

**Chemistry 2522**  
**Spring 2006; Midterm 2 Exam**

This exam has 8 problems on 6 pages. Make sure your copy is complete and correct.

Printed Name (*Last*, First) Key

Scores:

1. 8

2. 8

3. 19

4. 12

5. 15

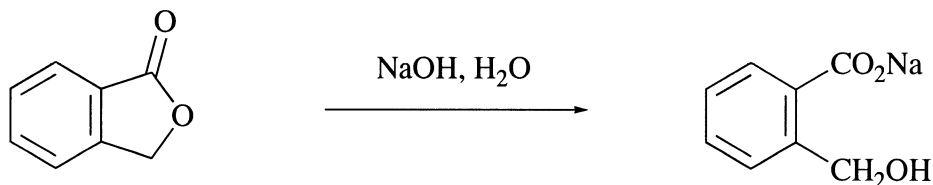
6. 14

7. 9

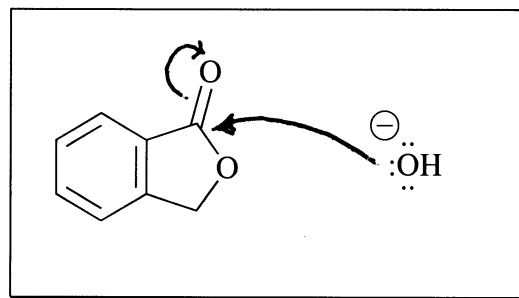
8. 15

Total: 100

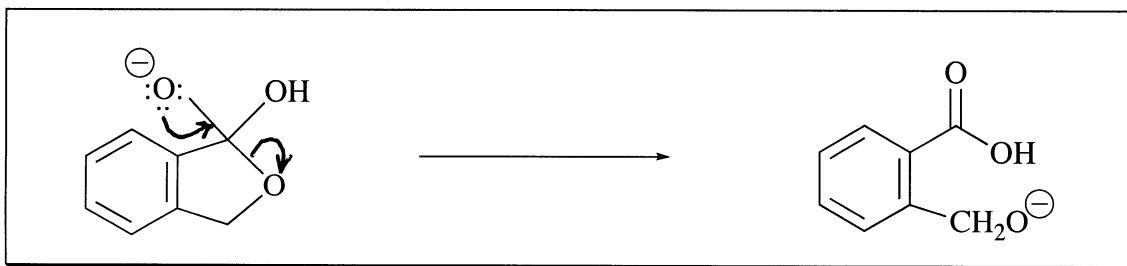
1. (8) Answer questions (a) and (b) on the **mechanism** of the following reaction:



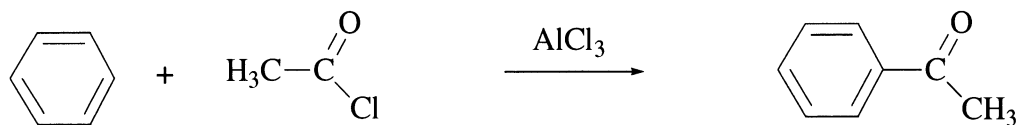
- (a) In the provided box, draw **two curved arrows** explaining the initial step (*nucleophilic addition*) in the mechanism of this reaction (4 pts):



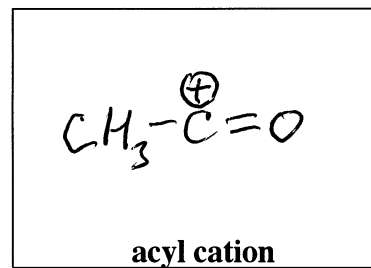
- (b) In the provided box, draw **two curved arrows** explaining the second step (*elimination*) in the mechanism of this reaction (4 pts):



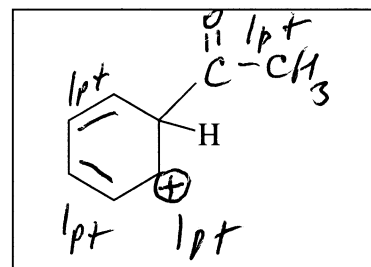
2. (8) Using provided boxes, answer the questions on the **mechanism** of the following reaction:



(a) In the provided box, draw the structure of the *electrophile (acyl cation)* in this reaction (4 pts):

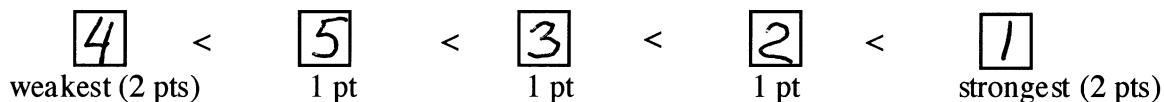


(b) In the provided box, finish drawing of the **carbocationic intermediate** formed by *electrophilic addition* of acyl cation to benzene (4 pts; 1 pt for each of the four missing fragments):



