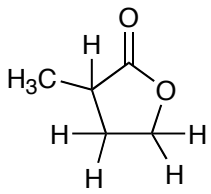
1,2-product | 1,2-product | 1,4-product | 1,4-product

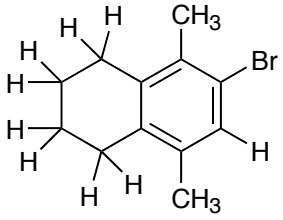
4. For each of the following molecules, indicate the number of different ^{1}H and ^{13}C resonances you would observe in the NMR spectrum. (12 pts)

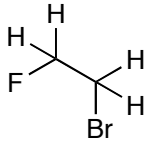
	Number of ^{1}H Resonances	Number of ^{13}C Resonances
		
		
		

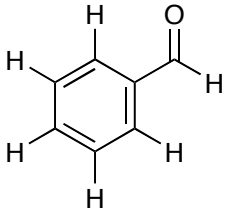
	Number of ^{1}H Resonances	Number of ^{13}C Resonances
		
		
		

5. For each of the following molecules, circle the hydrogens you would expect to find the furthest downfield (to the left) on the NMR spectrum. (8 pts)

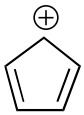


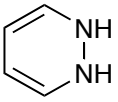


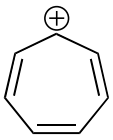


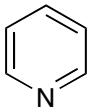


6. Circle all of the following molecules that would NOT posses an aromatic ring. (10 pts)

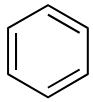


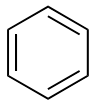
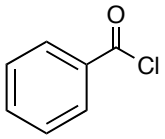


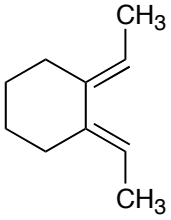
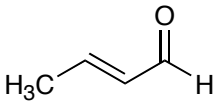


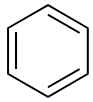
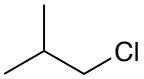


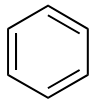
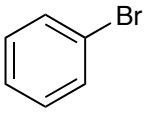
7. Provide the MAJOR product or reactants necessary for the following reactions. Show any stereochemistry clearly. (20 pts)

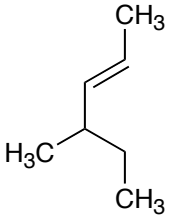
(a)  HNO_3, H_2SO_4 → [ ]

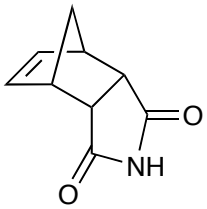
(b)   $AlCl_3$ → [ ]

(c)   → [ ]

