Chem 342 Organic Chem II

Midterm Exam 02
08 March 2002

KEY

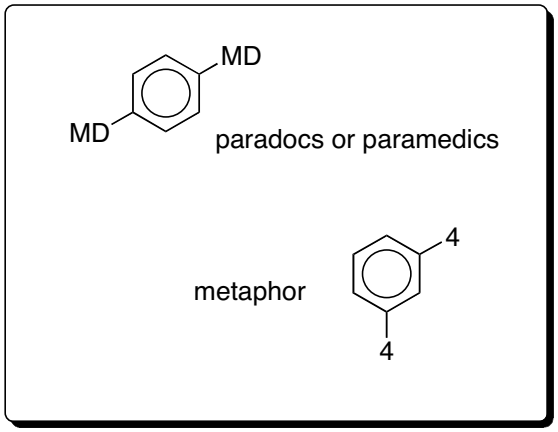
NAME_____

QUOTE OF THE DAY

Isaac Asimov said that if you want to find a chemist, ask him/her to discuss the following words:

mole
unionized

As he so eloquently put it, "If he starts talking about furry animals and organized labor, keep walking."



Please read through each problem carefully. Enter your answers in the spaces provided.

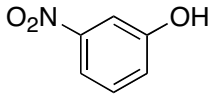
Problem 1	9 pts	_____
Problem 2	10 pts	_____
Problem 3	8 pts	_____
Problem 4	14 pts	_____
Problem 5	28 pts	_____
Problem 6	16 pts	_____
Problem 7	14 pts	_____
given		**1**
TOTAL		_____

A note about drawing structures: you should make your drawings as clear as possible to understand. Stereochemistry should be indicated unambiguously using conventional drawing techniques (eg. bold wedges and dashes). If you use anything besides line drawings, you need to include the hydrogens.

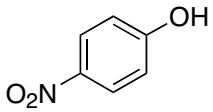
The most common mistake on an exam is not reading the question carefully. I suggest you go through the exam and answer the questions that come easily. Then go back and tackle the more challenging problems. Finally, check any work you have done, but remember, your first instinct is usually correct.

If you need scrap paper or more room, use the back of the test pages.

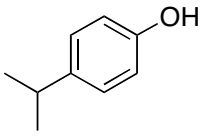
1. Rank the following phenols in order of acidity where 1 is most acidic, and 3 is least acidic. (9 pts)



2

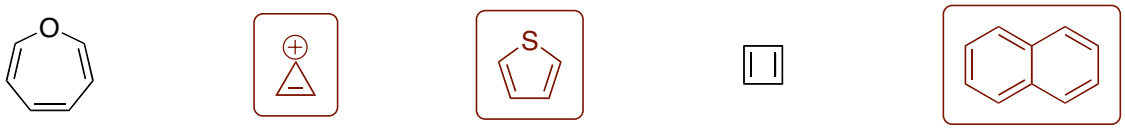


1

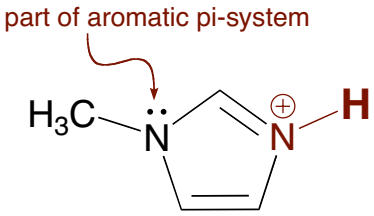


3

2. Circle all the following molecules that are aromatic. (10 pts)

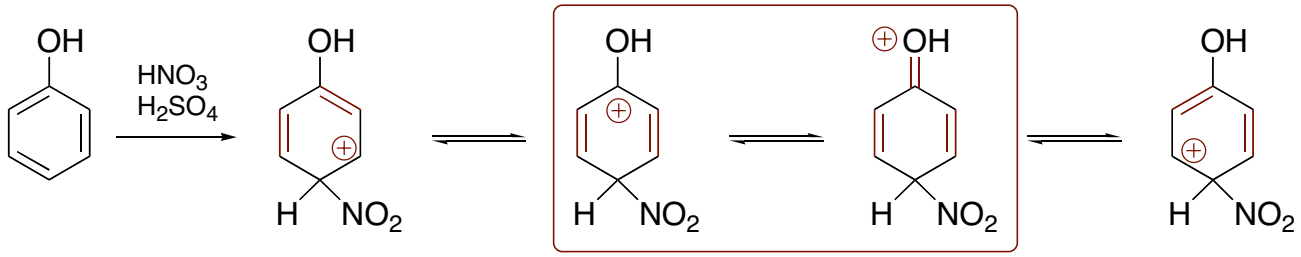


3. *N*-Methylimidazole is an aromatic heterocycle that contains two nitrogens. Upon treatment with acid, one of these nitrogens is preferentially protonated. On the structure below, draw the protonated form and briefly explain why the proton adds selectively to one of the nitrogens. (8 pts)



N-Methylimidazole will be protonated on the nitrogen shown. The lone pair of electrons on this nitrogen are perpendicular to the aromatic pi-system. The lone pair on the N-methyl nitrogen is not available for protonation as it is delocalized in the pi-system.