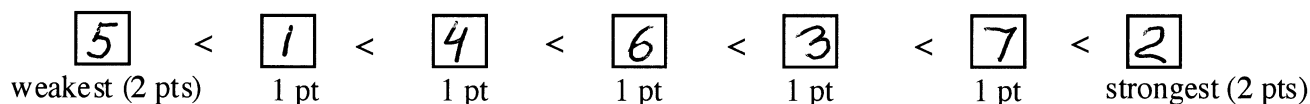
3. (19 pts) (a) (7 pts) Arrange the following compounds in order of increasing acidity (put the number in the appropriate box)

(1) 2,2-difluoropropanoic acid (2) 2-fluoropropanoic acid, (3) propanoic acid, (4) propane, (5) 2-propanol

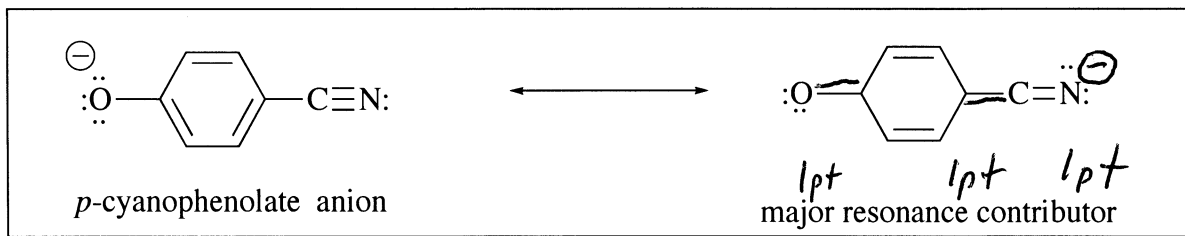


(b) (9 pts) Arrange the following **phenols** in order of **increasing acidity**:

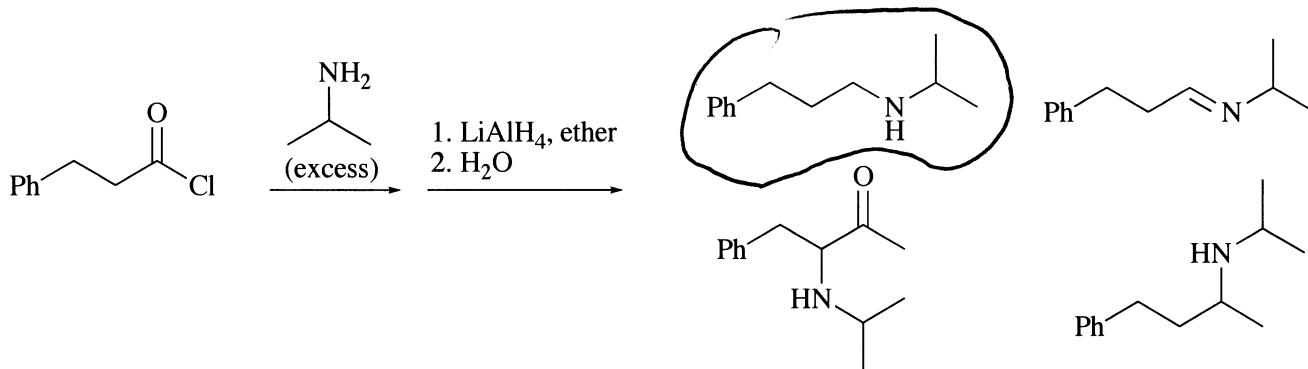
(1) 2,4-dimethylphenol, (2) 2,4,6-trinitrophenol, (3) *o*-nitrophenol, (4) *p*-methylphenol,  
 (5) 2,4,6-trimethylphenol, (6) phenol, (7) 2,4-dinitrophenol