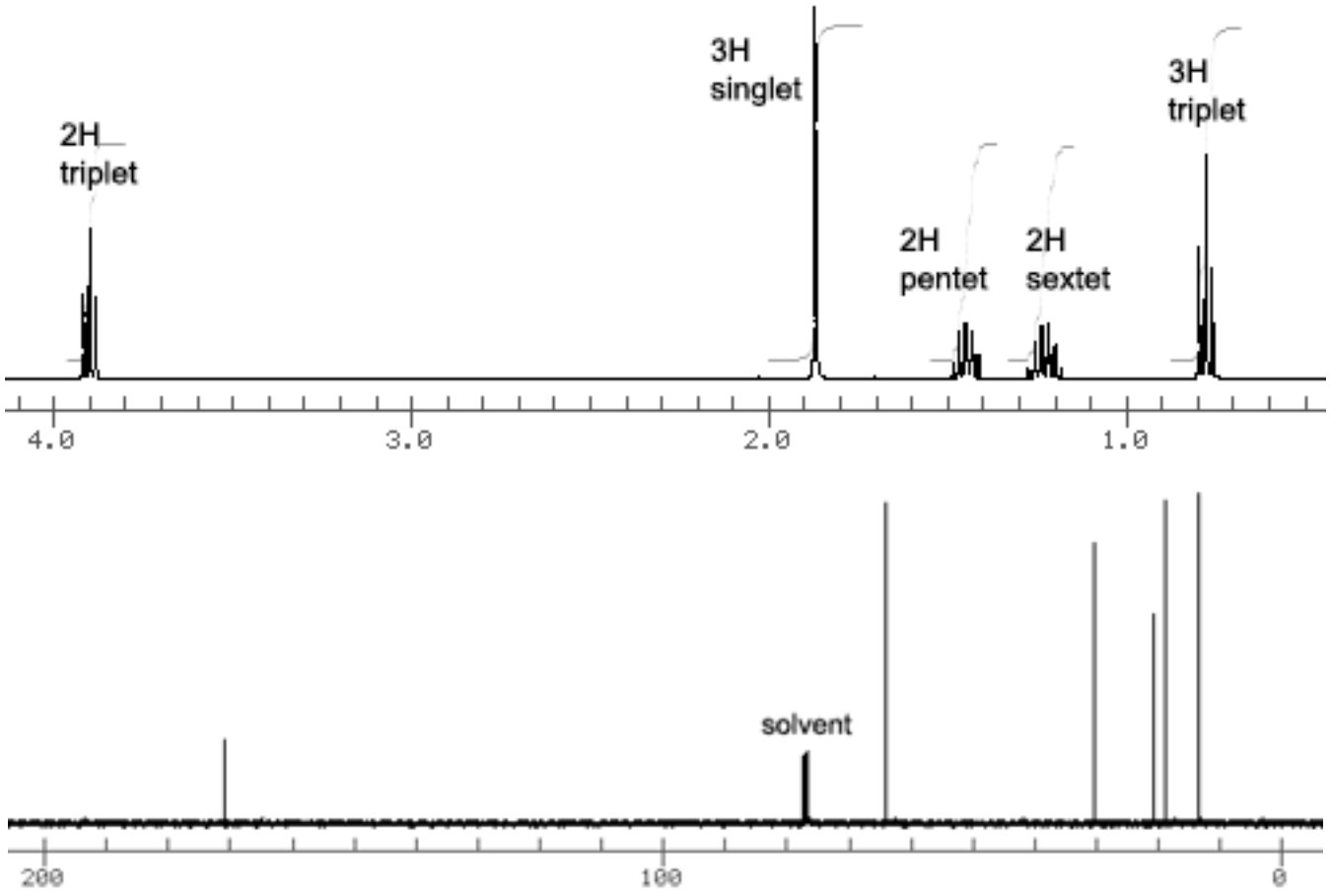
(d)   $AlCl_3$ → [ ]

(e)  [ ] → 

(f)  1) NBS, peroxides
2) KO*t*-Bu, *t*-BuOH → [ ]

(g)  [ ] → 

8. The proton and carbon NMR spectra for an unknown compound with the molecular formula $C_6H_{12}O_2$ is shown below. (18 pts)

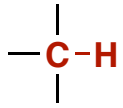
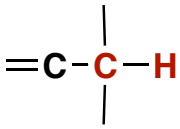
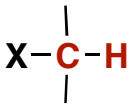
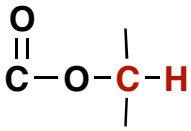
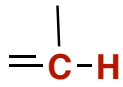
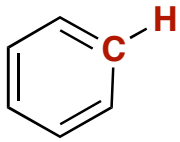
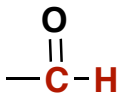
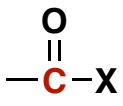
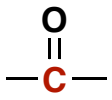


How many units of unsaturation does the molecule have?

What kind of functional group is present?

What is the structure of this molecule?

Typical NMR Chemical Shifts

Functional Group	Type	^{1}H Chemical Shift (ppm)	^{13}C Chemical Shift (ppm)
	Alkane	0.7 -1.8	10 - 60
	Allylic or next to carbonyl	1.6 - 2.4	30 - 60
	next to halogen or alcohol	2.5 - 4.0	20 - 85
	next to oxygen of an ester	4.0 - 5.0	50 - 85
	vinylic	4.5 - 6.5	110 - 150
	aromatic	6.5 - 8.0	110 - 140
	aldehyde	9.7 - 10.0	190 - 220
	alcohol	varies widely will exchange with D_2O	N/A
	carbonyl of ester, amide, or carboxylic acid (X = O, N)	N/A	165 - 185
	carbonyl of ketone or aldehyde	N/A	190 - 220