4. In the electrophilic nitration of phenol, the electrophile could add ortho, meta, or para. The carbocation intermediate formed from the addition of the electrophile to the para position can be represented by four different resonance structures. On the structures below, complete the drawings for the four resonance structures by filling in all the pi-bonds and formal charges. Circle any structures that are particularly stable. (8 pts)



Is phenol more or less reactive than benzene? (2 pts) **MORE REACTIVE**

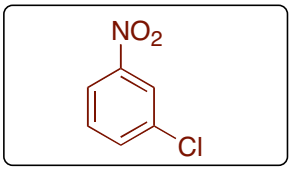
Would substitution in the meta position of phenol be preferred over the para position? Why? (4 pts)

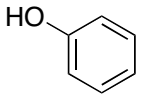
The para position would be preferred over the meta position because if the electrophile attacks the meta position, none of the resonance structures are especially stabilized.

5. Draw the major product for the following reactions. (28 pts)

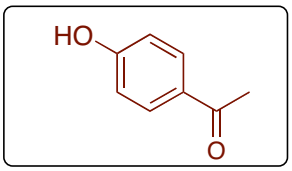
(a) 

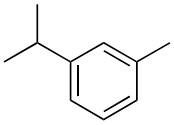
1) HNO_3, H_2SO_4
2) Cl_2, $FeCl_3$



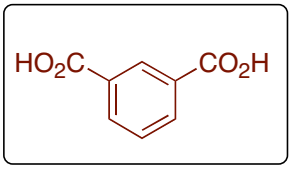
(b) 

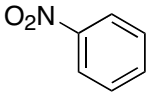
$AlCl_3$



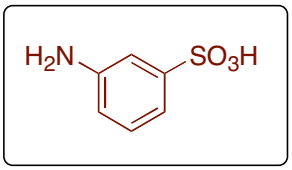
(c) 

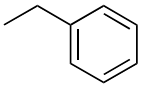
$KMnO_4$



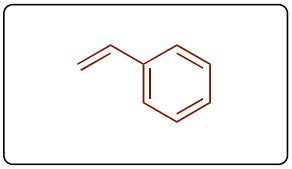
(d) 

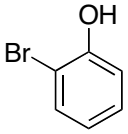
1) SO_3, H_2SO_4
2) H_2, Pd/C



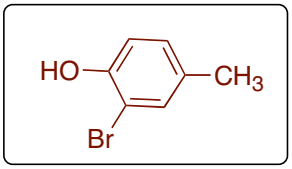
(e) 

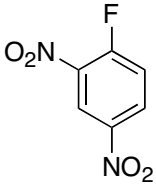
1) NBS, peroxides
2) KOH



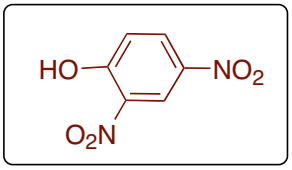
(f) 

CH_3Cl, $AlCl_3$



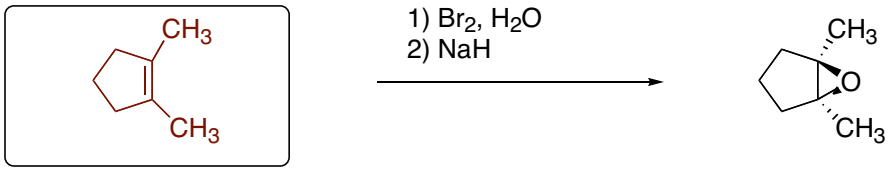
(g) 

KOH, 80 °C



6. Provide the starting material or the reagents necessary for the following reactions. (16 pts)

(a)



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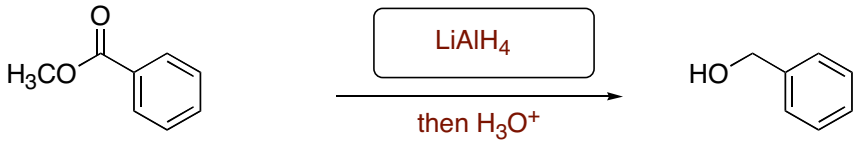

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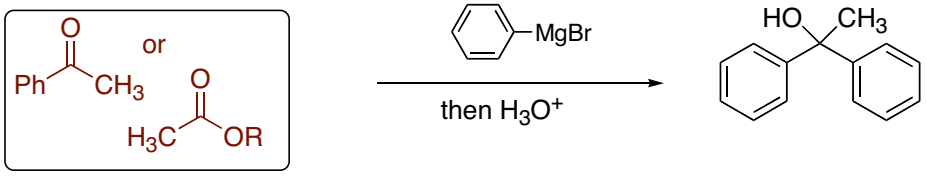
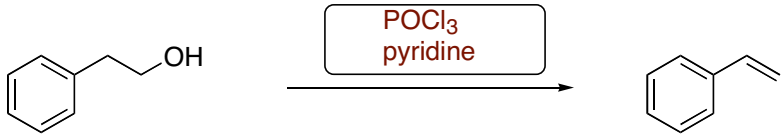


(d)



7. Starting from ethylbenzene and any other inorganic reagents you need, show how you would synthesize the following molecule. Note, this is a multistep synthesis. (14 pts)