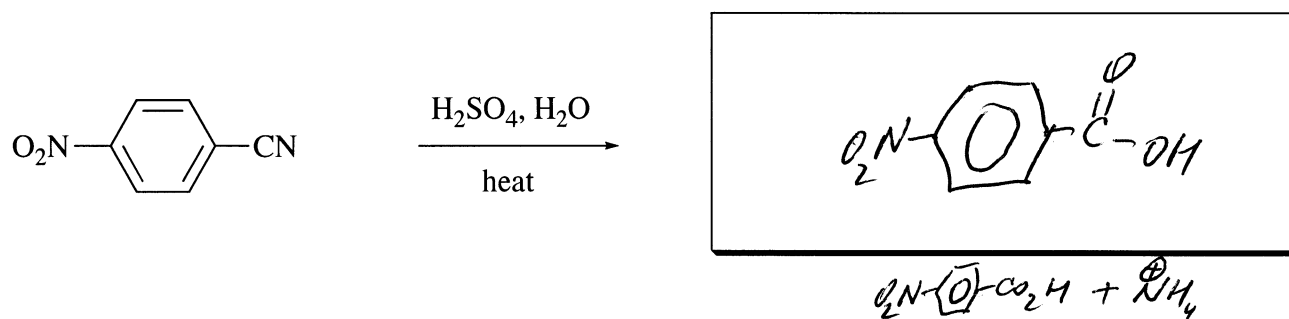
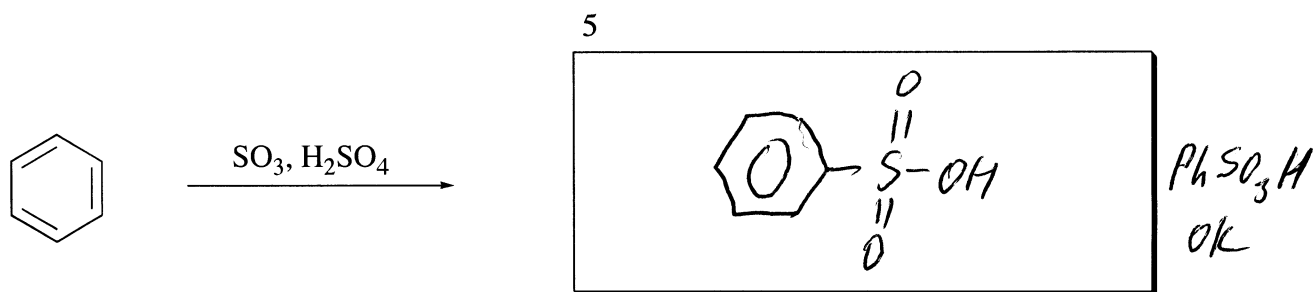


(c) (3 pts) Finish drawing of the important resonance contributor of *p*-cyanophenolate anion that explains the **high acidity** of *p*-cyanophenol (1 pt for each of the three missing fragments):

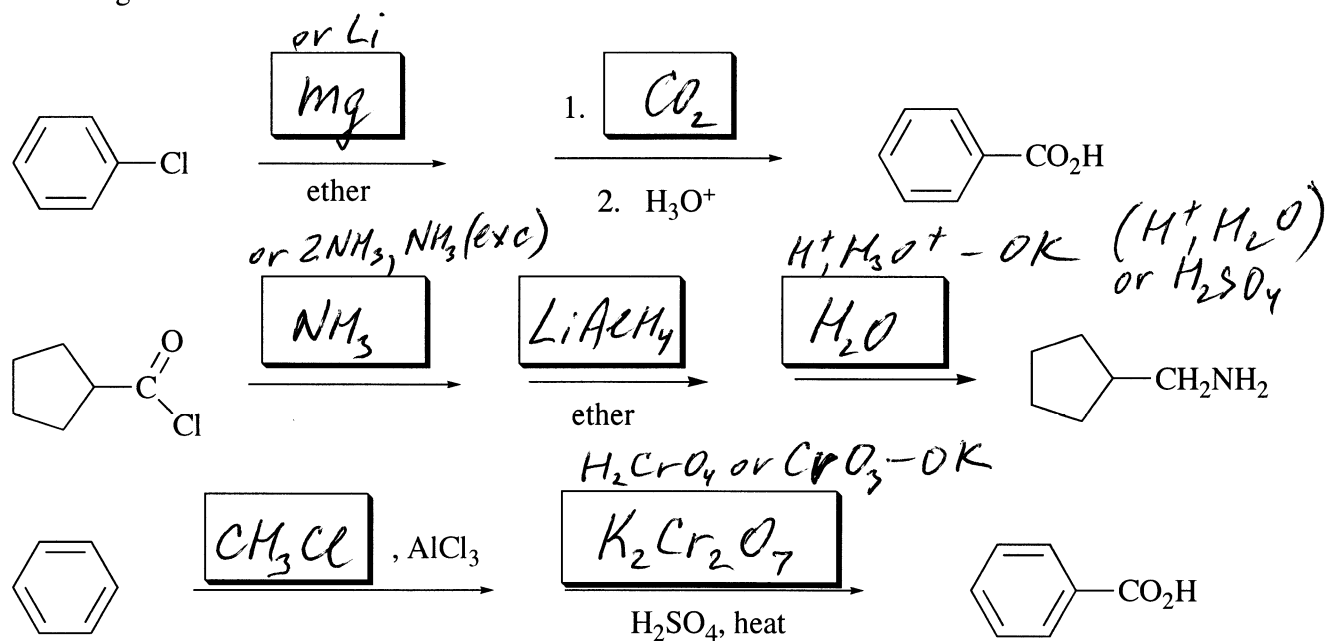


4. (12) Circle the **major organic product** obtained from each of the following of reactions (4 pt each):

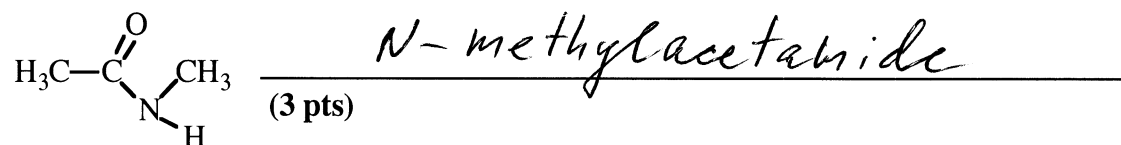




6. (14, 2 pts each box) Draw the molecule of a reagent that is required to perform each of the following reactions in the box above the arrow:

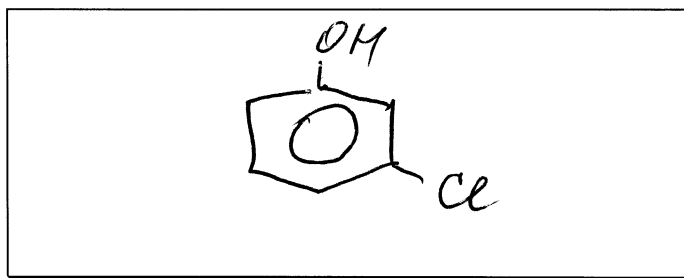


7. (9) Give either the **IUPAC name** or the **correct structure** for each of the following compounds:

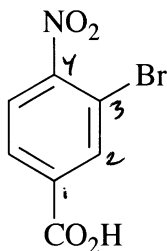


*m*-chlorophenol

(3 pts)



Circle the correct the IUPAC name of the following compound (3 pts):

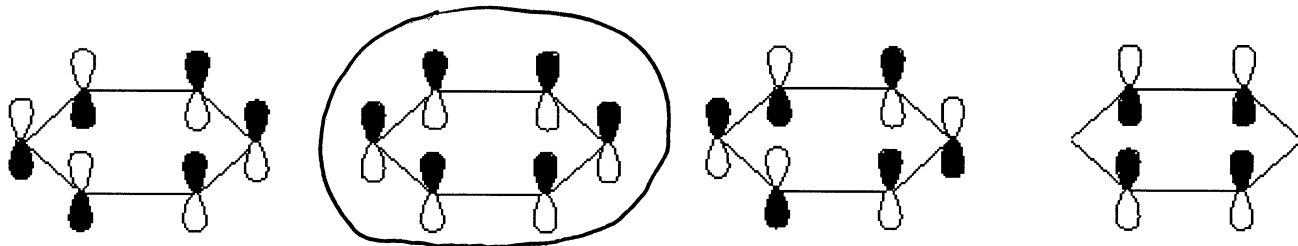
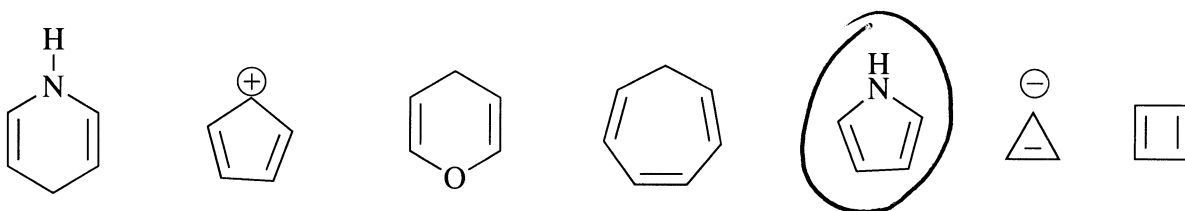


2-bromo-4-carboxynitrobenzene

2-bromo-1-nitro-4-benzoic acid

2-nitro-6-carboxybromobenzene

3-bromo-4-nitrobenzoic acid

8. (15, 5 pts each) For each of the following questions (a)-(c) **circle** the item that is the correct answer.(a) Which of the following represents the lowest energy bonding  $\pi$  molecular orbital of benzene?(b) Which one of the following molecules is **aromatic** according to the Hückel criteria?(c) Which of the following compounds is a conjugated **diene**?

2,4-hexadiene

1,4-cyclohexadiene

1,4-hexadiene

1,2-butadiene

cyclopentene

ethylene